WATER AND RELATED LAND RESOURCES
CENTRAL LAHONTAN BASIN
NEVADA - CALIFORNIA

JULY 1975

Based on a Cooperative Survey

by

THE NEVADA DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES, THE RESOURCES AGENCY OF CALIFORNIA and THE UNITED STATES DEPARTMENT OF AGRICULTURE

Prepared by

Economic Research Service - Forest Service - Soil Conservation Service

Max C. Fleischmann College of Agriculture, University of Nevada, Reno

USDA-SCS-PORTLAND, OREG. 1975

M7-L-23222


Madeline
Ravendale
EAGLE LAKE
McCOY FLAT RESVR
Willow Cr
Susanville
Susan R
Janesville
CALV
HO
LA
Long Valley Cr
Doyle
PYRAMID LAKE
Nixon
Truckee R
Lake
TRUCKEE
Wadsworth
SPARKS
RENO
River
STAMPEDE RESVR
Truckee
Truckee
Washoe Lake
Virginia City
Carson
Silver Springs
LAHONTAN RESVR
CARSON
Fallon
River
STILLWATER POINT RESVR.
Carson Lake
Tahoe City
LAKE TAHOE
Fallen Leaf Lake
CARSON CITY
Minden
Wabuska
Walker
Artesia Lake
Yerington
Schurz
River
WALKER LAKE
W Fk
E Fk
Walker
R
Topaz Lake
WALKER
W
Walker R
Babbitt
Hawthorne
BRIDGEPORT RESVR
E
Bridgeport
NEVADA
CALIFORNIA

91966

USDA Report on

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AGENCIES

California

- Human Relations
  - Public Health, Dept. of
- Resources Agency, The
  - Conservation, Dept. of
    - Soil Conservation, Div. of
    - Resource Conservation Districts
  - Forestry, Division of
  - Fish and Game, Dept. of
  - Parks and Recreation, Dept. of
  - Water Resources, Dept. of
  - Water Resources Control Board

Nevada

- Conservation and Natural Resources, Dept. of
  - Conservation Districts
  - Water Resources, Div. of
  - Forestry, Division of
  - Land Use Planning
  - Parks, Division of
- Historical Society
- Fish and Game, Dept. of
- State Highway, Dept. of
- State Library
- Environmental Health, Bureau of
- University of Nevada
  - Max C. Fleischmann College of Agriculture
    - Economics
    - Extension Service
    - Plant, Soils and Water
  - Desert Research Institute
  - Geology-Geography, Dept. of
  - History, Dept. of
  - Library
  - Mines, Mackay School of
  - Renewable Natural Resources

California and Nevada

- Tahoe Regional Planning Agency

United States

- Agriculture, Department of
  - Agricultural Stabilization and Conservation Service
  - Economic Research Service
  - Farmer's Home Administration
  - Forest Service
  - Rural Electrification Administration
  - Soil Conservation Service
- Commerce, Department of
  - Bureau of Census
  - National Oceanic and Atmospheric Adm.
    - National Weather Service
- Defense, Department of
  - Army
    - Corps of Engineers
    - Sierra Army Depot
  - Navy
    - Fallon Naval Air Station
    - Hawthorne Naval Ammunition Depot
- Environmental Protection Agency
- Interior, Department of
  - Fish and Wildlife Service
  - Geological Survey
  - Indian Affairs, Bureau of
  - Land Management, Bureau of
  - Mines, Bureau of
  - Outdoor Recreation, Bureau of
- Labor, Department of

GROUPS

Antelope Valley Mutual Water Company
Antelope Valley Water District
Carson City Regional Planning Commission
Carson City Water Company
Carson River Basin Council of Governments
Carson-Truckee Water Conservancy District
Carson-Walker Resource Conservation and Dev. Project
Douglas County Planning Commission
Hawthorne Utilities
Lassen Irrigation Company
Libraries: Carson City, Churchill, Douglas, Lassen, Lyon, and Washoe Counties
Nevada Appeal Newspaper
Nevada State Journal Newspaper
North Cal-Neva Resource Conservation and Dev. Project
Recorders: Carson City, Churchill, Douglas, Lassen, Lyon, and Washoe Counties
Reno Evening Gazette Newspaper
Sierra Pacific Power Company
Sierra Valley Water Company
Southwest Gas Company
Sun Valley Water and Sanitation District
Tanner Slough Irrigation District
Trans-Sierra Water Services, Inc.
Truckee-Carson Irrigation District
U. S. District Court Watermaster
Valley Water Company
Walker River Irrigation District
Washoe County Water Conservation District

WASHOE CO
LASSEN CO
PERSHING CO
Central Lahontan Basin
PLUMAS CO
CHURCHILL CO
SIERRA CO
NEVADA CO
PLACER CO
EL DORADO CO
STOREY CO
CARSON CITY
LYON CO
ALPINE CO
MINERAL CO
DOUGLAS CO
MONO CO
LOCATION MAP
CALIFORNIA
NEVADA
SMOKE CREEK DESERT
River
CARSON SINK
RENO
Truckee River
Carson River
Walker River
NEVADA
CALIFORNIA
CENTRAL LAHONTAN BASIN
CALIFORNIA AND NEVADA
MAY 1974
10 0 10 20 MILES
SCALE 1:1,500,000

C E N T R A L   L A H O N T A N   B A S I N

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The City of Reno, Nevada, alongside the Truckee River is
the population center of the Central Lahontan Basin

S U M M A R Y

Highlight

The Central Lahontan Basin has one of the highest population growth rates in the Nation. Future growth will depend on how conflicting demands for a limited water supply are resolved. Major consideration was given to the preservation of terminal lakes (water-based recreation and fisheries) and the irrigated agricultural economy while allowing for urban, forest products, and geologic commodities expansion. The USDA study presents one means of alleviating this complex problem. Changes in irrigated cropping patterns preserve the agricultural economy with a substantial reduction in water requirement. The conservation means conceived could preserve some terminal lakes and substantially reduce the decline of others. The USDA Plan includes 22 projects and programs, involving flood control, land treatment, recreation development and environmental enhancement producing in excess of 42 million dollars in average annual benefits and having an average annual cost of about 17 million dollars.

CONTENTS

Objective and Scope

The Central Lahontan River Basin encompasses a total area of 16,658 square miles: 5,352 square miles in California or 32 percent of the area; and 11,306 square miles in Nevada or 68 percent. It is 216 miles long, north to south, and has a maximum width of 170 miles. Most of the area is within the Basin and Range Physiographic Province and the extreme western portion lies in the Sierra Nevada Province.

Identification of problems and needs concerning the potential use of land and water resources and a discussion of USDA development opportunities constitute the main thrust of this report. Information is also provided to enable the USDA, other Federal agencies, and the States of Nevada and California to develop a sound basis for effective interagency coordination.

Land resources were inventoried in detail with regard to present use and potential. Water resources were analyzed both from stream gage records and from the use of a Basin Simulation Model computer program. River flows are displayed as average flows based on stream flow records and the eighty percent chance flows. Results suggest many opportunities for individual and group action involving land and water resource potentials that could have very beneficial economic effects. Additional investigations and environmental impact statements will be required on projects prior to implementation.

A water budget accounting system was developed to evaluate water resource-inflow-consumptive use-outflow relationships. These procedures took into account diverted water, consumptive use, and utilized reuse factors for the return flows from irrigation. In this manner, water availability figures were established. The amount of land presently used for irrigated agriculture, in some areas, is in excess of the water available.

Special economic emphasis may suggest directions for development. Use of land and water resources for producing geologic commodities or for urban and industrial use, may supersede their use for agriculture. Environmental and social well being factors were considered in the evaluation of alternatives for development. Projections in the report are based on Series C projections of population. These projections are now believed to be too high and may result in overstatement of demands for water-related services such as recreation and water supply. Future analyses should be based on current population projections which may reflect reduced demands for some goods and services.

This report summarizes the major resource inventories and evaluations. More detailed information and data are presented in the appendices. Refer to these reports for more detail regarding the data presented and procedures used.

Problems and Potentials

Construction of buildings, homes, roads, utilities, and recreation areas has accelerated the natural erosion at some locations. This has also resulted in the loss of wildlife habitat and has caused reductions in the deer herds and fish populations. More than 50 percent of this erosion comes from less than 24 percent of the total area. Some of the significant problem areas are around Lake Tahoe and at the mouth of the Truckee River at Pyramid Lake.

The soil survey mapped 53,000 acres of severely eroded land, the only degree of erosion recognized. This erosion was mostly related to those locations with a sparse vegetative cover, or to areas effected by wildfire.

Floods cause an estimated average annual damage of about 2.8 million dollars. As the development continues in the flood plain, the damage could be higher in the future. Effective flood plain zoning could control development in the flood plain.

Because there is an inadequate supply of water in the Basin to meet all of the demands, the users of water must compete for the available supply. There is more land suitable for agricultural crop production than can be irrigated. There is more potential for urban growth than can be supplied with water if existing levels of irrigated agriculture, fisheries habitat, and recreational uses are to be maintained.

The importance of terminal lakes, particularly Pyramid and Walker, for water-based recreation, fish and wildlife, and other uses is recognized. Present and forecast demand exceeds the amount required to maintain these lakes. Their preservation is a matter of present public concern and litigation. The USDA Plan presented in this report provides for the least over-use of water. Moreover, ways and means of water salvage are discussed.

The water shortage problem is aggravated by variation in annual streamflow and the seasonal distribution of the water supply. The months with the highest demand for water usually have the lowest flows. Inefficiency in the use of the available water supply also contributes to water shortages.

Though quality of water in the Basin is generally good, there are a few problems that degrade water quality. Mine tailings are eroding into some streams, eliminating or greatly reducing the fish populations. Urban, industrial, and agricultural wastes sometimes find their way into streams, lowering water quality and limiting downstream uses.

More efficient use of the Basin's resources is possible through new developments and the acceleration of existing programs. Improved water and related resource management, floodwater and sediment control and soil stabilization are all needed to help solve existing problems. These solutions will require additional technical and financial assistance.

Available ground water resources can be used to augment present and future water needs. Good management of this resource on a basin by basin basis could result in a firm water supply by balancing withdrawals with recharge. If ground water is mined, this resource will eventually be depleted.

Findings and Evaluations

Soil Survey and Land Use Suitability

The classification and mapping of soils within the Basin provided a basis of evaluation and planning for resource management. It provided useful interpretations such as a rating of physical land use suitability. This rating revealed that only 13 percent of the area rated poor for projected uses; and if the land is used in accordance with its best suitability, there is adequate acreage for most uses with minimal conflict.

The land use suitability study and analysis indicate there is adequate land available to accomodate all uses to the year 2020. Water is the controlling factor in land use. Future resource planning will require integration between the four major water consumers - agriculture, mining, urban and industrial uses, and terminal lakes for recreation.

Gross Water Yield

The average annual gross water yield of the Basin is 2.05 million acre-feet. The following tabulation shows the distribution of gross water yields by subbasin and net remaining water supply.

Subbasin	Gross Average Water Yield	Average Annual Depletion	Within Basin Transfer	Exported Out Of Basin	Net Water Supply
	------------	------------1000s	acre-feet------------		------------
Truckee	777	-704.8	-188.0	-9.2	-125.0
Carson	408	-604.0	+196.0	0.0	0.
Walker	413	-469.8	-1.0	-1.0	-58.8
Calvada	456	-422.8	-29.6	-0.2	+3.4

Annual depletions total 2.19 million acre-feet, or 106 percent of the supply. This excess depletion explains the decline of terminal lakes in the Basin. Depletions in relation to the supply are as follows:

1. Net evaporation from free water surfaces (51.1 percent), 1,047,400 acre-feet.

2. Irrigation (32.9 percent), 674,100 acre-feet.

3. Phreatophyte use (21.0 percent), 430,700 acre-feet.

4. Municipal and Industrial (1.9 percent), 38,500 acre-feet.

Water Supply for Major Water Consuming Land Uses

Two methods were used in the analysis of available water supply. The long time average annual streamflow was calculated based on stream gage records. The 80 percent chance streamflow was calculated on a probability basis with the basic data taken from stream gage records. The 80 percent chance flow is that flow which will be met or exceeded in 80 percent of the years when considered on a long time basis. It is important to note that those depletions occurring upstream from a stream gage are reflected in the gage figures, while depletions downstream are not. Consequently, allowance for evaporation from downstream water bodies or terminal lakes must be considered when analyzing stream gage data for use in projections of future water supply.

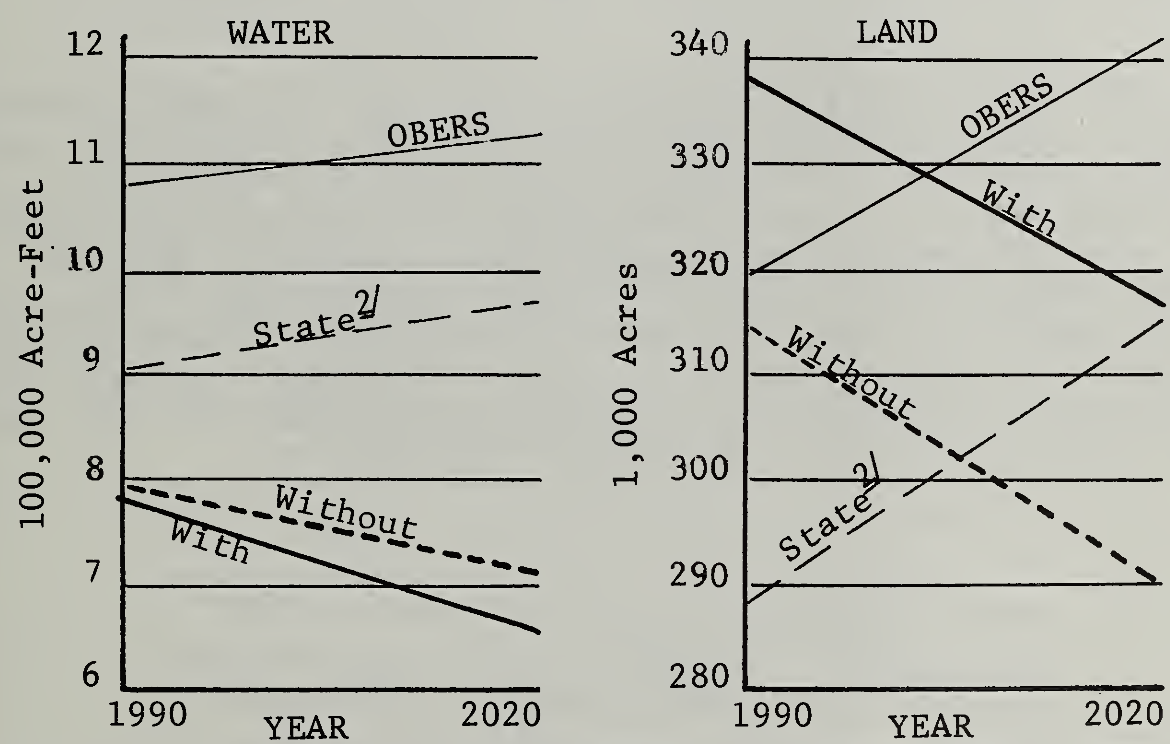
The increases in demand for geologic commodity and urban land and water are expected to be met because of the economics involved. Irrigated agriculture is the second largest consumer of water. Changes in irrigated agriculture are required to accomodate the other major water uses. An evaluation utilizing linear programing (L.P.) models was utilized to formulate projections for both the Without and With Plan irrigated agricultural resource use.

Irrigated Agriculture

Linear programing models of the subbasin were constructed for projection to the years 1990 and 2020. The models included streamflow, acreage of agricultural land by productivity class, the resource demands of crop acreages, and the net dollar returns from farm operations. The models were set to maximize net returns to irrigated agriculture both with and without the USDA plan. The models permitted the planting of five major crops and five kinds of livestock operations. The expected increases in irrigation efficiency and productivity and expected reductions in land and water available to agriculture were included in the Without Plan analysis. The With Plan models included acreage changes, irrigation efficiency improvement, phreatophyte control and water storage considerations of the USDA Plan.

In the models, the Carson Subbasin was divided into two parts, separated at the Lahontan Reservoir. The results of these linear programing models are taken as the agricultural use and production with and without the USDA Program, where applicable, they are compared with University of Nevada (State) and OBERS projections. The OBERS production figures were divided by the State projections of yield per acre and multiplied by water use per acre as determined by the modified Blaney-Criddle method. State and OBERS data were adjusted by the staff to conform with Basin boundaries.

Figure A - Projected irrigated agricultural resource use, Central Lahontan Basin[1/]



1/ With and Without USDA Plan data based on LP Model using average water supply, by months.

2/ State projections based on Nevada Water Planning Report No. 8, Revised Hay and Pasture Projections, other crops from body of report.

Table A compares the projections of water and land between the LP model, OBERS, and State, for an average water year.

Table A - Projections of water and land use by three methods, Central Lahontan Basin

Plan	1990 LP	1990 OBERS	1990 State[1/]	2020 LP	2020 OBERS	2020 State[1/]
Water - acre-feet						
Without	792,376	1,078,500	904,000	712,950	1,128,300	966,200
With	778,348	-	-	658,226	-	-
Land - acres						
Without	314,500	319,650	287,700	290,000	341,230	314,700
With	338,500	-	-	317,500	-	-

1/ State projections based on Nevada Water Planning Report No. 8, Revised Hay and Pasture Projections, other crops from body of report.

Different cropping patterns account for the major differences in the LP model resource use with that of the State and OBERS projections. The model concentrated on production of wheat and barley in consideration of the limited water supply. Less water is used by small grains than alfalfa or wild hay during summer. This production shift caused a major reduction in the amount of water consumed by irrigation. Production of the principal crops by plan is shown in Table B. Acreage of the principal crops by plan is exhibited in Table C. The extent of this difference is shown in Table D.

Table B - Projected tons of principal crop production by plans, Central Lahontan Basin[1/]

Crop and Kind of Plan	1990 LP	1990 OBERS	1990 State[2/]	2020 LP	2020 OBERS	2020 State[2/]
Wheat						
Without	180,769	5,162	8,892	220,205	6,906	17,563
With	196,679			264,205		
Barley						
Without	77,208	9,659	16,957	186,005	8,734	24,314
With	103,381			168,395		
Hay						
Without	241,859	434,310	316,000	368,196	641,873	383,300
With	291,439			393,534		

1/ Water supply based on average year data.

2/ State projections based on Nevada Water Planning Report Number 8, Revised Hay and Pasture Projections, other crops from body of report.

Table C - Projection of linear program, State and OBERS cropland acreages by plans, Central Lahontan Basin[1] acres

Crop and Plan	1990 LP	1990 OBERS	1990 State[3]	2020 LP	2020 OBERS	2020 State[3]
	-------	-------	-------	acres -------	-------	-------
Total hay						
Without	124,800	163,230	123,900	114,100	187,730	132,200
With	129,000			126,600		
Wheat						
Without	64,800	2,265	3,900	57,400	2,075	17,110
With	68,200			70,600		
Barley						
Without	35,500	5,475	9,600	61,800	3,460	16,775
With	45,700			56,500		
Imp. Pasture						
Without	89,600	143,500	143,500	56,800	143,500	136,500
With	95,500			64,000		
Other[2] Row Crops	(not inc.)	5,180	6,760	(not inc.)	4,470	12,140
Total						
Without	314,700	319,650	287,660	290,100	341,200	314,725
With	338,400			317,700		

1/ Water supply based on average year data.
2/ Silage, oats, and potatoes.
3/ State projections based on Nevada Water Planning Report No. 8, Revised Hay and Pasture Projections, other crops from body of report.

Table D - Acres of hay, pasture, and small grains planted by LP model, With and Without Plan, compared with State and OBERS, Central Lahontan Basin

	LP[1] With	LP[1] Without	State[2]	OBERS
1990				
Total hay and improved pasture	224,500	214,400	267,400	306,730
Small grains	113,900	100,300	13,800	7,740
Total	338,400	314,700	281,200	314,470
% in small grains	34%	32%	4.9%	2.5%
2020				
Total hay and improved pasture	190,600	170,900	268,700	331,230
Small grains	127,100	119,200	33,900	5,535
Total	317,700	290,100	302,600	336,765
% in small grains	40%	41%	11.2%	1.6%

1/ Water supply based on average water year.
2/ State projections based on Nevada Water Planning Report No. 8, Revised Hay and Pasture Projections, other crops from body of report.

Watershed Investigations

Thirty-two watersheds were investigated. Preliminary studies indicate 14 watersheds have potential for treatment under PL-566. The other 18 watersheds are not economically feasible and should be considered for treatment under other programs. The 14 watersheds have needs for flood protection, agricultural water management, and recreation. Twelve involve flood prevention which would reduce the Basin's 2.8 million dollars average annual flood damage by about 1.8 million dollars. There are seven watersheds where agricultural water management would be a part of the project. Improved irrigation would result on about 75.000 acres. Recreation is a purpose in seven watersheds and would provide an additional 582,000 visitor-days of water-based recreation annually. Additional environmental investigations are needed during detailed planning phases to determine all environmental effects.

Recreation

Some of the prime recreation areas in the west are located within the Basin, particularly in the Sierra Nevada. There are many campgrounds and picnic areas on National Forest, public domain, private, county, and State lands.

Developed recreation areas on Federal lands provided 6.8 million visitor-days use in 1970, which is below the 9 million visitor-day capacity. The USDA Plan for the areas will provide for an additional 16 million visitor-days. The projected 2020 recreation demand for both Federal and private lands is 106 million visitor-days.

There are many undeveloped campground and picnic sites on both public and private lands, which, when developed, could help meet the 2020 demand. In addition, full development of the water resources, as well as an improvement in watershed conditions, could furnish additional man-days of hunting and fishing.

Rangelands and Forest Lands

Livestock grazing is the most extensive use of land in the Basin. Ninety-three percent of the Basin's total area, about

9.5 million acres, produced about 960,000 AUMs of forage in 1970. Eighty-six percent of the grazing takes place on lands administered by Bureau of Land Management and on privately-owned lands. About 14 percent of the grazing takes place on National Forest lands.

Range forage production varies from low to high. About 55 percent was classed in the low forage production class, 29 percent in the medium forage production class, and 16 percent in the high forage production class. The Basin's forage resource potential has been calculated to be about 1,362,000 AUMs. This is 42 percent greater than the production obtained in 1970. A large portion of this potential can be achieved by 1990, by accelerating the range treatment programs.

Based on State of Nevada projections, a total grazing need of 1,191,175 AUMs by 2020 was developed for the Basin. This is a 231,000 AUM increase over the 1970 production. The State estimated that grazing on National Resource Lands will not increase beyond the present level, so additional AUMs must come from National Forest and privately-owned lands. The USDA Plan is estimated to increase the 1970 production by 87,840 AUMs, so a deficit of 143,175 AUMs will still exist by 2020. This is shown in Table E.

Table E - Projections of range and irrigated pasture forage production by ownership and time frame with USDA program, Central Lahontan Basin

Item	1970	1990	2020
	AUMs		
Range			
Federal	356,676	362,219	367,761 1/
Nonfederal	154,824	169,679	184,535 2/
Subtotal - Range	511,500	531,895	552,296
Irrigated Pasture			
Nonfederal	448,660	472,102	495,704 3/
Grand Total	960,160	1,004,000	1,048,000
Projected Need	960,160	1,016,700	1,191,175
Deficit	0	-12,700	-143,175

1/ Forest Service AUMs increase - 11,085 AUMs
2/ Private rangeland increase - 29,711 AUMs
3/ Irrigated pasture increase - 47,044 AUMs

There are about 1 million acres of commercial forest land in the Basin, of which 53 percent are Federally-owned and 47 percent privately-owned. In 1970, 115 million board feet of timber and wood products was harvested from these lands. The Federally-owned lands are being harvested on a sustained yield basis and present harvest rates will probably continue. The projected roundwood demand for the Basin to meet the national share increases to 314 million board feet by 2020. Projected capacity of wood processing plants in the Basin by 2020 will be 143 million board feet.

Current Programs

USDA programs presently in effect contribute to better management of water and related resources. For example, provision for land treatment and rehabilitation measures on water-yielding lands is made through the management programs of the U. S. Forest Service, and the program of technical assistance to landowners under the PL-46 activities of the Soil Conservation Service.

Watershed lands are protected from fire through the cooperative fire presuppression and suppression programs in the Forest Service, Bureau of Land Management, and the California and Nevada Divisions of Forestry.

In addition to USDA, other State and Federal agencies assist in the development and management of the Basin's water and related land resources. Many USDI agency programs form an integral part of the Basin's economy, along with important flood control and land managing functions of the Department of Defense agencies such as the Corps of Engineers and the U. S. Navy. Nevada's State Department of Conservation and Natural Resources and the Resources Agency of California provide vital services in many water and related land resource fields.

Impacts of the USDA Plan

Physical impacts and effects of the proposed USDA programs are: (1) provision for detention of floodwater and sediment; (2) creation of additional water storage and irrigation system improvements; (3) the creation of additional recreation areas; and, (4) the enhancement of crop, range and woodland area resources. These programs and projects would reduce the expenditures for removal of sediments in rivers, stream channels, and irrigation systems and minimize the occurrence of damaging flood events.

The USDA Plan, consisting of 22 different projects and programs, was analyzed by the four-account system of the Principles and Standards for Planning Water and Related Land Resources. Each of the identified watershed projects will require an environmental impact statement, prior to construction. The projects and programs by Subbasin are shown in the following tabulation:

Calvada Subbasin	Truckee River Subbasin
Susan River WIR* Piute Creek WIR Willow Creek WIR Forest Service Programs Accelerated conservation programs on private land	Evans Creek (Block "N") Watershed Incline Village WIR Galena Creek WIR Southwest Reno WIR Sun Valley WIR Forest Service Programs Accelerated conservation programs on private land
Carson River Subbasin	**Walker River Subbasin**
Carson City WIR West Fork Carson River WIR Forest Service Programs Accelerated conservation programs on private land	Pumpkin Hollow-Southeast Mason Valley WIR Bridgeport WIR West Walker-Antelope Valley WIR Smith Valley-Desert Creek WIR Forest Service Programs Accelerated conservation programs on private land
*Watershed Investigation Report	

TABLE F

DISPLAY OF USDA PLAN EFFECTS AND OTHER PROGRAM OPPORTUNITIES
Central Lahontan Basin

Plan Elements Totals by Subbasins	National Economic Development: Beneficial Effects ($1,000)	National Economic Development: Adverse Effects ($1,000)	SELECTED PLAN EFFECTS — Environmental Quality: Beneficial and Adverse Effects	Regional Development: Beneficial Effects ($1,000) CLB	Regional Development: Beneficial Effects ($1,000) RON	Regional Development: Adverse Effects ($1,000) CLB	Regional Development: Adverse Effects ($1,000) RON	Social Well-Being: Beneficial and Adverse Effects	Program Opportunities: USDA Program Opportunities	Program Opportunities: OTHER Program Opportunities
Calvada Land Treatment, 323,396 ac. Channels, 41 mi Dams SP-1 MP-1	10,410 Net Beneficial Effect = 6,390	4,020	1. Create 360 surface acres of permanent water area. 2. Inundate 6.25 miles of perennial stream. 3. Increase stream flow in Susan River during summer months. 4. Increase forage production by 130,000 pounds annually on wildlife land.	1. Income 34,028 Net Beneficial Effects = 6,390 2. Employment 2,193 man years of employment during project installation.	-23,618	938	3,082	1. Provide 4,567,900 visitor days of outdoor recreation. 2. Provide 100-year level of flood protection to Susanville Piute Creek drainage.	1. Three PL-566 watersheds with FmHA loans. 2. Land treatment - 323,396 ac. PL-46-USFS-RECP State & Private Forestry. 3. North Cal Neva RC&D Project.	1. Lassen Irrigation Company
Carson River Land treatment, 459,900 ac. Channels, 4 mi. Dams SP-1 MP-1	3,516 Net Beneficial Effect = 925	2,591	1. Create 139 surface acres of permanent water area. 2. Inundate 1 mile of perennial stream. 3. Establish 53,820 acres of wilderness area. 4. Increase forage production for wildlife - 180 tons annually.	1. Income 6,015 Net Beneficial Effects = 925 2. Employment 1,458 man years employment during project installation.	-2,499	474	2,117	1. Provide 1,505,500 visitor days of outdoor recreation. 2. Provide 100-year level of flood protection to Carson City.	1. Two PL-566 watersheds with FmHA loans. 2. Land treatment - 459,900 ac. PL-46-USFS-RECP-State and Private Forestry. 3. Carson Walker RC&D Project.	1. Bureau of Reclamation Watashemeau Reservoir Project
Truckee River Land treatment, 271,471 ac. Channels, 115 miles Dams SP-10 MP-9	24,929 Net Beneficial Effect = 17,306	7,623	1. Create 180 surface acres of permanent water area. 2. Inundate 1.6 miles of perennial streams. 3. Increase forage production on wildlife habitat area by 19,000 pounds annually.	1. Income 74,493 Net Beneficial Effects = 17,306 2. Employment 1,445 man years of employment during project installation.	-49,564	1,995	5,628	1. Provide 100-year level of flood protection to about 67,000 people. 2. Provide 9,263,940 visitor days of outdoor recreation.	1. Four PL-566 watersheds with FmHA loans. 2. Land treatment - 271,471 ac. PL-46-USFS-RECP-State & Private Forestry. 3. Carson-Walker RC&D Project.	1. Corps of Engr. 2. City of Reno 3. Bureau of Indian Affairs.
Walker River Land treatment, 261,681 ac. Channels, 15.7 miles Dams SP-4 MP-2	3,212 Net Beneficial Effect = 566	2,646	1. Create 57 surface acres of permanent water area for recreation. 2. Inundate 4.2 miles of perennial streams. 3. Increase Hoover Wilderness Area by 56,908 acres. 4. Increase forage production on wildlife habitat by 914 tons annually.	1. Income 5,936 Net Beneficial Effects = 566 2. Employment 1,444 man years during project installation.	-2,724	456	2,190	1. Provide 1,105,359 visitor days of outdoor recreation.	1. Four PL-566 watersheds with FmHA loans. 2. Land treatment - 261,681 ac. PL-46-USFS-RECP-State & Private Forestry. 3. Carson Walker RC&D Project.	1. Bureau of Reclamation. Walker River Project 2. Walker River Irrigation District
BASIN TOTALS Land treatment, 1,316,448 Channels, 175.7 miles Dams SP-16 MP-13	42,067 Net Beneficial Effect = 25,187	16,880	1. Create 736 surface acres of permanent water area. 2. Inundate 13.05 miles of perennial streams. 3. Increase stream flow in Susan River area in summer months. 4. Increase Hoover Wilderness Area by 56,908 acres. 5. Establish 53,820 acre wilderness area. 6. Increase forage production on wildlife habitat by 1,168.5 tons annually.	1. Income 120,472 Net Beneficial Effects 25,187 2. Employment -6,540 man years during project installation.	-78,405	3,863	13,017	1. Provide 100-year level of flood protection to Susanville (Piute Creek Drainage), Carson City, and about 67,000 people in Truckee River Subbasin. 2. Provide 16,442,699 visitor days of outdoor recreation.	1. Thirteen PL-566 watersheds with FmHA loans. 2. Land Treatment - 1,316,448 acres, PL-46-USFS-RECP-State & Private Forestry. 3. RC&D Projects: Carson-Walker, & North Cal-Neva	1. Bureau of Reclamation. 2. Corps of Engr. 3. Lassen Irrig. District. 4. Walker River Irrig. Co. 5. City of Reno 6. Bureau of Indian Affairs

Basin Summary of the Four Accounts

The following summary of the four accounts for each sub-basin and for the Basin, Table F, indicates the impacts the projects and programs will have on the Nation, the Basin, the environment, and on social well-being.

The linear programing models were not used to determine the impacts and values included in the four-account displays.

Changes in Resource Use

Implementation of the USDA Plan calls for some shifts in land and water resource use. The percentage change with respect to the total resource, compared with the Without Plan condition, are shown in Table G.

Table G - Percent change in total resource use to 2020, Central Lahontan Basin

Table G - Percent change in total resource use to 2020, Central Lahontan Basin

Resource Use	Without Plan	With Plan
Land		
Minimum Water Consuming Uses		
Non-irrigated crops	-0.13	-0.13
Grazing	-1.71	-4.43
Timber	-1.28	-0.76
Recreation, developed	+0.10	+0.36
Wilderness, designated	+0.31	+1.08
Fish and wildlife	+1.04	+1.32
Watershed, classified	+0.12	+0.22
Transportation and utilities	+0.25	+0.31
Miscellaneous land types	0.00	0.00
Major Water Consuming Uses 1/		
Irrigated agriculture	-0.72	-0.46
Urban and industry	+1.22	+1.29
Geologic commodities	+0.80	+1.20
Total - Land	0.00	0.00
Water		
Irrigated agriculture	-45.5	-49.3
Urban and industry	+16.5	+18.0
Geologic commodities	+ 8.3	+ 8.5
Total - Water	-20.7	-22.8

1/ Evaporation from water surfaces not included.

The projected shifts in land use are relatively minor when considering the total resource as indicated in Table G. In the 1970 base year, there were 141,000 acre-feet of water used in excess of water yield. The LP model considerations for irrigated agriculture indicate a possible future saving of more than 20 percent of the 1970 average gross water use.

Impacts of the USDA Plan on Irrigated Agriculture

This section on impacts of the USDA Plan on irrigated agriculture is based on data from the LP models. Data on acreage available for crop production, feeder cattle production are given in Tables H, I and J. Explanation of cattle operation terms is given in Chapter VII. The water use as developed by the models is dependent upon a higher percentage of grain production relative to alfalfa and pasture than was produced in 1970. Projected water use is shown in Tables K, L and M.

Table H - With and Without Plan availability of land for irrigated agriculture by subbasin and time frame, Central Lahontan Basin

Subbasin and time frame	Without	With
	acres	
Calvada		
1990	72,092	76,902
2020	71,092	76,092
Truckee		
1990	20,341	20,341
2020	10,197	10,197
Carson - upper		
1990	48,256	48,256
2020	44,296	44,296
Carson - lower		
1990	69,525	69,525
2020	68,175	68,175
Walker		
1990	120,489	128,489
2020	123,787	133,787
Basin Totals		
1990	330,703	342,703
2020	317,547	332,547

Table I - Projections of crop production With and Without USDA plan for two levels of water availability, 1990 and 2020, Central Lahontan Basin

Crop and Yield Unit	80% yr.1/ Without	80% yr.1/ With	Average yr. Without	Average yr. With
1990				
Alfalfa (tons)	195,987	174,003	240,000	291,439
Wheat (tons)	120,475	136,489	180,769	196 679
Barley (tons)	113,777	131,201	77,208	103,381
Wild hay (tons)	1,747	2,116	1,859	4,326
Improved pasture (AUM)	275,530	308,820	428,823	463,070
2020				
Alfalfa (tons)	277,935	353,947	364,072	393,534
Wheat (tons)	163,575	179,375	220,205	264,205
Barley (tons)	177,465	222,745	186,005	168,395
Wild hay (tons)	910	910	4,124	3,755
Improved pasture (AUM)	250,480	233,277	324,520	359,700

1/ The 80 percent chance flow is that flow which will be met or exceeded in 80 percent of the years when considered on a long time basis.

Table J - Projections of potential feeder cattle production With and Without Plan, for two levels of water availability, 1990 and 2020[1]

Type of Operation	80% year[2] Without	80% year[2] With	Average year Without	Average year With
1990	---in numbers	of cattle---		
Hay grain warm-up	89,698	107,268	64,368	87,260
Hay pasture warmup	91,820	102,920	142,924	154,328
Choice finish	181,548	210,225	207,327	241,585
2020				
Hay grain warm-up	174,223	221,452	199,170	207,730
Hay pasture warmup	83,490	77,759	108,170	119,901
Choice finish	257,765	299,205	307,325	327,685

1/ Portions of this feed would also be necessary to supply dairy cattle and horse production.
2/ 80% Chance flow is that flow which will be met or exceeded in 80 percent of the years when considered on a long time basis.

The differences in With and Without Plan water use are dependent upon phreatophyte control and increased irrigation efficiency programs (which increase the amount of water available for irrigated crops), the additional storage in proposed reservoirs and the additional acreages brought in with the USDA.

On subbasins where less than 100 percent of the land available for agriculture was used, remaining water exists due to the seasonal distribution of water flow. The excess flow in spring and early summer months is not available during the late summer months when it is needed to allow additional acreages to be planted.

Table K - With and Without Plan linear program projections of irrigated land and water use by subbasin, 1990

Subbasin and Item	80% year 1/		Average year	
	Without	With	Without	With
Calvada				
Water used - AF	70,000	72,000	102,000	102,000
Water left - AF	13,000	14,000	35,000	39,000
Land used - Ac.	30,101	39,594	59,566	72,293
Land used/land avail%	42	52	83	95
Truckee				
Water used - AF	54,000	54,000	54,000	54,000
Water left - AF 2/	140,000	141,000	236,000	333,000
Land used - Ac.	20,341	20,341	20,341	20,341
Land used/land avail%	100	100	100	100
Carson - lower 2/				
Water used - AF	262,000	246,000	262,000	246,000
Water left - AF	15,000	35,000	81,000	101,000
Land used - Ac.	69,525	69,525	69,525	69,525
Land used/land avail%	100	100	100	100
Carson - upper				
Water used - AF	92,000	119,000	169,000	185,000
Water left - AF	52,000	40,000	99,000	98,000
Land used - Ac.	29,216	41,581	47,560	48,256
Land used/land avail%	61	86	99	100
Walker				
Water used -AF	129,000	123,000	205,000	191,000
Water left - AF	30,000	29,000	58,000	64,000
Land used - Ac.	85,160	97,649	117,716	127,965
Land used/land avail%	71	76	98	100
Basinwide				
Water used - AF	607,000	615,000	792,000	778,000
Water left - AF 2/	250,000	259,000	509,000	635,000
Land used - Ac.	234,343	268,690	314,708	338,380
Land used/land avail%	71	78	95	99

1/ The 80 percent chance flow is that flow which will be met or exceeded in 80 percent of the years when considered on a long time basis.

2/ Water left figures in Truckee and Basinwide reflect flow in Truckee River before any diversion to the lower Carson. Average annual diversions to the lower Carson were 188,000 acre-feet, 1970 base.

Table L - With and Without Plan linear program projections of irrigated land and water use by subbasin 2020

Subbasin and Item	80% year1/ Without	80% year1/ With	Average year Without	Average year With
Calvada				
Water used - AF	66,000	69,000	95,000	97,000
Water left - AF	14,000	19,000	36,000	38,000
Land used - Ac.	28,768	38,822	57,095	72,678
Land used/land avail%	41	51	80	96
Truckee				
Water used - AF	23,000	23,000	23,000	23,000
Water left - AF 2/	143,000	144,000	335,000	335,000
Land used - Ac.	10,197	10,197	10,197	10,197
Land used/land avail%	100	100	100	100
Carson - lower 2/				
Water used - AF	238,000	221,000	238,000	221,000
Water left - AF	33,000	52,000	99,000	118,000
Land used - Ac.	68,175	68,175	68,175	68,175
Land used/land avail%	100	100	100	100
Carson - upper				
Water used - AF	82,000	105,000	181,000	158,000
Water left - AF	53,000	45,000	79,000	116,000
Land used - Ac.	23,531	28,967	44,218	44,146
Land used/land avail%	53	65	99	100
Walker				
Water used - AF	104,000	101,000	176,000	160,000
Water left - AF	28,000	27,000	54,000	64,000
Land used - Ac.	68,841	93,162	110,424	122,460
Land used/land avail%	56	70	89	92
Basinwide				
Water used - AF	512,000	518,000	713,000	658,000
Water left - AF 2/	272,000	287,000	603,000	672,000
Land used - Ac.	199,512	239,323	290,109	317,656
Land used/land avail%	63	72	91	96

1/ The 80 percent chance flow is that flow which will be met or exceeded in 80 percent of the years when considered on a long time basis.

2/ Water left figures in Truckee and Basinwide reflect flow in Truckee River before any diversion to the lower Carson. Average annual diversions to the lower Carson were 188,000 acre-feet, 1970 base.

Discussion of Water Use Projections

The water use by crops entered into the linear programing model varied for each crop by month and by soil type. The basis for this water use was an adaptation of the Blaney-Criddle method of determining water use. This is the method presently being used by the SCS, USDA. This method of determining crop water requirements has presently come into question by the Technical Committee on Irrigation Water Requirements of the Irrigation and Drainage Division of the American Society of Civil Engineers, as underestimating the water requirement of crops in semiarid to arid regions.

Four years of study by the University of Nevada[1/] shows for actual farming practices on the Central Lahontan Basin, an average of 4.0[2/] acre-feet per acre consumptive use[6/] (this use figure did not vary greatly by crops). Under the assumption of 75 percent[3] efficiency for field application, this necessitates 5.8 acre-feet of water to be applied at the field. If a conveyance efficiency to the field of 70 percent[4] is assumed, each acre of crops grown necessitates 8.2 acre-feet of water per acre.

If this water use figure is applied to the Newlands Irrigation Project, 528,500 acre-feet of water would have been used each year in the 1970-1973 time period. The reported diversions were 392,000[5] acre-feet per year.

If the University of Nevada observations of consumptive[6] use under actual farming practices and with the assumptions of 75 percent field efficiency and 70 percent conveyance efficiency) are applied to the acreages planted by the linear programing model With and Without USDA Plan, the water demanded in 1990 and 2020 would be as shown in Table M.

1/ C. N. Mahannah, J. Guitjens, E. York; Western Nevada Water Controversy, publication B34, Cooperative Extension Service, Fleischmann College of Agriculture, University of Nevada, Reno, January 1974
2/ Ibid page 27, note 10
3/ Ibid page 27, note 6
4/ Ibid page 23
5/ Ibid page 26
6/ As defined in University of Nevada publication, B34, footnote 1.

Table M - A comparison of projected water use by the Linear Programing model (using water demand by crop, by month, as adapted from the Blaney-Criddle method, USDA determined field and conveyance efficiency, and the projected water use if actually measured, present water use by agricultural crops, (under the assumptions of 75 percent field efficiency and 70 percent conveyance efficiency) is continued unaltered into the future and applied to the acres planted by the LP model.

Subbasins	1990		2020	
	Without	With	Without	With
	------acre-feet------			
Calvada				
Projected Actual farm use	490,100	593,300	468,600	596,600
Projected use by LP model	102,400	101,800	95,200	96,900
Truckee				
Projected Actual farm use	166,600	166,600	83,700	83,700
Projected use by LP model	53,900	53,900	22,700	22,700
Lower Carson				
Projected Actual farm use	570,400	570,400	559,700	559,700
Projected use by LP model	262,300	246,000	237,700	220,800
Upper Carson				
Projected Actual farm use	390,600	396,400	362,700	362,000
Projected use by LP model	169,200	185,200	181,100	158,200
Walker				
Projected Actual farm use	966,000	1,050,500	906,000	1,005,000
Projected use by LP model	204,600	191,400	176,200	159,700
Basinwide				
Projected Actual farm use	2,583,700	2,777,200	2,380,700	2,607,000
Projected use by LP model	792,400	778,300	712,900	658,300

Value of Agricultural Production

The LP model projected the value of the agricultural production under the Wtih and Without Plans by time frame and water availability. This is shown in the following tabulation:

Plan -$1,000-	1990		2020	
	80% yr.	ave. yr.	80% yr.	ave. yr.
Without	26,377	31,573	29,591	38,897
With	30,357	34,030	35,678	42,511
Difference With Plan	+3,980	+2,457	+6,087	+3,614

Although the linear program approaches the increased production from the agricultural sector in a different manner than the Principles of Standards determination of benefits, the portion of benefits attributed to the agricultural portion of the USDA Plan in the Principles of Standards turned out to be of a similar magnitude.

If the total of the projected increased returns to agricultural production from the USDA Plan, during an average water year, were to be attributed only to the agricultural labor sector (as opposed to being divided also to capital and land), the per employee increase in income would amount to 2,400 dollars in 1990 and 3,800 dollars in the year 2020. This would increase total OBERS projected personal income in the Basin by 0.12% in 1990 and 0.04% in 2020.

Limiting Water Months

The LP model determined the limiting water months for the With and Without Plan for an average water year. This is shown in Table N. The Calvada, Upper Carson, and Walker Subbasins used less than 100 percent of the land available for agriculture. This resulted in remaining water flowing to the terminal lakes, because of the excess flow in spring and early summer not being available later on for agriculture use. The lower Carson and Truckee Subbasins have no limiting water months because of existing storage facilities.

Even though only one month may be listed as limiting to production, this does not mean excessive amounts of water exist in other months. It does mean that because of the limiting month, production cannot be shifted to make use of the limited water amounts remaining.

Table N - With and Without Plan LP Model projections of limiting water months, average water year, by subbasin and time frame

Subbasin	1990		2020	
	Without	With	Without	With
Calvada	June	June	June	June
Walker	July Aug Sept Oct	Aug Sept Oct -	July Aug Sept Oct	Aug Sept Oct -
Carson - upper	Aug Sept	Sept -	None 1/ -	None 1/ -
Carson - lower	None	None	None	None
Truckee	None	None	None	None

1/ Only minor amount of water remaining in summer months caused by reduced acreage available for planting and cropping shifts.

CHAPTER I

INTRODUCTION

Highlight

As the introductory section to the Central Lahontan Basin report, this portion discusses background information, location, procedures, and objectives for carrying out the study.

CONTENTS

Background

This study deals with the use and development of water and related land resources of the Central Lahontan Basin in Eastern California and Western Nevada. The information presented is based on a cooperative study by the Resources Agency of the State of California, the Department of Conservation and Natural Resources of the State of Nevada, and the U. S. Department of Agriculture. The two state agencies jointly requested the U. S. Department of Agriculture to undertake the study in 1965.

Four interstate drainage systems drain the area defined as the Central Lahontan Basin. These systems have their headwaters on the eastern slopes of the Sierra Nevada in California and flow eastward toward Nevada.

Agencies in both States indicated that detailed information about natural resources and their uses was needed to aid in the understanding, management, and correction of current resource problems, and to provide guidance in the future use of resources in meeting the resource needs on their interstate stream systems.

Information developed by the study is available to all Federal and State water resource agencies; and city, county regional planning commissions, regulatory organizations, and other similar groups.

Location, Size, and Boundaries

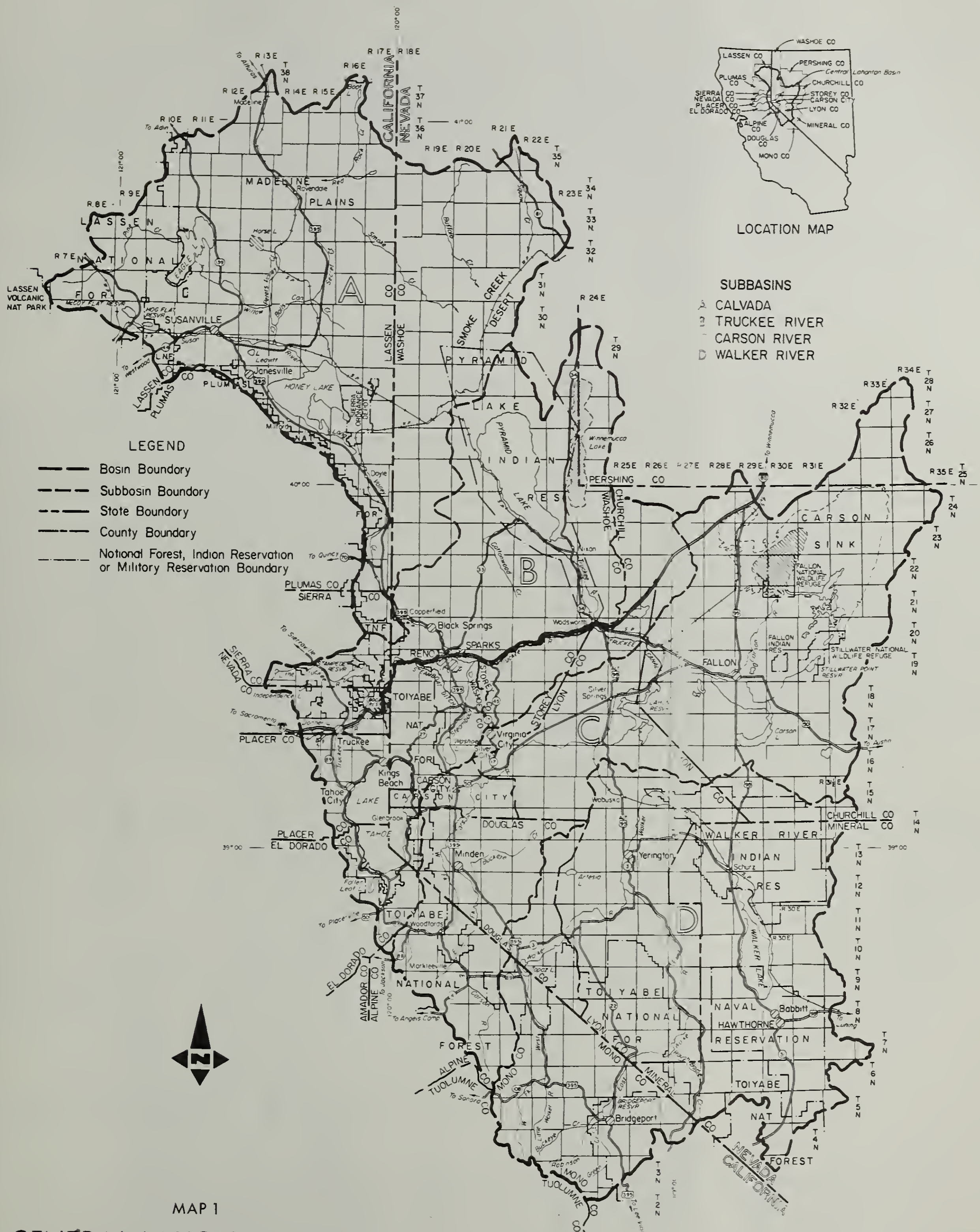
The Central Lahontan River Basin is located in Eastern California and Western Nevada. Its boundary encompasses an area of approximately 16,658 square miles, with 5,352 in California and 11,306 in Nevada. The Basin drains part of Alpine, Eldorado, Lassen, Mono, Nevada, Placer, Plumas, and Sierra Counties in California and Carson City, Churchill, Douglas, Lyon, Mineral, Pershing, Storey, and Washoe Counties in Nevada. It is approximately 216 miles long from north to south and 129 miles from west to east at the widest point. It is bound on the west by the Sierra Nevada and Cascade Range crests to various mountains and ranges on the east.

The Basin covers the Walker, Carson, Truckee, Honey Lake Valley, Eagle Lake, Smoke Creek Desert, and Madeline Plains drainage systems in California and Nevada as shown on Map 1. The Walker, Carson, and Truckee systems are each characterized by a major river of the same name which courses the entire length of these Subbasins, while the Honey Lake Valley system includes the Susan River and several other smaller drainages all terminating in a highly alkaline water body known as Honey Lake. The Madeline Plains, Eagle Lake, and Smoke Creek Desert systems are land locked basins with no major primary drainage-ways, but with many small significant stream systems that contribute to a terminal playa or lake.

For ease of identification, the Honey Lake, Eagle Lake, Smoke Creek Desert, and Madeline Plains systems collectively comprise the Calvada Subbasin. The Walker, Carson, and Truckee systems are each described as separate subbasins.

Acreages comprising the Central Lahontan Basin are given in the following tabulation:

Subbasin	California	Nevada	Total
	acres	acres	acres
Walker	595,700	2,137,956	2,733,656
Carson	290,130	2,343,780	2,633,910
Truckee River	517,975	1,787,474	2,305,449
Calvada	2,021,510	966,900	2,988,410
Totals	3,425,315	7,236,110	10,661,425



MAP 1

CENTRAL LAHONTAN BASIN

ALPINE, EL DORADO, LASSEN, MONO, NEVADA, PLACER, PLUMAS AND SIERRA COUNTIES, CALIFORNIA CARSON CITY, CHURCHILL, DOUGLAS, LYON, MINERAL, PERSHING, STOREY AND WASHOE COUNTIES, NEVADA

JULY 1975

0 10 20 30 MILES
SCALE 1:2,000,000

U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE USDA-SCS-PORTLAND, OREG. 1975

M7-PL-21805

Table 1 - Land and water acreages, by subbasin, county and state, acres, Central Lahontan Basin

State & County	Walker		Carson		Truckee		Calvada		County Totals		Basin Total	Total Area of County	Percent of County in Basin
	Land	Water	Land	Water	Land	Water	Land	Water	Land	Water			
Nevada													
Carson City	-	-	84,697	-	5,799	7,424	-	-	90,496	7,424	97,920	97,920	100
Churchill	102,445	-	1,373,985	21,025	156,965	-	-	-	1,633,395	21,025	1,654,420	3,144,320	53
Douglas	149,041	700	290,805	405	23,066	16,623	-	-	462,912	17,728	480,640	480,640	100
Lyon	798,604	1,080	409,086	7,637	78,582	371	-	-	1,286,272	9,088	1,295,360	1,295,360	100
Mineral	1,046,923	39,163	-	-	-	-	-	-	1,046,923	39,163	1,086,086	2,455,680	44
Pershing	-	-	112,705	-	107,800	-	-	-	220,505	-	220,505	3,859,840	06
Storey	-	-	43,435	-	124,245	-	-	-	167,680	-	167,680	167,680	100
Washoe	-	-	-	-	1,131,129	135,470	966,400	500	2,097,529	135,970	2,233,499	4,229,120	53
Totals - Nev.	2,097,013	40,943	2,314,713	29,067	1,627,586	159,888	966,400	500	7,005,712	230,398	7,236,110	-	-
Subbasin Total, Nev.	2,137,956		2,343,780		1,787,474		966,900		-	-	7,236,110	-	-
California													
Alpine	-	-	289,905	225	3,200	-	-	-	293,105	225	293,330	463,720	63
Eldorado	-	-	-	-	100,070	37,830	-	-	100,070	37,830	137,900	1,096,960	13
Lassen	-	-	-	-	-	-	1,871,119	90,200	1,871,119	90,200	1,961,319	2,910,720	67
Mono	590,563	5,137	-	-	-	-	-	-	590,563	5,137	595,700	1,948,806	31
Nevada	-	-	-	-	111,385	3,580	-	-	111,385	3,580	114,965	625,920	18
Placer	-	-	-	-	111,640	49,700	-	-	111,640	49,700	161,340	965,000	17
Plumas	-	-	-	-	-	-	20,200	-	20,200	-	20,200	1,642,240	1
Sierra	-	-	-	-	96,870	3,700	39,991	-	136,861	3,700	140,561	613,120	23
Totals - Cal.	590,563	5,137	289,905	225	423,165	94,810	1,931,310	90,200	3,234,943	190,372	3,425,315	-	-
Subbasin Total-Cal.	595,700		290,130		517,975		2,021,510		-	-	3,425,315	-	-
Subbasin Totals-Cal&Nev.	2,687,576	46,080	2,604,618	29,292	2,050,751	254,698	2,897,710	90,700	10,240,655	420,770	10,661,425	-	-
Subbasin Grand Total	2,733,656		2,633,910		2,305,449		2,988,410		-		10,661,425		

Source: U.S. Bureau of Census, June 1966
U.S. Bureau of Census, 1960
USDA Conservation Needs Inventory
USDA Central Lahontan Basin Planning Staff
County General Plans - Mono, Alpine, Nevada, Placer, Lassen

The Walker River terminates at Walker Lake; the Carson River drains into the Carson Sink; the Truckee River discharges into Pyramid Lake; and the Susan River drains into Honey Lake. Water from these rivers is used for agriculture, recreation, domestic, and industrial water supplies.

The Central Lahontan Basin is comprised of land and water acreages by subbasin, county, and state as shown on Table 1.

Objectives

The primary objective of USDA participation in the Central Lahontan Type IV Investigation is to facilitate the coordinated and orderly conservation, development, utilization, and management of the Basin's water and related land resources. As indicated by the stated objective, output from this investigation will be utilized within USDA to evaluate resource development possibilities relative to established programs such as Public Law 83-566 and multiple use planning and management of the National Forest System lands. The information developed during this study will also assist the management and planning on state and private lands and to assess the possibility of new programs. Output from this investigation will also be provided to other agencies for use in their resource development planning efforts.

Participation in this investigation will allow governmental units in California and Nevada to reach objectives. For example, in the State of Nevada's Guidelines for Nevada Water Planning, it is stated that plans for uses of Nevada's water and related land resources will have three broad objectives: enviromental quality, economic efficiency, and area development. The process of working toward these objectives will help to identify alternative courses of action, as well as supplying information which will be helpful in making sound final decisions.

More specifically, the data accumulated during this study will assist the states to:

1. Analyze basic data relative to amounts, use, and management of the Basin's water and related land resources.

2. Evaluate proposals for alternative levels of resource developments to meet different objective funtions.

3. Assess the role and potential contribution of USDA programs in state and regional planning efforts.

Results of the Study

USDA procedures for planning water and related land resources have been utilized in displaying USDA potential opportunities or plans for each of the four subbasins. Each plan presents opportunities that primarily fulfill one or more of the multiple objectives. The discussions also include a detailed physical description of the identified projects and programs. Implementation of the plan will aid in reaching the objectives.

Opportunities have not been formulated to emphasize the multiple objectives of national economic development and environmental quality. Multiple objective planning procedures have been used in evaluating the resource development opportunities. The four account evaluation system describes in quantitative and qualitative terms the favorable and adverse effects in areas of national economic development, environmental quality, regional development and social well-being.

No recommended plan will be developed. The USDA plan is one of several planning alternatives that the State of Nevada has included in the State Water Plan. A recommended plan, based on local interests and desires, is expected to emerge from a series of public hearings conducted by the State. Those components of the USDA plan which are included in the recommended plan are designed to meet short term critical needs, and may become part of an early action program.

Authority and Cooperating Agencies

The U. S. Department of Agriculture participation in this study is authorized under provision of Section 6, Public Law 83-566. This law authorizes the Department to cooperate with other Federal, State, and local agencies in making investigations and surveys of watersheds of rivers as a basis for development of coordinated programs. Other cooperating Federal agencies include: Bureau of Land Management, Bureau of Indian Affairs, Geological Survey, Bureau of Reclamation, Bureau of Mines, Bureau of Sport Fisheries and Wildlife, Bureau of Outdoor Recreation, Department of the Army, and the Department of the Navy.

Cooperating State agencies are the Nevada Department of Conservation and Natural Resources, which includes the State Engineer, Division of Forestry, and Division of State Parks; the Nevada Department of Fish and Game; and the University of Nevada Max C. Fleischmann College of Agriculture; the Resource Agency of California, which includes the Department of Water Resources, Department of Fish and Game, Department of Recreation, Division of Forestry, Division of Soil Conservation, and the State Water Resources Control Board.

Study Procedure

Survey work and report preparation was accomplished by a USDA River Basin Survey Staff composed of personnel from the Soil Conservation Service, Forest Service, and the Economic Research Service. General direction was given the Basin Staff by a USDA Field Advisory Committee, which included representatives of the three USDA agencies. The survey consisted partly of accumulation and evaluation of previously recorded data, both published and unpublished, much of which was furnished by other cooperating groups. In addition, the River Basin Staff made studies to gather basic information not otherwise available including a reconnaissance soil survey, reservoir site evaluations, field review of economic data, recreation appraisals, forage inventories, and hydrologic evaluation.

Federal, State, and local entities recognized the need for more information on soils than would be provided by the usual reconnaissance soil survey made in connection with Type IV investigations. They felt that this information was needed for use in formulating immediate and long-range plans for resource development and management. Therefore, the Field Advisory Committee directed that special emphasis be placed on the soil survey to provide additional interpretations. This resulted in five publications being prepared on soils, their characteristics and interpretations, presented on a subbasin and basinwide basis.

A total of 17 separate publications covering the major topics studied during the Central Lahontan Basin Survey will be published. The publications by title, subbasin, and type of distribution are listed here.

Walker

Main Report
Summary Report
APPENDIX I - Soils
*APPENDIX II - Other Data

Carson

APPENDIX I - Soils
Special Report - Flooding

Truckee

*Interim Main Report
APPENDIX I - Soils
APPENDIX II - Watershed Investigation Lake Tahoe Area
*APPENDIX III - Watershed Investigation Truckee River Area
Special Report - Flooding, including Lake Tahoe

Calvada

APPENDIX I - Soils
Special Report - Flooding

Basinwide

Main Report
APPENDIX I - Soils
*APPENDIX II - Other Data

* Limited Distribution

Report users who are interested in more detailed displays of resource data than that presented in the Basinwide Report, are encouraged to review the APPENDIXES I and II relating to that report. Contents of these reports are as follows:

APPENDIX I, Soils

1. Introduction
2. Some Interpretations from Soil Geography
   a. Introduction
   b. Soils and Climate
   c. Agrillic Horizon
   d. Non-Skeletal, Stony Soils
   e. Siliceous Soil Cement
3. Classification
   a. Introduction
   b. Soil Taxa
   c. Land Capability Subclass
   d. Land Resource Areas
   e. Soil Resource Groups

4. General Soil Map
5. Referances

APPENDIX II, Other Data

1. Basinwide
   a. Introduction
   b. History of Settlement
   c. Geology
   d. Land Resources
   e. Phreatophytes
   f. Fish and Wildlife
   g. Water Resources
   h. Recreation
   i. Programs
   J. Economic Analysis
   k. References
2. Subbasin Data Tabulations
   a. Land Status, ownership and use - by county and state
   b. Geology
   c. Soils
   d. Vegetative Cover and Phreatophytes
   e. Rangeland - by states
   f. Forest Land - by county and state
   g. Water Resources - streamflow data and flow charts
   h. Programs
   i. Recreation
   j. Fish and Wildlife resources
   k. Watershed Investigations
3. Maps, by Subbasin (Truckee, Calvada, and Carson only)
   Land Status
   Generalized Soils
   Generalized Geology
   Vegetal Cover
   Range Forage Production and Suitability
   Phreatophytes
   Generalized Aspect
   Annual Precipitation
   Water Yield
   Existing Recreation Sites
   Sediment Yield, Truckee Subbasin
   Sediment Yield, Lake Tahoe Area

Basic data used as a foundation for much of the statistical information presented in these reports are in the files of the USDA Central Lahontan River Basin Survey Staff, and are available to the public.

In the 1870s, Virginia City (above) with over 30,000 inhabitants was the population center of the Basin. In 1970, (below), the population was about 700. Victor Goodwin photo, (above)

CHAPTER II

HISTORY OF SETTLEMENT AND EARLY RESOURCE USE

Highlight

A historical account of settlement and man's early use of the Basin's resources are described. This provides background and setting for ensuing chapters that further analyze the past, present, and future use of the Basin's water and related land resources.

CONTENTS

Exploration and Travel

The use of the Basin and its resources began with early travelers and explorers. Jedidiah Smith, and his two companions, are considered to be the first white men to enter the Central Lahontan Basin. Smith's passage in 1827 was swift, and there is little recorded data of his experiences in the Basin. Peter S. Ogden entered Nevada in 1829 and followed the Humboldt River to its sink. He then proceeded to Southern California passing near Weeks, Adrian Valley, and Walker Lake. The next white men to journey through were the Walker-Bonneville group in 1833. They entered near the Humboldt Sink and traveled southward passing tributaries of the Basin over the Sierra Nevada at the head of one of the tributaries of the Walker River above Bridgeport Valley.

John C. Fremont made two trips into the Basin. His first was in 1843-1844 when he discovered and named Pyramid Lake. From here he traveled south to Bridgeport and then north, seeking a way over the Sierra Nevada during the heart of winter. He was the first white man to see Lake Tahoe. It is believed he viewed it from Red Lake Peak. He finally succeeded in crossing the mountains at what is now called Carson Pass, arriving at Sutter's Fort in early March. His next expedition was in 1845. He entered the Basin at Walker Lake and left via the Truckee River and Donner Pass. His expeditions were important, particularly for the accurate mapping work done by his cartographer, Charles Pruess. These expeditons gave names to many of the lakes and rivers and described the general geology of the area. His group also collected and identified many of the native plants.

Another important party was the Stephens-Townsend-Murphy group in 1844, who were the first emigrants to cross Donner Summit and blaze the way for the thousands that followed.

In 1846 the ill-fated Donner-Reed party attempted passage through the Basin but was caught at Donner Lake and Alder Creek by the heavy snow in late October and early November.

Migrations continued through the Basin during 1847 and 1848. In 1849, after gold was discovered in California, thousands of people left the east to seek fortunes in California's Mother Lode country and journeyed through the Basin by way of the Truckee and Carson Rivers.

Use of the Basin's resources became intense along the migration trails at this time, particularly for campfire wood and feed for livestock. Many a journal or diary record reported it was difficult to find wood for campfires, and that stock often had to be driven some distance from the trail for forage at night. This was particularly true in the Humboldt Sink and the lower Carson River area near Ragtown, where the migrants reached the Carson River after crossing the dreaded "forty-mile desert." It was also noted by the migrants, that there was limited big game and other wildlife for food.

Settlement

Prior to the 1849 gold rush none of the travelers had stayed in the Basin to make their homes. The Basin to most seemed to be a harsh barrier of barren land and high mountains.

The threat of being trapped by the snow hurried the travellers on their way. Through the 1850's settlement began taking place in Carson Valley, Truckee Meadows, and Honey Lake Valley. These first settlers traded with the thousands of migrants that passed through the Basin on their way to California. During this same decade farming and ranching began in the Basin. Gold discoveries in 1857 and 1859 near Bridgeport Valley led to that areas' settlement. Settlement in Antelope, Mason, and Smith Valleys began as ranching areas in 1859.

This discovery of the Comstock Lode triggered a mass movement into the Basin. Many thousands of people came back from the California gold fields. Mining became the most important economic activity and other activities were supported by the mining operations. The lumber and wood, ice, and agriculture industries all looked to the mines as markets for their products. When the mines flourished, other industries flourished, and settlement began to grow around the natural resource of each industry.

Early Trading Posts and Roads

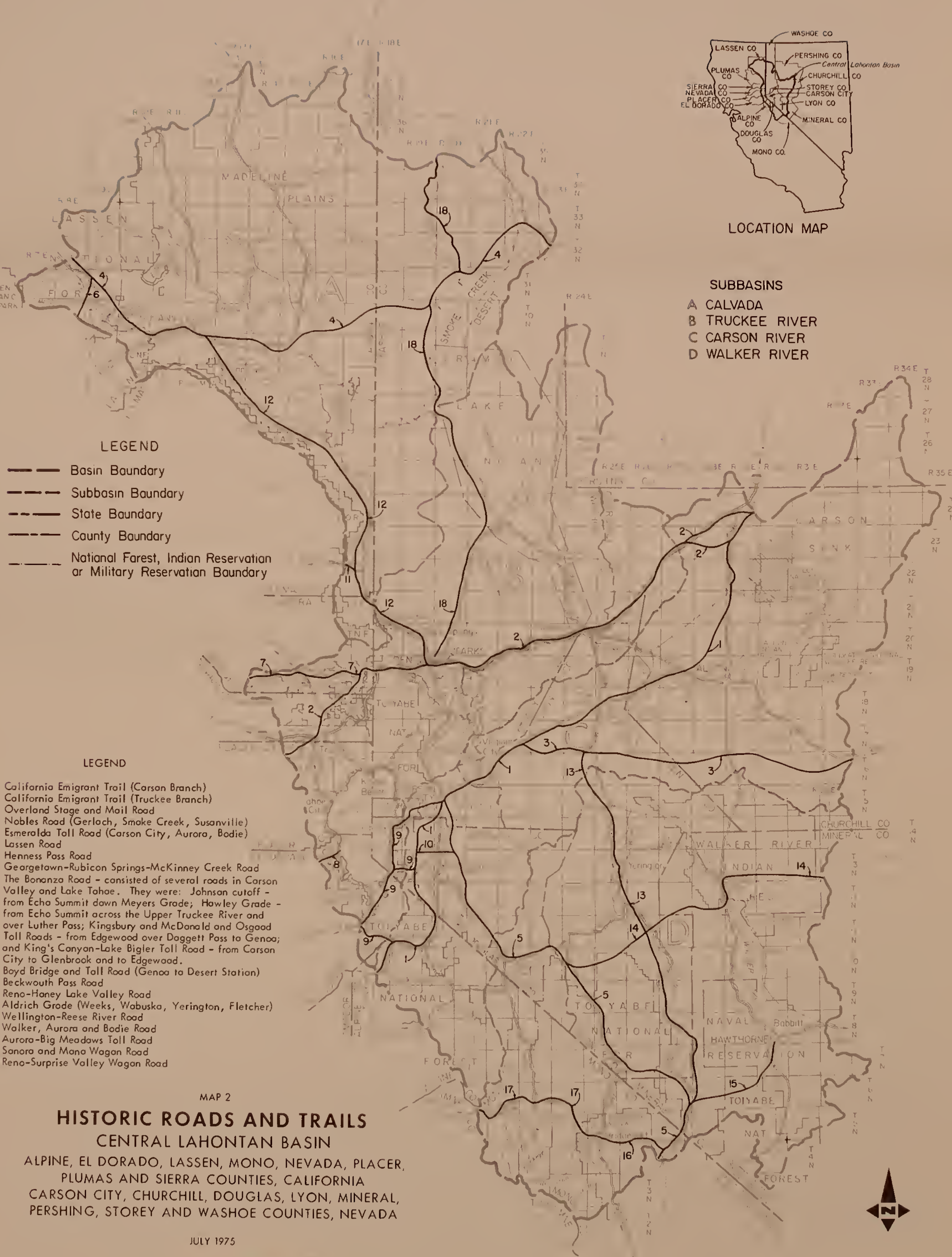
The mass migration of the "Forty-Niners" was followed by more settlers for nearly two decades and the establishment of overland roads, toll roads, and trading posts, see Map 1 and 2. The first post in the Basin was located at Genoa, Nevada, in Carson Valley. It was established in 1850 by H. S. Beattie to do business with the migrants on the Carson Branch of the California Trail. The next year John Reese and twenty Salt Lake City businessmen built a station there. The Truckee Branch and the Carson Branch of the California Emigrant Trail were already in use at this time, with the Carson Branch becoming more popular after the Donner Party tragedy.

The earliest post in Lahontan Valley was Ragtown, located on the Carson River at the end of the "Forty-Mile Desert" trail which ran from the Humboldt Sink to the Carson River. Ragtown became a trading post and rest stop for the migrants. An early town established along the California Emigrant Trail was Dayton in 1851. This followed the discovery of gold in Gold Canyon to the west.

The first permanent settlement in the Truckee Meadows was made by a Mr. Jamison, on the Truckee River in 1852. It was called Jamison's Station. In 1857 John F. Stone and Charles C. Gates established another post on the Truckee River.

Genoa, Nevada's first settlement, in Carson Valley about 1860.
Nevada Historical Society photo.

The Basin's early roads were heavily utilized by freight wagons such as this in the early settlement period. Nevada Historical Society photo.



LEGEND

1. California Emigrant Trail (Carson Branch)
2. California Emigrant Trail (Truckee Branch)
3. Overland Stage and Mail Road
4. Nobles Road (Gerlach, Smoke Creek, Susanville)
5. Esmeralda Toll Road (Carson City, Aurora, Bodie)
6. Lassen Road
7. Henness Pass Road
8. Georgetown-Rubicon Springs-McKinney Creek Road
9. The Bonanza Road - consisted of several roads in Carson Valley and Lake Tahoe. They were: Johnson cutoff - from Echo Summit down Meyers Grade; Hawley Grade - from Echo Summit across the Upper Truckee River and over Luther Pass; Kingsbury and McDonald and Osgood Toll Roads - from Edgewood over Daggett Pass to Genoa; and King's Canyon-Lake Bigler Toll Road - from Carson City to Glenbrook and to Edgewood.
10. Boyd Bridge and Toll Road (Genoa to Desert Station)
11. Beckwouth Pass Road
12. Reno-Honey Lake Valley Road
13. Aldrich Grade (Weeks, Wabuska, Yerington, Fletcher)
14. Wellington-Reese River Road
15. Walker, Aurora and Bodie Road
16. Aurora-Big Meadows Toll Road
17. Sonora and Mono Wagon Road
18. Reno-Surprise Valley Wagon Road

MAP 2

HISTORIC ROADS AND TRAILS

CENTRAL LAHONTAN BASIN

ALPINE, EL DORADO, LASSEN, MONO, NEVADA, PLACER, PLUMAS AND SIERRA COUNTIES, CALIFORNIA
CARSON CITY, CHURCHILL, DOUGLAS, LYON, MINERAL, PERSHING, STOREY AND WASHOE COUNTIES, NEVADA

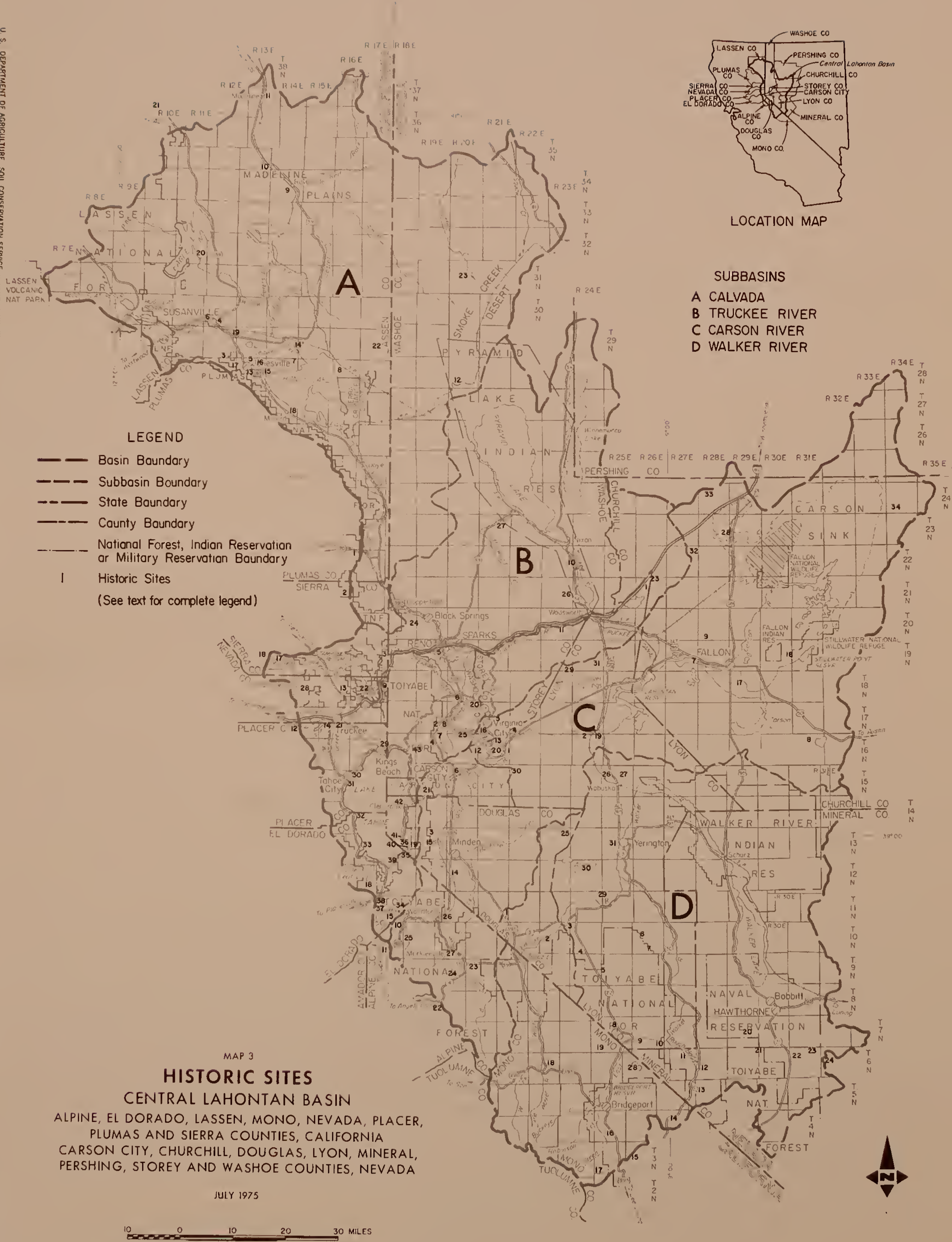
JULY 1975

10 0 10 20 MILES

SCALE 1:1,200,000

U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE

M7-SN-23015



MAP 3

HISTORIC SITES

CENTRAL LAHONTAN BASIN

ALPINE, EL DORADO, LASSEN, MONO, NEVADA, PLACER, PLUMAS AND SIERRA COUNTIES, CALIFORNIA
CARSON CITY, CHURCHILL, DOUGLAS, LYON, MINERAL, PERSHING, STOREY AND WASHOE COUNTIES, NEVADA

JULY 1975

M7-PN-23061

LEGEND
HISTORIC SITES, CENTRAL LAHONTAN BASIN

Historical Sites - Calvada Subbasin (A)

1. Beckwourth Pass
2. Mount Ina Coolbirth
3. Peter J. Lassen Grave
4. Fort Defiance
5. Fort Janesville
6. Susanville
7. Honey Lake Valley
8. Amedee
9. Ravendale
10. Termo
11. Madeline
12. Sand Pass
13. Janesville
14. Tule Confederacy
15. Michigan Flat
16. Buntingville
17. Elysian Valley
18. Milford
19. Johnstonville
20. Lassen Flume and Land Company
21. Hayden Hill
22. Mud Springs
23. Buffalo Creek

Historical Sites - Truckee Subbasin (B)

1. Brady Hot Springs
2. Bowers Mansion
3. Crystal Peak
4. Franktown
5. Lake's Crossing (Reno)
6. Steamboat Springs
7. Ophir
8. Washoe City
9. Floriston
10. Camp Ormsby
11. Derby Dam
12. Donner Pass
13. Alder Creek
14. Breen Cabin
15. Red Lake Peak
16. Mt. Tallac
17. Webber Lake
18. Henness Pass
19. Freel Peak
20. Geiger Grade
21. Truckee
22. Boca Ice and Mill Co.
23. Leete
24. Peavine
25. Jumbo
26. Olinghouse
27. Pyramid City
28. Gold Lake
29. Tahoe Hot Springs Hotel
30. Tahoe City
31. Von Schmidt's Log-Rock Dam
32. McKinney Station
33. Captain Dick's Island
34. Luther Pass
35. "Yanks" Station
36. Woodburn Millsite
37. Celio Ranch
38. Old Lake Valley Ranger Station
39. Bijou
40. Friday's Station
41. Hobart
42. Glenbrook
43. Old Bullwheel at Incline

Historical Sites - Carson Subbasin (C)

1. Dayton
2. Fort Churchill
3. Genoa
4. Sutro
5. Virginia City
6. Virginia and Truckee Railroad Roundhouse
7. Ragtown
8. Desert Station
9. Soda Lake
10. Hope Valley
11. Carson Pass
12. Silver City
13. Gold Hill
14. Mottsville
15. Van Sickle Station
16. Gold Hill Depot
17. St. Clair
18. Stillwater
19. Weeks (Bucklands)
20. Mound House
21. Swift's Station
22. Ebbetts Pass
23. Bullion
24. Chalmers Mansion
25. "Uncle Billy Robert's" Copper Mine
26. Woodfords
27. Markleeville
28. White Plains
29. Ramsey
30. Como
31. Talapoosa
32. Desert Queen Mine
33. Jessup
34. Copper Kettle District

Historical Sites - Walker River Subbasin (D)

1. Double Springs Station
2. Hoye Bridge
3. Wellington Station
4. Hall's Station (Desert Creek)
5. Dalzell Station
6. Pine Grove
7. Rockland
8. Williams Station
9. Sonoma Station
10. Elbow Station
11. Nine-Mile Station
12. Fletcher Springs Station
13. Aurora
14. Bodie
15. Monoville
16. Dogtown
17. Dunderberg Mines
18. Hardy Station (Sonora Junction)
19. Silverado, Clinton, Cameron, Star City, Belfort
20. Coreyville
21. Lucky Boy
22. Powell Station
23. Wilde Station
24. Summit Springs Station
25. Buckskin
26. Thompson Smelter
27. Wabuska
28. Masonic
29. Hudson
30. Ludwig
31. Yerington (Pizen Switch)

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It was known as Stone and Gates' Crossing. About 1860 several crossings or bridges were built to cross the Truckee River in the Truckee Meadows area. One of these was near the present town of Verdi; another near the mouth of Hunter Creek; and still another called Lake's Crossing, the most famous, which eventually became Reno.

Jim Beckwourth discovered what was to become Beckwourth Pass in 1851, and some migrants were diverted from the Truckee Trail over this route after his discovery. Beckwourth Pass, 5,218 feet, is the lowest pass across the Sierra Nevada. In 1852 Nobles Road was established which branched off the Applegate-Lassen Road at Black Rock and extended south and westward along Smoke Creek Desert, through Honey Lake Valley, and over Nobles Pass. In 1853 Isaac Roop built a trading post at the present Susanville in Honey Lake Valley.

In the 1850's the important trade activities were furnishing migrants with livestock, feed, and supplies. One observer counted 720 head of horses and mules moving over the Sierra Nevada from west to east on their way to Carson Valley where they could be traded or sold to replace the weary draft animals of the migrants. Another report stated on August 25, 1857 that there was an uninterrupted chain of wagons all the way on the California Trail.

Indian Reservations

The Northern Paiute Indian Nation was the principal Indian occupant of the Basin at the time of settlement. Their range of habitation actually greatly exceeded the Basin boundaries, but much of their culture was centered in the Truckee and Walker Subbasins. A small tribe, the Washoe, centered around the Lake Tahoe-Carson Valley area, but they were far outnumbered by the Paiute. These Indian tribes were mostly seedgatherers and fishermen. However, waters of the Truckee and Walker Rivers were noted as being used by the Indians for limited irrigation of crops as early as 1859 in the Pyramid and Walker Lake Valleys.

As settlement increased, the Federal Government in 1859 began setting aside portions of the public domain for the exclusive use of the Indians. The first of these reservations was established for the Pyramid Lake Paiute tribe at Pyramid Lake. It included the entire lake, plus a large acreage of land around the lake and along the lower Truckee River. The Executive Order officially proclaiming the establishment of this reservation was signed in 1874.

The Walker River Paiute tribe inhabited the Walker Subbasin, and their reservation was defined as including the north shores of Walker Lake and much of the lower Walker River. The reservation was established by Executive Order in 1902. The Campbell Ranch, an existing ranch unit in Mason Valley, was obtained for use of the Walker River tribe in 1936.

The Fallon Indian Reservation was established by Executive Order in 1893 and 1906 for use of the Paiute Indians in that area. The Washoe Reservation in Carson Valley, for use of that tribe, was established by purchase of privately-owned ranch lands in 1938 and 1940. Creation of the Nevada Indian Agency at Stewart and the Stewart Indian School started in 1889 with the Secretarial Order being signed in 1903.

Irrigated agriculture and range livestock grazing have been carried on almost continuously since the reservations came into being. The 5,000 acres of cultivated and irrigated croplands provide a sustained agricultural economy for the sole benefit of the Indians.

Agriculture

The first farming to take place in the Basin was started around the trading post in Carson Valley in 1851. Soon to follow were farms around the trading posts in Truckee Meadows and Honey Lake Valley. Farmers diverted water from the rivers and streams to supply their crops. Their produce was welcome relief to the migrants who had exhausted their supplies on the trip across the Great Basin. After the mines were discovered the farmers sold their crops to the many people brought in by the mining activity.

Farming was similar throughout the valleys in the Basin, with the following crops grown: fruit, vegetables, wheat, barley, oats, rye, corn, potatoes and hay.

Ranching got its start along with farming since many of the farmers had some livestock. Livestock arriving too late in the season to cross the snowy Sierra Nevada were fed in the Basin over the winter. Wildrye grass was plentiful and livestock could find feed all year long.

By the late 1850's many ranchers were moving into the Basin valleys to start ranching. A drought in California in 1862 - 1864 brought many more head of livestock into the Basin. Many of the early ranchers developed some irrigation to supply additional feed for their livestock.

Outlet gates at Lake Tahoe. The first dam was built here in 1874.

McCoy Flat Reservoir on the Susan River, Calvada Subbasin, was constructed in 1891.

Irrigation Water Supply Development

As irrigation developed and more and more water was diverted from the streams and rivers, it became evident that storage was necessary to supply water in the months of low flow. Some of these early reservoirs were constructed by individuals or small groups of farmers for their own use.

Over the years many larger irrigation water storage structures were constructed. The major structures for the storage of the Basins' irrigation water are Lahontan Reservoir of the Newlands Project which was finished in 1915; Topaz Lake, completed in 1922; Bridgeport Reservoir in 1923; Weber in 1934; and Boca in 1939. Lake Leavitt, Hog Flat, and McCoy Flat were built in 1891. A dam was constructed in 1874 at the outlet of Lake Tahoe providing storage for irrigation water. Additionally, numerous small private reservoirs were built to store water for irrigation.

Prior to the construction of irrigation storage reservoirs, the estimated irrigated land in the Basin in 1900 was 252,000 acres. In 1970, irrigated acreage was estimated at 364,300 acres. Despite the loss of cropland to urbanization, the overall increase of irrigated land is 112,300 acres. This increase is attributed principally to irrigation water storage.

Livestock Numbers

With the settlement and development of the valleys into agricultural units, livestock in large numbers were brought into the Basin. Thompson and West, the historical authority for the period, in 1873 listed 72,990 head of livestock in the Central Lahontan Basin.

Concurrent with early settlement in the Basin, thousands of sheep were beginning to use the Sierra Nevada for summer range. Not only did they come from the nearby counties in Nevada, but also from the Sacramento Valley and Southern California. From the end of the Civil War and into the early 1900's, sheep raising was the leading agricultural industry in California. One band quickly followed another from the winter ranges, and all of the thoroughfares into the Sierra were clogged with half-starved sheep eating every blade of grass, every shrub, and every forb along their way. It is reported that in 1871, 22,000,000 pounds of wool were shipped to the mills either in the East or San Francisco. Their comings and goings were worse than a plague to the cattle ranches whose property the sheepmen had to cross on their nomadic journeys to and from the mountain summer ranges.

With the development of irrigated haylands and pastures, the numbers of livestock in the Basin increased rapidly. By 1920, every acre of rangeland was literally covered with cattle, sheep, and horses--sometimes on a year-long basis. Cattlemen and sheepmen contested for use of rangeland and the water sources, with occasional human tragedy resulting and almost complete disaster to the rangeland as a long-term consequence. Today many thousands of acres of rangeland still haven't recovered from this abuse.

Livestock numbers declined after 1920, particularly sheep numbers, which dropped rather rapidly. Numbers of cattle gradually increased. By 1920, year-long grazing permitted a greater amount of forage to be taken from the rangeland than is allowed today, as presently most livestock are fed on the ranch from four to six months of the year. Land-managing agencies at the present time consider the federal ranges and most of the private range as being stocked at their capacity. This would indicate, therefore, that for many years the range and forested grazing lands were overstocked. It is estimated that range, forest, and pasture lands presently supply about 60 percent of the livestock needs leaving an additional 40 percent to be provided by other feeds such as hay, grain, or ensilage, or shipment of livestock to be fed elsewhere.

Mining

While settlement of the valleys for agriculture was taking place, the mining of silver and gold started in the Basin. The discovery of silver in June 1859 in the Comstock Lode brought hordes of prospectors to the Basin. In a few years mining camps sprang up at many locations. Among the most noted for mineral production were Aurora, Bodie, Pine Grove, Gold Hill, Rockland, Rawhide, Leete, LaPlata, Wonder, Como, Ramsey, Silver City, Virginia City, Jumbo, Olighhouse, Pyramid City, Desert Queen, and Silver Mountain. Aurora, Bodie, and Virginia City were the most celebrated, and gained world fame for their ore production. From the 1860's to the turn of the century, over a half billion dollars worth of ore was processed into metal, principally gold and silver.

It is an understatement to say that the mining activity in the Basin had an enormous impact on the locality, nationally and internationally. It had an impact that is beyond imagination, beyond description. It affected thousands of people, caused the exploitation, deterioration, and in some cases, destruction of natural resources; had a marked influence on the stock market; provided a ready market for the local agricultural products; produced millionaires; built the Trans Atlantic cable; founded the University of Nevada's Mackay School of Mines; and was the basic reason Nevada became a state at the time of the Civil War. It built the Virginia-Truckee Railroad; the Virginia-Marlette Lake Water System; the Sutro Tunnel; caused many miles of wagon roads to be constructed; and developed new mining techniques that are still in use today.

Prospecting and mining activities, until recently, developed with total disregard to other resources and esthetic values. As a result, there are hundreds of acres of unsightly dumps, tailings, prospect holes, rusted and useless broken equipment, and buildings dotting the landscape in the mining area. Some of these scars will never heal. In other cases, tailing deposits are polluting streams which probably can never be corrected. It could be said the mines created immense wealth, but at tremendous resource cost, which will be paid by ensuing generations.

Lumbering and Wood Production

Timber harvest and sawmilling in the Central Lahontan Basin went through three distinct periods. The first - 1849 to 1890, was the period of settlement, extensive mining activity, and land acquisition by large companies. The second - 1890 to 1930, was a time of great expansion and exploitation of the forests culminating in the abrupt decline of the industry during the depression years. The third - 1930 to present, has been the period of reorganization marked by mergers and land exchanges with the Federal Government. The timber companies have, in most cases, depleted the timber resources on their lands.

The demand for timber and firewood for mining in and around Virginia City was tremendous. Transportation systems had to be developed to bring the timber resource to the point of use. V-flumes were developed to bring timber and lumber from the Sierra crest to the valley floor.

Inclined railway of the Sierra Nevada Wood & Lumber Company at Incline Village, Lake Tahoe, about 1890. Finished lumber was hauled to the top of the incline, then transported by V-flume to Carson City and hauled by rail to Virginia City. The denuded slope in the background was typical of the Sierra Nevada timberlands after logging. The Ponderosa Ranch recreation facility now stands on this site. Victor Goodwin photo.

Lumber yard near Carson City about 1875 where Sierra Nevada wood products were collected and transported by rail to Virginia City for use in the Comstock mines. Victor Goodwin photo.

Hauling logs to a mill near Truckee, California, in 1886, Nevada Historical Society photo.

Sawmills were established in the Sierra Nevada around Lake Tahoe. Timber was cut in the Tahoe Basin and rafted to sawmills at Glenbrook and Incline. From there the lumber was taken up the west side of the crest by tram or rail, then flumed down to the valleys. The estimated production from 1879 to 1896 is given at two hundred million board feet of lumber and over a million cords of wood. Major portions of these mountains were literally stripped of virgin timber. Old photographs substantiate this fact.

At one time there were at least fourteen sawmills in the middle Truckee area. From 1867 to 1880 it was estimated that 500 million board feet of lumber was milled and shipped from these mills.

In the Calvada Subbasin several large mills were established and operated between 1911 and 1956. Red River Lumber Company was reported to be the largest mill in the world. Its Westwood mill capacity was 750,000 board feet per day. During this period the combined harvest and mill production amounted to 5.9 billion board feet.

Most of the mills operated on a "cut out-get out" operation. It was not until 1932 that a policy was established that four seed trees at least 18 inches in diameter be left per acre. This was the first woodland conservation act instituted by private industry within the Basin. A 1935 Forest Service report referring to the Red River Lumber Company lands stated that the cutover lands have been so heavily punished by logging and fire that no further timber harvest will be possible short of a full rotation of 120 years.

Two major users of the timber were the Central Pacific Railroad and the mining industry in and around Virginia City. The snowsheds took 65 million board feet of lumber, and the mines took over 600 million board feet of 14 x 14 or 16 x 16 Deidesheimer square-set timbers. The interior mountain ranges in Nevada were not left untouched. There was a need for cord wood. In the Dayton area, the demand was 1,815 cords of wood per day for a number of years.

Another industry using wood as its primary resource was the pulp and paper mill at Floriston, California. It operated between 1900 and 1930. This industry not only contributed to the depletion of the timber but had a marked effect on the fishery resource. Acid wastes from the pulp mill, along with sawmill wastes, were the principal contributing factors to the degradation of the Truckee River fishery for Lahontan cutthroat trout.

Ice Industry

An early industry of significance was ice harvesting by several companies from the period 1874 to 1902. Ice was cut from the ponds in the Truckee area during the winter months, stored, then shipped by rail throughout the year to the Comstock Lode to cool the mines. The Consolidated Virginia Mine used $1,700 worth of ice daily to cool the sweltering mines. It was also shipped to San Francisco where it was considered superior to artificial ice.

Another demand was created when long strings of railroad refrigerator cars began carrying produce from California eastward. Icing stations were located along the Central Pacific track to service these cars. Ice production companies were located at Boca, Prosser Creek, Bronco Creek, Essex, and Gray Creek.

Today only at Gray Creek, which is located on the south side of the Truckee River west of the California-Nevada border, can be seen any remnants of this once-thriving industry. A large washed-out log dam and totally desecrated reservoir basin still scar the landscape. Because of the long period of time that water was impounded, the reservoir basin is almost devoid of vegetation. It is also dotted with flood debris and raw sediment banks which are significant point sources of sediment pollution to the Truckee River.

The industry thrived through the 1880's and 1890's, employing hundreds of men, and harvesting up to 60,000 tons of ice annually. After the turn of the century, the industry eventually gave way to more advanced methods of cooling and refrigeration.

Railroads

The building of the Central Pacific Railroad through the Basin during the 1866 to 1868 period had a profound impact on the Basin's land resources. The Federal Government granted every other section of land for twenty miles on either side of the track to the railroad as an incentive for construction. The railroad (now Southern Pacific) still owns many thousands of acres of this land today.

Grazing and timber harvesting rights have been leased by the railroad to other companies or individuals for years.

As a result, at least until recent times, there was little or no control over harvesting the timber or forage resources from these lands. Widespread exploitation became commonplace. Because of the alternate land ownership pattern, it is extremely difficult to achieve good grazing management, fire control, and timber harvest management. Sparks from the boilers started thousands of forest and range fires which many times went unchecked until burned out.

The railroads had immeasurable constructive influence on the development of the Basin. Besides hauling in supplies needed by the miners and ranchers, and transporting out lumber and bullion products, they provided rapid access for the hundreds of settlers and travelers to the Basin from both the East and the West. In addition, they provided the counties with millions of dollars worth of revenue in taxable property. This revenue has been collected from the railroads for use within the counties to help support the county and city governments.

Soon after the Central Pacific Railroad was completed in May 1866, other early railroads were constructed such as the Virginia and Truckee (1872), the Nevada-California-Oregon (1890), and the Carson-Colorado (1888).

Harvesting ice near Boca about 1900. Victor Goodwin photo.

C H A P T E R III

NATURAL RESOURCES

H i g h l i g h t

This chapter presents a broad overview of some of the more important enviromental values in the Basin, and an accounting of significant water and related land resource features. It also reviews the use and management that is being made of the resources today. This information provides the basis for determining the problems and needs concerning the Basin's natural resources.

CONTENTS

Environmental Setting

The historic settlement and development along with the associated impacts on the Basin environment have been described. Though the effect on resources was enormous, it has not been totally permanent. During the past 50 years, with initiation of resource conservation programs, nature's healing processes have functioned well. In many areas the vast expanses of clear-cut timberlands have developed into fine second growth timber stands Many acres of severely deteriorated rangelands are slowly regaining their vigor. In several locations, severely eroded areas are undergoing natural restoration. A resource inventory of the Basin's resources as they exist today is now presented.

The Central Lahontan Basin is located in eastern California and western Nevada. It contains approximately 10,661,425 acres, with about 33 percent in California and 67 percent in Nevada. Percent land use within the Basin is: cropland, 3.6; water area, 3.9; urban, 1.2; forest, 9.9; and rangeland 81.4. These percentages do not necessarily agree with other figures in this report since multiple use is the rule and not the exception.

Visual Quality

The Basin is overwhelmingly natural in appearance. Obvious works of men occupy only a minor part of the area. Mountains and valleys can be seen from any position. Minutes away from any populated center one can experience solitude.

Scenery is abundant and diverse. Streams originating in alpine meadows descend through forest to the desert and disappear. In the lowland, the scars of the Ice Age are seen everywhere. Ancient Lake Lahontan shorelines can be followed for hundreds of miles through about one-fourth of the Basin. The lake bars, spits, and wave cuts can be readily seen and identified by anyone. These features clearly indicate that the area was once humid. Subsequent drying was slow enough for lower life forms to develop unusual modifications to survive in the oncoming harsh desert environment. This partially explains the abundance of unusual plant and animal species.

Most of the desert's teeming plant and animal life forms survive drought in a state of torpid hibernation. When the infrequent, uncertain rainstorms come these organisms spring

This view of Truckee,California, with Donner Lake in background illustrates man's influences on a wildland environment. Utility lines, freeways, railroad and industrial facilities, subdivisions and recreational areas are noticeable here. Truckee River Subbasin.

This Indian ceremonial ring of rocks is one of many historical and archealogical artifacts found in the Basin. Walker River Subbasin.

into their life functions at a rate seldom seen in other environments. It would compare to watching time-lapse movies. Further upslope where moisture is more dependable, vegetation is more diverse and higher forms of animal life exist.

During the Lake Lahontan and earlier pluvial time periods, glaciation occurred in the high mountains. Excavation and deposition created many small lakes that can be seen today. Other water surfaces are prominent features. There are 1,271 miles of fishable rivers and streams and 335,000 acres of lakes. Today, two large lakes, Walker and Pyramid, occur in a very unique desert setting.

Changing vistas are common. Though summer is mostly clear and sunny, high cumulus clouds frequently develop over the mountains, and often attain massive proportions adding variety to the scene. In the fall splotches of brilliant and intermingling foliage colors provide a spectacular display, followed by deep snow and hoary frosts of winter. As the snow recedes with snow remnants clinging to the high mountain peaks and ridges, the spring flower show begins at the lower elevations. If missed below it can be viewed later at a higher elevation. A potpourri of changing vistas are highly visible throughout the Basin.

Historical and Archeological Features

The Basin is a historian's dream. There are old mansions, emigrant trails, ghost towns, and other items of historic interest located throughout. There are at least 18 known emigrant trails and other historic roads that traverse the area. In addition, there are over 130 places that have been classified as having historical significance. CHAPTER II of this report has a more complete discussion of the Basin's history.

The Basin contains a vast storehouse of archeological fact and knowledge. The huge expanses of open arid lands, the relatively mild climate, and the widely disbursed water resources made the area well suited to habitation by early man. Many archeological sites have been identified and more are continually being uncovered. Many of the significant sites are located around the natural lakes of the Basin; lesser sites are located along the natural river courses. Scattered throughout the more remote areas are hunting stations or temporary camps where only some petroglyphs or rock writings may indicate an early use.

Fish and Wildlife

This resource is abundant in the Basin. Big game species abound in various locations. Upland game is present in most areas and the Basin is noted for mourning dove, pheasant, chukar and sage grouse hunting.

The lakes, reservoirs, and marshes are important to the waterfowl of the Pacific Flyway. Numerous waterfowl and shore birds nest around higher mountain lakes and meadows, as well as the lower irrigated meadows, pastures, and marshes.

The water resources of the Basin support both cold and warm water fisheries, and contain both stocked and native game fish.

Threatened Species

The alert observer may encounter several of the species listed in the 1973 edition of "Threatened Wildlife of the United States," published by the USDI Fish and Wildlife Service, when visiting the Basin. Many unique wildlife species such as bald eagles, golden eagles, white pelicans, ospreys, and two species of falcons are found in scattered locations in the Basin. The discovery of these unique or threatened wildlife species can add a new dimension to the diversity of the fish and wildlife resources of the area.

Natural Lakes

Extreme environmental concern is expressed for many of the Basin's natural lakes. Lake Tahoe is one of the world's clearest and most beautiful fresh water lakes. Major concern for this unique natural resource is centered around the quality of the water. The environmental concerns for Pyramid and Walker Lakes are similar. Both are terminal desert lakes and historically have both been receding. As these lakes become smaller, the mineral and salt content of the water increases. Consequently, the environmental concern of both lakes are centered around ways to increase the quantity and improve the quality of the waters going into them.

Climate

Variation in altitude and position of mountains make for wide extremes in the Basin climate. It ranges from warm-dry to cold-wet, desert to alpine, arid to subhumid.

All of these conditions are found within a thirty mile radius in the southern Walker Subbasin. The driest and warmest weather record is Thorne near the south shore of Walker Lake, which lies within the rain shadow of Mt. Grant. Pacific storms must pass over three other ranges of similar altitude before reaching this area. The Sierra Nevada is the westernmost, and wettest and coldest part of the Basin. Donner Pass represents a low point in its jagged crestline, boasting the highest snowfall, for its altitude and position of any point on earth.

Precipitation varies from about 3 to 60 inches, see Map 4. Most of this occurs as snow from November to February. Summer is mostly dry but scattered thundershowers occur. These vary from a sprinkle to flash-flood producing storms which can occur anywhere during any month of the year. Table 2 provides climate data for 15 locations.

Basin soils reflect prehistoric climate as well as the current situation. The General Soil Map, Map 5, indicates to some extent the geography of both precipitation and temperature. Figure 1 shows a typical seasonal variation in precipitation and temperatures.

Table 2 -- Climatic data for 15 selected stations, Central Lahontan Basin

Station	Elevation	Mean annual temperature	Frost-free season	Mean annual precipitation
	(feet)	(°F.)	(days)	(inches)
Boca, CA	5,532	41.7	10	-
Bridgeport, CA	6,420	43.0	51	10.20
Carson City, NV	4,675	49.7	123	10.81
Donner Park, CA	5,937	-	-	37.55
Fallon, NV	3,965	50.9	150	4.81
Glenbrook, NV	6,400	47.1	118	17.27
Hawthorne, NV	4,186	55.1	135	4.58
Lahontan Dam, NV	4,158	54.0	159	4.21
Minden, NV	4,700	49.4	104	9.35
Reno, NV	4,397	49.2	129	6.94
Schurz, NV	4,124	52.3	112	5.31
Smith, NV	4,750	49.4	90	6.69
Susanville, CA	4,195	49.5	121	15.27
Tahoe City, CA	6,228	42.4	77	30.27
Truckee, CA	5,982	43.5	30	28.12
Yerington, NV	4,375	50.1	107	4.79

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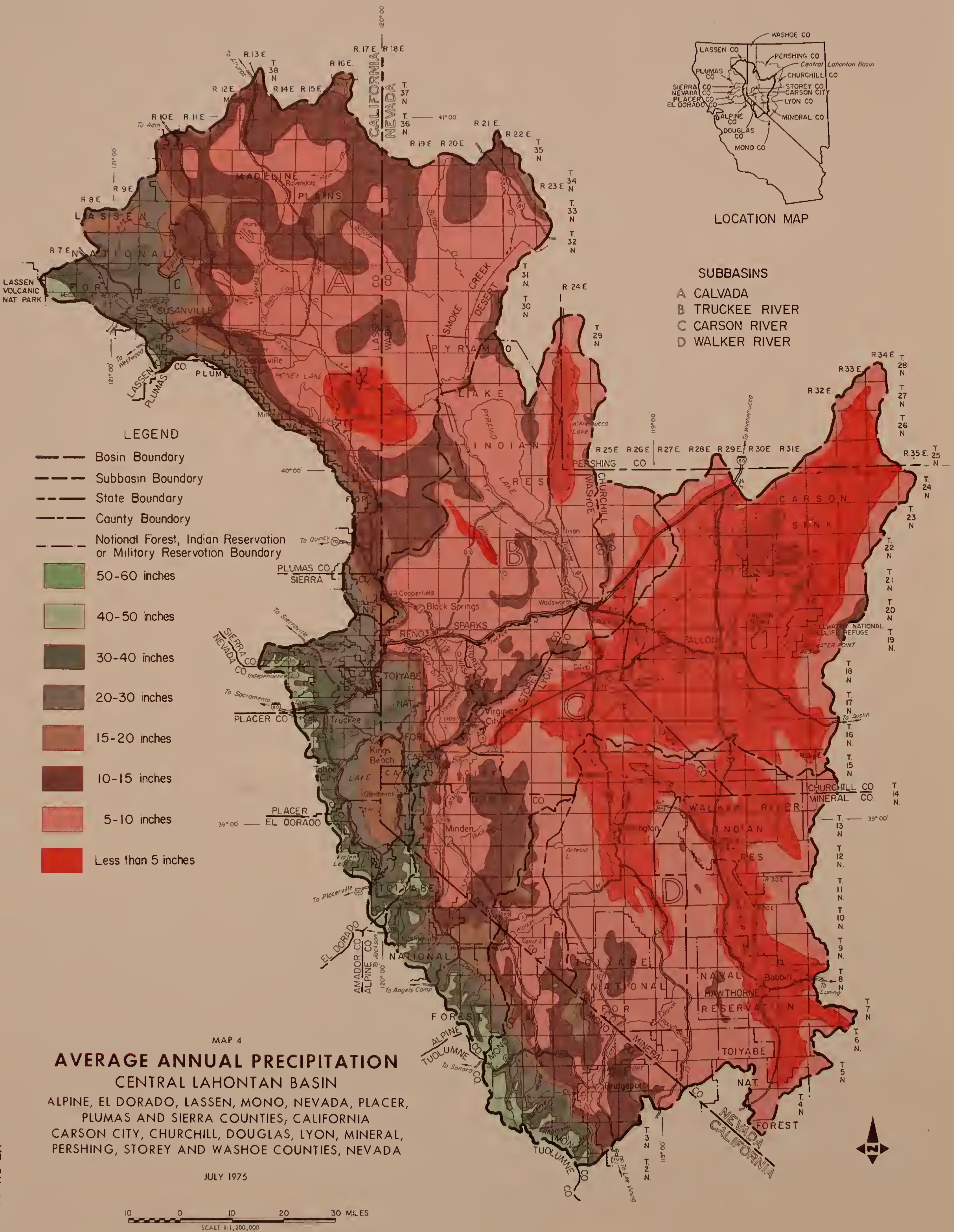


MAP 4

AVERAGE ANNUAL PRECIPITATION

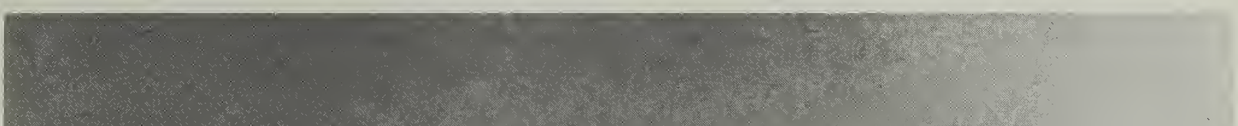
CENTRAL LAHONTAN BASIN

ALPINE, EL DORADO, LASSEN, MONO, NEVADA, PLACER, PLUMAS AND SIERRA COUNTIES, CALIFORNIA
CARSON CITY, CHURCHILL, DOUGLAS, LYON, MINERAL, PERSHING, STOREY AND WASHOE COUNTIES, NEVADA

JULY 1975

M7-PN-23033

Winter snowpack at Donner Summit, in the Sierra Nevada, Truckee Subbasin



The arid Smoke Creek Desert, annual precipitation 2-4", Calvada Subbasin

Wind sufficient to carry particulate matter moves northeasterly in direction as indicated by position and nature of eolian deposits. In addition, wind travels up and down mountain slopes. This air movement has a drying effect which causes high evaporation and generally low humidity.

Temperature inversions occur within the valleys during much of the year. The ceilings vary in height in different valleys. Tornadoes have occurred but are rare. Hailstorms occur more frequently but the hailstones are usually small in size and rarely cause damage. Length of growing season varies from about 130 days at lower elevations to less than 30 days in the high mountain valleys.

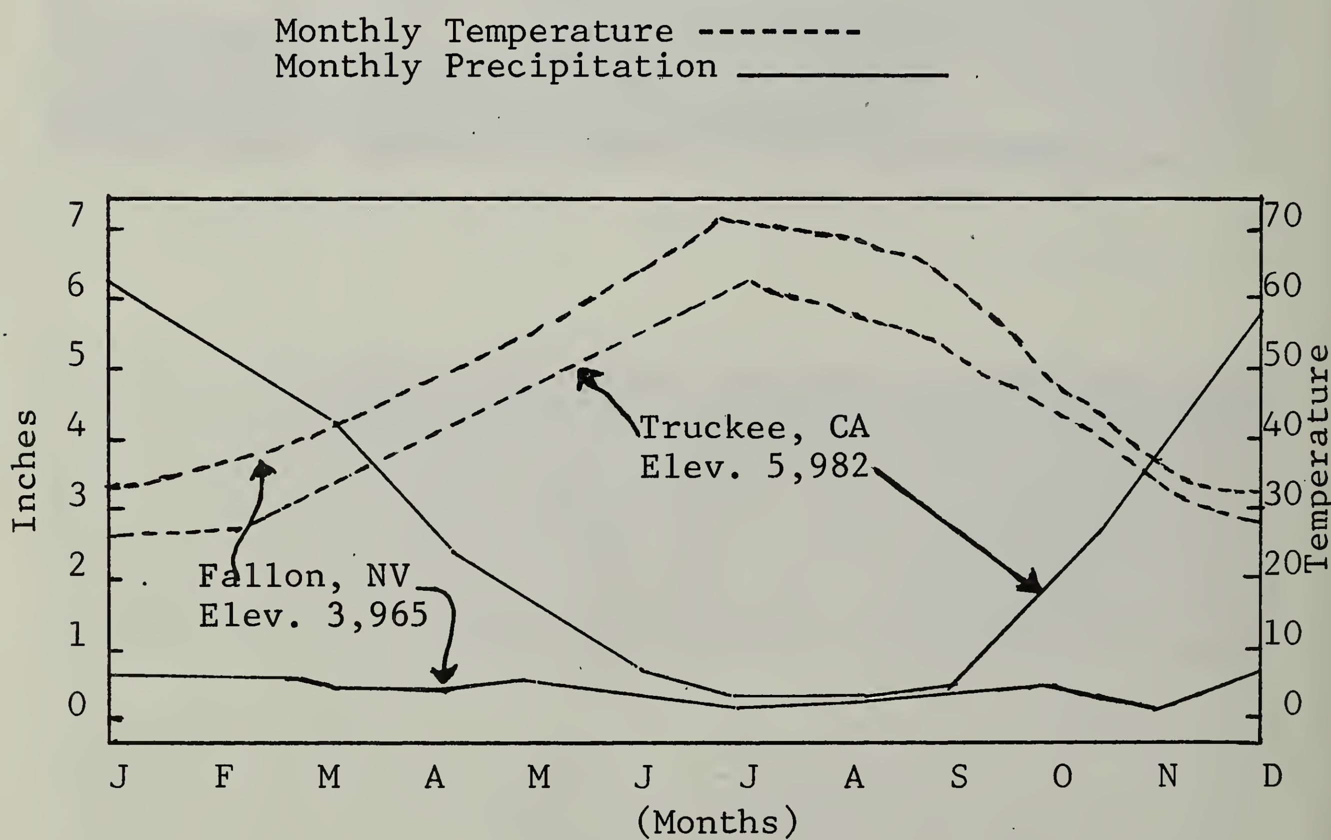


Figure 1. -- Comparison of an upland mountain station (Truckee) and lowland valley station (Fallon).

Physical Geography

The Central Lahontan River Basin mostly lies within a western part of the Basin and Range and eastern side of the Sierra Nevada physiographic provinces. Thirty-four large valleys, separated by an equal number of mountains or ranges, are present. In addition, there are numerous small valleys and their adjacent mountains. The Basin is divided into four subbasins. From south to north they are dominantly the watersheds of the Walker, Carson, and Truckee Rivers and are so named. The fourth and northern subbasin includes the drainages of Honey Lake Valley, Eagle Lake, Smoke Creek Desert, and Madeline Plains, collectively named the Calvada Subbasin.

The crest of the Sierra Nevada, which joins the Cascade Range in the north forms the Basin western hydrologic divide. Excelsior Mountain at the south end is the highest elevation, 12,440 feet above sea level. Though the crest line is jagged, it gradually lowers to 7,119 feet at Tule Mountain on the north end. This situation is somewhat reversed on the east side divide. There, it starts at near 8,000 feet in the south culminating at 9,056 feet on Granite Peak at the north end. Mountain summits are generally 2,000 to 5,000 feet above adjacent valley floors. A few exceed this.

Mountain slopes vary by subbasin. Slope percentages by subbasin from south to north are shown in the following tabulation:

Subbasin	Slope groups - %				
	0-5	5-15	15-30	30-50	50+
	Percent of Subbasin				
Walker	22.6	20.1	12.4	20.2	20.7
Carson	26.1	17.3	22.5	20.6	13.5
Truckee	17.5	19.7	11.6	35.4	16.1
Calvada	28.5	25.6	17.1	25.9	2.9
Basin Total	24.4	21.2	15.9	25.0	13.5

Land Resources

Geology

A brief summation of the Basin geology follows. More detailed information is provided in APPENDIX II. The 1969 USDA Report of Water and Related Land Resources - Walker River Subbasin, Nevada-California has more detail for the Walker Subbasin. These reports include generalized geology maps and more detailed discussions.

The present mountainous topography is a result of block faulting, warping, and erosion which began in pre-Pliocene time and continues to the present. Basement rocks are regionally and thermally metamorphosed volcanic and sedimentary rocks which have been intruded by granitic rocks of Cretaceous age.

These are overlain by voluminous Cenozoic volcanic and sedimentary deposits of lakes and streams. Rocks of marine origin are rare. The earliest flows were rhyolite followed by andesite and tuffbreccias. The most recent flows are basalts which predominate in the north. Granitic intrusive rocks are exposed in many parts of the Basin.

Deposits and structures resulting from at least four periods of Pleistocene glaciation are present. Concurrent with these periods, numerous lakes and rivers occupied the lowlands. The most recent, covering about one-fourth of the Basin, occurred in the late Pleistocene time. This was Lake Lahontan which left a complete record of its existence, much of which is evident today.

Tectonic activity, though diminishing, continues to the present. Numerous epicenters for historical earthquakes are present within the Basin. The east piedmont of the Carson Range is active and poses a problem for any development along the fault zones. About 50 thermal springs occur within the study area of which about three-fourths are in Nevada.

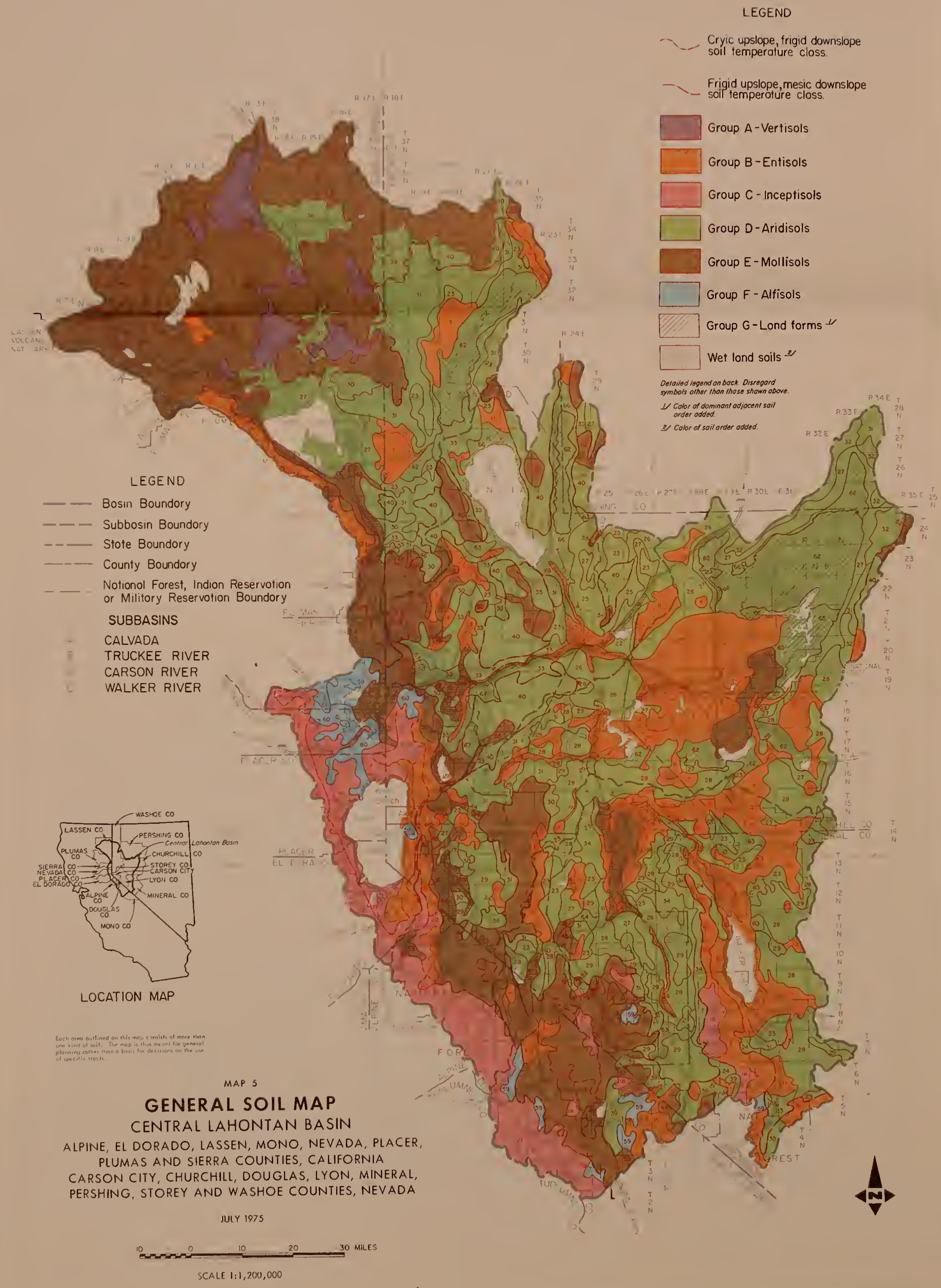
Geothermal Conditions

Numerous warm to hot springs are scattered throughout the Basin indicating the widespread occurrence of geothermal conditions. Steam vents issue from many of these springs. Other than a few spas in the Reno-Carson City area and a greenhouse heating development near Wabuska, little use has been made of these geothermal conditions. There is considerable interest in development of this resource for pollution-free power generation.

Soils

The soils of the Basin are complex. Seven of the ten taxonomic orders are present. Details on this resource, used by technicians, have been prepared and issued for each of the subbasins and the Basin as APPENDIX I.

The broad characteristics and relationships on Map 5 can be used, in a general way, to interpret potential of soils for agricultural, recreational, commercial, and industrial uses. Considerations involving erosion potential, water yield, sediment yield, present land use, and future development are



MAP 5

GENERAL SOIL MAP

CENTRAL LAHONTAN BASIN

ALPINE, EL DORADO, LASSEN, MONO, NEVADA, PLACER, PLUMAS AND SIERRA COUNTIES, CALIFORNIA
CARSON CITY, CHURCHILL, DOUGLAS, LYON, MINERAL, PERSHING, STOREY AND WASHOE COUNTIES, NEVADA

JULY 1975

GENERAL SOIL MAP LEGEND
CENTRAL LAHONTAN BASIN

Group A - Vertisols

Clay soils with tendency to crack to surface upon drying.

1. Chromoxererts, warm. Moderately deep and deep, dark-colored soils with open cracks more than 60 days annually on slopes usually less than 5%. Mesic.*

2. Chromoxererts, cool. Moderately deep and deep, dark-colored soils with open cracks more than 60 days annually on slopes usually less than 5%. Frigid.*

Group B - Entisols

Soils that have not accumulated sufficient organic matter to darken surface soil appreciably nor to weather in place enough to have characteristics of other groups.

3. Torrifluvents. Usually dry, stratified, bottom land soils having uneven profile organic matter distribution indicating occassional sedimentation, nearly level. Mesic.

4. Aquents - Aquolls - Orthents - Alluvial Land. River flood plain soils and geologic deposits with variable texture, stoniness, and drainage with slopes usually less than 2%. Non-saline. Mesic.

5. Orthents - Xerolls - Orthids. Low laying soils with variable texture and depth, affected by groundwater, and having slopes usually less than 2%. Saline. Mesic.

6. Xerofluvents - Maploxerolls, drained. Stratified soils of various textures occupying nearly level flood plain, reclaimed. Mesic.

7. Torripsamments - Salorthids - Playa. Numerous sand dunes and nearly level, fine-textures, saline-alkali snils and playa. Mesic.

8. Torripsamments - Durorthids. Essentially blow sand covered mountains with highly variable slopes. Shallow durorthids and included durargids occupy interspersed exposed mountain or hill tops, slopes 15 tn 50%. Mesic.

9. Torripsamments. Usually dry, very deep sandy soils occupying stony and rocky alluvial fans with generally less than 30% slopes. Mesic.

10. Torripsamments, dune land. Usually dry dune land with deep or moderately deep sandy soils with general land slope less than 15% except steep dune sideslopes. Mesic..

11. Torriorthents - Torripsamments. Very deep, coarse loamy or sandy soils occupying alluvial fans with slopes less than 15%. Mesic.

12. Torriorthents. Usually dry, coarse-textured soils occupying rocky mountain slopes generally less than 50%. Mesic.

13. Xeropsamments - Rock land. Usually moist, moderately deep sandy soils and rock land occupying mountains with slopes less than 50%. Mesic.

14. Xeropsamments. Usually moist, very deep, sandy soils occupying alluvial fans and flood channels with less than 15%.slopes. Mesic.

15. Xeropsamments - Rock outcrop. Usually mnist, sandy soils on rocky granitic mountains with slopes up to 70%. Includes wind-blown sands entrapped on volcanic flows and in craters in south Walker Subbasin. Frigid.

16. Xerorthents. Usually moist, coarse-textured soils occupying steep mountain slopes. Frigid.

17. Cryopsamments - Cryorthents. Shallow, rocky, coarse loamy and sandy soils occupying high, cold mountains, with slopes to 70%. Cryic.*

Group C - Inceptisols

Usually moist soils showing discernible weathering but not sufficient for following groups.

18. Xerochrepts - Maploxerolls. Stony and rocky mostly coarse-textured soils on steep slopes including moderately fine-textured soils in valley bottoms and mountains, 15 to 70% slopes. Frigid.

19. Xerumbrepts. Stony, coarse loamy soils occupying mountain slopes, glacial deposits, and small valleys with slopes usually less than 50%. Frigid.

20. Xerumbrepts - Xerochrepts. Moderately deep, very stony, gravelly loams occupying mountains, glacial deposits, and small valleys with slopes usually less than 50%. Frigid.

21. Cryumbrepts - Cryochrepts - Rock land. Rocky and stony, mostly shallow, coarse loamy soils occupying highest mountains with slopes usually more than 50%. Cryic.

Group D. Aridisols

Usually dry, low organic matter soils with slight to very strong weathering profiles.

22. Salorthids. Mighly saline-alkali, fine-textured soils occupying wet lowland with slopes less than 1%. Includes some brackish ponds. Mesic.

23. Camborthids. Mostly very deep, coarse loamy soils occupying alluvial plains or fans with slopes less than 15%; most with stony surfaces, non-stony in Carson Valley; may include some haplargids in Truckee Subbasin. Mesic.

24. Durorthids. Stony and rocky soils, shallow to duripan on mountain slopes and narrow valley fans with slopes usually less than 30%. Mesic.

25. Natrargids - Maplargids. Alkaline, deep and moderately deep, fine loamy soils occupying very stony mountains and hills with slopes generally 30 to 50%. Includes considerable rubble land. Mesic.

26. Nadurargids - Natrargids - Torriorthents. Alkaline soils generally shallow to duripan or bedrock occupying mountains or hills generally exceeding 30% slopes. Mesic.

27. Natrargids - Durargids. Fine-textured, saline-alkali soils, nearly level and shallow, loamy soils occupying terraces or alluvial fans with slopes usually less than 15%, mostly stony. Mesic.

28. Durargids - Durorthids - Rock land. Shallow, fine and loamy soils with stony surfaces occupying mountains with slopes greater than 15%. Mesic.

29. Durargids. Stony, moderately deep to duripan soils with fine loamy or fine-textured subsoils occupying alluvial fans or pediments with slopes usually less than 15%. Mesic.

30. Maplargids, sediments. Deep, fine and fine loamy soils occupying non-stony alluvial fans or pediments with less than 15% slopes. Mesic.

31. Maplargids, residuum. Shallow and moderately deep, fine-textured soils occupying mountain slopes and lava plateaus with usual slopes of 15% to 50%. Mesic.

32. Maplargids - Durargids - Rock land. Shallow and moderately deep, fine and loamy soils with stony surfaces occupying mountains with slopes less than 50%. Mesic.

33. Lithic Maplargids. Neutral, fine and fine loamy, shallow to bedrock soils occupying stony mountains and hills with 15 to 50% slopes. Mesic.

34. Paleargids. Very stony, moderately deep to duripan with strong clayey subsoils occupying old alluvial fans with slopes generally less than 15%. Mesic.

35. Camborthids - Maplargids. Shallow loamy soils occupying stony and extremely steep mountains, slopes 30 to 70%. Frigid.

36. Durargids - Paleargids. Moderately deep, stony-surfaced, fine-textured soils occupying mountain slopes less than 50%. Frigid.

37. Natrargids. Moderately deep fine loamy soils occupying basin rims having slopes less than 5%. Frigid.

38. Natrargids - Maplargids. Moderately deep, fine-textured soils occupying nearly level basins. Frigid.

39. Maplargids, moderately steep. Very stony, fine-textured soils occupying table land or hill slopes generally less than 30%. Frigid.

40. Maplargids, steep. Shallow and moderately deep, fine-textured stony soils occupying plateau and mountain slopes usually 30 to 50%. Frigid.

Group E - Mollisols.

Soils having dark colored surface horizons.

41. Maplaquolis. Poorly drained, fine loamy soils occupying nearly level bottom land; some drained. Mesic.

42. Maplaquolls - Argiaquolls. Deep, medium and fine-textured soils, poorly drained, occupying nearly level bottom land. Mesic.

43. Maplaquolls - Fresh Water Marsh - Ponds. Poorly drained, deep, fine-textured soils, marsh, and ponds, nearly level. Mesic.

44. Maplaquolls - Natrixerolls - Nadurargids. Ground water affected soils of various textures occupying nearly level river terraces. Mesic.

45. Maploxerolls. Very deep, sandy or coarse loamy soils occupying bottom land or alluvial fans generally less than 15% slopes. Mesic.

46. Haploxerolls - Argixerolls. Shallow to bedrock, stony and loamy soils occupying hill slopes generally less than 30%. Mesic.

47. Argixerolls. Moderately deep fine and coarse loamy soils occupying dissected pediments or alluvial fans having slopes generally less than 15%. Mesic.

48. Argixerolls, warm. Moderately deep, gravelly and stony loamy soils occupying mountain slopes generally exceeding 30%. Mesic.

49. Argiaquolls - Maplaquolls. Poorly drained, deep, medium and fine-textured soils occupying nearly level bottom land. Frigid.

50. Maploxerolls - Durixerolls - Mistosols. Moderately deep to hardpan and very deep, fine to medium textured mineral and organic soils occupying nearly level bottom land. Frigid.

51. Durixerolls. Shallow and moderately deep to duripan; stony, medium and fine-textured soils occupying lower position of mountain slopes having slopes generally 15 to 30%. Frigid.

52. Maploxerolls - Rock Outcrops. Moderately deep, stony, coarse-textured soils occupying mountain slopes generally less than 50%. Frigid.

53. Argixerolls - Maplargids. Rocky and stony, moderately deep fine and fine loamy soils occupying mountain slopes of more than 30%. Frigid.

54. Argixerolls, cool. Stony, moderately deep to bedrock, clayey soils occupying pediments with slopes less than 15%. Frigid.

55. Argixerolls - Maploxerolls. Moderately deep and deep, fine and loamy soils occupying mountains with slopes generally less than 50%. Frigid.

56. Argixerolls - Alfisols, gently sloping. Shallow to deep over bedrock, fine and coarse loamy soils occupying lava beds with slopes generally less than 15%. Frigid.

57. Argixerolls - Alfisols, steep. Stony or rocky, shallow or moderately deep over bedrock, fine loamy soils occupying mountain slopes generally more than 30%. Frigid.

58. Cryoborolls - Rock land. Moderately deep, rocky, gravelly, and stony loams occupying high, cold mountain slopes. Cryic.

Group F - Alfisols.

Usually moist light colored, loamy surface over clayey soils.

59. Maploxeralfs, steep. Stony, deep soils on mountain slopes generally exceeding 30%. Frigid.

60. Haploxeralfs. Stony, deep soils on mountain slopes generally less than 15% slopes. Frigid.

61. Maploxeralfs - Durixeralfs. Very deep and moderately deep to duripan soils occupying basin-like areas with slopes generally less than 5%. Frigid.

Group G - Land forms

Geologic formations with few separable soils.

62. Playa. Dry, saline lake bottoms without vegetation. Mesic.

63. Rock land. Mostly rock outcrop with very little vegetation.

64. Badland. Mighly eroded areas truncating ancient lakebeds mostly without vegetation. Mesic.

65. Ponds - Maplaquolls. Numerous ponds and small lakes with some poorly drained, saline, fine-textured soils intermixed, nearly level. Mesic.

66. Old Beaches. A wide variety of Lake Lahontan bars, spits, shorelines, tufa, and lake or wind deposits; shallow, usually to tufa, thinly vegetated. Mesic.

67. Bleached rock land. Extremely acid, soft bedrock usually supporting Jeffrey pine trees with no understory, slopes usually exceeding 30%. Mesic or frigid.

* Refers to soil temperature regime usually at 20 inches depth, nr depth of soil, if shallower, as follnws:

Mesic: Mean annual soil temperature nf 47°F. to 59°F.
Frigid: Mean annual soil temperature of less than 47°F.
Cryic: Frigid soil temperature regime with mean summer soil temperature less than 59°F.

Winter and summer soil temperatures must exceed 9°F. for the above regimes.

Each area outlined on this map consists nf more than one kind nf snil. The map is thus meant for general planning rather than n basis for decisions on the use nf specific tracts.

interrelated with soils and their distribution.

Table 3 lists the dominant present use of each General Soil Map Unit and a rating of its physical use suitability according to criteria given which are available in this report. A physical land use suitability map, Map 8, was prepared from this rating.

General Soil Map unit 11 west of Reno. See Table 3 for details. Physical Land Use Suitability Map: cropland and urban, rating good.

Washoe Valley freeway construction. General Soil Map unit 43. Physical Land Use Suitability: wetland wildlife and meadow hay or pasture, rating good. Planners compare and evaluate the higher costs of construction and maintenance of such a site with those of alternative locations.

Table 3 - Characteristics, Problems, use, and Physical Suitability Rating for General Soil Map Units, Central Lahontan Basin

Map Unit	Acreage	Physiography	Dominant elevation (feet)	Mean precipitation (inches)	Mean temperature (F)	Frost-free period (days)	Soil temperature class 1/	Dominant parent material 2/	Dominant slope (%)	Dominant, Key Vegetation	Principal problems 3/	Present major use 4/	Dominant land use suitability rating 4/ 5/ 6/ 7/ good	fair	poor
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Chromoxererts	82,750	Basins, table land	4,500-5,000	5-10	47-49	110-140	mesic	basalt	<5	Big sagebrush	Percs slow, shrink-swell	G, Wd		G	C, U, Wd
2. Chromoxererts	106,900	Basins, table land	5,000-5,500	5-10	45-46	80-110	frigid	basalt	<5	Big sagebrush	Percs slow, shrink-swell	G, Wd		G, Wd	C, U
3. Torrifluvents	81,950	Playa fringe	3,800-4,100	<5-10	49-51	100-120	mesic	various	<5	Greasewood	Salt, water	G			G
4. Aquents-Aquolls-Orthents. Alluvial land	72,250	Flood plain	3,800-5,000	<5	50-54	110-130	mesic	various	<5	Sedges	Drainage	M, Ww	M, Ww	C, G	
5. Orthents-Xerolls-Orthids	48,300	Basins	3,900-4,100	<5	50-52	100-120	mesic	various	<5	Upland greasewood, shadscale, Indian ricegrass	Thin, salt	G			G
6. Xerofluvents-Haploxerolls, drained	35,850	Flood plain	3,900-4,100	<5	50-52	100-120	mesic	various	<5	Cropland	Drainage, salt	C, U	C	U	G
7. Torripsamments-Salorthids-playa	301,250	Basin	3,900-4,100	<5	50-52	100-120	mesic	various	<5	Shadscale, iodine bush, greasewood	Salt	G			G
8. Torripsamments-Durorthids	124,900	Mountain slopes	4,200-5,400	<5-10	50-52	100-120	mesic	various	15-50	Dalea, Indian ricegrass, shadscale	Rough, erosion	G		G	G
9. Torripsamments	23,850	Alluvial fans	4,000-5,000	<5	49-51	100-120	mesic	granite	<15	Upland greasewood, shadscale	Rough, water stones,	G	U		G
10. Torripsamments	243,350	Dunes	4,000-5,000	<5	50-54	110-130	mesic	various	<15	Indian ricegrass, shadscale	Water	G	U	C	G
11. Torriorthents-Torripsamments	164,950	Alluvial fans	4,000-5,200	<5-10	50-54	110-130	mesic	various	<15	Upland greasewood, Indian ricegrass	Water	C, G	C, U	G	
12. Torriorthents-Rock land	104,700	Mountains	4,500-6,500	<5-10	49-51	100-120	mesic	various	30-50	Shadscale, ephedra, upland greasewood	Rough, slope	G			G
13. Xeropsamments-Rock land	11,700	Mountains	4,500-6,000	5-15	47-49	100-120	mesic	granite	<50	Big sagebrush, bitterbrush	Rough, slope, reclaim	G, Wd		G, Wd	G

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
14. Xeropsamments	27,450	Alluvial fans	4,500-6,000	5-15	47-49	90-110	mesic	various	<15	Big sagebrush, bitterbrush, spiny hopsage	droughty	G, Wd	G	C, U, G	Wd
15. Xeropsamments-Rock outcrop 8/	253,000	Mountains	4,500-7,500	10-20	43-47	85-110	frigid	granite; Basalt in S.Walker Subbasin	30-70	Timber, and pinyon pine, mountain shrub	Erosion rough, reclaim	H, Wd, G, T, U		H	Wd, G, T,U
16. Xerorthents	157,850	Mountains	6,000-10,000	5-15	43-47	50-100	frigid	granite	50-70	Pinyon pine, big sagebrush	Erosion, rough, reclaim, droughty	Wd, G, H		Wd	G,H
17. Cryorthents	28,200	Mountains	8,000-10,000	15-40	38-42	0-40	cryic	various	30-70	Sub-alpine conifer and shrubs	Rough, thin rock, erosion, reclaim droughty	H, Wd		H	G,Wd
18. Xerochrepts-	58,750	Mountains and small valleys	7,000-8,500	5-15	44-47	50-100	frigid	granite	50-70	Pinyon pine, big sagebrush, mountain shrub	Rough, thin rock, erosion, reclaim	Wd, H, G		Wd	H,G
19. Xerumbrepts 8/	163,900	Mountains and small valleys	6,500-8,000	5-20	43-47	30-70	frigid	various	15-70	Mountain shrub, Jeffrey pine	Erosion, rough, thin	Wd, H, U, T, G	Wd	H,T, G	U,G, T
20. Xerumbepts-Xerochrepts	19,350	Mountains and small valleys	7,000-10,000	15-40	39-43	0-60	frigid	granite	30-70	Sub-alpine, conifer, mountain shrub	Erosion, rough, rock thin, droughty reclaim	Wd, H, T, G	Wd	H	T,G
21. Cryumbrepts-Cryochrepts-Rock land	426,950	Mountains	7,500-11,500	20-60	38-42	0-40	cryic	various	>50	Sub-alpine, conifer, shrubs	Erosion rough, rock thin, access access	H, Wd	H	Wd	T,G
22. Salorthids	20,300	Basin	3,900-4,100	<5-10	50-52	110-130	mesic	various	<5	Saltgrass	Salt, wet	Ww	Ww	G	G,
23. Camborthids	288,500	Alluvial fans	3,900-5,000	<5-15	47-51	110-130	mesic	various	<15	Big sagebrush, Upland greasewood, bitterbrush	Water	C, G, Wd	C, U	G	G,Wd

Map Unit	Acreage	Physiography	Dominant elevation (feet)	Mean precipitation (inches)	Mean temperature (F)	Frost-free period (days)	Soil temperature class 1/	Dominant parent material 2/	Dominant slope (%)	Dominant, Key Vegetation	Principal problems 3/	Present major use 4/	Dominant land use suitability rating 4/ 5/ 6/ 7/		
													good	fair	poor
24. Durorthids	73,200	Mountains and narrow valley fans	5,000-7,000	<5-15	47-51	100-120	mesic	volcanic	<30	Shadscale, upland greasewood, pinyon pine	Thin	G		G	
25. Natrargids-Haplargids	100,250	Mountains, hills	4,000-5,500	5-10	48-52	110-130	mesic	volcanic	30-50	Shadscale, upland greasewood, bud sagebrush	Slope, stones, salt, rough	G			G
26. Nadurargids-Natrargids-Torriorthents	358,150	Mountains	4,000-6,000	<5-10	47-51	100-120	mesic	volcanic	30-50	Low sagebrush, shadscale, upland greasewood,	Stones, shrink-swell, thin	G			G
27. Natrargids-Durargids	246,700	Terraces, alluvial fans	4,000-5,000	5-10	47-50	100-120	mesic	volcanic, sediments	<15	Low sagebrush, shadscale, upland greasewood	Stones, thin, shrink-swell	G, Wd		G	U, Wd
28. Durargids-Durorthids-Rock land	657,950	Mountains	4,000-6,000	<5-10	48-52	100-120	mesic	volcanic	>15	Low sagebrush, upland greasewood, shadscale	Rock, thin, stones	G		G	
29. Durargids	284,650	Alluvial fans, pediments	4,400-5,000	<5-10	48-52	120-150	mesic	volcanic sediments	<15	Low sagebrush, upland greasewood, shadscale	Thin, stones	G		G	U
30. Haplargids, Sediments	124,250	Alluvial fans, pediments	4,400-5,000	5-10	47-50	100-120	mesic	various	<15	Big sagebrush, bitterbrush	Water, shrink-swell	G, U, Wd	C	G	Wd, U
31. Haplargids, residuum	569,900	Mountains, lava plateaus	4,400-6,500	5-15	46-49	90-110	mesic	volcanic	15-50	Big sagebrush, bitterbrush	Stones, rough, shrink-swell	G, Wd		G, Wd	G
32. Haplargids-Durargids-Rock land	91,000	Mountains	4,000-7,000	5-15	47-50	100-120	mesic	volcanic	<50	Big and low sagebrush, shadscale, juniper	Stones, rough, slope, rock	G		G	G
33. Lithic-Haplargids	213,850	Mountains	4,000-7,000	5-15	46-49	90-110	mesic	volcanic	30-50	Big and low sagebrush, juniper	Stones, slope	G			G
34. Paleargids	48,350	Alluvial fans	4,000-6,000	5-10	48-51	110-130	mesic	volcanic	<15	Upland greasewood, shadscale, low sagebrush	Stones, shrink-swell	G		G	U
35. Camborthids-Haplargids	28,750	Mountains	4,500-8,000	5-15	44-46	90-110	frigid	volcanic	30-70	Big sagebrush, juniper, bitter, brush	Slope, rock, stones rough	G, Wd			G, Wd

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
36. Durargids-Paleargids	29,900	Mountains	5,500-7,000	5-15	45-46	80-110	frigid	volcanic	<50	Big sagebrush, pinyon-juniper	shrink-swell, stones, thin	G, Wd		G,Wd	G
37. Natrargids	26,200	Basin rims	4,200-5,000	<5-15	45-46	80-110	frigid	volcanic	<5	Big sagebrush	shrink-swell, salt	G		G	G, U
38. Natrargids-Haplargids	90,350	Basins	5,000-5,500	<5	44-46	80-110	frigid	volcanic	<5	Upland greasewood, shadscale	shrink-swell	G, Wd		G	Wd,U
39. Haplargids, moderately steep	92,000	Upland plateau	5,000-5,500	10-15	44-46	80-110	frigid	volcanic	<30	Big and low sagebrush	shrink-swell, stones, rough	G, Wd		G,Wd	G
40. Haplargids, steep	407,500	Mountains,	5,000-7,000	10-15	43-45	70-110	frigid	volcanic	30-70	Big sagebrush, juniper	shrink-swell, stones, rough	G, Wd		Wd	G
41. Haplaquolls	91,300	Bottom land	4,000-4,800	<5-10	48-52	100-130	mesic	various	<5	Wet meadow	Drainage	C, M, G, Ww, U	M,Ww	C,G,	U
42. Haplaquolls-Argiaquolls	32,150	Bottom land	4,500-5,000	5-10	47-50	100-130	mesic	various	<5	Wet meadow	Drainage	M, Ww, U, C, G	M,Ww	C,G,	U
43. Haplaquolls-Fresh water marsh-Ponds	96,500	Bottom land	3,800-4,000	<5-10	49-51	100-120	mesic	various	<5	Greasewood, saltgrass	Drainage	C, U, M, G, Ww	Ww,M	C,G,	U
44. Haplaquolls-Natrixerolls-Nadurargids	37,850	River terraces	4,500-5,000	5-10	47-49	100-120	mesic	various	<5	Sedges, greasewood, saltgrass	Drainages	C, M, G, U, Ww	Ww,M	C,G, U	
45. Haploxerolls	116,900	Botton land, alluvial fans	4,100-4,500	10-20	47-49	100-120	mesic	granite	<15	Big sagebrush, bitterbrush	Floods	U, Wd, C, G	C, G	Wd,U	
46. Haploxerolls-Argixerolls	14,600	Hills	4,000-4,500	10-15	47-49	110-140	mesic	volcanic	15-50	Big sagebrush, juniper, bitterbrush	Slope, stones	G, Wd	Wd,G		G,U
47. Argixerolls	62,200	Alluvial fans, pediments	4,800-5,800	10-15	47-49	100-120	mesic	various	<15	Big sagebrush, juniper, bitterbrush	Water	G, Wd, U		U,G	Wd
48. Argixerolls, warm	2,853	Mountains	4,800-5,800	5-10	47-49	100-120	mesic	volcanic	>30	Big sagebrush, pinyon pine, bitterbrush	Slope, rough stones	G, Wd		Wd	G
49. Argiaquolls-Haplaquolls	28,350	Bottom land	5,000-6,000	10-15	45-47	90-110	frigid	various	<5	Wet meadow	Drainage	G, M, Ww		Ww, M, G,	

Map Unit	Acreage	Physiography	Dominant elevation (feet)	Mean precipitation (inches)	Mean temperature (F)	Frost-free period (days)	Soil temperature class 1/	Dominant parent material 2/	Dominant slope (%)	Dominant, Key Vegetation	Principal problems 3/	Present major use 4/	Dominant land use suitability rating 4/ 5/ 6/ 7/		
50. Haplaquolls-Durixerolls-Histosolls	28,350	Bottom land	5,000-6,000	5-15	44-46	90-110	frigid	various	<5	Wet meadows, big sagebrush	Drainage	G, M, Wd Ww		G,M, Ww	U
51. Durixerolls	32,750	Mountain foot slopes	5,500-7,500	5-15	44-46	80-110	frigid	volcanic	30-50	Pinyon pine, big and low sagebrush, bitterbrush	Slope stones	G, Wd		Wd	G
52. Haploxerolls-Rock outcrop	287,600	Mountains	6,000-8,000	10-20	40-44	25-60	frigid	granite	<50	Pinyon-juniper, bitterbrush, sagebrush, Mtn. mahogany	Slope, stones, droughty, reclaim	G, Wd	Wd	G	G
53. Argixerolls Haploxerolls	1,357,900	Mountains	6,000-8,000	10-20	40-45	25-70	frigid	volcanic	>30	Pinyon-juniper, bitterbrush, big sagebrush	Slope, stones, rock	G, Wd	Wd		G
54. Argixerolls, cool	17,500	Pediments	6,000-7,500	5-15	43-46	50-100	frigid	volcanic	<15	Big sagebrush, juniper, bitterbrush	Thin	Wd	Wd,G		U,G
55. Argixerolls-Haploxerolls	183,700	Mountains	6,500-8,000	10-30	40-44	25-70	frigid	volcanic	<50	Jeffrey pine, pinyon, bitterbrush, Mtn. mohogany, snowberry	Slope, rough	Wd, H, T	Wd	T	H,G
56. Argixerolls-Haploxeralfs, gently sloping	125,600	Lava plateau	6,500-8,000	20-40	40-43	10-60	frigid	various	<15	Silver sage, mtn. shrub, grasses	Thin	Wd, H T	Wd		H,U, G
57. Argixerolls-Haploxeralfs, steep	312,650	Mountains	6,000-8,000	20-50	38-42	10-50	frigid	various	>30	Timber pine	Slope, access	T, H, Wd		T,H, Wd	G
58. Cryoborolls-Rockland	68,550	Mountains	7,000-9,000	30-50	37-41	0-41	cryic	various	>50	Sub-alpine conifer	Slope, rock, thin access	T, H,	H	Wd	T,G
59. Haploxeralfs steep 8/	96,900	Mountains	7,000-9,000	20-40	39-42	10-50	frigid	volcanic	>30	Timber pine mtn. shrub	Slope, stones, rough, access, rock	T, H, Wd, U	Wd	T,H	G,U
60. Haploxeralfs	78,850	Mountains	6,800-8,000	20-40	38-43	10-50	frigid	volcanic	<30	Timber conifer, big sagebrush, sub-alpine conifer	Slope, access	T, H, Wd, U	Wd	T,H	U,G
61. Haploxeralfs-Durixeralfs	15,800	Basins	6,000-8,000	20-40	38-43	10-50	frigid	volcanic	<15	Timber conifer, big sagebrush	Thin	T, H, Wd, U	Wd	T,H, U	G

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
62. Playa 9/	503,600														
63. Rock land 9/	72,900														
64. Bad land 9/	10,300														
65. Ponds-Haplaquolls	88,700	Basin	3,900-4,100	<5	49-51	100-130	mesic	various	<5	Sedges, tules	Wet	Ww	Ww		M
66. Old beaches	165,700	Various	4,000-4,400	<5	49-51	100-130	mesic	various	<15	Shadscale, saltbush, Indian ricegrass		G		G	
67. Bleached rock land 9/	21,450														

FOOTNOTES

1/ See footnotes on General Soils Map for explanation.

2/ a) Volcanic includes metamorphosed sediments derived mostly from extrusive rocks of various ages.
b) Granite refers to any granitic rock such as granodiorite, monzonite, and granite.

3/ Explanation of terms used:
Access refers to accessibility;
Droughty refers to low-water-holding capacity of the soil;
Percs slow refers to slow permeability of the soil;
Reclaim refers to ability of devegetated soil to reestablish;
Rocks refers to attached bedrock exposures;
Rough refers to surface topography;
Stones include cobbles;
Thin refers to depth limitation of soil;
Water refers to lack of water.

4/ Land Use designation:
C Cropland;
G Grazing, mostly cattle or sheep;
H Watershed;
M Wet meadow pasture and/or hay;
T Timber
U Urban and/or industrial
Wd Openland wildlife; dominantly deer
Ww Wetland wildlife; dominantly fowl

5/ Rating does not consider present use.

6/ Ratings based on following criteria for each use:

Grazing	Good	Fair	Poor
Slope (percent)	0-15	15-30	>30
Water-holding capacity (inches)	> 5	3-5	< 3
Mean precipitation (inches/year)*	>10	5-10	< 5
Growing season (days)	>110	80-110	<80

* Disregard if poor or poorer drainage

	Good	Fair	Poor
Cropland			
SCS Land Capability Class	II	III	IV
Meadow hay and wetland wildlife.			
Soil temperature class	Mesic	Frigid	Cryic
Timber			
Slope (percent)	0-30	30-50	> 50
Frost action	low	mod.	high
Precipitation (inches/year)	> 40	20-40	< 20
Soil temperature class	--	--	Cryic
Watershed			
Yield (in inches/year)	> 20	10-20	< 10
Openland wildlife			
Bitterbrush (plants/acre)	> 15	< 15	none
Wetland wildlife	wet	seas. wet	dry
Urban and/or industrial **			
Slope (percent)	< 15	< 15	15
Soil temperature class	--	--	Cryic
Soil depth (inches)	> 60	40-60	40
Flooding	none	rare	occas.
Drainage	***	***	***
Shrink-swell	low	mod.	high
Frost action	low	mod.	high
Stoniness class	0.1	2	3,4,5
Rockiness class	0	1	2,3,4,5

** For further explanation of terms see USDA, SCS Guide for Interpreting Engineering Use of Soils; November, 1971

*** Good: Excessive, somewhat excessive
Fair: Moderately well
Poor: Somewhat poor, poor, very poor

7/ Rating of single use in more than one place is a result of overlaying criteria.

8/ Existing urban areas are in inclusions of favorable rating criteria.

9/ Landforms not rated.

Wetlands

The wetlands in the Basin include poorly-drained soils and associated fresh water that is mostly less than ten feet deep. Acreage by subbasin is shown in the following tabulation:

Subbasin	Wetland acres
Calvada	43,360
Truckee	41,780
Carson	127,370
Walker	45,290
Total	257,800

The U.S. Fish and Wildlife Service has classified wetlands of the United States into twenty types for wildlife management purposes. Of these, seven occur within the Basin. These are identified and located on Map 6.

Land Resource Areas and Soil Resource Groups

Major land resource areas consist of geographically associated land resource units. It represents a broad synthesis of knowledge about the soil resources of the United States and is designed primarily for use in the Soil Conservation Service in developing and coordinating its soil and water conservation programs. Six Land Resource Areas occur within the Basin. These are shown on Map 7.

In some parts of the report reference is made to Soil Resource Groups (SRG). This is a classification system that groups kinds of soils for similar productivity. The criteria used include depth, texture, frost-free season, water table, available water-holding capacity, and slope. This system was used by economists in this report for the economic impact analysis.

Physical Land Use Suitability

All land within the Basin is utilized for one or, more commonly, several uses. Determination of use having the

LEGEND

- Basin Boundary
- Subbasin Boundary
- State Boundary
- County Boundary
- National Forest, Indian Reservation or Military Reservation Boundary

SUBBASINS

- A CALVADA
- B TRUCKEE RIVER
- C CARSON RIVER
- D WALKER RIVER

PRINCIPAL INLAND WETLAND TYPES*

- 1 Seasonally Flooded Basins or Flats
- 2 Fresh Meadows and Type 3: Shallow Fresh Marshes
- 5 Open Fresh Water
- 9 Saline Flats
- 10 Saline Marshes and Type 11: Open Saline Water

* Type Numbers are taken from U.S. Fish and Wildlife Service Circular 39: Wetlands of the United States.

MAP 6

WETLANDS

CENTRAL LAHONTAN BASIN

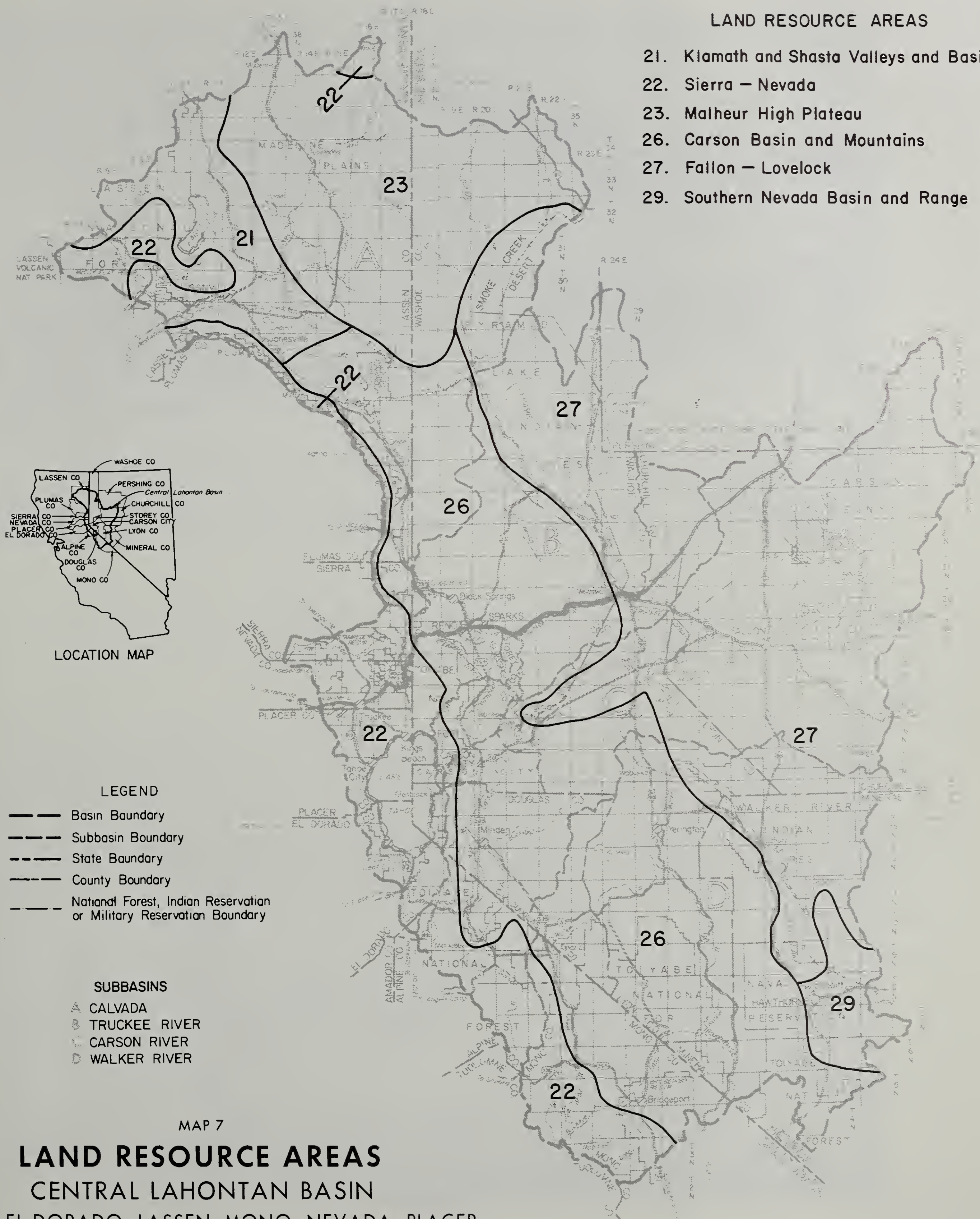
ALPINE, EL DORADO, LASSEN, MONO, NEVADA, PLACER, PLUMAS AND SIERRA COUNTIES, CALIFORNIA
CARSON CITY, CHURCHILL, DOUGLAS, LYON, MINERAL, PERSHING, STOREY AND WASHOE COUNTIES, NEVADA

JULY 1975

10 0 10 20 30 MILES
SCALE 1:1,500,000

M7-N-23193

U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE



LAND RESOURCE AREAS

21. Klamath and Shasta Valleys and Basins
22. Sierra — Nevada
23. Malheur High Plateau
26. Carson Basin and Mountains
27. Fallon — Lovelock
29. Southern Nevada Basin and Range

LEGEND

- Basin Boundary
- Subbasin Boundary
- State Boundary
- County Boundary
- National Forest, Indian Reservation or Military Reservation Boundary

SUBBASINS

A CALVADA
B TRUCKEE RIVER
C CARSON RIVER
D WALKER RIVER

MAP 7

LAND RESOURCE AREAS

CENTRAL LAHONTAN BASIN

ALPINE, EL DORADO, LASSEN, MONO, NEVADA, PLACER, PLUMAS AND SIERRA COUNTIES, CALIFORNIA
CARSON CITY, CHURCHILL, DOUGLAS, LYON, MINERAL, PERSHING, STOREY AND WASHOE COUNTIES, NEVADA

JULY 1975

10 0 10 20 30 MILES
SCALE 1:1,750,000

U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE USDA-SCS-PORTLAND, OREG 1975

M7-L-23184

Southwest Reno. General Soil Map unit 30. Physical Land Use Suitability: grazing, rating good. Steep embankment is cut into soft bedrock creating erosion problem.

Stillwater Wildlife Management Area near Fallon. Acres devoted to hunting, fishing, and general recreation purposes are 144,000. General Soil Map unit 65, Physical Land Use Suitability: wetland wildlife, rating good; Wetlands Map units 1 and 10 least detrimental effect on the environment and most benefit to the public usually involves conflicts. Opinions vary in accordance with occupation. Good land use may mean one thing to those involved with livestock production and another to those involved with urban, real estate, wildlife management, or other interests. This section presents results of an analysis of land use based on physical criteria.

Table 3 lists the dominant major uses of the General Soil Map mapping units. It also provides a rating for land use suitability without regard for present use. This was prepared from land facts involving soil, soil-related, climatic, and hydrologic data. The criteria for this is listed in the footnotes on Table 3. Eight land uses were considered. Mining (geologic commodities) and recreation were not considered inasmuch as either might occur anywhere. A summation of the land uses considered and their rated physical suitability is shown in the following tabulation:

Land Suitability Rating in Acres*

Use	Good	Fair	Poor	Total
Grazing	144,350	4,231,950	5,167,405	9,543,705
Openland wildlife	2,329,600	2,046,055	1,613,350	5,989,005
Urban and/or industrial	720,650	230,300	1,705,050	2,656,000
Watershed	495,500	968,650	368,050	1,832,200
Timber	---	851,800	767,850	1,619,650
Cropland	730,450	603,850	189,650	1,523,950
Wetland wildlife	353,350	52,950	---	406,300
Meadow hay and/or pasture	353,350	52,950	---	406,300
Totals	5,127,250	9,038,505	9,811,355	23,977,110

*Includes multiple use, therefore figures may not agree with others in text.

Table 4 shows only the best rating for a single or double use of the General Soil Map units and accounts for all the existing land. In this tabulation the multiple use was considered only where the uses had the same rating. For overlapping ratings only that involving the dominant acreage was considered. Artificially drained land was not differentiated from that in the natural state.

Table 4 - Summary of areas of best dominant physical land use suitability taken from Table 3

Dominant Physical Land Use Suitability	Rating - Acres			
	Good	Fair	Poor	Total
Grazing	27,450	1,915,900	1,208,450	3,151,800
Grazing and openland wildlife	--	818,350	28,750	847,100
Cropland	277,000	--	--	277,000
Cropland and urban and/or industrial	453,450	--	--	453,450
Urban and/or industrial	329,400	--	--	329,400
Openland wildlife	2,329,600	659,705	--	2,989,305
Native pasture and/or hay and/or wetland wildlife	442,050	52,950	--	495,000
Watershed	495,500	281,200	--	776,700
Timber and watershed	--	312,650	--	312,650
Totals	4,354,450	4,040,755	1,237,200	9,632,405
		Landforms not rated		608,250
		Total land		10,240,655

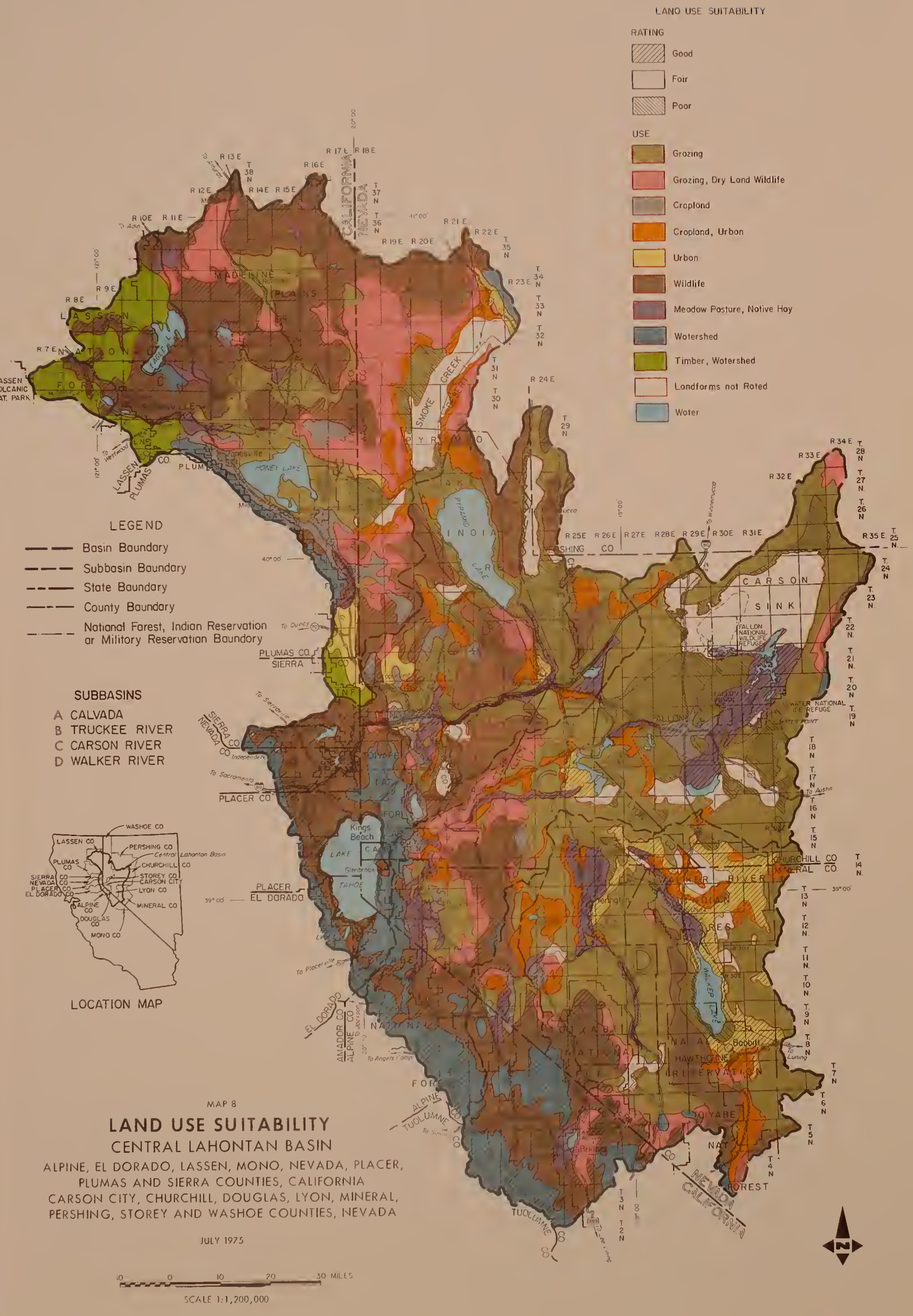
The data in Table 4 indicates that if the land is managed for its best physical land use suitability, there is adequate acreage for the uses considered with less than five percent conflict. Cropland and urban uses present the greatest problem. However, there is much more land available for these competing categories than is presently being used. The best rated physical land use suitability, as shown on Table 3, is compared with present use in the following tabulation:

The best rated physical land use suitability, as shown on Table 3, is compared with present use in the following tabulation:

Land Use	Best use	Present use
	------- Percent --------	
Grazing	32	43
Openland wildlife	30	30*
Watershed	8	8
Landforms not rated	7	7
Urban and/or industrial	6	< 1
Cropland	6	< 1
Wetland wildlife	4	< 1
Native meadow pasture and/or hay	4	1
Timber	3	10
Totals	100	100

*Assumed to be same as that for best use suitability

Map 8 shows the geography and ratings of the uses summarized on Table 4. All the data and this Map are subject to the limitations of the Generalized Soil Map and its scale. For this reason those uses which commonly occur on map inclusions are not accounted for in the data. This may be important for some uses such as timber production and urban developments in small isolated areas. The usefulness of Map 8 is therefore confined to broad regional, rather than local operational planning purposes.



LAND USE SUITABILITY
RATING
Good
Fair
Poor
USE
Grazing
Grazing, Dry Land Wildlife
Cropland
Cropland, Urban
Urban
Wildlife
Meadow Pasture, Native Hay
Watershed
Timber, Watershed
Landforms not Rated
Water
LEGEND
Basin Boundary
Subbasin Boundary
State Boundary
County Boundary
National Forest, Indian Reservation or Military Reservation Boundary
SUBBASINS
A CALVADA
B TRUCKEE RIVER
C CARSON RIVER
D WALKER RIVER
LOCATION MAP
MAP 8
LAND USE SUITABILITY
CENTRAL LAHONTAN BASIN
ALPINE, EL DORADO, LASSEN, MONO, NEVADA, PLACER, PLUMAS AND SIERRA COUNTIES, CALIFORNIA
CARSON CITY, CHURCHILL, DOUGLAS, LYON, MINERAL, PERSHING, STOREY AND WASHOE COUNTIES, NEVADA
JULY 1975
SCALE 1:1,200,000
CALIFORNIA
NEVADA
HONEY LAKE
PYRAMID LAKE
CARSON SINK
LAKE TAHOE
WALKER LAKE

M7-PN-23186

Land Status, Ownership, and Use

Slightly more than two-thirds of the Basin land and water resource areas are in Nevada. Table 5 tabulates land status by ownership, subbasin, and state. Table 6 indicates land use by use group and state. About three-fourths of this area is administered by Federal agencies. A breakdown of federal and nonfederal ownership by use and state is shown on Table 7. Maps 9, 10, 11, and 12 show land status.

Plant Materials

Native plants within the Basin are many and varied. They are a result of evolutionary response to extreme variations in the environment for thousands of years. This provides a genetic background which allows for an exceptionally wide range of adaptability or tolerance to environmental conditions. There are several thousand kinds of plants present. Some are few in number and include rare and unique species. Others are common and occur in distinctive plant communities discussed in Vegetal Types. Except for some plants of interest to the livestock industry, little is known about the horticulture of these native plants.

Xerophilous plant material is of particular interest at present because of its low water requirement and tolerance to problem-soil characteristics. There is a trend toward water conservation landscaping with such native plants, for urban landscaping, highway beautification, and special purposes such as erosion control.

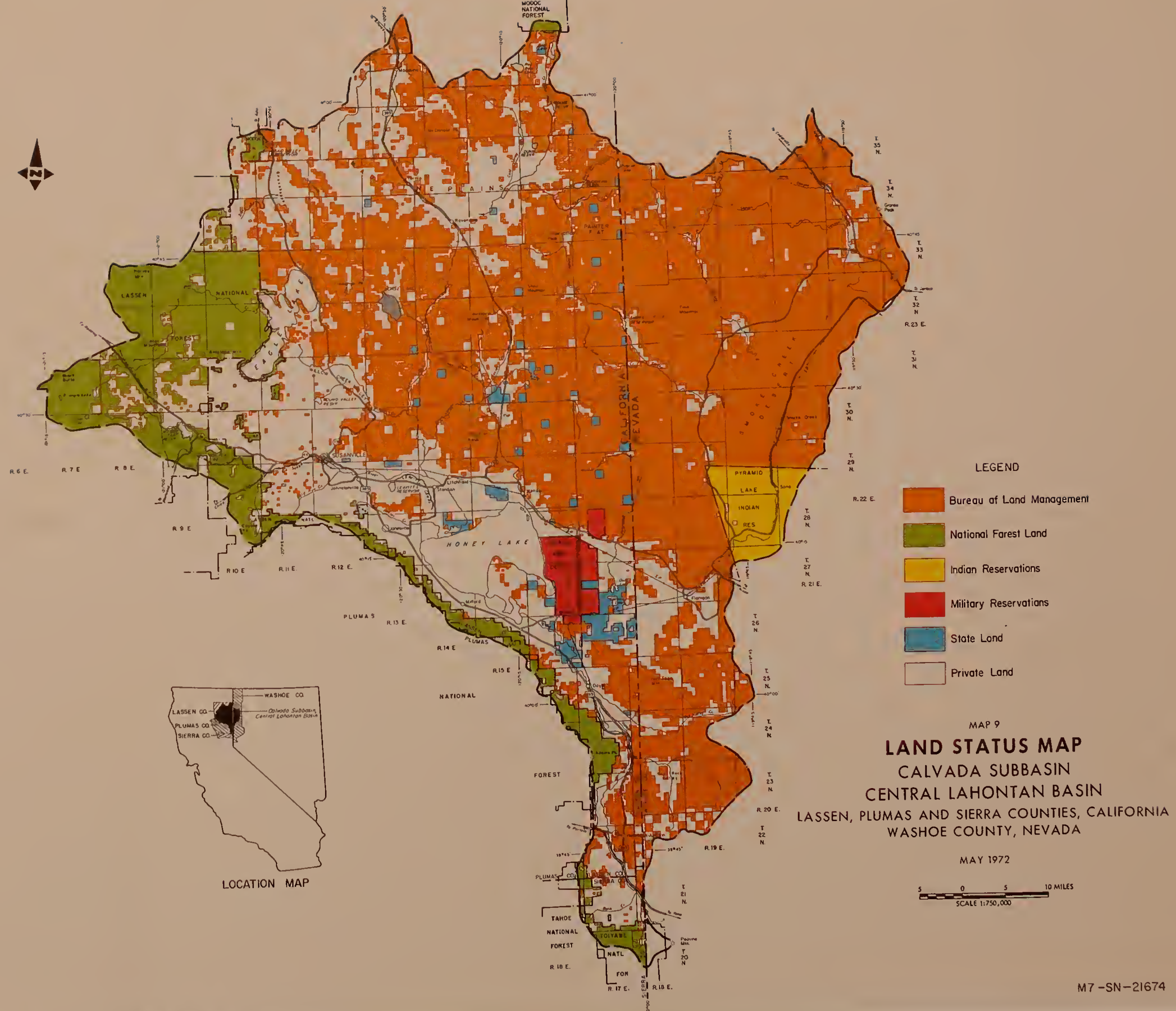
Vegetal Types

Vegetation within the Basin consists of a wide variety of shrubs, trees, grasses, grass-like plants, and forbs. These were grouped into vegetal types based on a reconnaissance survey, Bureau of Land Management, and Forest Service records. The vegetal type represents the predominant plant species present on the land. Table 8 summarizes their acreage by states and subbasin. Collectively, these represent about 86 percent of the Basin with the balance being water surface, urban, industrial, cropland, and barren.

Table 3, accompanying the General Soil Map, lists the key plants in each soil mapping unit. Table 9 lists 16 Basin vegetal types and predominant plants in each. More detailed maps and information on vegetation may be found in APPENDIX II.

Pinyon-juniper vegetal type, Walker Subbasin.

Mixed desert shrub vegetal type, Truckee Subbasin.



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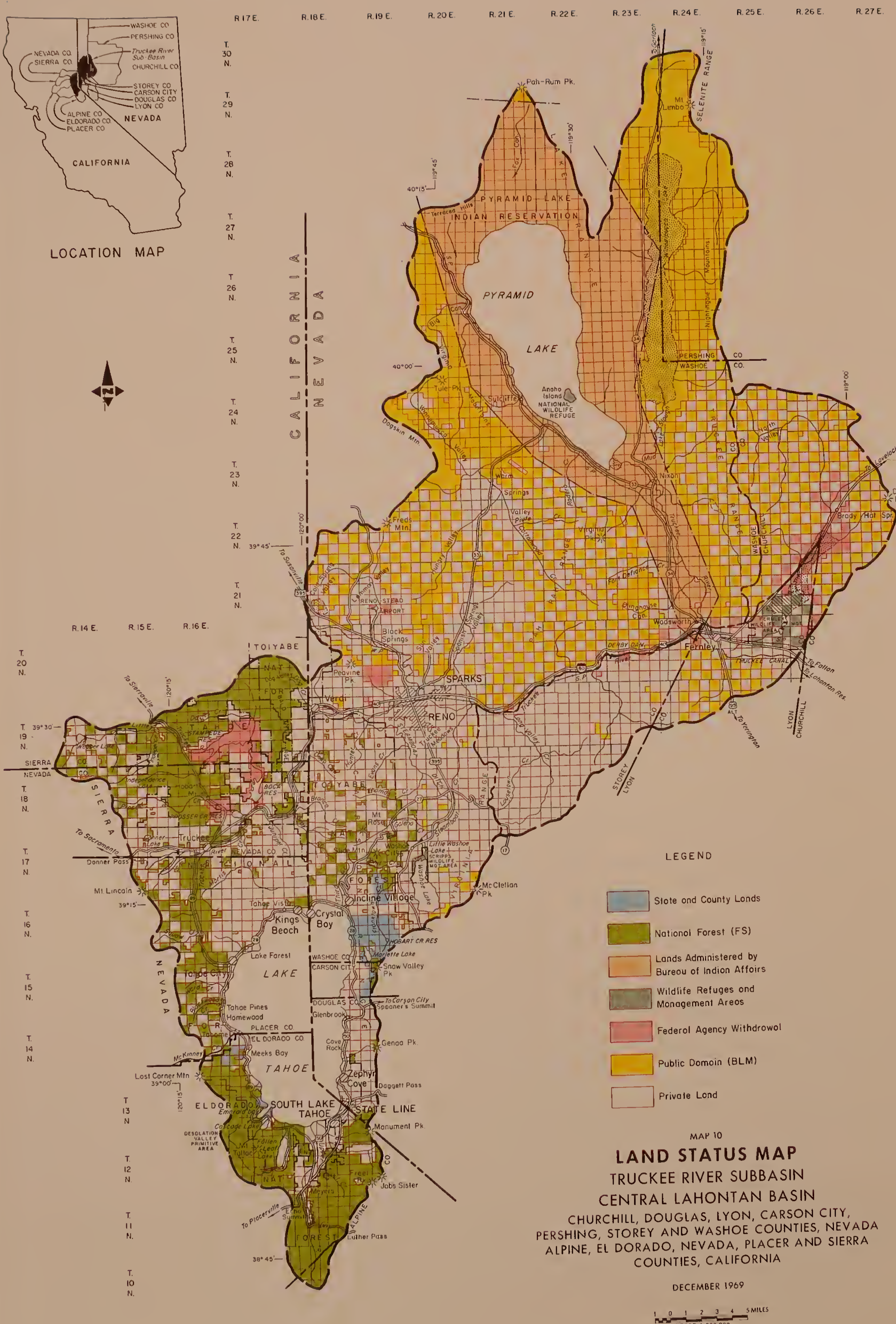


MAP 10

LAND STATUS MAP

TRUCKEE RIVER SUBBASIN

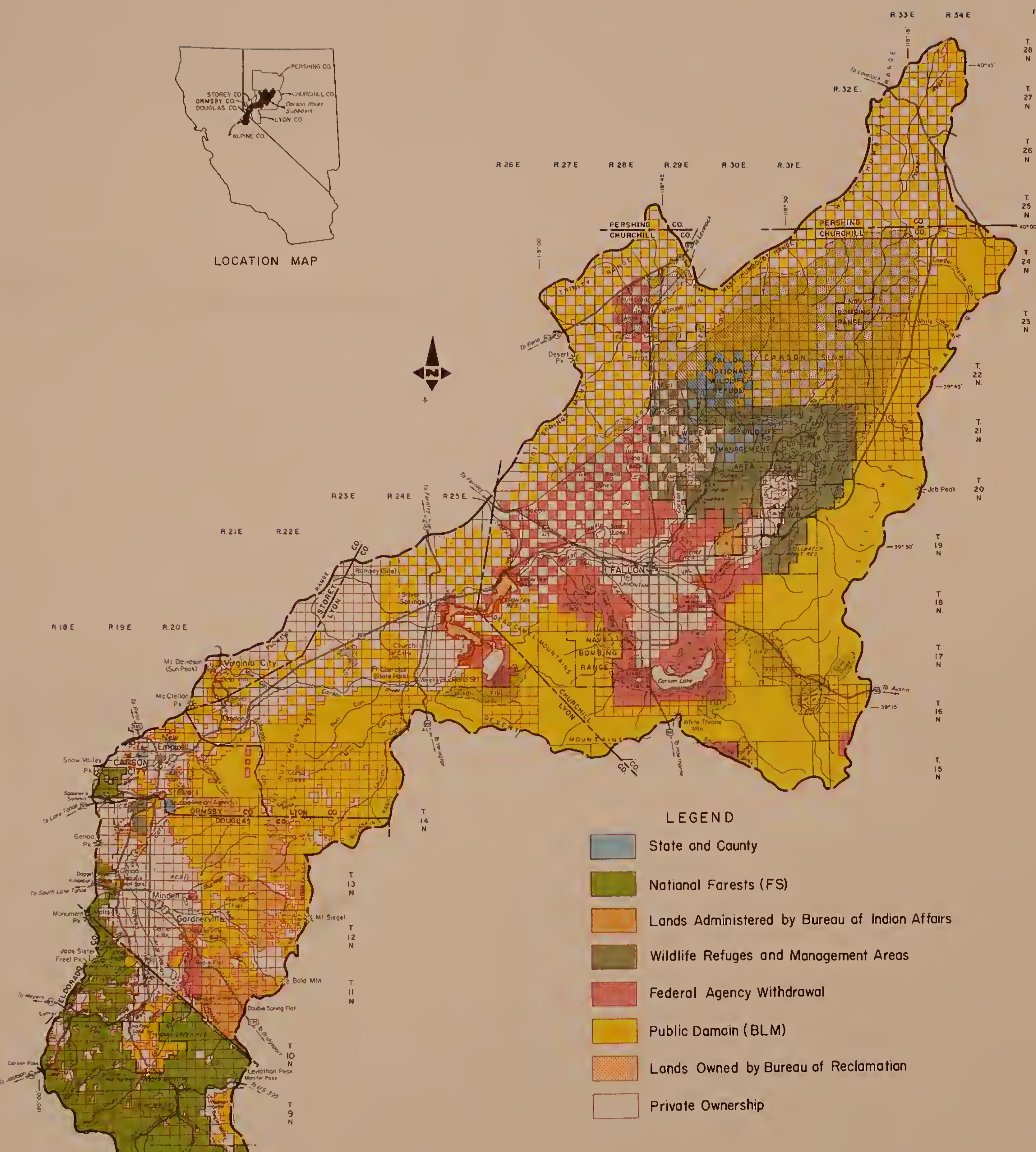
CENTRAL LAHONTAN BASIN

CHURCHILL, DOUGLAS, LYON, CARSON CITY, PERSHING, STOREY AND WASHOE COUNTIES, NEVADA
ALPINE, EL DORADO, NEVADA, PLACER AND SIERRA COUNTIES, CALIFORNIA

DECEMBER 1969

M7-PN-21143

U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE



MAP 11

LAND STATUS MAP

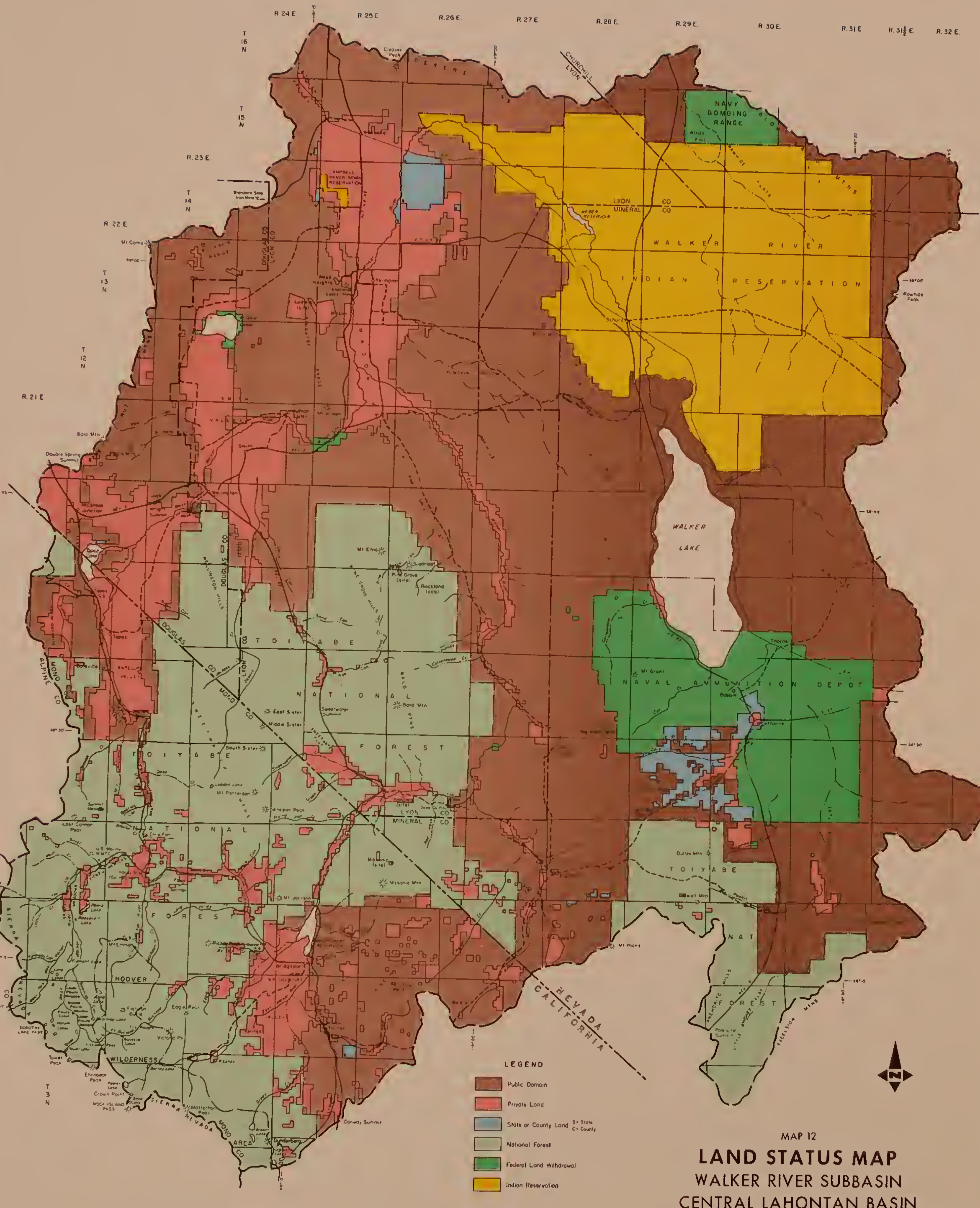
CARSON RIVER SUBBASIN
CENTRAL LAHONTAN BASIN

CHURCHILL, DOUGLAS, LYON, ORMSBY, PERSHING AND STOREY COUNTIES, NEVADA ALPINE COUNTY, CALIFORNIA

MARCH 1969

5 0 5 10 MILES
SCALE 1:750,000

U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE



MAP 12

LAND STATUS MAP

WALKER RIVER SUBBASIN

CENTRAL LAHONTAN BASIN

CHURCHILL, LYON, MINERAL AND DOUGLAS COUNTIES, NEVADA MONO COUNTY, CALIFORNIA

MARCH 1967

M7-RN-18573A

The plants indicated to be present in each type may not always occur to the same extent. This is notably true for Idaho fescue and bluebunch wheatgrass which were found to occur only in the northern half of the Basin. A description of each vegetal type is shown on Table 10. Further information on vegetation can be found throughout the text with reference to use and management and APPENDIX II.

Big sagebrush-grass vegetal type, Calvada Subbasin.

Mountain brush vegetal type, Calvada Subbasin.

Table 5 - Land status, by subbasin and state, includes water, by acres, Central Lahontan Basin.

Ownership	Walker		Carson		Truckee		Calvada	
	Nevada	California	Nevada	California	Nevada	California	Nevada	California
Private	213,450	87,860	713,503	39,611	809,350	188,818	105,640	257,484
State or County	30,121	860	79,186	1,038	64,786	89,917	--	42,710
National Forest	315,764	380,093	16,620	218,401	23,607	219,625	--	270,400
Public domain	1,089,567	126,887	1,031,025	18,500	453,682	--	805,145	1,416,951
Bureau of Sport Fisheries	--	--	162,491	--	247	--	--	--
Bureau of Reclamation	--	--	242,516	12,000	--	--	--	--
Military	160,125	--	30,980	--	--	--	--	33,965
Indian Lands	325,058	--	67,459	580	394,730	--	56,115	--
Other Federal withdrawal	3,571	--	--	--	41,072	19,615	--	--
TOTALS	2,137,956	595,700	2,343,780	290,130	1,787,474	517,975	966,900	2,021,510

Ownership	Basin Totals		Grand	
	Nevada	California	Totals	Percent
Private	1,841,943	573,773	2,415,716	22.7
State or County	174,093	134,525	308,618	2.9
National Forest	355,991	1,088,519	1,444,510	13.6
Public Domain	3,379,419	1,562,338	4,941,757	46.3
Bureau of Sport Fisheries	162,738	--	162,738	1.5
Bureau of Reclamation	242,516	12,000	254,516	2.4
Military	191,105	33,965	225,070	2.1
Indian Lands	843,362	580	843,942	7.9
Other Federal withdrawal	44,943	19,615	64,558	0.6
TOTALS	7,236,110	3,425,315	10,661,425	100.0

Table 6. -- Major land use or grouping, by states and acres, Central Lahontan Basin

Grouping	Principal Uses	States: Nevada	States: California	Total	Percent
Urban-Industrial	Towns, roads, railroads, homesites	102,856	24,869	127,725	1.2
Military	Military bases	53,280	33,965	87,245	0.8
State Parks	Recreation	38,213	5,722	43,935	0.4
Cropland, Irrigated	Pasture, hay, grain, row crops	237,726	107,524	345,250	3.3
Mountain Meadows Irrigated	Grazing, wildlife, recreation	2,703	16,370	19,073	<0.1
Cropland, Dry	Pasture and grain	351	18,656	19,007	<0.1
Rangeland 1/	Grazing, wildlife, recreation, watershed	5,188,227	1,175,808	6,364,035	59.4
Forest and Woodland	Wood products, recreation, wildlife, watershed, grazing	846,090	1,852,029	2,698,119	25.3
Lakes, Reservoirs and Rivers	Irrigation, recreation, municipal, flood prevention	230,398	190,372	420,770	4.0
Playa, barren	Recreation, military target area	536,266	--	536,266	5.4
TOTALS		7,236,110	3,425,315	10,661,425	100.0

1/ Includes 534,674 acres phreatophytes: Nevada - 413,404 acres
California - 121,270 acres

U. S. Army's Herlong Ordnance Depot, Calvada Subbasin.

Emerald Bay State Park, California, Truckee Subbasin.

Table 7 - Major land use or grouping, by federal and non-federal ownership and state, acres, Central Lahontan Basin

Grouping	Principal Uses	Nevada		California		Total		Total by State		Basin Totals
		Federal	Nonfederal	Federal	Nonfederal	Federal	Nonfederal	Nevada	California	
Urban-Industrial	Cities, roads, railroads		102,856		24,869		127,725	102,856	24,869	127,725
Military	Bases and ranges	53,280	--	33,965	--	87,245	--	53,280	33,965	87,245
State Parks	Recreation	--	38,213	--	5,722	--	43,935	38,213	5,722	43,935
Cropland, Irrigated	Cropland, pasture	--	237,726	--	107,524	--	345,250	237,726	107,524	345,250
Mountain Meadows, Irrigated	Grazing, wildlife	--	2,703	--	16,370	--	19,073	2,703	16,370	19,073
Cropland, dry	Pasture and grain	--	351	--	18,656	--	19,007	351	18,656	19,007
Rangeland	Grazing, wildlife, recreation, mining	3,767,294	1,420,933	691,576	484,232	4,458,870	1,905,165	5,188,227	1,175,808	6,364,035
Forest and Woodland	Wood products, grazing	631,244	214,846	1,333,058	518,971	1,964,302	733,817	846,090	1,852,029	2,698,119
Commercial Forest	Timber production	(8,031)	(76,200)	(549,368)	(422,052)	(557,399)	(498,252)	(84,231)	(971,420)	(1,055,651)
Unproductive Forest	Grazing, wildlife, mining	(623,213)	(138,646)	(745,990)	(96,919)	(1,369,203)	(235,565)	(761,859)	(842,909)	(1,604,768)
Productive Reserve	Timber productiion, wildlife	--	--	(37,700)	--	(37,700)	--	--	(37,700)	(37,700)
Playa, Barren	Recreation, bombing ranges	536,266	--	--	--	536,266	--	536,266	--	536,266
Water Surfaces	Recreation, esthetic, irrigation	Unclassified		Unclassified		Unclassified		230,398	190,372	420,770
TOTALS		4,988,084	2,017,628	2,058,599	1,176,344	7,046,683	3,193,972	7,236,110	3,425,315	10,661,425

Table 8 . - Vegetal types - by vegetal cover categories, subbasin and states, Central Lahontan Basin, Acres

Vegetal cover categories	Calvada Subbasin		Truckee Subbasin		Carson Subbasin		Walker Subbasin		State Totals		Basin total	Percent
	Nevada	Calif.	Nevada	Calif.	Nevada	Calif.	Nevada	Calif.	Nevada	California		
Big sagebrush-grass	311,670	693,650	688,940	17,000	238,980	8,190	175,740	12,000	1,415,330	730,840	2,146,170	23.5
Low sagebrush-grass 1/	226,120	72,730	44,050	---	126,560	---	181,380	39,700	578,110	112,430	690,540	7.6
Pinyon-juniper	---	---	148,030	---	151,490	4,980	386,235	106,650	685,755	111,630	797,385	8.7
Juniper-sage	39,800	357,690	10,100	---	---	---	---	---	49,900	357,690	407,590	4.5
Mixed desert shrub	128,910	9,970	385,950	---	633,520	---	728,655	---	1,877,035	9,970	1,887,005	20.7
Desert shrub-grass	---	---	24,240	---	202,850	---	342,615	---	569,705	---	569,705	6.2
Rabbit brush-greasewood	65,240	120,400	52,080	---	148,040	---	---	---	265,360	120,400	385,760	4.2
Dalea-fourwing saltbush	---	---	---	---	184,940	---	---	---	184,940	---	184,940	2.0
Buffaloberry-willow-cottonwood 2/	---	---	---	---	6,100	---	82,060	1,260	88,160	1,260	89,420	1.0
Bulrush-wiregrass	---	---	---	---	40,630	---	---	---	40,630	---	40,630	0.4
Mountain meadows	---	2,310	1,365	7,635	---	2,713	---	5,050	1,365	17,708	19,073	0.2
Perennial grasses 3/	---	23,300	---	---	---	---	7,380	4,750	7,380	28,050	35,430	0.4
Annuals 4/	49,890	12,960	34,740	---	---	---	---	---	84,630	12,960	97,590	1.1
Mountain brush	---	80,090	---	---	---	---	---	---	---	80,090	80,090	0.9
Browse-aspen-grass	---	---	52,110	17,685	---	---	9,680	169,853	61,790	187,538	249,328	2.7
Conifer-browse-grass	1,800	427,500	100,099	382,018	48,600	266,059	6,470	211,960	156,969	1,287,537	1,444,506	15.9
TOTALS	823,430	1,800,600	1,541,704	424,338	1,781,710	281,942	1,920,215	551,232	6,067,059	3,038,103	9,125,162	100.0

Note: Some vegetal cover categories were combined on this summary table

1/ Low sagebrush-grass includes: winter fat; low sagebrush-blacksage.
2/ Buffaloberry-willow-cottonwood includes: cottonwood-willows.
3/ Perennial grasses includes: seeded lands.
4/ Annuals includes: annual weeds.

Table 9 - Predominant vegetation by species and vegetal type, Central Lahontan Basin

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Species		Vegetal Sites															
Scientific name	Common name	Big sagebrush-grass	Mixed desert shrub	Conifer-browse-grass	Pinyon-Juniper	Low sagebrush-grass	Desert shrub-grass	Juniper-sagebrush	Rabbitbrush-greasewood	Browse-aspen-grass	Dalea-fourwing saltbush	Annuals	Buffaloberry-willow-cottonwood	Mountain brush	Bulrush-wiregrass	Perennial grass	Mountain meadows
TREES AND SHRUBS																	
Abies concolor	White fir			X													
A. lasiocarpa	Alpine fir			X													
A. magnifica	California red fir			X													
Allenrolfea occidentalis	Iodine bush								X		X				X		
Amelanchior alnifolia	Western serviceberry									X							
Arctostaphylos patula	Greenleaf manzanita			X										X			
Artemisia arbuscula	Low sagebrush				X	X		X						X			
A. nova	Black sagebrush					X											
A. cana	Silver sagebrush	X															
A. rothrockii	Rothrock sagebrush			X													X
A. spinescens	Bud sagebrush		X			X											
A. tridentata	Big sagebrush	X		X	X			X		X				X			
Atriplex canescens	Fourwing saltbush		X				X				X						
A. confertifolia	Shadscale					X											
A. lentiformis	Quailbush								X				X				
Castinopsis sempervirens	Sierra chinquapin			X													
Ceanothus cordulatus	Mountain whitethorn			X													
C. prostratus	Squaw carpet			X										X			
C. velutinus	Snowbrush ceanothus			X						X				X			
Cercocarpus ledifolius	Mountain mahogany			X	X			X		X				X			
Chrysothamnus nauseosus	Rubber rabbitbrush	X						X			X						
C. viscidiflorus	Douglas rabbitbrush	X				X								X			
Dalea polyadenia	Nevada dalea		X				X				X						
Ephedra nevadensis	Nevada ephedra	X	X							X							
E. viridis	Green ephedra	X	X		X												
Eurotia lanata	Winterfat		X				X										
Grayia spinosa	Spiny hopsage	X	X			X											
Hymenoclea monogyra	Burrobrush		X														
Juniperus occidentalis	Western juniper			X				X						X			
J. osteosperma	Utah juniper				X			X									
Libocedrus decurrens	Incense cedar			X													
Lycium andersonii	Anderson wolfberry		X								X						
Opuntia spp.	Pricklypear, cholla	X	X			X		X			X						
Pinus albicaulis	Whitebark pine			X													
P. contorta, var. latifolia	Lodgepole pine			X													
P. flexilis	Limber pine			X													
P. jeffreyi	Jeffrey pine			X													
P. lambertiana	Sugar pine			X													
P. monophylla	Single leaf pinyon pine	X			X	X											
P. monticola	Western white pine			X													
P. ponderosa	Ponderosa pine			X													
P. washoensis	Washoe pine			X													

Table 9. - Predominant vegetation, by species and vegetal type, Central Lahontan Basin, cont.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Populus fremontii	Western cottonwood								X				X				
P. tremuloides	Quaking aspen			X						X				X			
Prunus andersonii	Desert Peach	X															
P. emarginata	Bitter cherry			X													
P. virginiana	Chokecherry									X							
Pseudotsuga menziesii	Douglas fir			X													
Purshia glandulosa	Desert bitterbrush	X															
Purshia tridentata	Antelope bitterbrush	X		X	X									X			
Quercus kelloggii	Black oak			X													
Ribes spp.	Currant, gooseberry	X		X										X			
Rosa spp.	Rose	X								X			X				
Salix spp.	Willow								X	X			X				X
Salvia dorrii carnosa	Sage	X															
Sarcobatus vermiculatus	Black greasewood		X				X		X		X						
S. baileyi	Upland greasewood		X				X		X								
Shepherdia argentea	Silver buffaloberry												X				
Suaeda fruiticosa	Alkali seepweed								X		X		X				
Symphoricarpus vaccinoides	Snowberry			X										X			
Tamarix gallica	Fivestamon tamarisk								X				X				
Tetradymia canescens	Gray horsebrush	X	X														
T. comosa	Hairy horsebrush										X		X				
T. glabrata	Littleleaf horsebrush	X	X								X						
Tsuga mertensiana	Mountain hemlock			X													
GRASSES AND GRASSLIKE																	
Agropyron spicatum	Bluebunch wheatgrass	X			X	X		X						X		X	
A. trachycaulum	Slender wheatgrass			X						X							
A. cristatum	Crested wheatgrass															X	
Bromus carinatus	California brome			X						X							
B. rubens	Red drone		X														
B. marginatus	Mountain brome									X				X			
B. tectorum	Cheatgrass	X			X	X	X					X		X			
Carex spp.	Sedges			X									X		X		X
Deschampsia caespitosa	Tufted hairgrass									X							X
Distichlis stricta	Saltgrass								X		X		X				
Elymus cinereus	Great Basin wildrye	X						X		X				X			
E. glaucus	Blue wildrye			X						X							
E. triticoides	Creeping wildrye	X											X				X
Festuca idahoensis	Idaho fescue	X		X		X		X						X			
F. ovina	Sheep fescue																X
Hesperachloa kingii	Spikefescue				X	X											
Juncus spp.	Wiregrass														X		X
Koelaris cristata	Prairie junegrass	X			X	X				X							
Melica spp.	Oniongrass	X								X				X			
Oryzopsis hymenoides	Indian ricegrass	X	X				X				X						
Phleum alpinum	Mountain timothy																X
Poa ampla	Big bluegrass	X												X			
P. canbyi	Canby bluegrass	X				X		X						X			
P. nevadensis	Nevada bluegrass	X			X					X							
P. secunda	Sandberg bluegrass	X			X	X		X		X							

Table 9 - Predominant vegetation, by species and vegetal site, Central Lahontan Basin, cont.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Scirpus validus	Softstem bulrush												X		X		
Sitanion hystrix	Bottlebrush squirreltail	X	X	X	X	X		X		X				X			
Sporobulus airoides	Alkali sacaton								X				X				
Stipa comata	Needle-and-thread			X													
S. elmeri	Elmer needlegrass	X	X				X										
S. lemmoni	Lemmon needlegrass	X															
S. thurberiana	Thurber needlegrass	X			X	X		X		X				X			
S. occidentalis	Western needlegrass	X		X													
S. speciosa	Desert needlegrass				X	X											
TYPICAL FORBS																	
Aconitum spp.	Monkshood																X
Arabis spp.	Rockcress				X	X											
Argemone spp.	Prickly poppy	X															
Aster spp.	Aster					X											X
Astragalus spp.	Locoweed	X			X												
Balsamorhiza spp.	Balsam root	X		X	X	X				X				X			
Bassia spp.	Bassia											X			X		
Brassica spp.	Mustards	X									X	X					
Castilleja spp.	Indian paintbrush	X		X	X			X		X							X
Crepis spp.	Hawksbeard	X								X							
Erigeron spp.	Fleabane			X													X
Eriogonum spp.	Buckwheat	X	X		X	X		X		X							
Iva spp.	Proverty weed	X	X									X					
Iris spp.	Iris																X
Lupinus spp.	Lupine	X		X	X			X		X		X					
Malva spp.	Mallow	X								X							
Mimulus spp.	Monkey flower									X							X
Penstemon spp.	Penstemon					X				X							
Phlox spp.	Phlox	X				X				X							
Salsola spp.	Russian thistle		X			X					X	X					
Typha spp.	Cattail														X		
Wyethia spp.	Wyethia			X				X						X			

Table 10 — Dominant characteristics of vegetal types. Central Lahontan Basin

Vegetal type	Soil Taxa	Soil Temperature	Physiography	Other
Annuals	Any	Any	Any	Only in Calvada and Truckee Subbasins. Mostly disturbed soils.
Big sagebrush-grass	Aridisols, Mollisols, Vertisols, Alfisols, Inceptisols	Upper moisture range of mesic, frigid	Hills, fans, mountains, flood plains	Well drained, deep soils.
Browse-aspen-grass	Mollisols, Aridisols, Inceptisols	Frigid	Mountain slopes	Only in Truckee and Walker Subbasin.
Buffaloberry-willow-cottonwood	Entisols, Mollisols	Mesic	Flood plain bottoms	Only in Carson and Walker Subbasin poorly and poor drained soils.
Bulrush-wiregrass	Mollisols	Mesic	Flood plain bottoms	Mostly in Stillwater area, poor drainage.
Conifer-browse-grass	Inceptisols, Entisols Mollisols, Alfisols	Frigid, cryic	Mountain slopes and narrow valleys	Vegetation components not evenly dispersed.
Dalea-fourwing saltbush	Entisols, Aridisols	Mesic	Fans, dunes	Occupies Carson Subbasin lowlands, coarse-textured, well-drained soil
Desert shrub-grass	Entisols, Aridisols	Mesic	Fans, dunes	Mostly in Carson and Walker Subbasins lowland.
Juniper-sage	Vertisols, Aridisols Mollisols	Mesic, Frigid	Mountain slopes, fans	North of Truckee River, precip. >10 inches.
Low sagebrush-grass	Mollisols, Aridisols	Mesic, Frigid	Fans, mountain slopes	Shallow to hardpan or bedrock.
Mixed desert shrub	Aridisols	Mesic	Fans, hill, mountains	Occurs throughout Basin.
Mountain brush	Mollisols	Frigid	Mountain slopes	Occurs in Calvada Subbasin only.
Mountain meadows	Inceptisols, Alfisols Mollisols	Frigid	Basin and valley lowland	Throughout Basin, high mountains, poor drainage.
Perennial grasses	Any	Mesic, Frigid	Any	Involves range seedings
Pinyon-juniper	Aridisols, Mollisols, Entisols	Frigid, more moist mesic areas	Mountain slopes	Mostly south of Truckee River
Rabbitbrush-greasewood	Entisols, Mollisols	Mesic	Basins, flood plain, lowland	Poor drainage area, usually saline.

Minerals

A review of the Basin's extensive historic mineral explorations is given in CHAPTER II. In APPENDIX II, a table showing a valuation of the mineral output from the many mining camps is also given. These discussions point out that from about 1860 to after the turn of the century over a half billion dollars worth of ore, principally gold and silver, was processed.

Since that time, mineral production has dropped drastically. Extensive gold and silver mining has given way to copper and iron developments, plus a host of lesser know mineral explorations involving diatomite, gypsum, cinders, silica, sodium compounds, fluorspar, barite, sulfur, antimony, tungsten and mercury.

The Yerington Mining District of Lyon County is the present center of the copper mining industry. But the recent locating of huge low grade deposits of iron ore may soon make this district a large producer of iron. The Buckskin Mining District in Douglas County and the Mineral Basin District in Pershing County are the significant iron ore producers at this time. Diatomite mining in Storey and Churchill Counties,gypsum in Pershing, cinder quarries in Storey and Washoe, and Carson City, sodium compounds in Churchill, and silica and fluorspar in Douglas round out the location of the other significant mining activities in the Basin.

Water Resources

Water Supply

Surface Water

The average annual gross water yield for the Central Lahontan Basin is 2.05 million acre-feet. Gross water yield is defined as the available water, both surface and subsurface, prior to use by man's activities, use by phreatophytes, or evaporation from free water surfaces. This represents approximately 22 percent of the total precipitation in the Basin, or 2.30 inches of water over the entire Basin. The annual gross water yield ranges from less than 0.2 inches on much of the Basin to over 40 inches on some high mountain areas. This geographical distribution of yield is illustrated on Map 13. Less than 14 percent of the total area contributes about 70 percent of the water supply of the Basin.

Anaconda Copper Corp. Weed Heights operation near Yerington is the center of Basin mineral industry, Walker Subbasin

220,000 AF Stampede Reservoir on the Little Truckee River stores a portion of the water supply in the Truckee Subbasin

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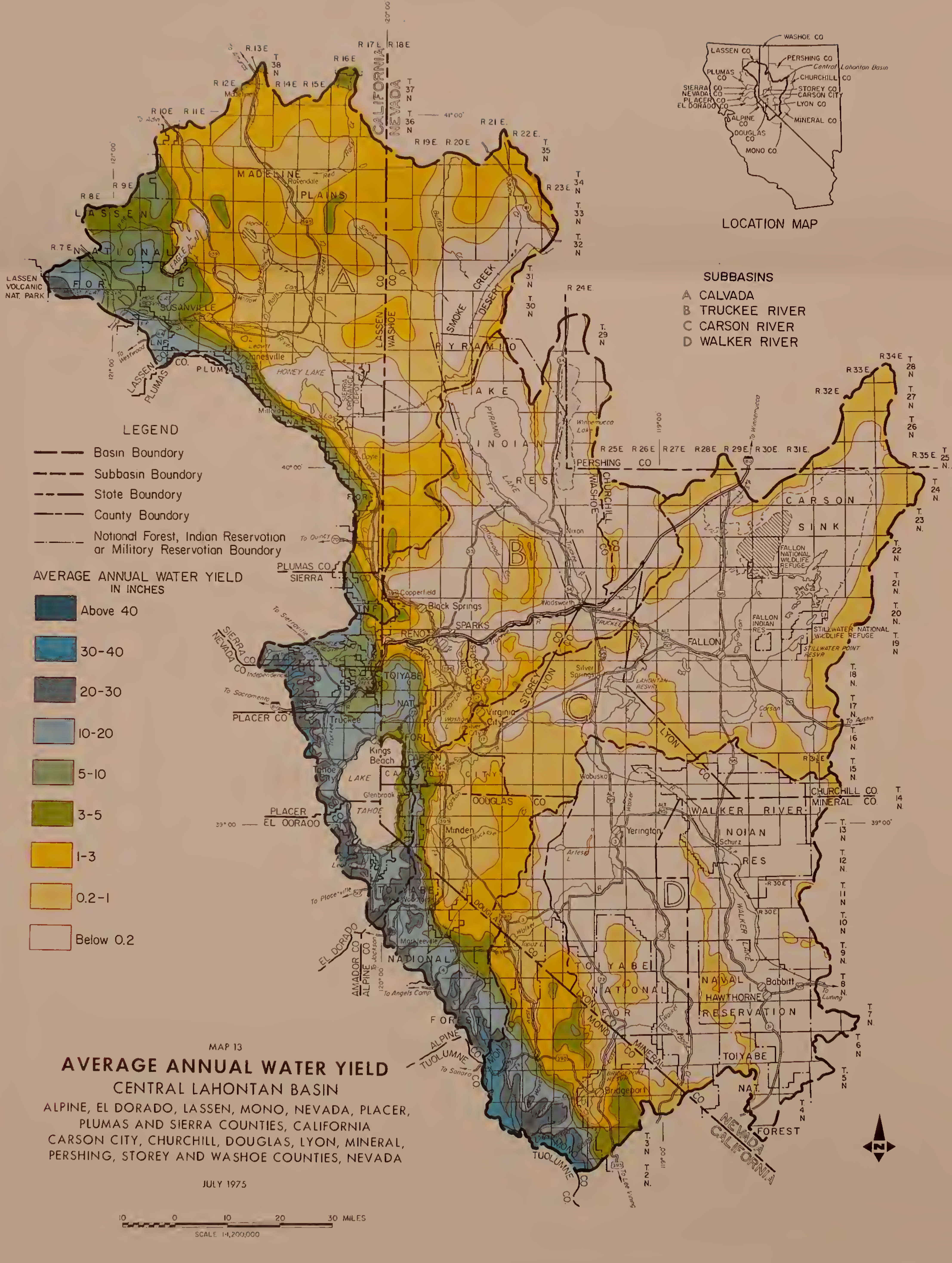


MAP 13

AVERAGE ANNUAL WATER YIELD

CENTRAL LAHONTAN BASIN

ALPINE, EL DORADO, LASSEN, MONO, NEVADA, PLACER, PLUMAS AND SIERRA COUNTIES, CALIFORNIA
CARSON CITY, CHURCHILL, DOUGLAS, LYON, MINERAL, PERSHING, STOREY AND WASHOE COUNTIES, NEVADA

JULY 1975

M7-PN-23064

Average annual water yield varies considerably from year to year. For planning purposes it is desirable to know what a more reliable yield might be. For this reason the yield that can be expected to be met or exceeded 80 years out of 100 was calulated. This is referred to as an 80 percent chance yield. Average annual and the 80 percent chance gross water yield for each subbasin in 1,000s acre-feet are shown in the following tabulation:

Subbasin	Average	80% Chance
	---------- 1,000s acre-feet ------	
Truckee	777	496
Carson	408	283
Walker	413	294
Calvada	456	251

Gross yield, depletions, and net yields for watersheds within each subbasin may be found in APPENDIX II. Over 63 percent of the average annual runoff occurs during the months of April, May, and June. This is a result of the melting of the winter snowpack. Figure 2 illustrates the seasonal distribution of runoff within the Basin.

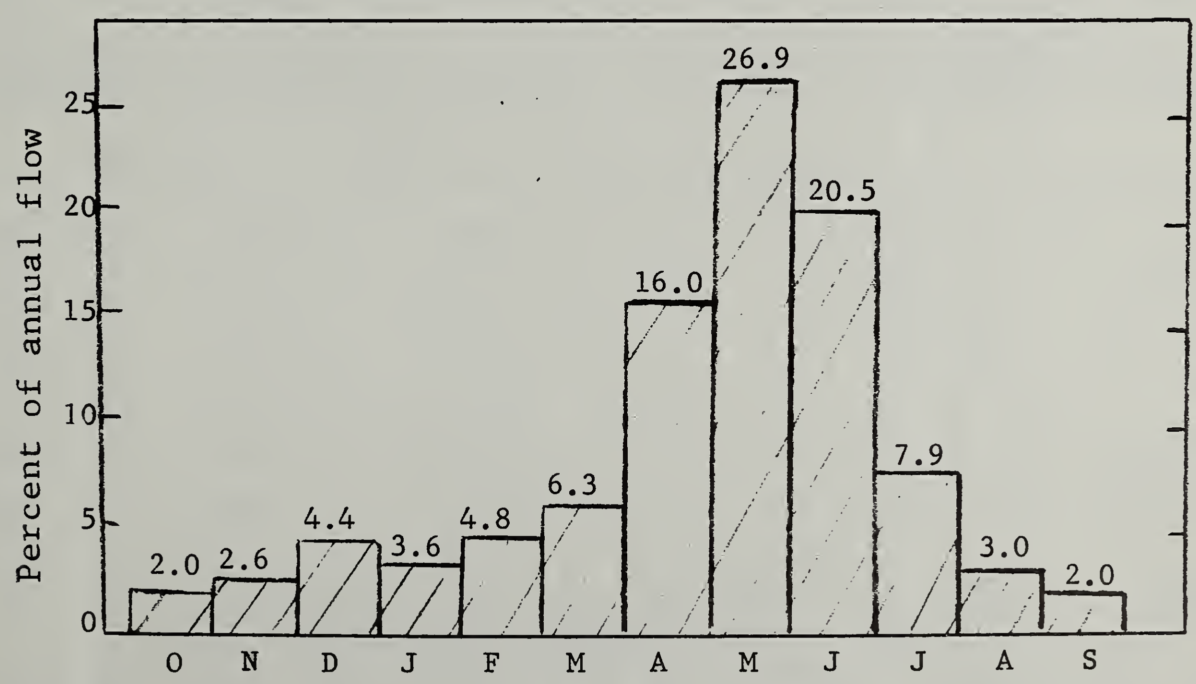


Figure 2. - Chart showing weighted average annual seasonal distribution of runoff for unregulated streams.

Data on the water available in each subbasin by month is shown in Table 10A. The figures are based upon stream flow records and show both average and 80 percent chance water availability. Data for the Lower Carson is provided only as a single figure due to the existence of Lahontan Reservoir. The annual water figure given includes the winter flow.

Table 10A- Average and 80 percent chance streamflow based on streamflow records, Central Lahontan Basin, (4 stream gage locations, see APPENDIX II)

Date	Average Stream Flow in Acre-Feet, By Subbasin				
	Upper Carson	Lower[1/] Carson	Truckee[1/]	Walker	Calvada
March	17,800		32,300	10,500	18,700
April	49,800		67,200	23,400	31,500
May	93,500		118,200	61,000	20,700
June	75,300		85,900	72,200	13,200
July	26,200		36,700	45,100	8,300
August	9,400		30,700	21,600	4,400
September	6,100		29,700	12,300	1,900
October	5,900		21,600	5,800	4,700
Annual	322,500	370,000	518,000	279,600	163,100
	80 Percent Chance Stream Flow in Acre-Feet				
March	11,800		21,500	4,800	10,500
April	31,800		29,700	15,700	13,200
May	56,300		37,900	47,400	12,100
June	34,400		29,700	41,200	6,800
July	11,700		30,700	21,500	2,000
August	5,400		30,700	12,400	1,200
September	3,700		29,700	6,700	1,200
October	4,200		21,000	3,600	2,100
Annual	203,600	288,000	338,700	180,400	88,800

1/ Water left figures in Truckee and Basinwide reflect flow in Truckee River before any diversion to the lower Carson. Average annual diversions to the lower Carson were 188,000 acre-feet, 1970 base.

Ground Water

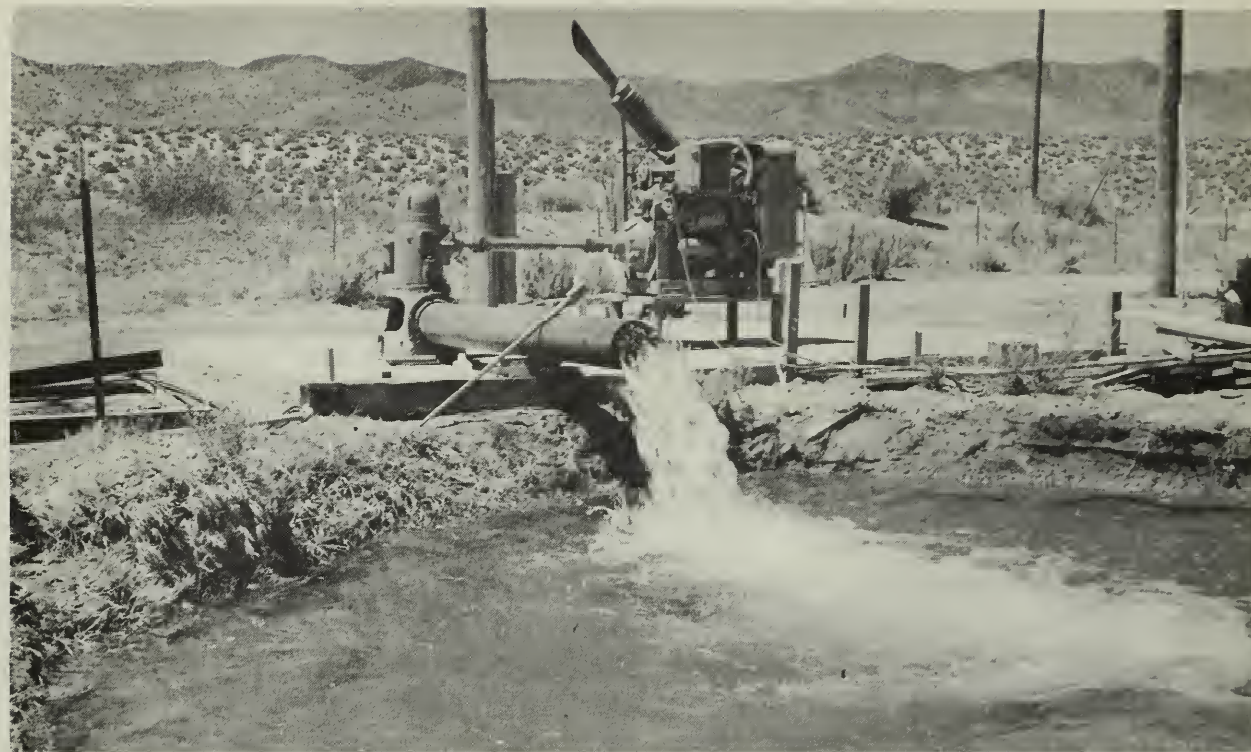
The ground water resources of the Basin are closely related to the surface water resources in that recharge of the ground water supply comes mostly from surface water. Some ground water recharge occurs directly from infiltrated precipitation.

Map 14 shows the location of the Basin's major valley ground water reservoirs. These reservoirs are composed of the alluvial deposits that partly fill the valleys of the Basin. These deposits generally contain sand and gravel aquifers which in most cases provide the only supply of ground water available for large-scale development. Other valley ground water reservoirs exist in the Basin which are not shown on the map either because of small size or shallow thickness of the saturated fill. The map also shows the critical ground water basins designated by the Nevada State Engineer. These are so designated so that an attempt can be made to avoid locally excessive drawdown of water levels from the pumping of wells.

Ground water in storage for the mapped valley ground water reservoirs and the source of this data is shown in Table 10B. The storage interval used for most of the storage volumes is the upper 100 feet of saturated valley fill. Additional volumes of ground water may be in storage at depths exceeding the indicated storage interval.

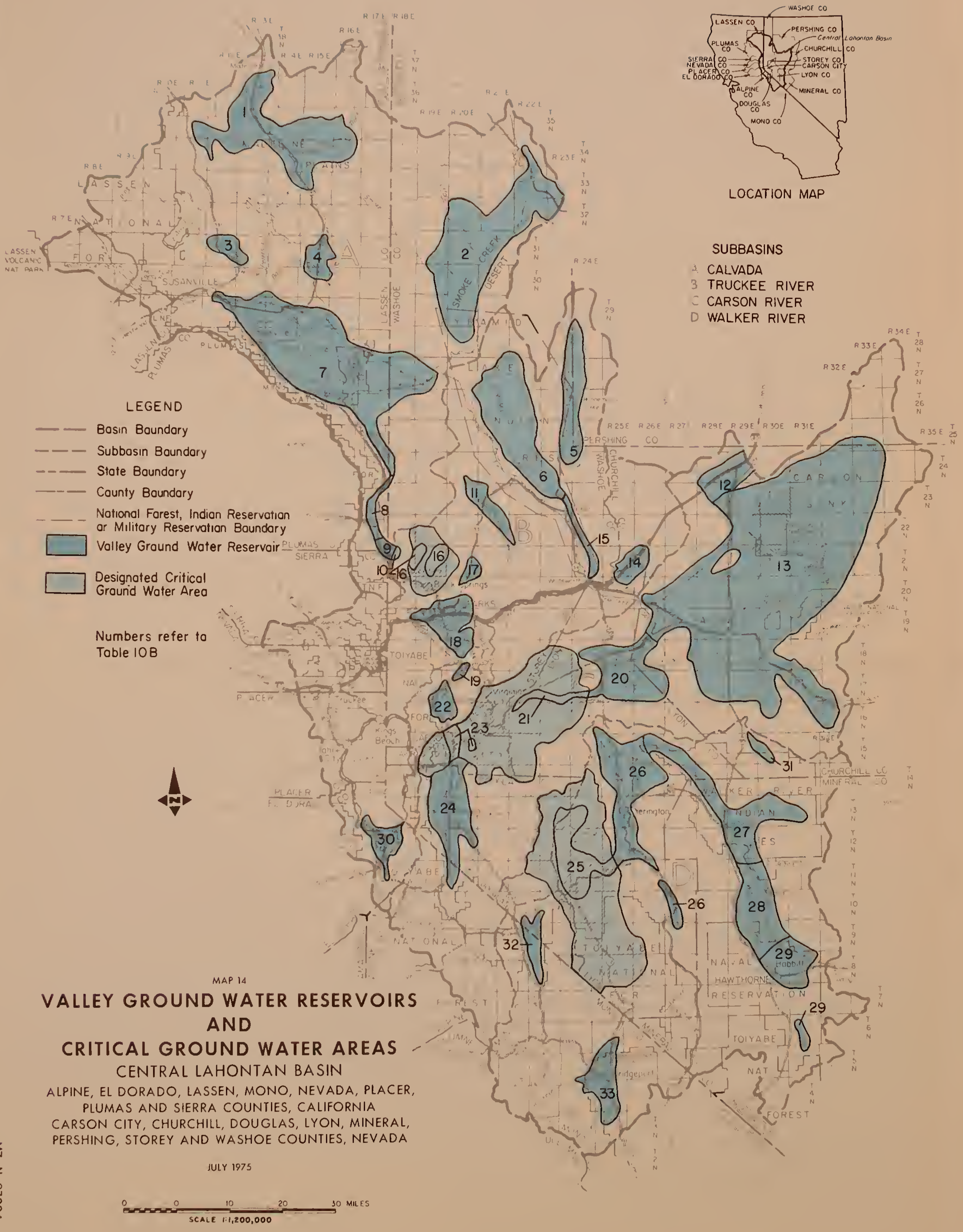
In general, the bedrock found in the Basin is relatively impermeable and yields limited quantities of ground water. In some locations, the valley fill areas are almost totally isolated from the saturated valley fills of adjoining areas by relatively impervious bedrock. This is generally true between the major subbasins in the Basin. Relatively little ground water movement occurs between the subbasins. Within the Calvada Subbasin, however, the recent basalt flows are highly permeable in the Eagle Lake area. Ground water moves freely to discharge in springs, streams, and lakes in the surrounding area.

The average amount of ground water withdrawn from wells each year is estimated at 55,000 acre-feet. Of this, about 37,000 acre-feet are used on irrigated lands. Well yields vary widely, from less than 10 to over 4,000 gallons per minute. Specific capacity ranges from 0.1 to 160 gallons per minute per foot of drawdown.



Ground water development for irrigation, Carson Subbasin. Pat Glancy photo.

This well is being developed for municipal and industrial water for Carson City. Pat Glancy photo.



MAP 14

VALLEY GROUND WATER RESERVOIRS AND CRITICAL GROUND WATER AREAS

CENTRAL LAHONTAN BASIN

ALPINE, EL DORADO, LASSEN, MONO, NEVADA, PLACER, PLUMAS AND SIERRA COUNTIES, CALIFORNIA
CARSON CITY, CHURCHILL, DOUGLAS, LYON, MINERAL, PERSHING, STOREY AND WASHOE COUNTIES, NEVADA

JULY 1975

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M7-N-23224

Table 10B - Ground water in storage, Central Lahontan Basin

No. on Map 14	Valley ground water reservoir	Storage interval feet	Ground water storage 1,000 AF	Source
1	Madeline Plains-Grasshopper	10-600	2,000	1
2	Smoke Creek Desert	upper 100	2,000	2
3	Willow Creek Valley	"	120	3
4	Secret Creek Valley	"	230	3
5	Winnemucca Lake Valley	"	960	2
6	Pyramid Lake Valley	"	1,900	2
7	Honey Lake Valley -			
	California	10-750	16,000	1
	Nevada	upper 100	550	2
8	Long Valley	"	220	3
9	Upper Long Valley	"	100	3
10	Cold Springs Valley	"	45	2
11	Warm Springs-Winnemucca	"	420	2
12	White Plains	"	420	2
13	Carson Desert	"	8,500	2
14	Argo Area-Hot Springs Flat	"	770	2
15	Dodge Flat	"	260	2
16	Lemmon Valley	"	277	2
17	Spanish Springs Valley	"	170	2
18	Truckee Meadows	"	450	2
19	Pleasant Valley	"	30	2
20	Churchill Valley	"	740	2
21	Dayton Valley	"	440	2
22	Washoe Valley	"	270	2
23	Eagle Valley	"	200	2
24	Carson Valley	"	810	1&2
25	Smith Valley	"	980	2
26	Mason Valley and Pine Grove Flat	"	2,900	2
27	Walker Lake-Schurz Area	"	1,500	2
28	Walker Lake-Lake Area	"	100	2
29	Hawthorne and Whiskey Flat	"	900	2
30	South Tahoe Valley	20-100	84	1
31	Rawhide Flat	upper 100	60	2
32	Antelope Valley	"	540	1&2
33	Bridgeport Valley	20-120	280	1
		TOTAL	45,226	

Source: 1 - California Department of Water Resources
2 - Nevada Division of Water Resources
3 - Central Lahontan Basin Staff

Some of the most favorable areas for obtaining ground water appear to be the middle to lower portions of extensive alluvial fans, where aquifers receive ground water recharge from adjacent high mountains. Good aquifers may also occur in coarse deposits associated with streams. Fine-grained lake deposits are in general poor aquifers.

Appreciable thicknesses of coarse alluvium between the lake beds, or bench, bar, and terrace deposits may be good aquifers, provided they are relatively extensive, saturated, and receive an adequate quantity of good quality recharge. Relatively low to moderate yields are often obtained from fine-grained fan alluvium and glacial debris, which is commonly variable in permeability. Many glacial deposits are similar to some lake terraces, in that they may be situated largely above the water table, or limited in extent.

Figures for both present maximum pump capacity and presently estimated use are presented in Table 11.

Table 11 - Ground water supply used for irrigation in some major use areas, Central Lahontan Basin[1/]

Upper Carson		
Present maximum pump capacity 3,000 AF/month		
Average ground water pumped, 7,000 AF/year		
Estimate	3,000	in July
	3,000	in August
	1,000	in September
Walker		
Present maximum pump capacity 12,000 AF/month		
Average ground water pumped, 17,000 AF/year		
Estimate	5,000	in July
	10,000	in August
	2,000	in September
Calvada		
Present maximum pump capacity 7,000 AF/month		
Average ground water pumped, 11,000 AF/year		
Estimate	500	in June
	5,000	in July
	500	in September
1/ Truckee and Lower Carson ground water use for irrigation is estimated to be 2,000 acre-feet per year.		

Water Quality

The quality of water, as a consideration in the development of land and water resources, received little attention until the enactment of the Water Quality Act of 1965. This amended the Federal Water Pollution Control Act requiring states to establish water quality standards for interstate streams within their boundaries by June 30, 1967. Responsibility for establishing these standards was given to the appropriate state authority and to the Administrator of the Environmental Protection Agency. Section 10 of the Act says the standards shall take into consideration use and value for public water supplies, propagation of fish and wildlife, recreational purposes, and agricultural, industrial, and other legitimate uses.

Prior to the enactment of the Water Quality Act the major thrust regarding water quality related only to two uses. This involved municipality waste water treatment for control of water-borne diseases and mineral content of irrigation water regarding soil and crop tolerance considerations. Public concern for protection of the environment stimulated a search for criteria for water quality standards for all uses. The Department of the Interior issued a publication in 1968 providing guidelines for water quality criteria. Fifty items were listed for surface water supplies considering physical state, microbiology, inorganic chemistry, organic chemistry, and radioactivity.

With few exceptions no rigid water quality standards can, at the present time, be developed to meet all water uses and situations. Interstate standards vary within and between the states. To meet the requirements of the Water Quality Act for interstate waters, the standards set up represent the condition of separate streams as of the year 1966. Table 12 provides standards for the principal interstate streams of the Basin.

Surface Water

The broad range of interstate stream standards shown in Table 12 is a result of downstream impairment of water. This range is typical of results obtained from more recent monitoring data of these streams and others within the Basin. This is a result of both natural and man-induced pollution. The source of the latter is one or more of the following: domestic and municipal sewage, irrigation return flow, industrial wastes,

Table 12. -- Water Quality Standards for Interstate streams 1/ and 2/.

Stream and Water Uses	Temperature (°C) summer average	pH annual annual median	Dissolved oxygen (mg/1.) summer average	Phosphates (mg/1.) average annual	Nitrates (mg/1.) single value	Total dissolved solids (mg/1.) average annual
Carson River Body contact recreation 3/, fish and wildlife, aesthetics, irrigation, stock water, power generation	21	7.1-8.8	7.0-8.0+	0.05-1.0	2.0-3.0	75-450
Truckee River Municipal, industrial, fish and wildlife, aesthetics, irrigation, stockwater, body contact recreation, power generation	17	7.4-8.3	6.5-8.0	0.1-0.75	2.0-5.0	100-250
Walker River Municipal, body contact recreation; fish and wildlife, aesthetics, irrigation, stock water	20	7.0-8.5	7.0	0.2-0.7	2.0-4.5	100-450
U.S. Public Health Service Standard						
Drinking water	--	---	---	---	45	500

1/ Source: State of Nevada, Interstate Water Quality Standards and Plan of Implementation, 1967.
2/ Values vary at designated positions along streams.
3/ Variable coliform organism counts.

Water quality standards assist in maintaining the high quality of the Basin's streams. Truckee River, Truckee Subbasin.

and sediment. Nonetheless the quality of water at the lower reaches of the interstate streams meets U.S. Health Service drinking water standards. In general, the water quality of the streams in the Basin is good.

Terminal lake waters concentrate dissolved solids largely through evaporation. The effect of time can be seen in the following tabulation:

Terminal Lake	Approximate dissolved solids in Mg/l	
	(1882)	(1970)
Pyramid Lake	3,500	5,000
Walker Lake	2,500	8,500

The disproportionate concentration of salts in the lakes is due mostly to differences in water volume. Reduction in lake mineral content only occurs in those lakes that overflow and receive fresh water. A tunnel was created to effect a partial drainage of Eagle Lake, northwest of Susanville. Subsequent refilling with fresh water lowered the salt content. Most of the lakes in the higher mountains overflow, including Lake Tahoe, and therefore maintain a relatively low salt content. Honey Lake is a terminal lake with excessive fluorine, boron, iron, and arsenic content. Therefore, Honey Lake, as well as Pyramid and Walker Lakes are unsuited for domestic or irrigation use.

Surface waters originating in the Sierra Nevada are of the calcium bicarbonate type, soft to slightly hard, and generally good for all uses. Long Valley Creek is an exception and is not suited for irrigation of some crops due to boron content.

Ground Water

As with surface water, ground water tends to deteriorate in the lower portions of closed ground water basins such as Madeline Plains, Honey Lake, Pyramid Lake, Carson Sink, and Walker Lake. The mineral content of this water cannot be reduced through its use and reuse. In higher valleys such as Eagle, Washoe, Truckee Meadows, Carson, and Smith, ground water generally contains less than 500 Mg/l of dissolved solids.

Thermal springs occur throughout the Basin. Notable among these are those near Honey Lake, Streamboat Springs, and others in the Truckee Meadows, Brady Hot Springs, various springs on the margins of Carson Valley, Fales Hot Springs near Bridgeport, and those near Artesia Lake and Wabuska. In general, the thermal springs have a high dissolved solids content and minor constituents of importance such as fluorine, boron, and iron. High sulphates are usually common to such waters.

Use and Management

Water

Depletions

More water is depleted annually from the Basin than is available as yield. This is resulting in the decline of terminal lakes in the Basin. The average annual water depletions in the Basin have been estimated at 2.19 million acre-feet. Table 13 lists major depletions by subbasin. Depletions for watersheds within each subbasin may be found in APPENDIX II. Percentage figures at the bottom of the table indicate that average annual depletions are 6.9 percent greater than the average annual water supply of 2.05 million acre feet.

Table 13 - Average Annual Water Depletion by Subbasin (acre-feet)

Subbasin	Irrigation	Phreatophytes	Surface Water Net Evaporation	Municipal & Industrial
Truckee	73,700	42,300	554,300	31,800
Carson	281,200	133,000	180,100	1,700
Walker	211,100	81,900	173,200	3,600
Calvada	108,100	173,500	139,800	1,400
Total	674,100	430,700	1,047,400	83,500
% Total Water Supply Depleted	32.9	21.0	51.1	1.9

The largest depletion is from evaporation of free water surfaces. Most of this loss is from natural water bodies. The following tabulation lists net evaporation from some of the major lakes in the Basin, surface areas as of October 1, 1970:

Pyramid Lake (above) and Walker Lake (below) have a combined average net evaporation in excess of a half million acre-feet annually

Annual Net Evaporation (Acre-Feet)	
Lake Tahoe	127,000
Pyramid Lake	385,000
Walker Lake	148,000
Eagle Lake	57,700
Honey Lake	66,300

The Lake Tahoe figure is the 1931 to 1960 average. The other figures are based on October 1, 1970 surface area.

Average annual gross lake evaporation varies from a low of 30 inches at high elevations to 52 inches in the desert areas. Net evaporation varies from 0 (precipitation exceeds evaporation) to 48 inches.

Table 14 shows the Basin's irrigated land by subbasin, county, and state. Irrigated land depletes an average of 674,000 acre-feet of water annually from the Basin. This is an average of 1.85 feet of water for each acre irrigated. Much of the irrigated land does not receive a full water supply. The potential consumptive use for major irrigated crops as computed from average climatic data for several weather stations is shown in Table 15. The table shows growing season consumptive use only. Non-growing season use is, on the average, more than satisfied by precipitation.

Table 14 - Irrigated land by county, subbasin and state, Cetral Lahontan Basin, (acres)

State & County	Walker	Carson	Truckee	Calvada	County Totals	State Totals
Nevada						
Carson City	--	1,638	--	--	1,638	
Churchill	--	72,887	--	--	72,887	
Douglas	989	43,219	--	--	44,208	
Lyon	73,539	4,631	2,984	--	81,154	
Mineral	7,240	--	--	--	7,240	
Pershing	--	--	--	--	--	
Storey	--	--	563	--	563	
Washoe	--	--	30,400	2,339	32,739	
TOTALS, Nev.	81,768	122,375	33,947	2,339	--	240,429
California						
Alpine	--	7,906	--	--	7,906	
Eldorado	--	--	2,100	--	2,100	
Lassen	--	--	--	68,316	68,316	
Mono	38,100	--	--	--	38,100	
Nevada	--	--	2,250	--	2,250	
Placer	--	--	1,485	--	1,485	
Plumas	--	--	--	--	--	
Sierra	--	--	1,800	1,937	3,737	
TOTALS, CA	38,100	7,906	7,635	70,253	--	123,894
Subbasin Totals	119,868	130,281	41,582	72,592	--	--
Basin Totals	--	--	--	--	--	364,323

Table 15 - Growing season consumptive use by month for major crops at selected weather stations in inches of water, Central Lahontan Basin

Weather Station and Crop	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Season total
Fallon									
Alfalfa	-	2.8	4.3	6.0	7.9	6.5	4.0	0.5	32.0
Grass pasture	0.3	2.7	3.6	4.9	6.5	5.5	3.5	1.8	28.8
Spring grain	0.2	2.1	4.7	6.3	2.3	-	-	-	15.6
Minden									
Alfalfa	-	0.2	3.6	5.2	6.8	5.4	3.3	-	24.5
Grass pasture	-	1.4	3.0	4.3	5.6	4.6	3.2	1.8	23.9
Spring grain	-	0.8	3.2	5.9	4.9	0.4	-	-	15.2
Reno									
Alfalfa	-	0.4	3.8	5.3	7.1	5.8	3.6	-	26.0
Grass pasture	-	1.6	3.1	4.4	5.9	5.0	3.2	1.8	25.0
Spring grain	-	.09	3.4	6.0	4.7	0.4	-	-	15.4
Susanville									
Alfalfa	-	0.4	3.8	5.4	7.1	5.9	3.8	1.0	27.4
Grass pasture	-	1.6	3.2	4.4	5.9	5.1	3.4	1.8	25.4
Spring grain	-	0.9	3.4	6.1	4.8	0.4	-	-	15.6
Yerington									
Alfalfa	-	0.9	4.0	5.6	6.9	6.3	3.5	-	27.2
Grass pasture	0.1	2.0	3.3	4.5	5.7	5.4	3.3	1.8	26.1
Spring grain	0.1	1.2	3.9	6.2	3.7	0.4	-	-	15.5

Phreatophytes occupy 530,000 acres of land in the Basin. They deplete 438,000 acre-feet of water annually. The amount depleted is the amount used in excess of effective precipitation; that is, it is the amount the phreatophyte plants withdraw from the ground water. Consumptive use of phreatophytes is indicated in Table 16.

Heavy growth of phreatophytic vegetation, Walker Subbasin

Table 16 - Annual consumptive use in inches by phreatophyte species, Central Lahontan Basin

Density	Depth to Water Table (feet)	Brush[1/]	Grasses[2/]	Cottonwood	Great Basin Wild Rye
High	4	22.2	5.6	45.0	27.7
	6	16.9	3.1	38.3	20.3
	8	13.6	2.5	32.4	13.8
	10	11.3	-	26.5	8.6
Medium	4	17.76	4.6	-	22.2
	6	13.6	2.5	-	16.2
	8	10.8	2.0	-	11.0
	10	9.0	-	-	7.0
Low	4	13.3	3.4	-	16.6
	6	10.2	1.9	-	12.1
	8	8.2	1.6	-	8.3
	10	6.7	-	-	5.2

1/ Brush includes greasewood, quailbush, rabbitbrush, some saltbushs, hairy horsebrush, etc.

2/ Grasses and grass-like plants.

Municipal and industrial water depletions are small in comparison with the total water supply, amounting to less than two percent of the total. Only a portion of the water withdrawn is actually depleted. For example, the Sierra Pacific Power Company holds a 69,000 acre-feet water right from the Truckee River for the Reno-Sparks area, but is withdrawing only about 55 percent of that with the depletion amounting to less than 40 percent of the withdrawal. Depletions are estimated to range between 25 and 45 percent of the total amount withdrawn for municipal use. Table 17 shows estimated withdrawals and depletions for some of the municipalities in the Basin.

Table 17 - Estimated water use for selected municipal water supply systems, Central Lahontan Basin, acre-feet

Municipal area	Water withdrawn	Source		
		Surface	Well	Depletion
Reno-Sparks	38,000	31,000	7,000	15,000
Carson City	2,400	1,000	1,400	700
Yerington	630	-	630	170
Susanville	2,740	-	2,740	1,000

Source: Estimated Water Use In Nevada, 1969 Central Lahontan Basin Staff

Although a comparatively small use at present, the demand for municipal water is increasing more rapidly than for any other water use. Table 18 shows the increase in demand for the Reno-Sparks and Carson City water systems from 1940 through 1970.

Table 18 - Historic growth in municipal water demand, acre-feet per year

Year	Carson City Municipal system	Reno-Sparks Sierra-Pacific system
1940	Not available	13,800
1945	Not available	17,600
1950	377	21,100
1955	513	24,200
1960	863	28,600
1965	1,600	30,100
1970	2,520	39,500

Source: Nevada Division of Water Resources

Industrial water depleted from self-supplied systems is approximately 12,000 acre-feet per year. Some of this is evaporation. Industrial uses (excluding power generation) are estimated to consume 60 percent of their withdrawals.

Sierra Pacific Power Company has two gas or oil operated steam generating plants in the Basin. The Tracy plant is east of Sparks and uses water from the Truckee River. The Fort Churchill plant is about 15 miles north of Yerington and uses water from the Walker River. Water is used at these plants to cool condensers and for boiler feed-water. Offstream reservoirs are used for settling and cooling ponds. The evaporation from these ponds accounts for much of the water depletion of the plants.

Approximately 6,600 acre-feet of water are withdrawn per year for rural domestic and livestock use in the Basin. It is estimated that about three-fourths of this, or approximately 5,100 acre-feet is depleted. Livestock deplete about 3,000 acre-feet per year at a rate of 15 gallons per day for cattle and two gallons per day for sheep. Most of the water for livestock is supplied from streams often through irrigation systems. Wells and springs provide additional livestock water. Rural domestic withdrawals are estimated at 100 gallons per person, per day. Most of the rural domestic supply is from wells.

Non-depleting Uses

In 1969 an estimated 950,000 acre-feet of water was used for hydro-electric power generation in the Basin. This is a non-depleting use of the water resource. Plants currently in operation are all on the Truckee River, and these are Farad, Fleisch, Verdi, and Mogul.

Until recent years the Truckee-Carson Irrigation District operated two hydro-electric power plants on the Carson River, one at Lahontan Dam and the other on the canal below Lahontan, under provisions of the 1926 contract with the United States. Between 1951 and 1963 an average of 166,000 acre-feet of water per year was released through these plants. Most of this water was used for irrigation on the Newlands Project. However, during this period an average of 42,800 acre-feet of water per year was released through the plants between November 15 and March 15. These winter releases were not available for irrigation but were utilized by the Stillwater Wildlife Management Area.

Recreation might be said to be another non-depleting use of water, although evaporation from free-water surfaces is the largest depletor of the resource. It is estimated that there are over 3.5 million visitor-days use associated with water-based recreation on both natural and man-made lakes and on 1,270 miles of fishable streams in the Basin.

Water Management

The management of the water resources in the Basin had its beginnings with the early settlement of the area.

Land has historically been developed for irrigated crop production in locations where water was readily available. In order to increase the water supply in the summer, reservoirs have been built to store water from the high runoff months of April, May, and June. Reservoirs have also been constructed for other purposes including flood control, recreation, power, fish and wildlife, or any combination of these.

Table 19, and Map 15, list the reservoirs in the Central Lahontan Basin and shows their location. The total maximum reservoir capacity is about 1.8 million acre-feet. Some reservoirs will rarely fill, others have large volumes of non-usable storage included as part of their maximum capacity, due to allowances for sediment storage and flood water detention.

Table 19 - Existing storage reservoirs, Central Lahontan Basin

Map No.	Name	County	Source	Acres Maximum Surface	AF Maximum Capacity	Year Comp.	Major Use
Calvada Subbasin							
1	Tulelake Reservoir	Lassen	Cedar Creek	2,650	39,500	1904	I, R
2	Boot Lake	Lassen	Upper Red Rock Creek	500	1,200	Unk.	I
3	Madeline	Lassen	Tulelake Reservoir	75	400	1900	I
4	Mitchell Field	Lassen	Trib. to Madeline Pl.	144	480	1924	I
5	Big Meadows	Lassen	Dry Creek	20	50	1920	I
6	Mendiboure	Lassen	Van Loan Creek	104	1,100	1949	I
7	Van Loan	Lassen	Van Loan Creek	20	100	1920	I
8	Dodge Reservoir	Lassen	Red Rock Creek	488	9,363	1937	I
9	Said Valley	Lassen	Said Valley Creek	156	470	1955	I
10	Dunn Reservoir	Lassen	Red Rock Creek	460	2,100	1910	I
11	Spaulding	Lassen	Canyon Creek	18	147	1954	I
12	Pilgrim Lake Res.	Washoe	Trib. to Buckhorn Creek	65	250	1920	I
13	Buckhorn	Lassen	Buckhorn Creek	300	2,000	1904	I
14	Swanberger	Lassen	Trib. to Slate Creek	80	320	1925	I
15	Heath Reservoir	Lassen	Slate Creek	440	8,650	1967	I, R
16	Dueasse	Lassen	Trib. to Madeline Pl.	200	600	1918	I
17	Squaw Valley	Washoe	Squaw Creek	47	1,200	1948	I
18	Branham Flat	Lassen	Branham Creek	125	1,200	1880	I
19	Fredonyer	Lassen	Pine Creek	20	300	1914	I
20	Coon Camp	Lassen	Coon Creek	69	548	1900	I
21	Horse Lake Reservoir	Lassen	Snowstorm Creek	34	193	1912	I, R
22	Horse Lake	Lassen	Pine Creek	2,840	13,200	Unk.	I
23	Dewey Parker	Washoe	Buffalo Slough	156	428	1950	I
24	Craemer	Lassen	Trib. to Horse Lake	500	3,000	1910	I
25	Smoke Creek	Lassen	Smoke Creek	88	1,200	1949	I
26	Beckett Reservoir	Lassen	Piercen Springs	36	114	1963	I
27	Petes Valley	Lassen	Petes Creek	48	500	1954	I
28	Hagata Reservoir	Lassen	Hagata Canyon	21	129	1916	I
29	Round Valley	Lassen	Coyote Creek	400	5,250	1892	I
30	Caribou Lake	Lassen	Susan River	85	606	1928	I
31	McCoy Flat	Lassen	Susan River	1,800	13,000	1891	I
32	Hog Flat	Lassen	Trib. to Susan River	1,000	6,400	1891	I
33	Barry	Lassen	Trib. to Susan River	29	113	1941	I
34	Peconom	Lassen	Antelope Creek	41	173	1920	I
35	Millpond	Lassen	Trib. to Susan River	25	200	1920	I
36	Ward Lakes (2)	Lassen	Balls Canyon	60	950	1889	I
37	Emerson	Lassen	Hills Creek	42	418	1940	I
38	Johnston	Lassen	Dry Creek	15	70	1938	I
39	Shugru	Lassen	Trib. to Susan River	33	195	1925	I
40	Lake Leavitt	Lassen	Susan River	2,560	12,100	1891	I
41	Fleming Reservoir	Lassen	Susan River	35	100	1922	F & W
42	Hartsen Lake	Lassen	Susan River	864	2,750	1940	F & W
43	Cottonwood Cyn. Res.	Washoe	Cottonwood Creek	5	15	1950	I
44	Parman	Lassen	Downing Creek	3	42	1947	I
45	Spanish Flat	Washoe	Dry Valley Creek	236	1,000	1958	I
46	Milk Ranch	Washoe	Dry Valley Creek	23	252	1958	I
47	Red Rock Ranch Res.	Washoe	Springs	14	25	1935	I
48	McClusky Ranch Res.	Washoe	Springs	19	40	1950	I
49	Aldabe	Sierra	E. Br. Long Valley Creek	9	140	1951	I
Truckee River Subbasin							
50	Winnemucca Ranch Res.	Washoe	Springs	22	60	1958	I
51	Spanish Springs	Washoe	Orr Ditch	30	185	Unk.	R
52	Fernley Dam #1	Lyon	Tailwaters	276	910	1954	F & W
53	Fernley Dam #2	Lyon	Tailwaters	95	476	1957	F & W
54	Highland Reservoir	Washoe	Highland Ditch	10	54	1875	M & I
55	Peavine Mtn. Res.	Washoe	Peavine Creek	42	731	1964	FC, SR

Table 19 - Existing storage reservoirs, Central Lahontan Basin

Map No.	Name	County	Source	Acres Maximum Surface	AF Maximum Capacity	Year Comp.	Major Use
56	Virginia Lake	Washoe	Cochran Ditch	24	140	Unk.	R, F & W
57	Hunter Reservoir	Washoe	Hunter Creek	5	60	1863	M & I
58	Sunrise Reservoir	Sierra	Sunrise Creek	15	187	1946	F & W
59	Stampede	Sierra	Little Truckee River	3,450	220,000	1969	FC, P, R, M&I
60	Wheeler	Washoe	Evans Creek	46	948	1889	I
61	Lake Alexander	Washoe	Steamboat Creek	58	250	1889	I
62	Independence Lake	Nevada	Independence Creek	725	17,500	1879	P, M & I
63	Boca	Nevada	Little Truckee River	1,040	40,850	1939	I
64	Prosser	Nevada	Prosser Creek	920	30,000	1962	FC, R, P, M&I
65	Martis Creek	Nevada	Martis Creek	770	20,400	1972	FC, M&T
66	Gooseneck Flat	Nevada	Martis Creek	30	125	1959	I
67	Donner Lake	Nevada	Donner Creek	960	9,400	1877	M & I, P, I
68	Dry Lake Reservoir	Nevada	Dry Lake Basin	45	350	1957	I
69	Incline Lake	Washoe	Third Creek	30	157	1939	R
70	Price Lake	Washoe	Ophir Creek	10	54	Unk.	I
71	Washoe Lake	Washoe	Franktown & Ophir Creek	5,800	31,000	1864	I, F & W, R
72	Hobart Lake	Washoe	Hobart Creek	10	110	1875	M & I, F & W
73	Marlette Lake	Washoe	Marlette Basin	381	11,800	1877	F & W, M & I
74	Spooner Lake	Douglas	N. Canyon Creek	100	1,580	1882	R
75	Lake Tahoe	El Dorado Placer, Washoe, Carson City, Douglas	Lake Tahoe Basin	124,000	744,600	1874	I, R, P, FC, M & I, F & W
76	Stony Ridge Lake	El Dorado	Meeks Creek	57	315	Unk.	F & W, R
77	Quail Lake	El Dorado	Springs	14	70	Unk.	M & I
78	Heather Lake	El Dorado	Glen Alpine Creek	37	142	Unk.	F & W, R
79	Fallen Leaf Lake	El Dorado	Glen Alpine Creek	1,380	6,800	Unk	F & W, R
80	Susie Lake	El Dorado	Glen Alpine Creek	36	99	Unk.	F & W, R
81	Gilmore Lake	El Dorado	Glen Alpine Creek	78	320	Unk.	F & W, R
82	Echo Lake	El Dorado	--	338	1,900	Unk.	P, R, F & W
83	Round Lake	El Dorado	Upper Truckee River	41	300	Unk.	F & W, R
Carson River Subbasin							
84	Desert Gun Club Res.	Churchill	Tailwaters	100	500	1940	R
85	Harmon Lake	Churchill	Tailwaters	200	400	1955	R
86	Hazen	Churchill	Tailwaters	10	20	1954	R
87	Old River	Churchill	Carson River	270	500	1958	I
88	Ollies Pond "S"	Churchill	Carson River	350	700	1955	I
89	Stillwater Point	Churchill	Tailwaters	1,900	19,000	1947	F & W
90	Lahontan	Churchill-Lyon	Carson River	14,800	322,000	1915	I, F & W, R, FC
91	Sheckler	Churchill	Carson River	1,000	10,500	1955	I
92	Dangberg #1 & 2	Douglas	E. Carson River	45	375	1905	I
93	Dangberg #3	Douglas	E. Carson River	80	500	1905	I
94	Dangberg #4	Douglas	E. Carson River	150	1,000	1905	I
95	Bosc	Douglas	Tailwater	30	90	1882	I
96	Mud Lake	Douglas	Indian Creek	300	3,252	1879	I
97	Scott Lake	Alpine	Scott Creek	30	600	1926	I, R
98	Harvey Lake	Alpine	Unnamed	17	410	Unk	I
99	Crater Lake	Alpine	Crater Lake Creek	20	320	1937	I, R
100	Indian Creek	Alpine	Indian Creek	160	3,130	1967	I, R
101	Red Lake	Alpine	Red Lake Creek	85	1,410	1924	I, R
102	Forestdale	Alpine	Forestdale Creek	36	594	Unk.	I, R
103	Lost Lake East	Alpine	Lost Creek	16	92	1925	I, R

MAP 15

EXISTING STORAGE RESERVOIRS

CENTRAL LAHONTAN BASIN

ALPINE, EL DORADO, LASSEN, MONO, NEVADA, PLACER, PLUMAS AND SIERRA COUNTIES, CALIFORNIA
CARSON CITY, CHURCHILL, DOUGLAS, LYON, MINERAL, PERSHING, STOREY AND WASHOE COUNTIES, NEVADA

JULY 1975

10 0 10 20 30 MILES
SCALE 1:1,200,000

M7-PN-23034

Table 19 - Existing storage reservoirs, Central Lahontan Basin

Map No.	Name	County	Source	Acres Maximum Surface	AF Maximum Capacity	Year Comp.	Major Use
104	Lost Lake West	Alpine	Lost Creek	5	127	1925	I, R
105	Tamarack Lake	Alpine	Pleasant Valley Creek	35	400	1905	I, R
106	Heenan Lake	Alpine	Heenan Creek	129	3,000	1929	F & W
107	Lower Sunset Lake	Alpine	Pleasant Valley Creek	41	860	1895	I, R
108	Raymond Lake	Alpine	Trib. Pl. Valley Creek	5	50	1895	I, R
109	Upper Sunset Lake	Alpine	Pleasant Valley Creek	18	68	1904	I, R
110	Wet Meadows	Alpine	Wet Meadows Creek	33	450	1895	I, R
111	Lower Kinney Lake	Alpine	Silver Creek	43	920	1926	I, R
112	Upper Kinney Lake	Alpine	Silver Creek	20	328	1895	I, R
113	Kinney Meadows	Alpine	Kinney Creek	33	900	1929	I, R
Walker River Subbasin							
114	Weber	Mineral	Walker River	900	13,000	1933	I, R
115	Topaz Lake	Douglas	W. Walker River	2,410	61,000	1922	I, R
116	Rose Creek	Mineral	Rose Creek	32	656	1932	M & I
117	Cat Creek	Mineral	Cat Creek	25	1,155	1931	M & I
118	Lobdel Lake	Mono	Desert Creek	48	640	1948	I, R
119	Junction	Mono	Black Creek	21	350	1905	I, R
120	Poore Lake	Mono	Poore Creek	94	1,200	1900	I, R
121	Bridgeport Reservoir	Mono	E. Walker River	3,000	42,455	1923	I, R, FC
122	Lower Twin Lake	Mono	Robinson Creek	440	4,050	1888	I, R
123	Upper Twin Lake	Mono	Robinson Creek	300	2,050	1905	I, R
124	Green Lake	Mono	Green Creek	80	400	Unk.	I, R

Source: U. S. Bureau of Reclamation, Nevada State Engineer, Calif. Dept. of Water Resources, Calif., State Water Resources Control Board, U. S. Geological Survey, Calif Dept. of Fish & Game, Susan River Decree, Nev. Dept. of Fish & Game, USDA River Basin Staff, Walker River Decree, Truckee River Decree.

Legend: I, Irrigation; R, Recreation; P, Power; FC, Flood Control; M&I, Municipal & Industrial Water; F & W, Fish & Wildlife; SR, Sediment Reduction

322,000 AF Lahontan Dam and Reservoir on the Carson River. It provides water to the Newlands Project near Fallon. The canal at right is a transbasin diversion bringing a portion of the Truckee River to Lahontan.

Table 20 shows the ownership of the reservoirs by subbasin, state, and type of ownership.

Table 20 - Ownership of existing reservoirs, Central Lahontan Basin

	Private		Local Govt		State		Federal		Total		
Subbasin	Cal.	Nev.	Cal.	Nev.	Cal.	Nev.	Cal.	Nev.	Cal.	Nev.	All
Calvada	38	8	-	-	3	-	-	-	41	8	49
Truckee	7	9	-	1	6 1/	5	6	1	18	16	34
Carson	16	10	1	-	-	-	-	3	17	13	30
Walker	7	1	-	-	-	-	-	3	7	4	11
Subtotal	68	28	1	1	8	5	6	7	83	41	124
TOTALS	96		2		13		13		124		---

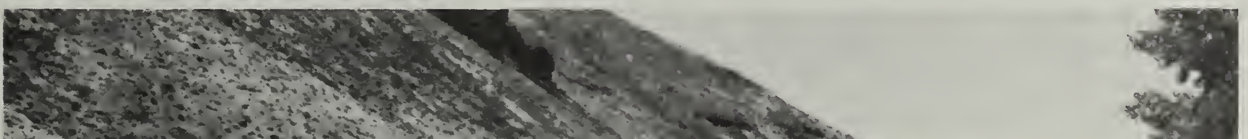
1/ One reservoir in California is operated by Nevada Fish & Game

Table 21 shows the irrigation related practices on the land at this time for the management of irrigation water.

Table 21 -- Irrigation water management practices on the land, Central Lahontan Basin

Practice	Unit	Walker	Carson	Truckee	Calvada	Basin Total
Irrigation canal or lateral	feet	1,102,847	2,899,253	482,670	250,000	4,734,770
Irrigation field ditch	feet	2,099,103	2,833,685	508,233	543,704	5,984,725
Irrigation ditch and canal lining	feet	56,464	248,728	59,606	12,600	377,398
Irrigation pipeline	feet	112,337	170,091	85,607	92,263	460,298
Irrigation sprinkler system	acres	464	480	1,141	2,100	4,185
Irrigation water management	acres	21,960	54,031	6,890	5,493	88,374
Irrigation land leveling	acres	45,115	69,449	4,311	13,406	132,281
Land smoothing	acres	10,397	34,360	80	1,697	46,534
Drainage main or lateral	feet	284,013	1,539,348	33,054	20,212	1,876,627
Irrigation pit or regulating res.	no.	11	10	2	17	40
Structure for water control	no.	21,392	31,194	6,373	132	59,091
Drainage field ditch	feet	321,342	637,022	177,350	8,600	1,144,314
Drain (conduit)	feet	13,420	43,878	1,760	4,000	63,058

Many thousands of acres of the Basin irrigated croplands have been levelled to provide a uniform grade for irrigation



Derby diversion dam on the Truckee River diverts water to Lahontan Reservoir for use in the Carson Subbasin.

Another aspect of the management of the water resource is the interbasin transfer of water. This occurs both internally and externally. Table 22 lists both natural and man-made transfers of water occurring within the Basin and to adjoining river basins. Of the transfers of water among the subbasins of the Central Lahontan, one is of particular interest. This is the diversion of Truckee River water to Lahontan Valley in the Carson Subbasin. In the past the average amount delivered each year to the Carson River from the Truckee River has been about 184,000 acre-feet. Naturally occurring ground water flows between subbasins are minor except for the area around Eagle Lake.

Table 22 -- Interbasin water transfers

From Subbasin or river basin	Ave. Ann. amount acre-feet	Purpose	To Subbasin or river basin
Little Truckee, Truckee River	7,500	Irrigation	Sierra Valley, Feather River
Tahoe, Truckee River	3,250	Sewage export	Carson Valley, Carson River
Derby Dam, Truckee River	184,000	Irrigation	Lahontan Valley, Carson River
Marlette Lake, Truckee River	720	Municipal	Carson City, Virginia City, Carson River
Echo Lake, Truckee River	1,700	Power	American River
Mason Valley, Walker River	1,000	Natural ground water flow	Adrian Valley, Carson River
Virginia Creek, Walker River	1,000	Irrigation	Mono Lake Basin
Humboldt Sink, Humboldt River	7,000	Natural high water spill-over	Carson Sink, Carson River
Cedar Creek, Pit River	4,800	Irrigation	Madeline Plains, Calvada
Clover Valley, Calvada	200	Irrigation return flow	Lake Almanor, Feather River
Eagle Lake, Calvada	52,000	Natural ground water flow	Unknown
Unknown	22,400	Natural ground water flow	Willow Creek, Pete's Creek, Calvada
Eagle Lake, Calvada	5,800	Irrigation, tunnel leakage	Willow Creek, Calvada

Water Supply Forecasting

To more effectively use the water resource, the science of snow surveying and streamflow forecasting has been developed. Streamflow forecasts are made for most of the major streams of the Basin. These forecasts are based on 21 of the more than 50 snow courses located in the high snowpack areas of the Basin. These 21 courses are listed in APPENDIX II. Snow course measurements are taken either manually on a monthly basis or continuously from recording snow sensors. From the predicted seasonal supply of water, water management schemes concerning reservoir operation, irrigation, cropping, urban use, power generation, and many related activities are developed.

Water Rights

Irrigation for profitable crop production in the Central Lahontan Basin is essential. Presently there are about 364,000 acres being irrigated from both surface and underground sources. Included in this is 67,542 acres of land classed as semi-irrigated pasture which may receive only one irrigation and which may or may not have a water right. Table 23 indicates irrigated acres and tabulated water rights acres by subbasin and state. On the Truckee River alone, the Federal watermaster estimates there are about 13,000 water right holders. The remaining three subbasins combined total less than half that number.

The laws governing the rights to the use of water in the Basin are significantly different in the two states. Nevada has adopted the Doctrine of Appropriation in its entirety while California recognizes rights related to the ownership of land such as riparian, littoral, correlative (ground water), and federal reserved as well as appropriation.

Additional discussion covering the Basin's water rights can be found in APPENDIX II.

Table 23 -- Irrigated lands and irrigation water rights, acres, Central Lahontan Basin, 1973

Subbasin and State	Acres irrigated 1/	Surface water rights 2/	Underground Water Rights		
			Total	Supplemental	Non-supplemental
Walker	119,868 3/	124,975	36,133	24,891	11,242
Nevada	81,768	81,187	34,488	24,081	10,407
California	38,100	43,788	1,645	810	835
Carson	130,281 4/	127,151	15,766	12,054	3,712
Nevada	122,375	117,731	15,766	12,054	3,712
California	7,906	9,420	0	0	0
Truckee	41,582 5/	53,958	6,667	4,137	2,530
Nevada	33,947	46,238	6,667	4,137	2,530
California	7,635	7,720	0	0	0
Calvada	72,592 6/	65,400	9,798	6,858	2,940
Nevada	2,339	2,900	1,898	1,558	340
California	70,253	62,500	7,900	5,300	2,600
TOTALS	364,323	371,484	68,364	47,940	20,424

Source: Nevada State Engineer, California Department of Water Resources, California Water Resources Control Board, Truckee River Decree, Proposed Carson River Decree, Walker River Decree, Susan River Decree, River Basin Planning Staff.

1/ Lands irrigated from surface and underground sources.

2/ Includes decreed, vested, and riparian rights.

3/ Includes 11,673 acres semi-irrigated pasture and mountain meadows which may or may not have water rights.

4/ Includes 24,601 acres semi-irrigated pasture and mountain meadows which may or may not have water rights.

5/ Includes 17,914 acres semi-irrigated pasture and mountain meadows which may or may not have water rights.

6/ Includes 13,354 acres semi-irrigated pasture and mountain meadows which may or may not have water rights.

A good water right is essential for obtaining profitable crop production in the Basin.

Urban and Industry

There are 214,970 acres in the Basin devoted to urban, industrial, and transportation uses. This includes cities, small towns, roads, freeways, railroads, large mining operations, and the industrial portions of the military bases at Herlong, Fallon, and Hawthorne. The population center for the entire Basin is the Reno-Sparks-Lake Tahoe-Carson City complex. The largest acreage of this category occurs in the Walker Subbasin, which is because of the U.S. Navy's Hawthorne Naval Ammunition Deport. Urban land by subbasin is shown in the following tabulation:

Subbasin	Urban acres
Calvada	40,595
Truckee	59,159
Carson	23,936
Walker	91,280
Totals	214,970 acres

These areas are delineated on subbasin maps in APPENDIX II. Not included in this acreage is an estimated 100,000 acres of existing and planned low-density housing and mobile home developments that are scattered throughout the Basin. These second home and/or retirement communities have developed rapidly during the past 10 years. The majority of these developments occur on privately owned land. The exception is at Markleeville and South Lake Tahoe where subdivisions have been built on Forest Service land under lease agreement.

Cropland

Intensive farming operations are carried out on about 3.5 percent of the Basin. This cropped land totals 383,330 acres. About 364,300 acres are irrigated and about 19,000 acres are dry-farmed, relying solely on natural precipitation. Crop production on most of these dry-farmed areas is a marginal operation in average water years, and is carried on almost entirely in the Calvada Subbasin where natural annual precipitation exceeds 12 inches.

The majority of the irrigated crop production is carried out at 10 locations. These are the Truckee Meadows, Fernley, Carson Valley, Lahontan Valley, Smith Valley, Mason Valley in Nevada, and Honey Lake, Bridgeport and Antelope Valleys, and the upper Carson Valley area in California. Specific locations of all the irrigated lands are shown on the individual subbasin maps in APPENDIX II.

Urbanization of former agricultural lands is significant at several locations in the Basin, such as in Carson Valley Carson Subbasin

Irrigated pasture constitutes the largest acreage of cropland in the Basin.

Livestock forage is the chief crop grown. Alfalfa, wild hay, irrigated pasture and small grains account for 99 percent of the cropland. Small acreages of onions, garlic, potatoes, sugar beets, and melons are also grown where irrigation water is plentiful and the climate is suitable.

About 2,700 acres of idle cropland was tabulated when the basic data was assembled. This developed cropland was not being cropped at that time for various reasons related to water availability or economics and could go back into production as the situation changes.

Table 24 shows the crops grown in the four subbasins during the period this report was developed. There were 1,844 farm/ranch operating units tabulated in the Basin, with 1,484 being in Nevada and 360 in California. Almost half of the Basin total are located in the Carson Subbasin and about 60 percent of these are in the Lahontan Valley where many small farm units are characteristic. Most of the California units are located in the Honey Lake Valley portion of the Calvada Subbasin.

Table 24 - Cropland acreage by crop and subbasin, Central Lahontan Basin, 1973

Crop	Subbasin				Basin Total
	Calvada	Truckee	Carson	Walker	
Alfalfa hay	12,379	9,660	42,138	32,224	96,401
Small grains	2,360	659	5,571	3,842	12,432
Vegetables/row crops	300	283	3,100	646	4,329
Irrigated pasture	16,375	2,966	49,994	32,415	101,750
Wild hay	26,411	10,100	3,748	3,465	43,724
Semi-irrigated pasture	11,430	8,914	21,888	41,730	83,962
Mountain meadows	2,310	9,000	2,713	5,050	19,073
Other	1,027	--	1,129	496	2,652
irrig. subtotal	72,592	41,582	130,281	119,868	364,323
Dryland pasture	11,167	--	--	--	11,167
Dryland grain	7,489	200	151	--	7,840
Dryland subtotal	18,656	200	151	--	19,007
Total Farmland	91,248	41,782	130,432	119,868	383,330

Rangeland

Grazing

Livestock grazing is the most extensive use of land in the Basin and is shown on Map 16. Ninety-three percent of the Basin's total area, 9,381,118 acres, were estimated to provide 960,160 Animal Unit Months (AUMs) of forage from forest, range, and pasture lands for livestock in 1970. This figure is based on permits and licenses issued by the Federal land management agencies and the estimated AUMs harvested from private rangeland and pasture. The grazing resource and the AUMs of use by subbasin are shown in the following tabulation:

Subbasin	Grazing area 1970			AUMs of use 1970		
	Rangeland	Pasture	Total	Rangeland	Pasture	Total
Calvada	2,624,030	67,693	2,691,723	189,200	112,200	301,400
Truckee	1,966,042	30,980	1,997,022	102,500	39,960	142,460
Carson	2,063,652	78,343	2,141,995	86,200	167,000	253,200
Walker	2,471,438	78,940	2,550,378	133,600	129,500	263,100
Basin Totals	9,125,162	225,956	9,381,118	511,500	448,660	960,160

Eighty-six percent of the rangeland grazing takes place on National Resource Lands administered by the Bureau of Land Management (BLM) and on privately-owned rangelands. BLM grazing district offices at Carson City, Winnemucca, and Susanville administer the National Resource Lands. National forest lands within the Toiyabe, Lassen, El Dorado, Tahoe, and Plumas National Forest provide about 14 percent of the rangeland grazing. Permitted National Forest grazing by subbasin and type of livestock is shown in the following tabulation:

Subbasin	Cattle and Horses		Sheep and Goats	
	(acres)	(AUMs)	(acres)	(AUMs)
Calvada	175,292	13,028	1,340	1,050
Truckee	11,254	4,571	38,008	9,488
Carson	32,213	5,160	19,183	7,405
Walker	205,007	13,404	107,163	32,421
Totals	423,764	36,163	165,694	50,364

Livestock grazing is important to the Basin in that it provides a usable and renewable resource without requiring drastic modification in land or water resources. Properly managed, it is compatible with most other land resource uses, and normally does not detract from the quality of the environment.

The Forest Service and Bureau of Land Management and their permittees are cooperating in range revegetation, construction of range improvements, and better control of livestock. This should eventually result in restoration of much of the range to its original productivity. In some cases, no increase in AUMs is indicated as the range improvement will allow the area to better meet the present use obligations.

Range Forage Production

Range forage production varies from low to high, with a large percentage of the Basin being in the low forage production class. There are few pristine range areas as most of the range lands have been heavily used by sheep, cattle, and horses for more than 100 years. Out of the 9,125,162 acres of rangeland forest and woodland in the Basin, 2,129,260 acres are classed as unusable by livestock. Range forage production has been calculated on the remainder. Acres of forage production classes on suitable range by subbasin is shown in Table 25. The unusable rangeland, forest and woodland is shown on Table 26 by subbasin and state.

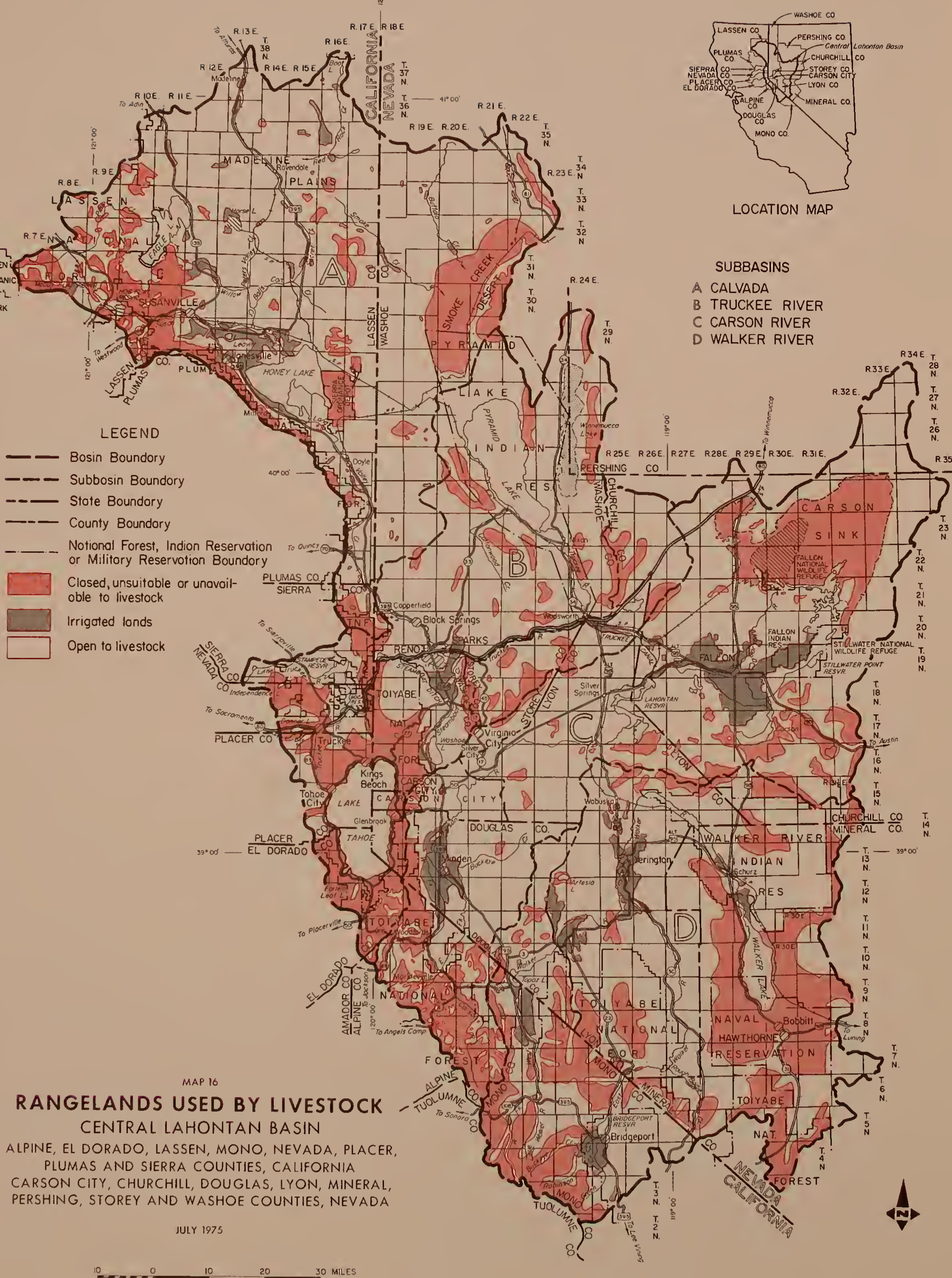
Table - 25 - Usable range forage acreage by production classes

Subbasin	Acres by Production Classes			
	High	Medium	Low	Total
Calvada	282,970	659,680	1,350,180	2,292,830
Truckee	43,460	390,625	946,437	1,380,522
Carson	162,035	495,701	1,083,104	1,740,840
Walker	609,030	505,920	466,760	1,581,710
Total	1,097,495	2,051,926	3,846,481	6,995,902

Table 26 - Inaccessible and unsuitable rangeland, forest, and woodland, by vegetal types, subbasin, and state - acres

Site	Walker		Carson		Truckee		Calvada		Total		Basin	Per-
	Nevada	Calif.	Nevada	Calif.	Nevada	Calif.	Nevada	Calif.	Nevada	Calif.	Totals	cent
Big Sagebrush - Grass	10,010	-	4,000	3,000	76,430	-	8,100	39,920	98,540	42,920	141,460	7
Low Sagebrush - Grass	21,480	10,200	3,430	-	13,850	-	-	3,270	38,760	13,470	52,230	2
Pinyon - Juniper	337,315	50,350	2,000	1,980	41,020	-	-	-	380,335	52,330	432,655	21
Juniper - Sage	-	-	-	-	10,100	-	22,570	3,190	32,670	3,190	35,860	1
Desert Shrub - Grass	14,675	-	11,896	-	-	-	-	-	26,571	-	26,571	1
Mixed Desert Shrub	225,785	-	41,130	-	29,190	-	1,100	9,970	297,205	9,970	307,175	16
Dalea - Fourwing Saltbush	-	-	7,110	-	-	-	-	-	7,110	-	7,110	T
Conifer - Browse - Grass	600	178,910	30,554	234,290	64,929	332,756	1,800	239,300	97,883	985,256	1,083,139	49
Browse-Aspen-Grass	2,100	38,343	-	-	9,660	17,685	-	1,980	11,760	58,008	69,768	3
TOTAL	611,965	227,803	100,120	239,270	245,179	350,441	33,570	297,630	990,834	1,165,144	2,155,978	100

This sagebrush-grass vegetal type would be considered to be in the high forage production class.



MAP 16

RANGELANDS USED BY LIVESTOCK

CENTRAL LAHONTAN BASIN

ALPINE, EL DORADO, LASSEN, MONO, NEVADA, PLACER, PLUMAS AND SIERRA COUNTIES, CALIFORNIA
CARSON CITY, CHURCHILL, DOUGLAS, LYON, MINERAL, PERSHING, STOREY AND WASHOE COUNTIES, NEVADA

JULY 1975

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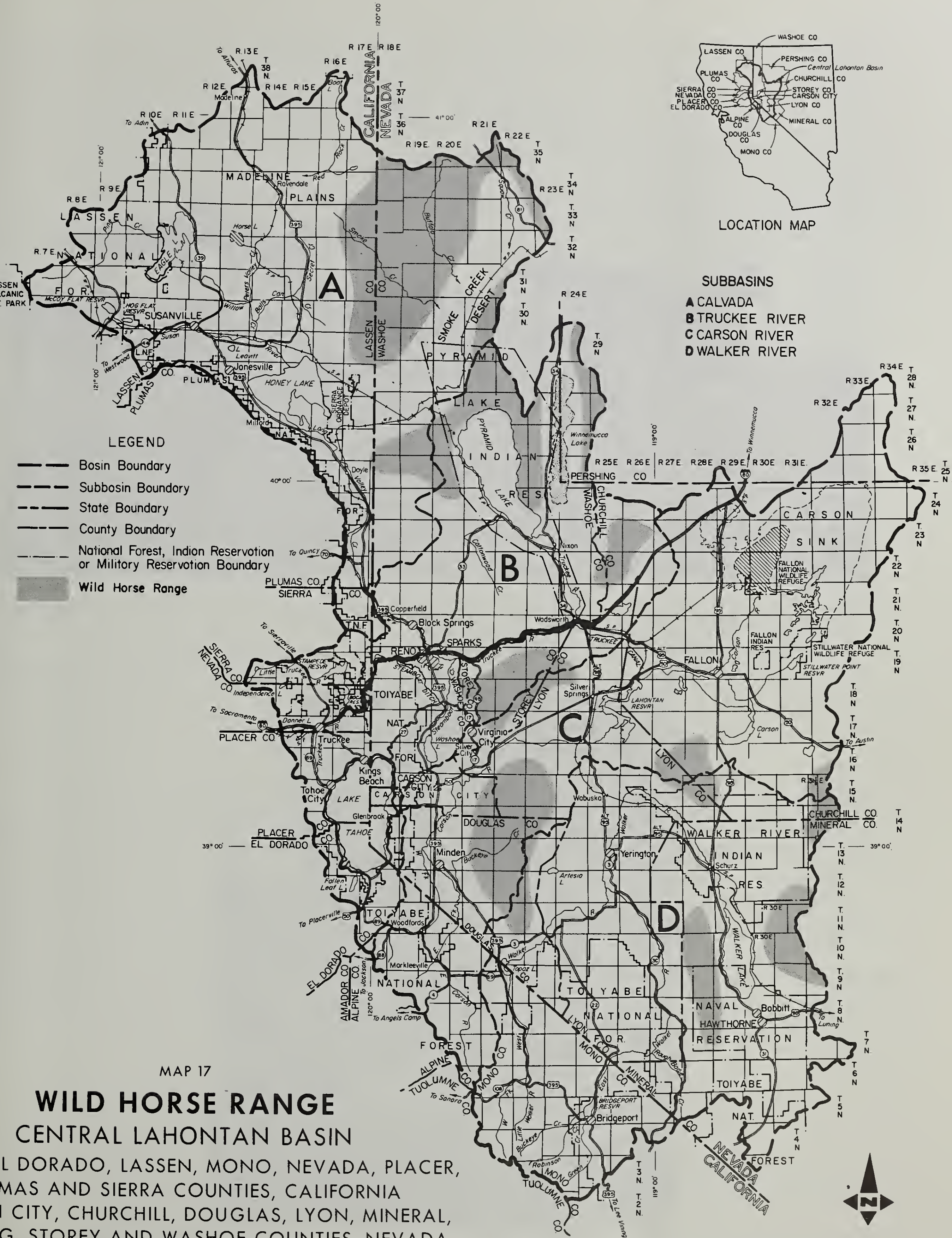

MAP 17

WILD HORSE RANGE

CENTRAL LAHONTAN BASIN

ALPINE, EL DORADO, LASSEN, MONO, NEVADA, PLACER, PLUMAS AND SIERRA COUNTIES, CALIFORNIA
CARSON CITY, CHURCHILL, DOUGLAS, LYON, MINERAL, PERSHING, STOREY AND WASHOE COUNTIES, NEVADA

JULY 1975

10 0 10 20 30 MILES
SCALE 1:1,750,000

S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE

Wild horses can be found at several locations in the Basin. Bureau of Indian Affairs photo

Virgin Sierra Nevada timber stand about 1900, prior to logging. Victor Goodwin photo.

Wild Horse Grazing

Bands of wild, free-roaming horses also use the Basin's rangelands. The early settlers allowed the horses to roam at will, and many mixed with Indian horse bands eventually becoming a permanent part of the wildland environment. Until recent years, very little consideration by the federal land administering agencies of the horse bands grazing habits were documented. Now, however, grazing adjudications do allocate a portion of the range resource to these animals. Map 17 indicates the range areas in the Basin where a significant number of wild horses have been located.

Forest and Woodland

The Basin's forest and woodlands serve many purposes. They are the "tree farms" for commercial production of timber and other forest products and are the habitat for a large wildlife population. They serve as summer range for domestic livestock and are the center of the rapidly growing field of outdoor recreation. They are vital as the source of and storage place for much of the Basin's water supply.

Timber Production

Forest land in the Basin has been divided into two classes: (1) commercial forest land where annual growth exceeds 20 cubic feet of marketable industrial wood per acre; (2) noncommercial forest land where the annual growth is less than 20 cubic feet of merchantable industrial wood per acre, or where slopes are too steep or sites are otherwise too fragile to warrant timber harvesting. There are 1,055,651 acres classed as commercial forest land and shown on Map 18. Acreage by ownership and state is shown in the following tabulation:

Commercial Forest Land Acres	
Area	Acres
Basin wide	1,055,651
Federal	(557,399)
Nonfederal	(498,252)
Nevada	84,231
California	971,420

Second growth commercial timberland, Truckee Subbasin.

Logging operation, Calvada Subbasin

On national forests in the Basin, commercial forest land (see Map 18) has been further delineated into reserved and nonreserved land. The reserved land is an administrative withdrawal from timber harvesting. These productive reserved lands are in the Caribou, Desolation Valley, and Hoover Wilderness areas. There are 37,700 acres of productive reserved forest land in the Basin. The nonreserved forest lands constitute the land from which timber and other forest products are harvested. This land has been further delineated as marginal or standard. The marginal category consists of land that for one or more reasons is not presently economical to harvest. This may be land that is very rocky, inaccessible of low volume per acre having unmarketable species, or not loggable with present methods. There are 25,544 acres classed as marginal in the Basin. The remaining 992,407 acres of commercial forest land are classed as standard.

Use

In 1970, there were 114.9 million board feet cut from the commercial forest lands. The allowable cut of marketable industrial round wood from the national forest land is 73.86 million board feet (mmbf) annually and an average of 4,172 acres are involved in the harvest of this volume. Because of present rapid depletion of the timber stands on privately owned forest land, it is difficult to assign it a sustained yield volume, therefore it would be difficult to assign an allowable cut for these lands.

There are four mills in the Basin which are the primary processors of this industrial wood. Other forest products harvested from the commercial forest land are post and poles, fuel wood, and Christmas trees. The following tabulation lists the products and volumes harvested in 1970.

Sawtimber	Post and Poles	Fuel Wood	Christmas Trees
-1,000 bf-	cords -1,000 bf-	cords	numbers
47,902	108.7	3,900	38,173

Management

Timber management and harvesting practices vary widely with ownership. Much of the timber harvesting on private lands has been on a near clear-cutting, liquidation basis. Nearly all of the private commercial forest land has been cutover. Regeneration is generally present, though many of the cutover stands and burns are inadequately stocked. The area involved in these deforested commercial lands due to fire are 6,794 acres of public and 6,818 acres of private land.

Some of the larger timber land owners, particularly those with sawmills that are dependent upon a sustained raw material supply, are practicing conservative cutting with provisions for regeneration. Both California and Nevada have forest practices acts aimed at improving the management of private forest lands. National forest timber is managed, by law, on a "sustained yield" basis; that is, harvesting is kept in balance with growth. The allowable cut is subject to recalculation at approximately 10-year intervals. Such factors as degree of wood utilization, rapidity of regeneration of cutover, and fire-scarred land and accessibility of salvageable dead timber may affect the allowable cut. Increased demand for small logs, defective logs and low value species in recent years has resulted in increased harvest of marketable wood.

Management practices are used which will result in optimum production of timber crops without impairment of the productivity of the land. Cutting has generally been on an individual tree or group selection basis, overstory removal is used where adequate advance regeneration is already present. Regeneration methods include protecting existing young trees during logging leaving groups of older trees as a source of seed, and planting nursery-grown seedlings where necessary. Natural regeneration is often slow and uncertain because of drought conditions.

Under intensified management, a gradual long-term increase in the allowable cut is expected. Management and harvesting methods on other Federal lands in the Basin are very similar to those on National Forest land. However, the scattered nature of these lands makes intensive management extremely difficult.

Most of the cutover land in the Basin has been logged by tractor methods. Where the ground is steep or the soil is of an erosive nature, or where skid roads are located without sufficient regard for soil protection needs, considerable

LEGEND

- Basin Boundary
- Subbasin Boundary
- State Boundary
- County Boundary
- National Forest, Indian Reservation or Military Reservation Boundary
- Commercial Forest
- Unclassified

Commercial Forest Land is that land that either is now, or is capable of producing 20 cubic feet of commercial round wood per acre per year.

SUBBASINS

A CALVADA
B TRUCKEE RIVER
C CARSON RIVER
D WALKER RIVER

MAP 18

COMMERCIAL FOREST LAND

CENTRAL LAHONTAN BASIN

ALPINE, EL DORADO, LASSEN, MONO, NEVADA, PLACER, PLUMAS AND SIERRA COUNTIES, CALIFORNIA
CARSON CITY, CHURCHILL, DOUGLAS, LYON, MINERAL, PERSHING, STOREY AND WASHOE COUNTIES, NEVADA

JULY 1975

10 0 10 20 30 MILES
SCALE 1:1,500,000

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M7-N-23137

damage to the watershed has resulted. This has been true to some extent in logging operations on all ownerships. Today logging operations on National Forests are planned for soil and watershed protection. Generally, tractor logging is limited to slopes of 30 percent or less. Skid trails and other areas where the vegetal cover has been disturbed are seeded to grass if an erosion hazard exists. The mixed conifer stands that are beginning to be harvested on National Forest land are located on steep ground, over 30 percent slope, and will require some form of skyline or helicopter logging method.

For the immediate future, continuing depletion may be expected with near exhaustion of private timber within perhaps 25 years, followed by an extended period of little or no cutting while present young stands are attaining merchantable size. During this period the timber supply for the Basin will be almost entirely from public lands. Thereafter, timber production from private lands will be closely related to intensity of management.

However, utilization standards could change to allow sawtimber in smaller sizes to be cut. In this case, cutting from private lands will probably continue at current or accelerated rates, especially in Calvada Subbasin where most of the private timber is located.

Fish and Wildlife

Fish and wildlife are important resources. The wide range in elevation, climate, topography and vegetation, influence and create a variety of habitats. Varied habitat types ranging from low rainfall greasewood desert and warm-water reservoirs at the lower elevations to alpine-arctic communities and cold, snow-fed streams above timberline support many kinds of animal life. Map 19 shows the Wildlife Habitat Areas for the major game species.

Designated Wildlife Areas

There are 11 locations within the Basin where important wildlife habitat has been set aside and managed for this purpose. Some areas are open to hunting. These are shown in Map 20 and Table 27

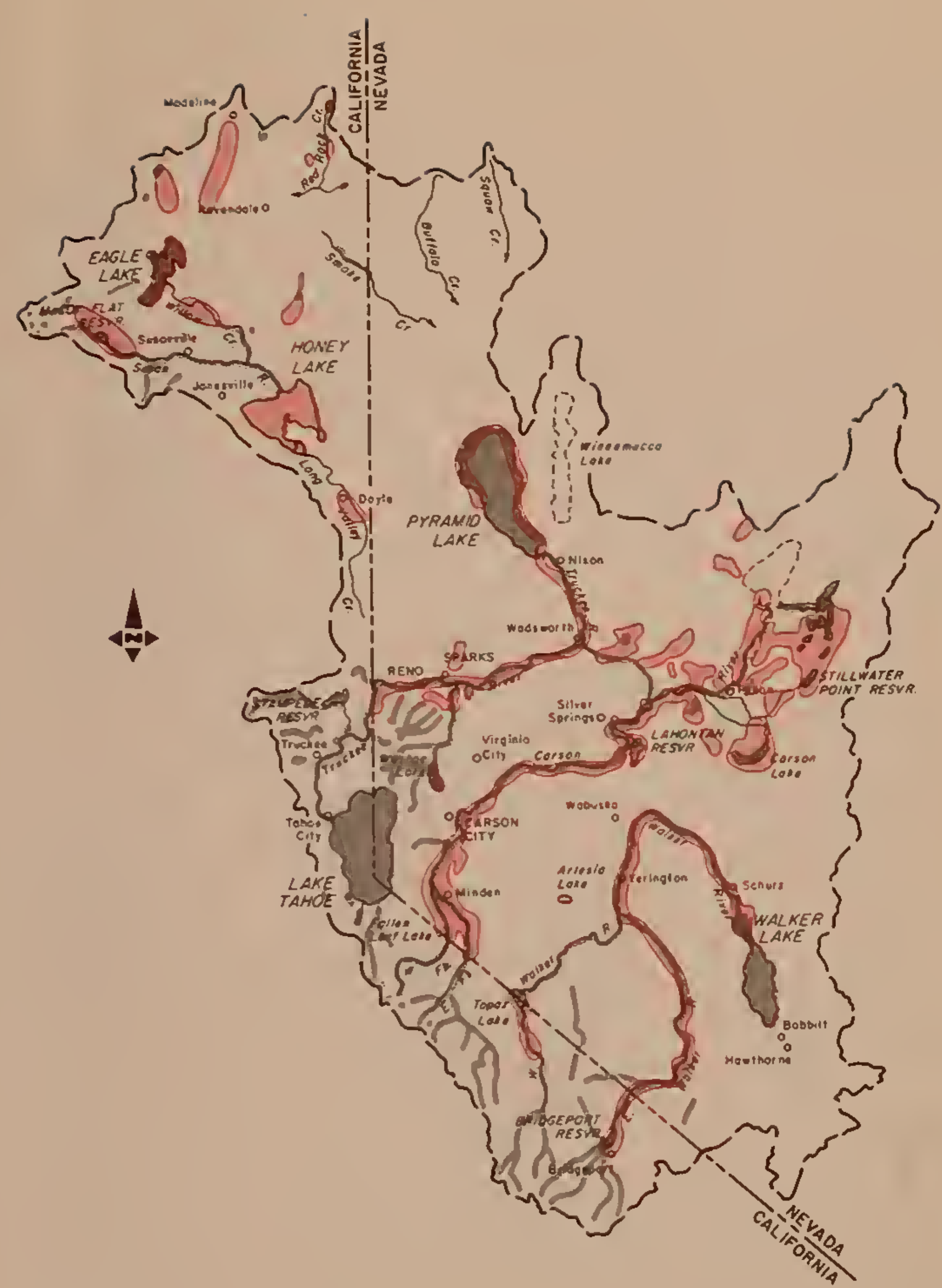
Anaho Island National Wildlife Refuge in the center of Pyramid Lake is a haven for migratory birds, Truckee Subbasin

Newly hatched Canada geese, Scripps State (Nevada) Wildlife Management Area, Truckee Subbasin. Nevada Department of Fish and Game photo.

MAP 19

WILDLIFE HABITAT AREAS

CENTRAL LAHONTAN BASIN



FISHERIES AND WATERFOWL

- Fisheries
- Waterfowl

UPLAND GAME

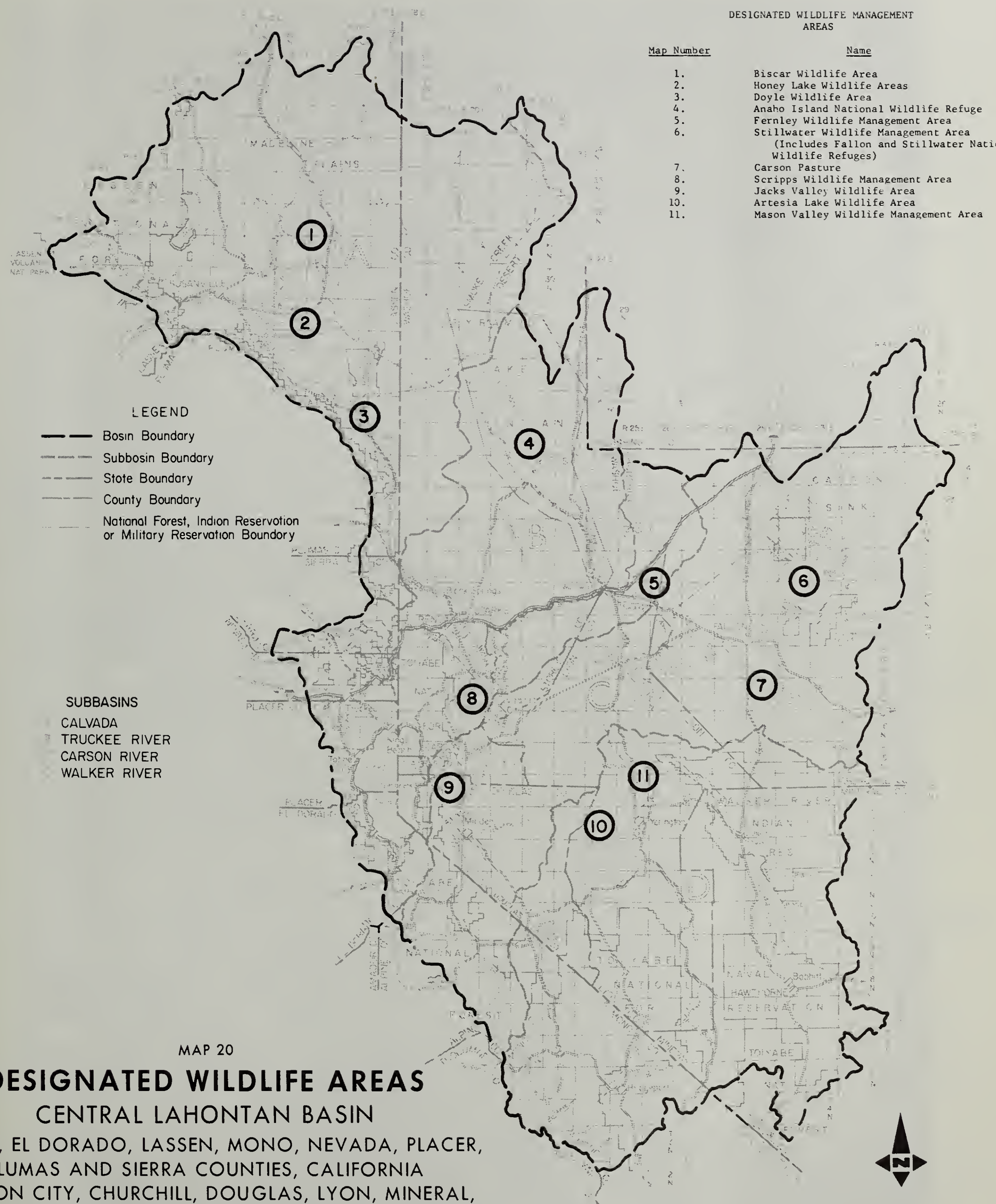
- Chukar
- Pheasant
- Sage Hen
- Turkey

BIG GAME

- Antelope
- Deer Winter Range
- Big Horn Sheep Areas Existing and Proposed
- Deer Migration Routes

DESIGNATED WILDLIFE MANAGEMENT AREAS

Map Number	Name
1.	Biscar Wildlife Area
2.	Honey Lake Wildlife Areas
3.	Doyle Wildlife Area
4.	Anaho Island National Wildlife Refuge
5.	Fernley Wildlife Management Area
6.	Stillwater Wildlife Management Area (Includes Fallon and Stillwater National Wildlife Refuges)
7.	Carson Pasture
8.	Scripps Wildlife Management Area
9.	Jacks Valley Wildlife Area
10.	Artesia Lake Wildlife Area
11.	Mason Valley Wildlife Management Area



MAP 20

DESIGNATED WILDLIFE AREAS

CENTRAL LAHONTAN BASIN

ALPINE, EL DORADO, LASSEN, MONO, NEVADA, PLACER, PLUMAS AND SIERRA COUNTIES, CALIFORNIA
CARSON CITY, CHURCHILL, DOUGLAS, LYON, MINERAL, PERSHING, STOREY AND WASHOE COUNTIES, NEVADA

JULY 1975

U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE USDA-SCS-PORTLAND, OREG. 1975 M7-L-23031

Deer on winter range, Walker Subbasin
Santa Monica Evening Gazette photo.

Table 27 - Designated wildlife areas, Central Lahontan Basin

Name	Size (acres)	Managed by 1/	Habitat type	Type of wildlife	Public Hunting
Biscar	5,000	BLM	Rangeland	Upland game	No
Honey Lake	4,980	CDFG	Wetlands	Waterfowl	Yes
Doyle	13,503	CDFG	Rangeland	Big game	No
Anaho Island Refuge	650	FWS	Rangeland	Migratory Birds	No
Fernley	13,669	NDFG	Wetlands	Waterfowl	Yes
Stillwater					
Stillwater Refuge	24,203	FWS	Wetlands	Waterfowl	No
Management area	119,663	NDFG	Wetlands	Waterfowl	Yes
Fallon Refuge	17,902	FWS	Wetlands	Waterfowl	No
Carson Pasture	25,000	NDFG	Wetlands	Waterfowl	Yes
Scripps	2,659	NDFG	Wetlands	Waterfowl	Yes
Jacks Valley	3,115	NDFG	Rangeland	Big game	Yes
Alkali Lake (Artesia)	3,448	BLM-NDFG	Wetland	Waterfowl	Yes
Mason Valley	8,766	NDFG	Wetlands-Rangeland	Waterfowl, Upland game	Yes
TOTAL	232,558				

1/ Managed by: BLM - USDI Bureau of Land Management
CDFG - California Department of Fish and Game
BSFW - USDI - Fish and Wildlife Service
NDFG - Nevada Department of Fish and Game

Big Game

Big game species within the Basin include mule deer, antelope, black bear, and mountain lion. Bighorn sheep are also present, but are not hunted. Mule deer are the most numerous and are economically the most important big game animal. The Basin is divided into several deer herd management units. Some of these deer herds migrate between California and Nevada - summering in the mountains of California and wintering on the lower slopes foothills in Nevada. These inter-state herds are managed by state agencies. Deer numbers have declined since the early 1960s. Several small populations of antelope are found throughout the lower elevations. The antelope are hunted in both states on a limited permit basis. The desert bighorn sheep has been re-introduced into an area on the Wassuk Range along the western edge of Walker Lake.

The small populations of black bear and mountain lion are thought to be static.

Deer harvest for a five-year period within the Basin is shown in Table 28.

Table 28 - Deer harvest, Central Lahontan Basin, 1968 - 1972, by State and Subbasin

Subbasin, State ant type		1968	1969	1970	1971	1972	Totals
Calvada							
California -	Bucks	1,570	1,528	2,160	2,071	2,382	9,711
	Antlerless	0	273	0	0	0	273
Nevada -	Bucks	46	25	50	71	94	286
	Antlerless	221	65	0	4	36	326
Totals		1,837	1,891	2,210	2,146	2,512	10,596
Truckee							
California -	Bucks	451	265	371	237	338	1,662
	Antlerless	0	0	0	0	0	0
Nevada -	Bucks	506	92	189	222	279	1,288
	Antlerless	500	162	4	2	65	733
Totals		1,457	519	564	461	682	3,683
Carson							
California -	Bucks	472	288	311	254	394	1,719
	Antlerless	0	0	0	0	0	0
Nevada -	Bucks	52	134	22	50	104	362
	Antlerless	298	156	2	1	16	473
Totals		822	578	335	305	514	2,554
Walker							
California -	Bucks	745	326	533	379	569	2,552
	Antlerless	0	0	0	0	0	0
Nevada -	Bucks	282	70	59	54	141	606
	Antlerless	474	181	0	3	33	691
Totals		1,501	577	592	436	743	3,849
GRAND TOTALS		5,617	3,565	3,701	3,348	4,451	20,682

Source: California and Nevada Departments of Fish and Game

Waterfowl

The lakes, reservoirs, and marshes of the Basin are important to waterfowl and shorebirds in the Pacific flyway. Numerous birds nest near mountain lakes and streams as well as on irrigated meadows, pastures and marshes. Some of the more important waterfowl and shorebird habitat includes Eagle Lake, Honey Lake, Washoe Lakes, Pyramid Lake, Carson Sink, Fernley and Stillwater Marshes. Lake Tahoe, Topaz and Walker Lakes provide large resting areas for birds during the spring and fall migrations. Farmlands provide a large part of the food supply for these birds.

The magnitude and trend of waterfowl harvest within seven designated wildlife management areas (WMA) in the Basin is shown in the following tabulation. The Wetlands Map shows the type of wetland habitat on these areas.

Subbasin and WMA		1968	1969	1970	1971	1972
		Number of birds				
Calvada -	Honey Lake	3,289	4,201	4,365	5,906	2,270
Truckee -	Scripps	663	1,188	658	780	213
	Fernley	4,680	4,236	2,380	4,635	983
Carson -	Stillwater	13,986	26,272	31,660	32,783	23,918
	Carson Lake	19,245	17,915	20,575	33,857	21,622
Walker -	Artesia Lake	--	986	280	450	128
	Mason Valley	2,262	4,908	3,150	5,591	4,858
Basinwide Totals		44,125	59,706	63,068	84,002	53,992

Source: California and Nevada Departments of Fish and Game

Fish

The water resources of the Basin support significant fisheries. The native game fish present are the Eagle Lake Trout, the Lahontan cutthroat throut, and the mountain whitefish. The Eagle Lake trout is the only known trout to survive in the Lake's alkaline waters. The Lahontan cutthroat trout, originally widespread, is now restricted to a few isolated waters. Attempts are being made to re-establish this species. The Lahontan National Fish Hatchery at Gardnerville was built for the express purpose of propagating the Lahontan cutthroat. The mountain whitefish is quite abundant in the California portion of the Basin. Its importance as a game fish is negligible.

Many other fish have been introduced into the Basin with the rainbow trout being the most important. Large numbers are planted annually, although natural reproduction also occurs. The brown trout has been able to sustain itself in most lower elevation trout waters. Brook trout are planted extensively in many of the higher elevation lakes and natural reproduction occurs in many streams. They are taken in numbers second only to the rainbow. Both golden trout and arctic grayling have been planted in a few high elevation back-country lakes where they do provide an interesting variety to the angler. Two other species, the lake trout and kokanee are found in the the larger lakes. Lake trout make up about 50 percent of the total weight of fish removed from Lake Tahoe.

Warmwater fish, including largemouth bass, white bass, carp, white crappie, pumpkinseed, yellow perch, green sunfish, white catfish, channel catfish and bullheads are found in the lower elevation streams and reservoirs.

A 23 pound Mackinaw trout taken from Lake Tahoe in 1973. South Lake Tahoe News Service photo.

Pyramid Lake produced this 17 pound Lahontan cutthroat trout in 1972. Nevada State Journal photo.

Fishable waters and average annual fish planting, by subbasins are shown in the following tabulations:

Subbasin	Lakes and Reservoirs (acres)			Stream (miles)		
	Nevada	California	Total	Nevada	California	Total
Walker	39,977	5,137	45,114	186.0	279.0	465.0
Carson	12,310	652	12,962	41.4	134.5	175.9
Calvada	48	24,975	25,023	0	71.0	71.0
Truckee	153,454	98,369	251,823	209.7	348.9	558.6
Totals	205,789	129,133	334,922	437.1	833.4	1,270.5

Subbasin	Fish Planting (pounds)		
	Nevada	California	Total
Walker	48,850	106,200	155,050
Carson	27,450	25,473	52,923
Calvada	900	50,022	51,022
Truckee	211,300	88,700	300,000
Totals	288,500	270,495	588,995

Source: Nevada Department of Fish and Game
California Department of Fish and Game
USDA River Basin Planning Staff

Upland Game

Upland game species include the mountain quail, California quail, mourning dove, pheasant, chukar, sage grouse, blue grouse, ruffed grouse, turkey, blacktail and whitetail jackrabbits, pygmy and cottontail rabbits, snowshoe hare and tree squirrel. The most frequently pursued upland game, the mourning dove, pheasant, and rabbits are found on the lower elevation slopes, meadows and farmlands. The native sage grouse and relatively recently introduced chukar more commonly frequent the rangelands.

Furbearers and Small Mammals

Included here are the beaver, skunk, racoon, badger, red and gray fox, kit fox, coyote, mink, otter, muskrat, marmot and bobcat. Little work or research has been done to determine the status or the means of improving habitat for these species. There has been an increased harvest of coyotes, bobcats and muskrats in the past few years because of increased fur prices and increased interest in varmint hunting.

Non-Game Birds

A variety of shore birds frequent many of the Basin's ponds and marshes. Black-necked stilts, snowy plover, Wilson's phalaropes, avocets, and long-billed curlews, nest at Stillwater and are abundant from early spring through late fall. Western grebes, snowy egrets, white-faced ibises, and black-crowned night herons add color to the open ponds and bulrush stands. Hundreds of white pelicans put on a spectacular show as they wheel in flight high above the marshes or fish in large groups on the ponds. Whistling swans provide the winter spectacular as their music and easy flight lends life to the dormant scene.

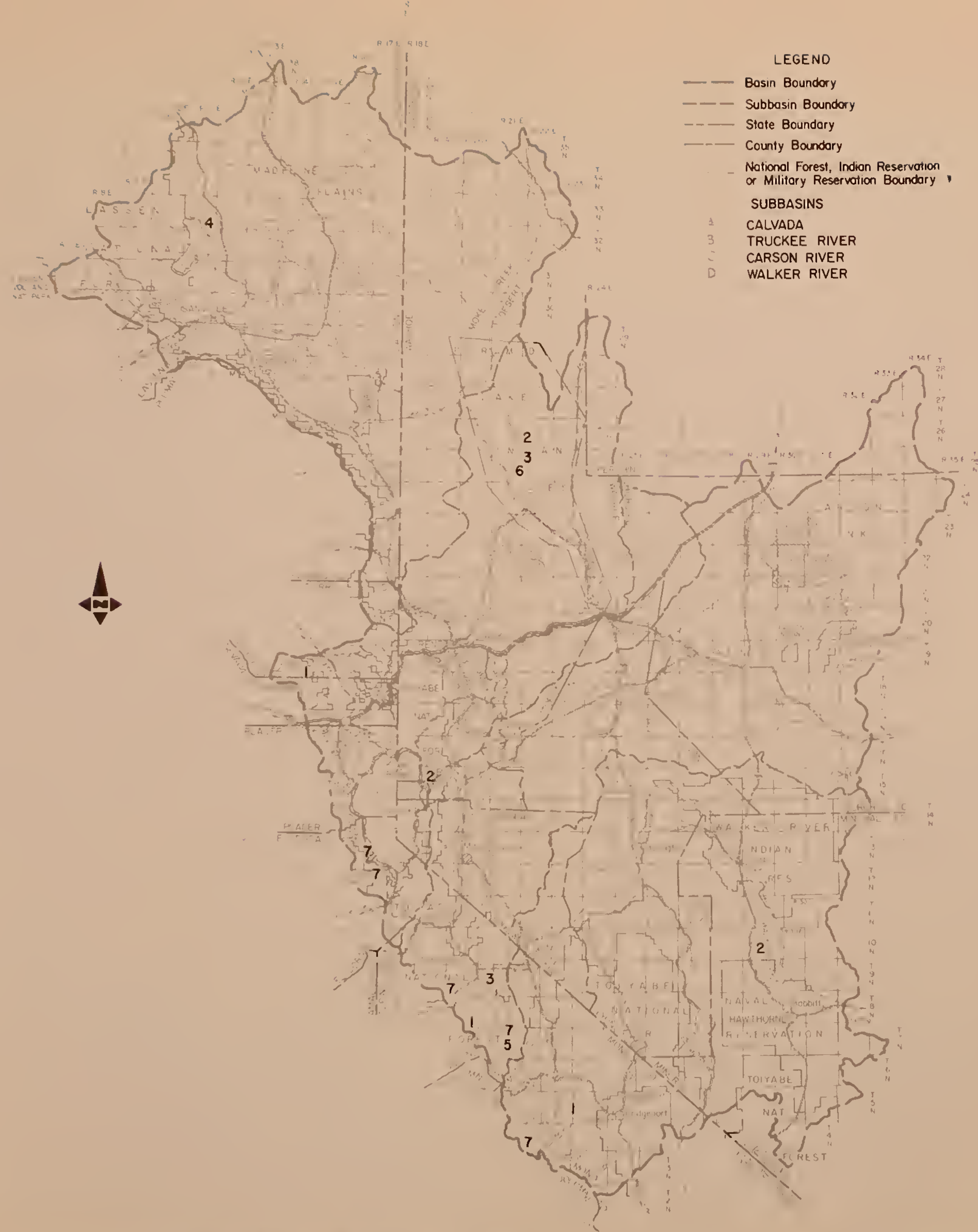
In winter, birds of prey gather at the marshes. Both bald and golden eagles are common. Marsh hawks and rough-legged hawks are obvious, but the wary prairie falcon is more difficult to observe. Song birds and other land birds are common. These include the poorwill, night hawks, hummingbirds, kingfishers, black birds, starlings, robins, wrens, jays, sparrows, and many others.

Threatened Species

Species which are on the Secretary of the Interior's List of Endangered Native Fish and Wildlife include the Lahontan cutthroat trout, the Paiute cutthroat trout, and the cui-ui. Pure populations of the Lahontan cutthroat trout are found in Independence Lake, and in a few scattered tributaries. It has been estimated that there are only about 2,000 to 3,000 pure strain Lahontan cutthroat trout in the waters mentioned above.

The distribution of the Paiute cutthroat trout is very limited. They are found only in Silver King Creek and its tributaries. Current numbers, including two other creeks outside the Basin in California, are estimated to be about 500 adults. The cui-ui is found only in Pyramid Lake. Although total numbers are not known, the population is seriously depleted. Map 21 shows the location of unique and/or threatened fish species in the Basin.

The bald eagle and golden eagle, though not listed as an endangered species, are occasionally sighted in the Basin. The peregrine falcon, which is listed as endangered, and the merlin nest in the area. The prairie falcon, listed as a rare species is also known to visit the Basin.



LOCATION MAP

LEGEND FOR UNIQUE and/or THREATENED FISH SPECIES

Map No.	Species	Location
* 1	Lahontan Cutthroat Trout - pure strain	Independence Lake, By-Day Creek, Cascade Lake
2	Lahontan Cutthroat Trout - Walker Lake strain Summit Lake strain	Pyramid Lake, Walker Lake, Marlette Lake
3	Lahontan Cutthroat Trout - Heenan Lake strain	Heenan Lake, Pyramid Lake
4	Eagle Lake Rainbow Trout	Eagle Lake
* 5	Pauite Cutthroat Trout	Silver King Creek
* 6	Cui-ui (Lake sucker)	Pyramid Lake
7	Golden Trout	Tallac Lake - Truckee Raymond Lake - Carson Harem Lakes - Walker Tamarack Lake - Carson

*Threatened species, as contained in Secretary of Interior's List of Endangered Native Fish & Wildlife, 1972.

MAP 21

UNIQUE AND/OR THREATENED FISH SPECIES

CENTRAL LAHONTAN BASIN

ALPINE, EL DORADO, LASSEN, MONO, NEVADA, PLACER, PLUMAS AND SIERRA COUNTIES, CALIFORNIA
CARSON CITY, CHURCHILL, DOUGLAS, LYON, MINERAL, PERSHING, STOREY AND WASHOE COUNTIES, NEVADA

JULY 1975

10 0 10 20 30 MILES
SCALE 1:1,500,000

Recreation

This Basin has some of the world's most outstanding natural recreation and scenic resources. Climatic conditions in the Basin vary from the semi-arid in the valleys, to the sub-humid-arctic along the crest of the Sierra Nevada. The Basin has three distinct recreation landscapes. These are defined as follows:

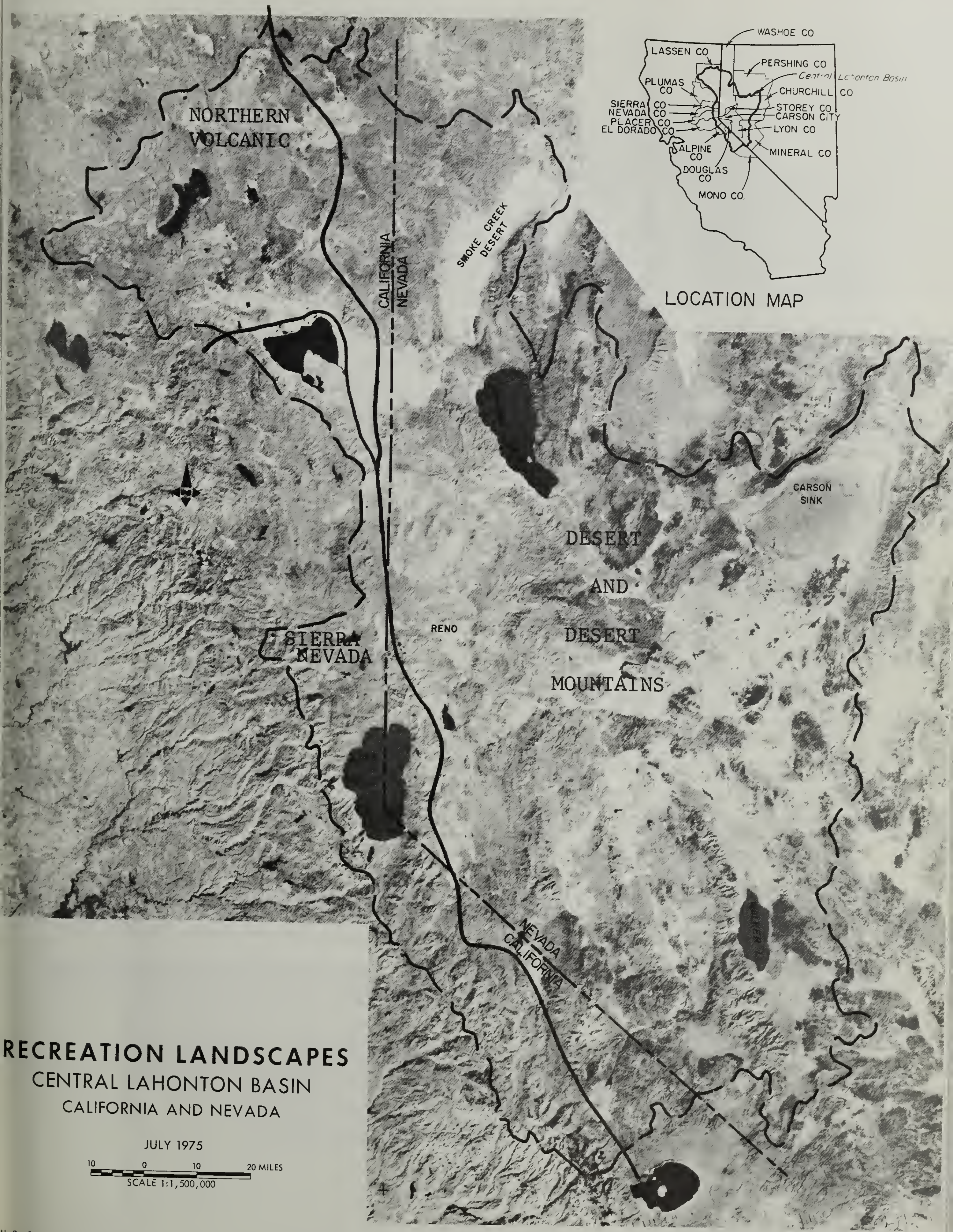
Sierra Nevada Recreation Landscape - The Sierra visitor enjoys awesome scenery in the typically high and very rugged terrain in the southern portion of the Basin. From Monitor Pass northward, the slopes are more gentle, the canyons not as precipitous, and the forests are denser and greener than in the southern portion. Heavy winter snowfall in the Sierra creates ideal conditions for winter sports as indicated by the heavy recreation use at numerous resorts. In the spring, the snow melts slowly keeping the streams flowing, filling hundreds of lakes and providing excellent fishing and other water-oriented recreation opportunities. Much of the Sierra Nevada is under federal ownership and although it provides thousands of recreation days, it still has a vast potential for additional public recreation use.

Northern Volcanic Recreation Landscape - The northern volcanic landscape dominates the surrounding terrain. Nearby, Mt. Lassen is the only active volcano in the conterminous United States. Lassen, Modoc and portions of Plumas county are in this landscape. The Modoc Plateau is a thick accumulation of lava flows with major depressions containing lakes, marshes and sluggish streams. This area is not as heavily used as the others because of its remote location and lack of vegetation, but visitors seeking to get away can find large stretches of unpopulated and undeveloped countryside.

Desert and Desert Mountain Recreation Landscape - This is the largest of the recreation landscapes. It has a hot dry climate in summer and a cold relatively dry climate during the winter. The area has become increasingly popular with those who want to experience the pleasures of the desert's colorful, intriguing, and seemingly boundless vistas and incomparable solitude. For the novice, there is much to be learned about the desert's unusual and very specialized flora and fauna. The desert region is most attractive to visitors during the winter and spring months, when many other areas have limited recreation opportunities. This makes it an especially valuable resource. The largest public landowner in this landscape is the Bureau of Land Management which administers more than 60 percent of the area. The majority of the private land recreation potentials are also in this landscape.

Beach scene at Lake Tahoe

Boating on Pyramid Lake. Nevada Highway Department Photo.



RECREATION LANDSCAPES

CENTRAL LAHONTON BASIN

CALIFORNIA AND NEVADA

JULY 1975

10 0 10 20 MILES

SCALE 1:1,500,000

Recreation Use

Table 29 lists the 1970 recreation use for the Central Lahontan Basin by subbasin. APPENDIX II contains subbasin maps showing the existing recreation sites. Recreation use on federal lands includes those agencies that have administrative responsibility of the land. The Bureau of Land Management and the Forest Service are responsible for the majority of the federal lands. The Bureau of Reclamation, even though they retain ownership of the land, contract the administration of recreation to other public entities. Non-federal public lands are those lands open to the public and administered by State or local governments. The total outdoor recreation use for 1970 was about 12 million visitor-days. Fifty-two percent of this use was on federal lands.

Table 29 - Outdoor recreation use 1970, Central Lahontan Basin, visitor-days

Subbasin and State	Land Ownership			State Totals		Subbasin Totals
	Federal	Non-Federal		Calif	Nevada	
		Public	Private			
Calvada						
Calif	572,885	79,735	58,100	710,724	--	755,082
Nevada	44,358	--	--	--	44,358	
Truckee						
Calif	3,846,907	862,511	1,687,046	6,396,464	--	8,829,590
Nev	217,300	1,437,826	778,000	--	2,433,126	
Carson						
Calif	329,600	58,000	49,480	500,080	--	884,232
Nev	13,100	156,787	214,265	--	384,152	
Walker						
Calif	960,900	65,000	150,000	1,176,400	--	1,288,200
Nev	66,600	32,000	13,200	--	111,800	
Basinwide Totals	6,114,650	2,691,859	2,950,591	8,783,668	2,973,436	11,757,104

The importance of water-based recreation use is illustrated by a study conducted by John G. McNeely, Jr. and William F. Kelly at the University of Nevada during 1968-69. Personal interviews and questionnaires were used to develop estimates of recreationist use and expenditures at three lakes in the Basin-Lake Tahoe, Pyramid Lake, and Lahontan Reservoir (Table 30). Recreationists who reside outside the Basin spend about ten times more per visitor day than residents and account for 87 percent of total recreationist expenditures.

Table 30 - Water based recreation expenditures at Lake Tahoe, Pyramid Lake, and Lahontan Reservoir, 1966

Lake 1/	Visitor days of recreation			Expenditures, dollars		
	Residents	Non-residents	Total	Residents	Non-residents	Total
Tahoe 1/	143,000	170,500	313,500	60,000	764,500	825,800
Pyramid	89,400	15,800	105,200	44,700	80,100	124,800
Lahontan	53,000	3,000	56,000	22,800	3,700	26,500
Total	285,400	189,300	474,700	127,800	849,300	977,100

Source: John G. McNeely, Jr., and William F. Kelly, unpublished research, University of Nevada, 1968-1969

1/ Includes only Tahoe recreationists who visited the Nevada side of the Lake.

Average annual angler days of fishing use in the Basin is given in the following tabulation:

Angler Days Use			
Subbasin	Nevada	California	Total
Walker	60,790	214,250	275,040
Carson	101,200	398,000	499,200
Calvada	500	166,960	167,460
Truckee	519,457	194,097	713,554
Totals	681,947	973,307	1,655,254

Source: Nevada Department of Fish and Game
California Department of Fish and Game
USDA River Basin Planning Staff

Recreation Lands

Land area in the Basin has been inventoried and classified by the Bureau of Outdoor Recreation. The land area available for recreation use was classified into six classes. Class through VI indicate the type of use. Class I is most intensive, and Class VI the least intensive use. Land class definitions are briefly described in the following tabulation:

Class I	Lands	- High Density Recreation Areas
Class II	Lands	- General Outdoor Recreation Areas
Class III	Lands	- Natural Environment Areas
Class IV	Lands	- Outstanding Natural Areas
Class V	Lands	- Primitive and Wilderness Areas
Class VI	Lands	- Historic and cultural Sites

See APPENDIX II for a more detailed definition of the land classes. Using this classification, there is a total of 7,476,380 acres in the Basin available for recreation. Acreage of land classes available by ownership is shown in the following tabulation:

	Recreation Land Class - acres						
Ownership	I	II	III	IV	V	VI	Total
Federal	420	127,660	5,155,240	7,500	117,560	2,850	5,411,230
Local	1,104	306	440	--	--	--	1,850
Private	1,258,613	330,128	474,559	--	--	--	2,063,300
Totals	1,260,137	458,094	5,630,239	7,500	117,560	2,850	7,476,380

Watersheds

Watersheds include all land within a drainage area that either yields or is capable of yielding water. There are two major elements that affect or control the destiny of a given watershed. These are (1) its physical geography, and (2) its reaction to the influences of man. In this study a broad concept of watershed is used to permit consideration of problems and solutions, regardless of where they occur.

Watershed management relies upon principles of good land management, as this influences the quality, timing and quantity of water. It attempts to coordinate land and water use, not in terms of any one resource, but on the basis that all resources are interrelated and interdependent as they protect soil and water quality.

The impact of man and his activities on physical geography tends to complicate an already complex situation. Through wise and conscientious land use practices, man can improve on natural conditions, or through unwise and slovenly practices, can worsen conditions. Productivity potentials of the land resources may be decimated or lost. Serious consequences such as flooding, soil erosion, sedimentation, and deterioration of the environment will result.

Physical Geography

Other sections of the report contain descriptions and measurements of the various components of physical geography. The material contained in this section draws freely from those sources and adds data particularly related to watershed management and its associated problems.

Climate - Extremes of the observed and recorded elements of the Basin's climate have profound effects on watershed management. Most precipitation falls as snow in frontal storms. Winter months are periods of highest precipitation. Summer thunderstorm or dry-mantle storms cause damage to the watershed.

Temperature has a more subtle effect on watershed manangement programs than does precipitation. Wide variations in temperature, from warm to severe freeze, during the spring growing period may cause frost damage and retard growth in certain native plant species, and on reforested areas. Very hot spring dry spells have caused damage to coniferous plantings, by overstressing the transpiration mechanism. Late spring and summer ground level temperatures may be high enough to kill natural and planted seedlings even though soil moisture may be adequate for growth. This condition occurs on timber sites after the forest canopy is removed or destroyed. Planting on burned watersheds and reforestation is a marginal program because of this effect.

Soil Erosion - Soil erosion affects the productivity of the land where erosion occurs and affects the productivity of land where depositon takes place. Man's activity has accelerated the normal or geologic erosion activity. Excessive grazing, careless timber harvest, improper road construction and maintenance are the main sources of accelerated erosion. The destruction of plant cover and ground litter by frequent wildfire has also been responsible for accelerated erosion thoughout the Basin.

It must be clearly recognized that watershed management will never reduce or stop all erosion. Natural or geologic erosion occurred in the Basin long before man appeared on the scene.

Vegetal Cover

Soils, topography, climate, and vegetation are all related. There are distinct ecological zones between the high mountain areas and desert lowlands. The topography and precipitation affects plant cover. Vegetal types have a rather distinct structural form or pattern which determines the way in which vegetation acts in influencing hydrologic process. The distribution, kind and amount of natural vegetation, keyed as it is to environmental condition is intimately related to the development and use of the land for cultivated crops, timber, recreation, wildlife and other uses.

The land manager must know far more about a watershed than simply what cover type is present. He must know the characteristic and variation present within the particular plant community. He must consider the key value for vegetal cover as an erosion retarder by means of interception of rainfall and distribution of runoff over longer periods of time. The manager must be prepared for long periods of slowly increasing benefits rather than dramatic short term pay-off. This is because many years are required to recover full production and soil protection capabilities.

Land Ownership

Land ownership and administration policy strongly influence land management. Federal, state or county, and privately owned land in the Basin are shown in the following tabulation.

Land Ownership - acres				
Subbasin	Federal	State or County	Private	Total
Calvada	2,472,461	42,710	382,539	2,897,710
Truckee	775,125	24,536	1,251,090	2,050,751
Carson	1,741,317	62,553	800,748	2,604,618
Walker	2,057,780	30,981	598,815	2,687,576
Totals	7,046,683	160,780	3,003,192	10,240,655

Over 70 percent of the Basin's lands are in federal ownership, and are mostly covered by management plans consequently, some type of management exists on these lands. The privately owned lands, particularly the rangelands, may or may not be under an adequate management system. Since many of these lands are intermingled with federal lands, they may be managed with them. Where large blocks of nonfederal land occur, management for watershed uses may be lacking.

Many land use problems continue to plague the watershed areas but progress is being made in treating these problems. Some of this progress such as the growing acceptance of proper range use through deferred or rotation grazing is significant. The accentuated public awareness and concern for the environment will probably accelerate this progress.

Classified Watersheds

Classified watersheds are those important water-yielding areas specifically and formally set aside for the storing, conserving, and protecting from pollution the water supply of a city or municipality. When located on Federal land the area is classified for watershed purposes and designated by an act of the U. S. Congress. Other land ownerships may become classified by action of State or local regulatory agencies, or the outright purchase for municipal needs.

The classified watersheds involve only a small portion of the Basin's total watershed lands, 117,000 acres. These watershed lands provide important protection to several of the Basin's municipal water supplies. Uses incompatible with maintaining desirable hydrologic characteristics of the classified watersheds are often excluded. This includes mining, logging, domestic livestock grazing and intensive recreational development.

Watershed lands may be set aside for other important reasons, such as protection from erosion and sediment, or water quality and experimental purposes. This report includes these special designations as classified watersheds. The following tabulation shows the extent of classified watersheds by subbasin and the number of municipalities involved:

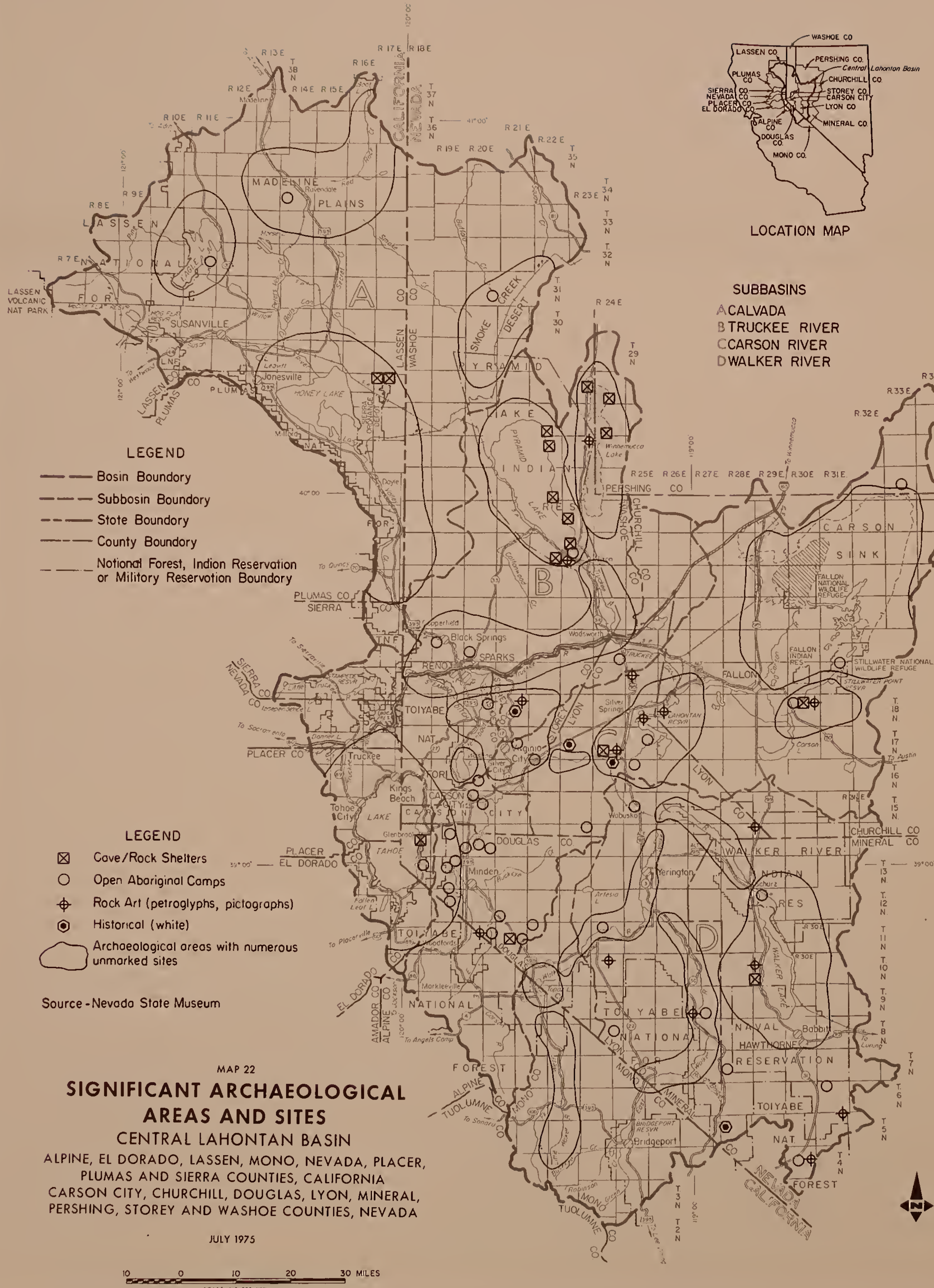
Subbasin	Municipalities	Acres
Calvada	0	0
Truckee	5	25,000
Carson	1	15,000
Walker	2	77,000
Totals	8	117,000

Archeological Resources

The Central Lahontan Basin contains a vast storehouse of archeological fact and knowledge. Many archeological sites have been located, and more are continually being uncovered. Just how significant a particular site might be depends on a number of criteria. There are such factors as the number and type of activities that took place there and how long the site was occupied. Until evidence can be evaluated by a competent archeologist, every site must be considered significant.

Many of the significant sites in the Basin are located around the natural lakes, where the necessities of life were readily available. These would include Walker, Pyramid and Eagle Lakes, and the Carson Sink-Stillwater areas. Lesser sites are located along the natural river courses, but many of these have been destroyed by the later works of man. Scattered throughout the more remote areas are hunting stations or temporary camps where only some petroglyphs or rock writings may indicate an early use.

General locations of known sites in the Basin by type are shown on Map 22.



MAP 22

SIGNIFICANT ARCHAEOLOGICAL AREAS AND SITES

CENTRAL LAHONTAN BASIN

ALPINE, EL DORADO, LASSEN, MONO, NEVADA, PLACER, PLUMAS AND SIERRA COUNTIES, CALIFORNIA
CARSON CITY, CHURCHILL, DOUGLAS, LYON, MINERAL, PERSHING, STOREY AND WASHOE COUNTIES, NEVADA

JULY 1975

U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE

M7-PN-23213

CHAPTER IV

ECONOMIC AND SOCIAL CONDITIONS

Highlight

Beautiful mountain and desert scenery, the Nevada gaming industry, and accessibility to major urban centers have a major influence on social and economic conditions. The trade and service industries provide 80 percent of the Basin employment, agriculture, forestry, and mining are significant employers in localized areas and major user of the Basin's land and water resources. Recreation activity at the lakes and reservoirs in the Basin contributes to the economy and is a significant source of income at the Pyramid Lake Indian Reservation.

CONTENTS

Population

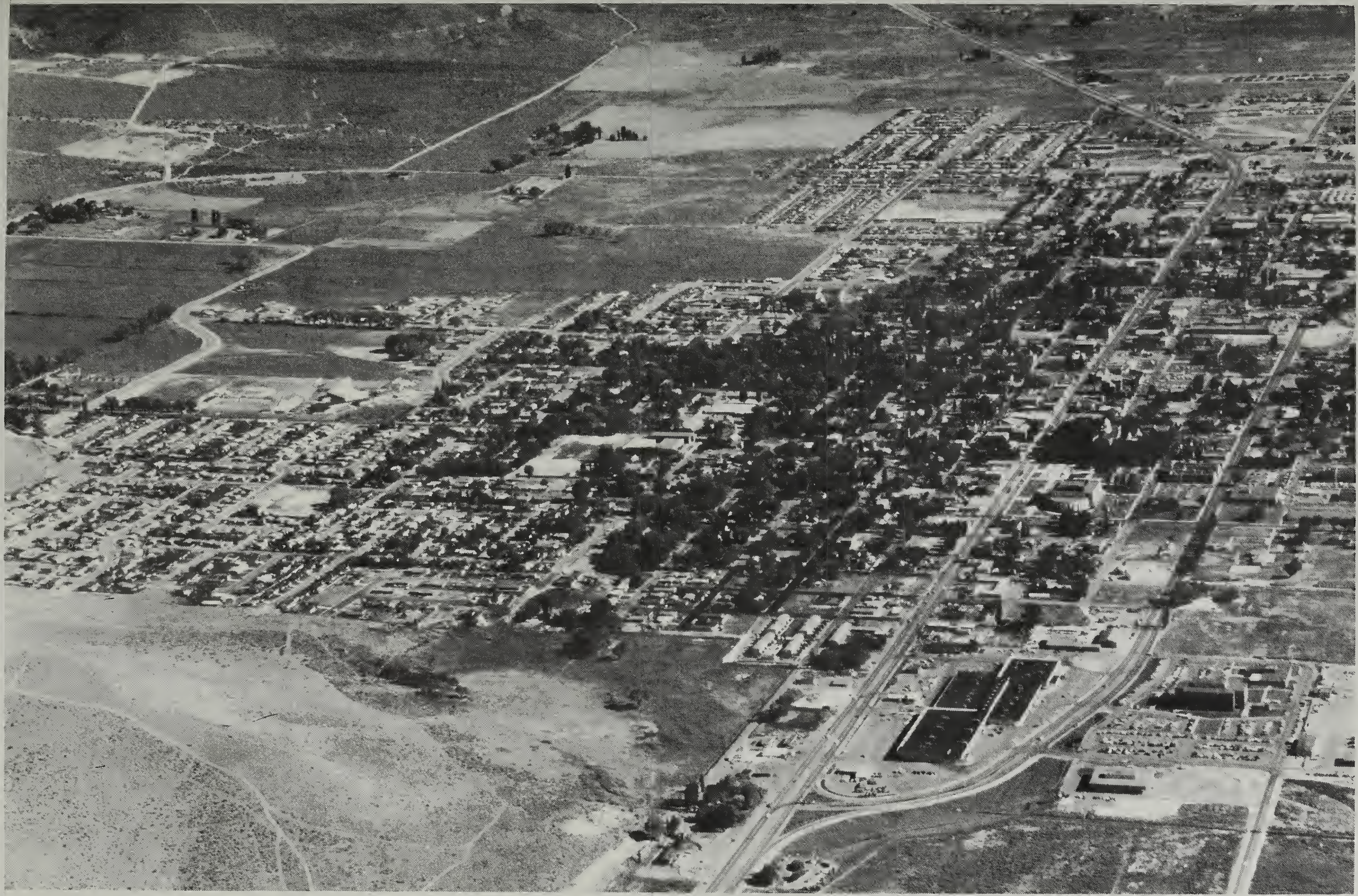
The population center of the Basin is the Reno-Sparks-Carson City-Lake Tahoe area. Reno, Sparks, and part of Lake Tahoe lie in Washoe County, the most populous county in the Basin. Carson City has a city-county type of government and is the second most populous county.

The Basin's population increased by 49 percent between 1960 and 1970. Nevada had the highest population growth rate in the nation - 71 percent - in that period. The Nevada portion of the Basin accounted for one-third of Nevada's total population in 1970. The major component of population change was inmigration from California.

Table 31 -- Population and percent change 1960-1970 by county and state, Central Lahontan Basin

County	Population 1970	Percent change 1960-1970
Carson City	15,468	199.6
Churchill	10,513	24.4
Douglas	6,882	97.7
Lyon	8,221	33.8
Mineral	6,545	15.0
Storey	695	22.4
Washoe	120,475	44.1
Nevada	168,799	49.3
Alpine	383	21.9
Lassen	13,804	8.2
Mono	1,800	39.5
Nevada	2,270	17.1
Placer	6,239	92.1
El Dorado	14,929	88.9
Sierra	95	35.0
California	39,520	43.2
Central Lahontan Basin	208,319	46.2

Source: 1970 Census of Population
California Department of Water Resources



Carson City, Nevada's capital, has shown the largest percentage population increase of any community in the Basin.

Native Americans

There are eight separate groups of American Indians, associated with the Shoshone, Washoe, and Paiute tribes who are residents on lands officially devoted to Indian use. These persons numbered 2,615 in 1969, and their reservation lands included 802,467 acres. Total Indians living on reservation lands and in other urban and rural locations numbered 4,164 in the study area. This means that 1,549 of these Indians did not reside on reservation lands. In 1969, unemployment among them averaged approximately 21 percent, and underemployment, 46 percent. Most of the eight groups have relatively insignificant group incomes, with the member's personal earnings being the chief source of individual support. Two groups, the Pyramid Lake Reservation and the Walker River Reservation, have a significant group annual income of approximately \$48,000 and \$30,000 respectively. This group income amounts to an average of roughly \$100 per person. Various persons within the eight groups have formed cattlemen's associations, but there are no current statistics showing the average net income from their individual cattle-farming operations.

Table 32 - Census of Native Americans, Nevada Portion Central Lahontan Basin, 1970

County	Native Americans	% of County Total	% of Nevada Portion
Churchill	419	3.98	10.1
Carson City	525	3.39	12.6
Douglas	194	2.82	4.7
Mineral	582	8.25	14.0
Lyon	509	6.19	12.2
Storey	9	1.29	0.2
Washoe	1,926	1.59	46.02
Total	4,164	2.45	
Source: 1970 Census of Population			

One notable source of group income for the Pyramid Lake Reservation is fishing fees charged to recreational fishermen at Pyramid Lake, which is entirely on the Reservation's property. In 1968, it was estimated that 10,165 persons held permits to fish at the Lake. The number of such permits has been increasing yearly.

Income

The total income in the Basin was $694.8 million dollars in 1970. The per capita income was $3,594. This is 115 percent of the national average. The historical trend has indicated a rapid growth of personal income in the Nevada counties. All the counties in the Nevada portion, except for Churchill and Lyon, had a per capita income higher than that for the U. S.

Table 33 - Per Capita and Total Income by County, Central Lahontan Basin, 1970 dollars

County	Per Capita Income	Total Income
Carson City	3,591	55,545,588
Churchill	2,845	30,004,102
Douglas	4,200	28,904,400
Lyon	3,011	24,753,431
Mineral	3,200	22,563,200
Storey	3,618	2,355,318
Washoe	3,857	467,128,984
Total Nevada Portion	3,715	631,255,023
Alpine	3,271	1,471,950
Lassen	2,901	48,725,196
Nevada		
Mono	3,317	13,321,072
Sierra		
Total California	3,107	63,518,218
Total Central Lahontan Basin	3,594	694,733,241
United States	3,119	

Source: U.S. Dept. of Commerce, County and City Data Book, 1972

Employment

By far the most important component of the Basin's economy is the service sector. Table 34 shows employment statistics for the Basin. Unemployment in the Nevada and California portions was 6.1, and 10.0 percent, respectively, in 1970.

The overall economy grew steadily during the 1960-1970 decade. The only sector experiencing a decline was agriculture, forestry, and fisheries. Total acreage of farmland was not substantially reduced, yet there was a decreased demand for agricultural labor due to mechanization and increased labor productivity.

Table 34 - Employment by industry and states, Central Lahontan Basin, 1970

Industry	Nevada Number	Nevada % of Total	California Number	California % of Total
Agriculture, Forestry and Fisheries	1,955	2.7	674	9.4
Mining	1,136	1.6	29	0.4
Construction	5,700	7.9	504	7.0
Manufacturing	4,190	5.8	525	7.3
Transportation, Communication & Utilities	5,697	7.9	302	4.2
Wholesale & Retail Trade	14,531	20.2	1,211	16.8
Finance, Insurance and Real Estate	3,515	4.9	247	3.4
Services	28,886	40.2	1,931	26.9
Public Administration	6,219	8.7	1,767	24.6
Total Employed	71,829		7,190	

Source: 1970 Census of Population.

Selected Social Indicators

Most of the counties in the study area have experienced a large net inmigration over the past decade indicating that social conditions are not stagnant over most of the area. The area is highly variable as to the extent of urbanization. The population of college graduates is used as an indicator of the number of persons selecting to live in the area who generally have a greater mobility. The Nevada portion's percentage of families with an income under ten thousand dollars is relatively consistent with the exception of a larger percentage of such families being in Churchill county.

Recipients of old age assistance and the number of families with aid to dependent children are indicators of those segments of the population which have been, for various reasons, placed outside of the formal economic system. The average monthly payments to families with dependent children and the percentage of local government expenditures for public welfare are indicators of the level of local social concern for disadvantaged members of its resident population. The median value of single family housing is used as an indicator of the tax base and of the median level of living conditions in the county. Selected social indicators for the Basin are shown in Table 35.

Table 35 — Selected social indicators, Central Lahontan Basin

County	Net migration 1960-70 %	Urban %	Negro population	Spanish heritage %	Pop. 25 yrs. & over, 4 yr. college or more %	Families under $10,000 %	Number of Recipients of Old Age Assistance	(No.Fam.) Aid to families with dep. children	average monthly payment per family	Local Govt. exp. for public Welfare %	Median value owner occup. single family housing
NEVADA											
Carson City	77.8	100.	(B)	4.2	15.1	20.7	79	184	84	1.2	22,700
Churchill	11.0	28.1	(B)	4.1	7.4	40.8	147	276	110	1.7	16,780
Douglas	83.9	-	(B)	(B)	10.7	29.6	28	55	93	1.4	28,800
Lyon	20.1	-	(B)	5.1	8.0	29.7	72	150	93	2.6	17,013
Mineral	-1.6	49.4	473	6.3	5.8	23.5	52	115	93	3.2	12,634
Storey	23.6	-	(B)	(B)	13.5	16.2	6	8	61	1.6	14,118
Washoe	27.5	82.2	2,033	5.1	13.5	23.8	919	1,734	91	.7	23,668
State avg.	50.4	80.9		5.6	10.8	25.5			111	1.2	22,570
CALIFORNIA											
Alpine	13.9	-	(B)	(B)	3.0	36.3	7	58	220	14.1	27,300
El Dorado	36.9	41.8	(B)	4.4	10.4	32.3	835	2,858	213	9.8	20,055
Lassen	.5	39.3	597	7.8	7.5	31.9	256	754	196	11.6	12,895
Mono	68.8	-	(B)	(B)	10.5	27.4	46	145	161	3.6	25,377
Nevada	24.4	19.8	(B)	4.6	9.7	38.9	7.2	1,414	230	13.9	17,559
Placer	26.3	40.5	(B)	9.3	10.0	30.8	1,252	5,141	226	9.1	18,576
Sierra	.7	-	(B)	(B)	9.4	39.1	42	51	143	4.8	11,952
State avg.	24.5	90.9		15.5	13.4	27			226	13.4	23,100

(B) Less than 400

Source: U. S. Department of Commerce, County and City Data Book, 1972

Agriculture and Livestock

Crops

Crop production in the Basin consists mainly of feed crops grown to satisfy the demands of the livestock industry. In 1968, 96 percent of the irrigated land was used for pasture and the production of various kinds of hay and ensilage. Most of the croplands are found in the Carson and Walker River Subbasins in Nevada. Except for the Calvada Subbasin, most of the cropland in the California portion is fragmented and scattered.

Food and cash crops are grown for export and local consumption. Tables 36 and 37 show crop data for the Basin.

Table 36 - Crop acreage and production, Central Lahontan Basin, 1970

Crop	Acres	Yield Unit	Yield per acre	Total production
Alfalfa	96,401	Tons	3.5	337,403
Wild hay	43,724	Tons	1.2	52,468
Irrigated pasture	101,750	AUMs	3.4	345,950
Semi-irrigated pasture	83,962	AUMs	1.0	83,962
Mountain meadows	19,073	AUMs	0.7	13,351
Wheat	5,230	Tons	1.5	7,845
Barley	6,692	Tons	1.2	8,030
Oats	510	Tons	1.0	510
Potatoes	923	Tons	16.0	14,768
Onions	576	Tons	19.0	10,444
Garlic	249	Tons	4.0	996
Corn silage	2,000	Tons	19.0	38,000
Cantaloupe	25	Cwt	80.0	2,000
Sugar beets	481	Tons	14.0	6,734
Watermelons	75	Cwt	80.0	6,000
Idle land	2,652	-	-	-
Dryland pasture	11,167	AUMs	0.5	5,583
Dryland grain	7,840	Tons	0.5	3,920
Total Farmland	383,330	-	-	-

Table 37 -- Irrigated crops by county and state, Central Lahontan Basin, 1970

State and county	Alfalfa hay	Small grains	Vegetable and row crops	Irrigated pasture & wild hay	Semi-irrigated pasture	Mountain meadows	Other	County totals
				--- acres ---				
NEVADA								
Carson City	265	-	-	429	944	-	-	1,638
Churchill	29,968	5,241	3,100	21,315	12,157	-	1,106	72,887
Douglas	10,170	291	-	25,468	8,274	-	5	44,208
Lyon	32,447	3,884	656	13,406	29,869	378	514	81,154
Mineral	1,170	85	35	490	4,500	960	-	7,240
Pershing	-	-	-	-	-	-	-	-
Storey	210	-	-	205	148	-	-	563
Washoe	7,551	609	238	14,053	8,923	1,365	-	32,739
Totals	81,781	10,110	4,029	75,366	64,815	2,703	1,625	240,429
CALIFORNIA								
Alpine	815	22	-	4,214	142	2,713	-	7,906
El Dorado	-	-	-	-	-	2,100	-	2,100
Lassen	12,058	2,300	300	39,659	11,044	2,310	1,027	68,698
Mono	1,687	-	-	24,740	7,961	3,712	-	38,100
Nevada	-	-	-	-	-	2,250	-	2,250
Placer	-	-	-	-	-	1,485	-	1,485
Plumas	-	-	-	-	-	-	-	-
Sierra	60	-	-	1,495	-	1,800	-	3,355
Totals	14,620	2,322	300	70,108	19,147	16,370	1,027	123,894
Basinwide total	96,401	12,432	4,329	145,474	83,962	19,073	2,652	364,323

Farm Numbers and Population

The 1969 Census of Agriculture reported about 2,100 farms in the Basin. This is a decline of 181 farms since 1964. This reflects the nationwide trend of merging of agricultural units to improve efficiency. Only about 3.5 percent of the Basin's population resides on these farms which occupy about 15 percent of the Basin area. Both farm numbers and population are expected to continue their decline because of advancing urbanization and the need to further streamline the agricultural financial and management functions. See tables 38 and 39.

Table 38 - Number of farms by size, Central Lahontan Basin[1/]

Acres	1964		1969	
	Number	% Total Farms	Number	% Total Farms
1 to 49	855	36.9	782	36.6
50 to 499	1,020	44.6	946	44.3
500 to 999	171	7.3	158	7.4
1,000 to 1,999	114	4.9	106	4.9
2,000 and over	154	6.6	142	6.6
Total	2,315	100.0	2,134	100.0

Source: 1969 Census of Agriculture

1/ California portion represented by total for Alpine, Lassen and Mono Counties.

Table 39 - Percent of population on farms and percent of land in farms by county, Central Lahontan Basin

County	Percent of population on farms, 1970	1960-70 percent change	Percent of total County land in farms, 1969
Nevada	2.3	--	15.2
Carson City	0	0.	21.2
Churchill	14.6	25.2	10.3
Douglas	6.0	26.4	35.8
Lyon	14.6	19.0	21.5
Mineral	2.9	78.4	13.7
Storey	0.	0.	(1)
Washoe	0.5	15.8	21.4
California	4.7	--	14.9(2)
Alpine	0.	0.	(1)
El Dorado	1.7	--	20.6
Lassen	5.1	22.2	21.8
Mono	3.8	4.9	4.8
Nevada	1.9	--	11.0
Placer	2.8	--	23.1
Sierra	2.7	--	8.3

Source: County and City Data Book, Table 2

(1) Data withheld to avoid disclosure of information.

(2) California data in this column is for entire county.

Size of Farms and Land Tenure

The Basin does not have acute problems of land tenure. Median farm size was between 70 and 99 acres both in 1964 and 1969. More than a quarter of the farmers held from 10 to 49 acres. The percentage decrease in the number of farms was approximately the same as the percentage decrease in the farmlands, and no change in farm size was evident during this time period. Tables 40, 41, 42, and 43 show land tenure and size characteristics for the Basin.

Table 40 - Land Tenure Characteristics, Central Lahontan Basin, 1969 1/

Type of Tenure	Number	% of Total
All farm operators	2,134	100.0
Full Owners	1,539	72.1
Part Owners	419	19.6
Tenants	176	8.3

Source: 1969 Census of Agriculture.

1/ California portion represented by total for Alpine, Lassen, and Mono Counties.

The Fallon area has the largest number of farm units.

Pleasure horses are rapidly increasing at several locations in the Basin.

Table 41 - Land tenure characteristics by County, Central Lahontan Basin, 1969

County	Full Owners Number	% of Total	Part Owners Number	% of Total	Tenants Number	% of Total	Total Number of Operators
NEVADA							
Carson City	15	88.2	2	11.8	0	0.	17
Churchill	303	71.6	96	22.7	24	5.7	423
Douglas	75	75.8	19	19.2	5	5.1	99
Lyon	184	70.8	53	20.4	23	8.8	260
Mineral	12	57.1	8	38.1	1	4.8	21
Storey*	--	--	--	--	--	--	--
Washoe	131	64.5	43	21.2	29	14.3	203
CALIFORNIA1/							
Alpine*	--	--	--	--	--	--	--
Lassen	231	75.0	60	19.5	17	5.5	308
Mono	24	70.6	6	17.6	4	11.8	34

1/ California data is total for representative counties.

* Data withheld to avoid disclosure.

Source: 1969 Census of Agriculture.

Table 42 -- Percent of farms with 2,000 or more acres, percent of total county farm acreage, and percent of total county irrigated acreage, Central Lahontan Basin, 1969

County & State	% of Farms	% of County farm acreage	% of County Irrigated farm acreage
NEVADA	15.8	94.6	67.4
Carson City	5.9	(1)	0.
Churchill	1.2	75.4	9.8
Douglas	12.1	85.3	57.8
Lyon	9.6	72.7	43.6
Mineral	14.3	98.0	(2)
Storey	(2)	(2)	(2)
Washoe	10.8	94.3	31.6
CALIFORNIA (2)	3.8	69.8	36.3
Alpine	(1)	(1)	(1)
El Dorado	3.0	64.9	34.1
Lassen	23.4	85.7	77.8
Mono	32.3	89.0	75.8
Nevada	3.0	32.7	9.1
Placer	1.7	48.7	13.5
Sierra	28.0	82.6	47.3

Source: 1969 Census of Agriculture.

(1) Data withheld to avoid disclosure of information for individual farms.

(2) California data is for entire county.

Table 43 -- Acres of farms with 2,000 or more acres and total county farm acres, Central Lahontan Basin, 1969

County	Acres in Farms with 2,000 or more acres	Total County Acres in Farms
Carson City	(1)	--
Churchill	243,821	323,204
Douglas	137,175	160,861
Lyon	203,140	279,460
Mineral	323,961	330,462
Storey	--	--
Washoe	821,309	870,797
Nevada	1,729,406	1,964,784
Alpine	(1)	(1)
Lassen	546,731	637,854
Mono	83,403	93,743
Calif.(2)	630,134	731,597

Source: 1969 Census of Agriculture.
(1) Data withheld to avoid disclosure of information for individual farms.
(2) California data is total for representative counties.

Farm Expenses, Sales and Income

All farms in the Basin are mechanized to some degree. The average farm has at least one automobile, one truck or pickup, and one tractor. The average book value of machinery and equipment used on farms is greater than $10,000.

Farm expenses were relatively high with respect to receipts. The total expenses were 37.5 million dollars, which accounted for over 90 percent of the market value of all agricultural products sold. The single highest expense was the purchase of livestock and poultry, which accounted for more than 8.5 million dollars in 1969, or about 23 percent of the total. The feed for these animals was the next highest expense, more than 6.5 million dollars. The cost of agricultural chemical use was less than three percent of all expenses in 1969. Much of the chemical expense was for insect control for livestock and poultry. The average expense of fertilizers for crop production in 1969 was estimated to be only about two dollars per acre. The cost of purchasing seeds, bulbs, plants and trees, lowest on the list, just exceeded a quarter of a million dollars.

The average sales in 1969 were about $19,000 per farm per year. The median, however, was in the sales class of $20,000 to $39,000. The reason for the higher figure is that almost 40 percent of the farms were in the "others" category, composed of part-time and part-retirement farms, and economic class 6 farms, all of which had total sales under $2,500 per year. Only one percent of the rest of the farms fell in this income bracket. Total farm income for 1969 was 41.6 million dollars.

More than half the farmers were dependent on off-farm income in 1969. This is approximately the same percentage as in 1964, but the number working off-farm over 100 days per year doubled in the five-year period.

Table 44 - Percent of farms with annual sales of $80,000 or over, by County, Central Lahontan Basin, 1969

State and County	Percent
NEVADA	8.6
Carson City	0.
Churchill	6.1
Douglas	10.1
Lyon	7.3
Mineral	0.
Storey	1/
Washoe	2.0
CALIFORNIA 2/	
Alpine	1/
El Dorado	2.8
Lassen	7.8
Mono	8.8
Nevada	1.1
Placer	4.1
Sierra	4.0

Source: 1969 Census of Agriculture.
1/ Data withheld to avoid disclosure of information for individual farms.
2/ California data is for entire county.

Livestock and Poultry

The livestock industry is the heart of agricultural activity in the Basin. Cattle and calves are the main animals raised. Most farms keep a small number of other kinds of animals such as hogs, for additional income. Horses and ponies are being raised quite extensively for pleasure riding, but are also used on farms and ranches. Sheep and goats are grazed where steepness and infertility of land present problems in using it for other purposes. A number of farms in the California portion commercially raise chickens. In the Nevada portion, many farms keep chickens for their own consumption and an additional income.

The total cattle and calves industry reached its peak for the Nevada portion in 1954, when 175,000 head were counted. A large shortage of supply in 1949 was the cause of this expansion. The production increase was too large for the market to absorb; production decreased and reached an equilibrium point in 1959 which has since been maintained with very slight fluctuation. A large demand for beef has strengthened the livestock industry in the Nevada portion. Similar data for the California portion are not available.

It is estimated that the California portion of the Basin contained 494 dairy cattle in 1970 and that the Nevada portion averaged 6,805 head annually over the 1966-1970 time period. It is estimated the Basin presently maintains an average of 7,300 head of dairy cattle.

Cattle feed lot operations are located basically in the Nevada portion of the Basin. The major production areas are in the Lower Carson and Walker subbasins. An estimated average of 42,200 head were annually sold in the Basin during the 1966-1970 time period. The number of head varies substantially between years and is highly dependant upon the local price of grain relative to the price of beef. No slaughter operations of major importance exist inside the Basin. Most cattle are shipped to the California market. A large number of the calves to be fed come from outside the Basin.

The sheep and lambs sector has declined rapidly in the Nevada portion because of decreased demand. By 1969 there were only 46,000 head, as compared with almost 100,000 head in 1949. A similar situation prevails in the California portion.

Estimates are that the total horse numbers in the Basin range between 12,000 to 16,000 head. As an indication of the interest in pleasure horses, a university course entitled Horse Production was reinstituted by popular demand at the University of Nevada after being dropped for a number of years.

Pleasure horses require between 0.5 and 1.5 pounds of feed per day per 100 pounds of body eight. Pasture can provide ample feed for about six months, but hay is required for the other six months. About 2.0 acres are required to produce the hay and pasture to support one pleasure horse per year. Thus, between 24,000 and 32,000 acres of land are presently utilized to support horses. Hay can be imported, so it is not necessary that acres used to support horses be entirely within the Basin.

Non-Agricultural Industries

Scenic and recreational attractions as well as accessibility to major urban centers have fostered growth of the trade and service industries. The scenery and gaming industry of the Lake Tahoe-Reno area is a tourist attraction of national and international importance. Major transportation facilities include the Southern Pacific and Western Pacific Railroads, Reno International Airport, and Interstate 80. The trade and service sector accounted for 80 percent of total employment in 1970.

The relatively high proportion of employment in the construction industry is associated with the Basin's high rate of population and recreational services growth. A significant portion of manufacturing employment is associated with processing agricultural, timber, and mineral resources.

Approximately $59 million of minerals were produced in the Basin in 1970. Commodities produced, employment, and value of production are shown in Table 45. About 37 thousand acres of land were used for mining related activity.

Interstate 80 is the main east-west thoroughfare across the Basin.

Wood products processing plant at Susanville, Calvada Subbasin. The Subbasin is the center of the Basin's wood products industry.

Table 45 - Geologic commodity production and employment, Central Lahontan Basin, 1970

Commodity	Production (thousands of dollars)			Employment		
	Calif	Nevada	Total	Calif	Nevada	Total
Copper	-	40,800	40,800	-	470	470
Diatomite	-	1,270	1,270	-	120	120
Iron	-	4,930	4,930	-	85	85
Saline playa products	-	7,000	7,000	-	25	25
Sand and gravel	388	2,640	3,028	5	36	41
Stone	159	1,590	1,749	7	66	73
Total	547	58,230	58,777	12	802	814

Source: Information is Based on University of Nevada and Nevada State Engineer's Office data. Full reporting limited by disclosure.

Forestry

The Central Lahontan Basin contained 1.05 million acres of commercial forest land in 1970. Over 970 thousand acres were in California and 84 thousand acres were in Nevada. Total growing stock was 2,208 million cubic feet. Standing saw timber was 11,870 million board feet. Production of saw logs, veneer logs, and miscellaneous industrial timber products was 29.3 million cubic feet.

Employment in forest management was 213 persons while employment in lumber and wood products industries was 999 persons in 1970. Payrolls were 1.1 and 2.6 million dollars respectively.

Twenty-two lumber and wood product establishments and 11 furniture and fixture establishments are located in the Basin. Capacity of primary wood product processing plants is 128 million board feet per year.

Most of the timber as well as the primary processing plants are located in the California portion of the Basin. The majority of the commercial forests in the Nevada portion are used for non-timber products such as fuelwood and posts.

Skiing at one of the many winter resorts in the Basin is a large contributor to the local economy. Nevada Highway Department photo.

Recreation

Outdoor recreation is a significant contributor to the Basin economy. Beautiful mountain and desert scenery and easy access to major urban centers results in a continually expanding demand for outdoor recreation. In 1970, there were about 12 million visitor-days use of outdoor recreation tabulated.

Seventy percent of the Basin's lands are in Federal ownership and much of the recreation activity takes place on these lands. Recreation activities and visitor-day use on Federal lands has been segregated into three categories: (1) developed recreation areas, (2) dispersed or undeveloped recreation areas, and (3) hunting and fishing.

In 1970, the theoretical visitor-day capacity of recreation developments on Federal lands was 9.3 million visitor-days. The 1970 visitor-day use on these lands is shown in the following tabulation:

Category	Calvada	Truckee	Carson	Walker	Basinwide
	----------- 1,000s visitor days -----------				
Developed areas	300.7	1,864.2	96.2	268.6	2,529.7
Dispersed areas	316.5	2,199.1	309.5	758.9	3,584.0
Hunting and fishing	62.3	400.7	86.4	215.2	764.6
Total	679.5	4.464.0	492.1	1,242.7	6,878.3

The greatest expenditures by recreationists are in the developed recreation areas, but the greatest visitor-day use is in the dispersed areas. Table 46 presents a detailed display of visitor-day use and expenditures for the Federal developed recreation areas. Expenditures for the other two categories are less than 50 percent of those incurred for the developed areas.

Table 46 - 1970 Visitor-day use and expenditures for Federal developed recreation areas, by subbasin and Basin, Central Lahontan Basin

Activity	Calvada	Truckee	Carson	Walker	Basin
	------------	---1,000s	visitor day	s--------	---------
Camping	236.3	680.7	31.3	214.5	1,162.8
Picnicking	5.4	108.0	-	-	113.4
Swimming	8.3	93.2	-	-	101,5
Boating	12.8	9.1	-	7.0	28.9
Group Camps	-	77.8	-	3.2	81.0
Visitor Observation Site	-	42.1	-	-	42.1
Resorts	1.2	63.3	17.0	25.6	107.1
Summer homes	36.2	333.2	8.8	16.3	394.5
Winter sport	-	447.0	35.8	-	482.8
Other	.5	9.8	3.3	2.0	15.6
Total Visitor-Days	300.7	1,864.2	96.2	268.6	2,529.7

Activity	Value/visitor day	Calvada	Truckee	Carson	Walker	Basin
	------------	1,000s do	llars expen	ditures-	---------	
Camping	1.50	354.4	1,021.1	47.0	321.8	1,744.2
Picnicking	1.50	8.1	162.0	-	-	170.1
Swimming	1.50	12.4	139.8	-	-	152.2
Boating	1.75	22.4	15.9	-	12.25	50.6
Group Camps	6.00	-	466.8	-	19.2	486.0
Visitor Observation Site	1.50	-	63.2	-	-	63.2
Resorts	7.00	8.4	443.1	119.0	179.2	749.7
Summer homes	6.00	217.2	1,999.2	52.8	97.8	2,367.0
Winter sport	9.00	-	4,023.0	322.2	-	4,345.2
Other	4.00	2.0	39.2	13.2	8.0	62.4
Total Expenditures		625.0	8,373.2	554.2	638.2	10,190.5

Wildfires are one of the Basin's major resource management problems.

CHAPTER V

EXISTING RESOURCE PROBLEMS

Highlight

This chapter describes significant water and related land resource problems in the Basin as to their cause, extent, and frequency, and economic and social consequences. These problems are presented as to their major effect on the land, water, and environment of the Basin. Problems involving losses through damage or inefficiencies as well as those relating to management, development and growth are discussed.

CONTENTS

Land

Soils

Soils and soil-related characteristics may create problems for some uses but benefit others. For example, surface stoniness, benefits native plant growth by reducing heat penetration and evaporation. The increased production of forage benefits both livestock and wildlife use. On the other hand, excessive stoniness hinders logging, road building, and cultivation and may be considered to be a problem for such uses. Table 3 briefly identifies the dominant problems of the soils shown on the General Soil Map. These are provided for eight major uses of the Basin soils. The following discussion further defines the soil problems related to specific land uses.

Cropland

Irrigated cropland is affected by soil limitations in several areas. Shallow soils restrict root penetration and do not allow for adequate leveling or shaping. Low water holding capacity soils require frequent but light irrigations which are costly and lead to inefficiency. Some soils are underlain by lake sediments which affect crop management and yields. Drainage problems affect many lowland soils, while frequent flooding is the problem to most cropland soils adjacent to water courses. Soils with horizons that tend to create perched water tables when excessive irrigation water is applied are common in several of the Basin's irrigated areas.

Salt concentrates at the soil surface on land affected with a high water table. This reduces the kind of plants that can be grown, their productivity, and increases their water requirement. Drainage systems on such land provides a means of reducing the salt to increase kinds of crops that can be grown, their productivity, and lower the water requirement. However, more water will be required, as compared with non-saline soil needs, to maintain an adequate salt balance.

Urban and/or Industrial Use

Frost action, erosion, overflow, shrink-swell clay hazards, steep slopes, poor drainage, shallow soil depth, and plant establishment on disturbed soils are the principal soil and soil-related problems affecting urban land use. All occur to some extent within the Basin at present. Satellite dwelling clusters, without community sewage systems, are posing problems involving septic tank absorption fields. For this use the principal soil factors and soil-related problems are permeability, percolation, drainage, overflow, slope, depth, rockiness, and amount of coarse rock fragments present. In some areas improper selection of filter fields threaten pollution of ground water.

Sewage lagoons and sanitary landfill sites are associated with urban land use. Soil and soil-related problems affecting these uses include poor drainage, shallow depth to limiting layers, steep slopes, flooding, and soil texture.

Temporary erosion and sedimentation are common to many of the urbanizing area soils. Dust from wind erosion is most common. When the vegetation is removed and the soil is physically disturbed the soil particles are readily transported by wind and water. This problem is most severe in the loamy and fine sandy soils.

Watersheds

The Basin's higher water yielding watersheds present major problems in present use. These areas yield more than three inches of water per acre per year. This is a fragile environment being subjected to intensive use by man. The high elevation, steep, rugged mountains are primarily on the western side of the Basin. Much of the area is barren in appearance but includes patches of conifers, aspen, and meadows. In general, the soils are thin, coarse-textured members of Entisols and Inceptisols. These soils are highly susceptible to erosion and generally infertile. Though they receive the highest precipitation in the Basin, they must be considered droughty because of dry summers and low water-holding capacity. This poses a particular problem for vegetation establishment on disturbed soils such as ski slopes.

The soils of the lower water-yielding watersheds are generally moderately deep, medium and fine-textured, fertile members of Mollisols and Aridisols. Erosion of soils stripped of vegetation has been and is a serious problem.

Wildlife, Rangeland, Forest and Woodland

Native plant productivity is of concern for wildlife rangeland, forest, and woodland uses. These land uses are interrelated and include multiple use land. The more important soil problems are related to available water-holding capacity, fertility, drainage, slope, slope-aspect, etc.

Accelerated erosion is the most serious soil problem. It is necessary to maintain vegetation to limit erosion to the natural rate. An erosion hazard rating for the various soils is indicated in APPENDIX I and a general reference with respect to problem soils is listed in Table 3.

Drainage

There are about 475,000 acres of land affected to some extent by a high water table within the Basin. Much of this land has already been drained or is of questionable feasibility for drainage. Acreage suited for and needing agricultural drainage is tabulated as follows:

Subbasin	California	Nevada	Total
Calvada	28,000	--	28,000
Truckee	--	11,000	11,000
Carson	500	61,500	62,000
Walker	17,500	17,500	35,000
Totals	46,000	90,000	136,000

Disposal of drainage water is a problem if return flow to the surface drainage system is to be utilized. Return flow drainage water is necessarily of lower quality. Under present conditions its re-entry into the surface drainage system might not be permitted since it is considered to be a source of pollution.

Erosion and Sedimentation

There are two kinds of erosion occurring in the Basin. Natural erosion, the wearing away of the soil by natural processes, and accelerated erosion resulting from man's activities.

Eroded agricultural land resulting from high flows in East Carson River, Carson Subbasin

Both natural and accelerated erosion contribute to sediment plumes along the south shore of Lake Tahoe, Truckee Subbasin

The highest rate of sediment yield in the Basin occurs along the lower reaches of the Truckee River channel. The records of the national stream quality accounting network station, Number 10351700, indicate an average of 206,000 tons per year of sediment transported past the gage near Nixon.

Sources of sediment are the products of sheet erosion, gully erosion, streambank erosion, road and trail erosion, and landslides. Acceleration of sediment production is directly attributable to man's activities that have disturbed the landscape and caused significant soil transport. In this category are causes such as logging, all types of construction, grazing, recreation activities, and fire. For example, in the Incline Village Area at Lake Tahoe, 78 percent of the sediment production was produced by the 21 percent of the drainage area that had been developed by man. Sediment transport also results in transport of soil nutrients. When these nutrients are deposited in water bodies, they may result in algae blooms, and along with turbidity, produce undesirable effects. This factor is a major concern in Lake Tahoe.

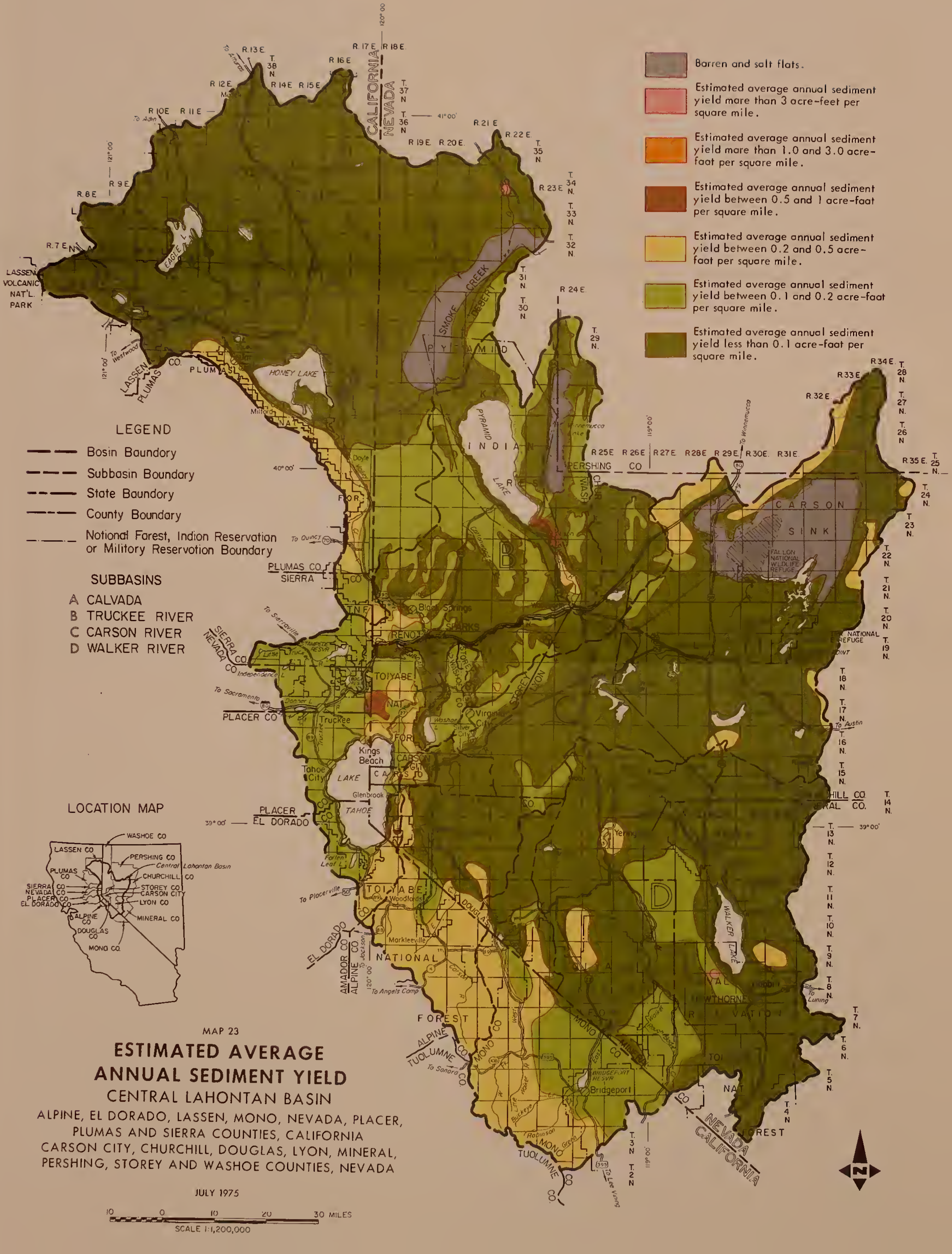
Estimates of sediment yield for the Basin are shown on Map 23. Acreages of sediment yield units are shown in the following tabulation:

Sediment yield units		Acres
AF/SM*	T/SM**	1,000s
<0.1	196	7,480
0.1-0.2	392	1,211
0.2-0.5	392-980	1,100
0.5-1.0	980-1,960	22
1.0-3.0	1,960-5,880	0
>3.0	>5,880	4

*AF/SM - Acre feet per sq. mi.
**T/SM - Tons per square mile

Criteria for the development of Map 23 was developed by the Watershed Management Subcommittee of the Pacific Southwest Interagency Committee. A separate map for the Tahoe Basin was prepared and is in APPENDIX II.

The maps were prepared showing the relative estimated general magnitude of sediment yield from different source areas within the Basin. The estimates have limitations and should be


Barren and salt flats.
Estimated average annual sediment yield more than 3 acre-feet per square mile.
Estimated average annual sediment yield more than 1.0 and 3.0 acre-faat per square mile.
Estimated average annual sediment yield between 0.5 and 1 acre-faat per square mile.
Estimated average annual sediment yield between 0.2 and 0.5 acre-faat per square mile.
Estimated average annual sediment yield between 0.1 and 0.2 acre-faat per square mile.
Estimated average annual sediment yield less than 0.1 acre-faat per square mile.
LEGEND
Basin Baundary
Subbasin Boundary
State Baundary
County Baundary
Natianal Forest, Indian Reservation or Military Reservation Boundary
SUBBASINS
A CALVADA
B TRUCKEE RIVER
C CARSON RIVER
D WALKER RIVER
LOCATION MAP
CALIFORNIA
NEVADA
HONEY LAKE
EAGLE L
PYRAMID LAKE
CARSON SINK
LAKE TAHOE
WALKER LAKE
RENO
Truckee
Bridgeport
Markleeville
MAP 23
ESTIMATED AVERAGE ANNUAL SEDIMENT YIELD
CENTRAL LAHONTAN BASIN
ALPINE, EL DORADO, LASSEN, MONO, NEVADA, PLACER, PLUMAS AND SIERRA COUNTIES, CALIFORNIA
CARSON CITY, CHURCHILL, DOUGLAS, LYON, MINERAL, PERSHING, STOREY AND WASHOE COUNTIES, NEVADA
JULY 1975
10 0 10 20 30 MILES
SCALE 1:1,200,000

M7-PN-23160

used only where sediment yield data based on suspended sediment load samples are not available. Annual sediment yield estimates for selected locations on the Carson and Truckee Rivers is shown on Table 47.

Table 47 - Estimated sediment yield per year at selected locations, Carson River and Truckee River Subbasin, Central Lahontan Basin

Carson River Subbasin		
	Sediment Yield	
Area	acre-feet	tons
Bennett Canyon	.36	700
Clear Creek	2.14	4,200
Pine Nut Creek	5.05	9,900
Pine Flat Basin	.31	600
Buckeye Creek	7.65	15,000
Luther Creek	.92	1,800
Sheridan Creek	.31	600
Gold Canyon	1.73	3,400
Hope Valley	.97	1,900
Horseshoe Bend	4.03	7,900
Pleasant Valley	.56	1,100
Mount Bullion	9.69	19,000
Bagley Valley	2.09	4,100
Six Mile Canyon	3.01	5,900
El Dorado Canyon	10.20	20,000
Ramsey-Silver Springs	3.42	6,700
Brunswick Canyon	26.53	52,000
Truckee River Subbasin		
South Lake Tahoe	14.28	28,000
West Lake Tahoe	3.67	7,200
North Lake Tahoe	3.21	6,300
Incline Village	8.67	17,000
Galena Creek	4.39	8,600
Southwest Reno	16.84	33,000
Sun Valley	1.02	2,000
Squaw Valley-Donner Lake	9.69	19,000
Truckee-Verdi	28.57	56,000
Washoe Valley	10.71	21,000
Long Valley-Biddleman	10.71	21,000
Golden Valley		Minimal
Warm Springs Valley	6.12	12,000

Farming

Most of the Basin's farmlands presently being used for crop production are well suited for this use. Hazards in use reflecting soil depth, texture, water table, slope, and alkalinity have received much consideration in determing the cropping patterns that now exist. Of the 383,330 acres being farmed, about 260,000 acres are now in permanent vegetative cover and about 123,000 acres are being cultivated, either annually or as part of an established crop rotation.

The lighter textured cultivated fields in Smith, Mason, Lahontan, and Honey Lake Valleys are subject to wind erosion. Annual cultivation on the dryland grain fields in the Calvada Subbasin has been mitigated to some degree by use of mulch tillage but the remaining part of this acreage still receives little or no protective treatment. Flood irrigated cultivated lands in Smith Valley, Fernley, and Honey Lake Valley on slopes in excess of two percent present irrigation problems involving erosion, deposition, gullying, and difficulty in obtaining proper water application. Droughty soils on gentle slopes in Lahontan and Smith Valleys and at Fernley require sometimes massive applications of irrigation water to sustain normal production. The heavy textured and alkali areas in Lahontan, Mason, and Honey Lake Valleys require extensive reclamation and management to prevent reoccurrence of the problem.

About 132,000 acres of the Basin's croplands have been leveled or smoothed to provide for more efficient use for irrigation. The removal of top soil in many cases exposes unsuitable soil strata upon which reestablishment of vegetation is very difficult. Because of ownership and economics, there may be no other alternative.

Grazing

The history of grazing land use in the Basin is similar to its history in areas throughout the west. Extensive grazing of domestic livestock began in the 1870s. Rangeland was in excellent condition, and livestock numbers grazed were far in excess of the sustained capacity of the resource. The first indication of rangeland depletion occurred during a series of dry summers beginning about 1910. However, it was not until about 1930 that any significant reduction in livestock numbers took place. By then, grazing land was generally in a depleted condition from which it has only recently begun to recover.

Deteriorated rangeland conditions resulted in productivity losses. Overuse of rangeland by domestic livestock and unpermitted horses has resulted in a change of vegetation to less desirable species and in most cases lower yields. Use of land unsuitable for grazing because of excessively steep slopes or unstable soil has added to this problem. The rangeland carrying capacity is believed to be about one-half of what it was originally. About 3.8 million acres or 54 percent of the Basin's usable range is in the low forage production class.

Lack of adequate stockwater on rangeland is another significant problem. This problem is discussed in this chapter under Water, Inadequate Supply.

Timber Production

Production of commercial roundwood in the Basin in 1970 is listed in CHAPTER III. CHAPTERS IV and IX indicate that the demand for commercial roundwood is increasing. The acreage of commercial timberland is decreasing by about 2,500 acres per year because of changes in land use. Each year some commercial forestland is taken out of production for other land uses such as recreation, watershed protection, urban development; and by the construction of roads, utility lines and reservoirs.

One major problem is the present yield per acre is about 3,600 bf below optimum over a rotation period. Another major problem is the present low efficiency of log breakdown. This results in potentially usable wood ending up as mill residue. The average in the Basin is for every 1,000 bf log scale, 200 bf ends up in mill residue. These problems can only be solved by both the timber growers and the timber processors working together as a team. The land and management problems associated with timber production are summarized as follows:

Federal land

1. Most timberland producing below potential.
2. Commercial timber land deforested by fire, currently not producing timber.
3. Poor accessibility.
4. Lack of markets for some species.
5. Poor utilization of logging and mill residue.
6. Insufficient contract requirements to encourage better utilization.

Private land

1. Generally low productivity.
2. Low market value.

This burned over timber stand has been revegetated naturally by dense brush, thus making it difficult to reestablish trees.

The "yellow" waters of Bryant Creek loaded with poisonous mineral washes effect a portion of the East Carson River.

3. Poor accessibility.
4. Usually small units, resulting from inholdings surrounded by Federal lands.
5. Poor markets for forest products other than sawtimber.
6. Relative high value of forest land for forage production.
7. High real estate values and speculations for other uses prevent long-term investment, especially in Truckee and Walker River Subbasins.
8. Reforestation in old burns and brush fields.

Mining

Mining for ores and industrial minerals, development of claims, prospect excavations, building sites, access roads, and other related activities have contributed to many of the existing resource problems within the Basin. Surface and subsurface excavations from mining have resulted in open pits, mine shafts, tailing piles, dumps, and bulldozer trails in many locations. This usually removes the protection provided to the erodible soils by a canopy of vegetation, litter on the surface of the ground, or the accumulation of rock fragments.

In many places, the piles of mine tailings or dumps are being eroded because they offer little resistance to the energy of raindrops or other surface runoff. These dumps may alter the natural regimes of the drainage channels which may have existed previously. Many dumps contain sulfides, which are oxidizing, and contribute acid drainage waters to downstream waters or infiltrate into the ground water. Former tailing ponds for the discharge of wastes from cyanide mills are found in some gold-silver producing areas. A number of these old ponds are deteriorating and in some cases the sediment contained is being actively eroded, contributing to downstream sedimentation and water quality problems.

Air and water pollution from mining activities, processing plants, and industries is still occurring, though on a much smaller scale than was noted in previous years. A particularly severe mineral pollution problem exists in the California portion of the East Carson drainage from the abandoned Leviathan Mine. Pollution from poisonous acidic or basic wastes has destroyed all fish and fish food organisms in 11.3 miles of Bryant and Leviathan Creeks and has also affected a portion of the Carson River. Construction sites or pits which are excavated for borrow, sand, gravel, or other materials produce effects that are fairly similar to the effects of mining, except that water quality and other problems associated with mineralization usually are not present.

Recreation

The common problem throughout the Basin on BOR Class II and III land is that development of recreation facilities is not keeping up with demand by about 50,000 visitor days annually. When a site in a facility is used at 50 percent of theoretical maximum capacity it would be fully occupied. It has been established that when use of any campground approaches 30 percent of its theoreticl maximum capacity, the area is receiving heavy use. When the use exceeds this 30 percent level, deterioration of the facility and the surrounding area occurs. Presently campground use in the Basin is 43 percent of maximum capacity.

There are other problems in specific areas such as: inadequate access to streams, lakes, and other suitable areas for recreation use, inadequate sanitary facilities, and inadequate facilities to accommodate the latest type of camping equipment and vehicles.

The rapid change in the type of recreation equipment has made a lot of the existing facilities obsolete. Most of the existing campgrounds were developed to meet the needs of tent camping and some trailers. Inefficient use of facilities and the sites will exist until new campgrounds are built with sanitation stations to accommodate the "Now" camper.

Overcrowding of recreation areas is a problem in portions of the Basin.

Wildfire

Evidence of destructive forest fires exists throughout the Basin, in the form of old fire scars and fire-altered vegetation. During the 1920s and 1930s after much of the land had been cutover, the area burned each year by wildfires increased. To counter this, new fire control methods and techniques were developed and a vigorous fire prevention program initiated. At the present time, the average annual acreage burned in the Basin is 6,500 acres. The fuel build-up in the Basin is probably greater than in many other areas of the country. The climate is not conducive to the natural decomposition of fuels, consequently dead plant materials remain potential fuel for a fire for many years. Average annual monetary damages resulting from watershed problems caused by fire are shown in the following tabulation:

Problem	Land Evaluation Category	Monetary Damages in (1,000 dollars)		
		Nevada	Calif.	Total
Fire	Forest and range	1,147	378	1,525
	Urban	18	-	18
Total		1,165	378	1,543

Urbanization and Construction

Rapid urban expansion has characterized the Basin during the past 20 years which has resulted in a very active construction and building industry. Extensive construction involving subdivisions, homes, industrial facilities, roads, freeways, utilities, and recreation developments has been necessary to meet the demands of the increasing population. Much of this work has been carried on with little or no apparent concern for the Basin's natural resources and their limitations. Exceeding these limitations has, in many ways, resulted in significant resource problems concerning flooding, soil erosion, sedimentation, water pollution, and loss of fisheries and wildlife habitat - particularly big game winter range.

About 20,000 acres of irrigated cropland and in excess of

90,000 acres of range and forest lands have been converted to urban, industrial, and recreational uses. These lands were mostly privately-owned, and were located adjacent to the urban centers or to good transportation arteries. In several locations, problems have arisen when the soils and land characteristics began to manifest themselves into critical hazards to the land occupiers. These characteristics generally involve the soil profile, erosion potential, and flooding or drainage problems.

The most intensive urban and industrial uses are expected to continue to take place on the irrigated croplands in Truckee Meadows and Carson Valley. The loss of these acres would have a major impact on the Basin's agricultural economy. If present trends continue, the change in irrigated land acreages by subbasin could occur as shown in the following tabulation:

Subbasin	1973 Irrigated	2020 Irrigated	Change
Calvada	72,592	71,092	- 1,500
Truckee	41,582	10,198	-31,384
Carson	130,281	112,971	-17,310
Walker	119,868	123,789	+ 3,921
Totals	364,323	318,050	-46,273 net change

Watershed Conditions

Watershed conditions in the Basin, though greatly improved during the past 40 years, are still rated poor in many areas because of accelerated erosion. Slopes denuded by fire, heavy logging, over grazing, and construction still exist in each of the four subbasins. The greatest problems are at Lake Tahoe and elsewhere in the Truckee Subbasin. These areas are affected by severe sheet and gully erosion which causes sedimentation in streams, and degradation and erosion of channels. Many of these problem areas are located on privately owned land, which makes it difficult to implement remedial programs. On Federal lands, the land administering agencies are heavily emphasizing the planning and rehabilitation of these problem areas. Chapter X and APPENDIX II present a more detailed discussion of this subject.

Urban expansion into the Basin's range and wildlands poses critical fire protection problems, Carson Subbasin. L&M Photo Service photo.

Irrigated cropland in the Truckee Subbasin is being urbanized at a rapid rate.

The Truckee River at flood stage in Reno, 1950. Gene Christensen photo.

The Susan River, Calvada Subbasin, is a chronic flood producer.

Water

Floods and Flooding

Floods in the Basin cause an average of 2.8 million dollars of damage annually based on 1965 economic conditions and prices. Map 24 shows some of the major flood-prone areas in the Basin. Not all of the flood-prone areas are shown. Sloping lands subject to occasional sheet flow are mostly omitted from the Map.

Floods occur from three different conditions. Floods that have caused the most damage result from general rainstorms occurring during the winter months. This combination of conditions led to disastrous floods in November 1950, December 1955, and February 1963. Rapid snowmelt in the spring and early summer months has resulted in flooding several times; these floods have caused less damage than the general winter rain type. Summer convection storm floods are common throughout the Basin. The high intensity rainfall from these storms is limted to small areas and flood damages are local, but are occasionally quite severe. Table 48 lists some of the historical floods that have occurred between 1950 and 1970.

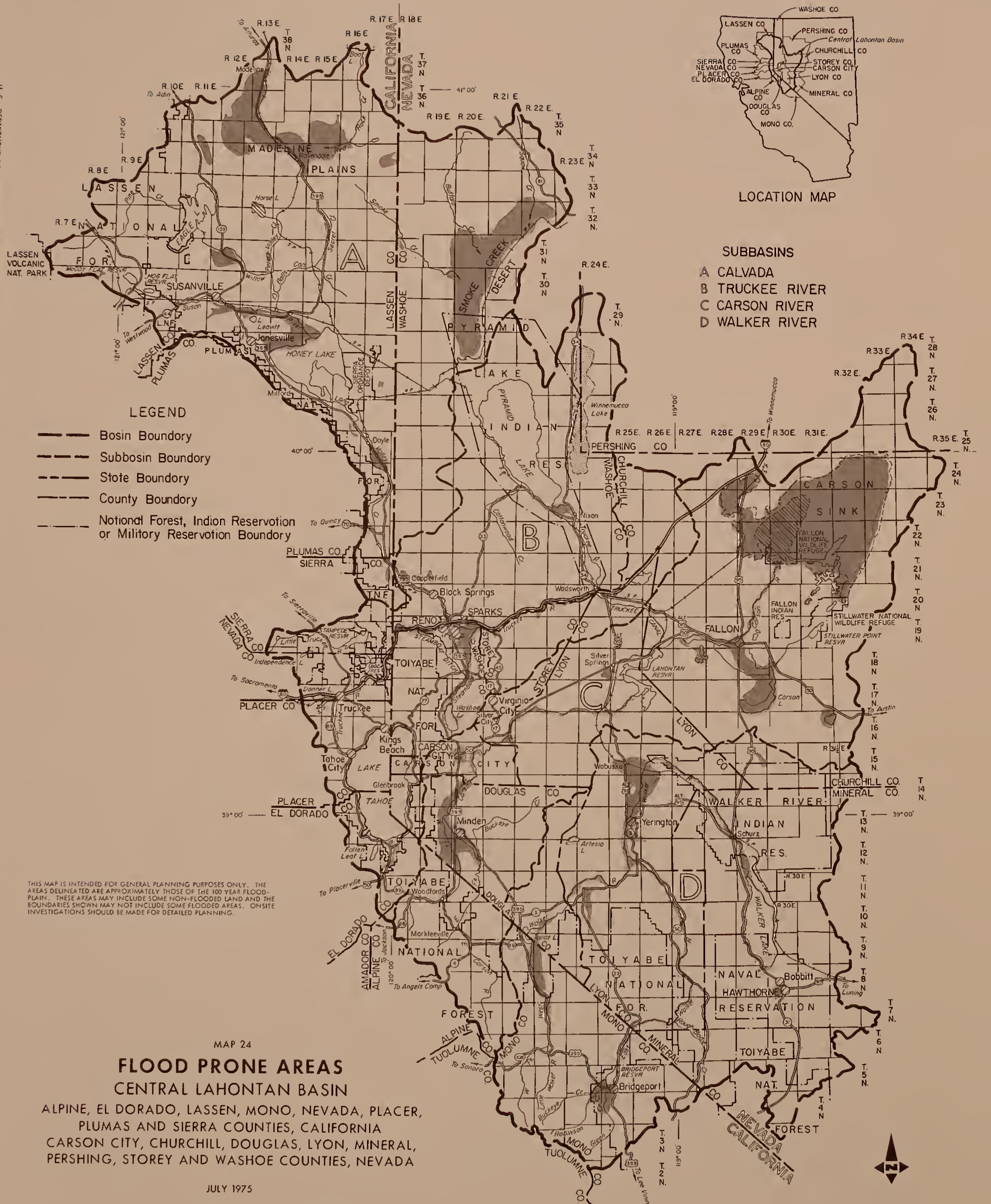
Table 49 summarizes average annual flood damages based on 1965 prices and project conditions for each of the subbasins. Although some flood control projects have been completed in the Truckee River Subbasin since 1965, damages from flooding are expected to increase because of more intensive urban use of the floodplain. Not only does increased development in the flood plain increase opportunity for damage directly, it also increases flood hazard in less obvious ways. By obstructing the flood plain with urban development, the floodwater is forced to higher, more damaging stages. Also, by removing natural vegetative cover through timber harvest, grazing, or urbanization, runoff peaks may be increased with resulting increased damages downstream. All of these things have occurred in the Basin. Progress has been made in some locations in remedying or controlling these situations, in other locations these problems are accelerating.

Table 48- Some historical floods, 1950-1970, Central Lahontan Basin

Date	Stream or area	Damage at time of flood (dollars)	Remarks	Source
November 1950	Truckee River	3,013,000		1
	Carson River	825,000		1
	Walker River	334,000		1
April 1952	Susan River	NA		
June 1952	Carson River	27,000		3
July 1952	Galena Creek	45,000		2
June 1953	Cat Creek	40,000		2
July 1955	Cat Creek	800,000		2
July 1955	Highway 95, west of Walker Lake	3,000	highway closed one day	5
December 1955	Truckee River	1,806,000		1
	Carson River	1,486,000		1
	Walker River	480,000		1
	Susan River	NA (1 life lost)	road & bridge damage, $66,800	
July 1956	Galena Creek	100,000	4 lives lost	2
	Peavine Mt.	226,000	1 life lost	1
February 1957	Susan River	NA		
August 1961	Biddleman Springs	100,000		4
October 1962	Susan River	264,000		3
Jan-Feb. 1963	Truckee River	1,884,000		1
	Carson River	1,284,000		1
	Walker River	210,000		3
	Susan River	175,000		3
December 1964	Truckee River	1,894,000		1
	Carson River	625,000		1
July 1965	Pumpkin Hollow Area	12,000		2
July 1965	Highway 95 west of Walker Lake	15,000	Highway closed 2 days, detoured 3 days	5
August 1965	Third Creek, (Incline Village)	41,000		2
December 1965	Carson River	65,000		1
	Susan River	NA		
August 1967	W. Walker River Area	100,000		2
	Second Cr.(Incl.Vil)	103,000		2
January 1969	Sun Valley	11,700		2
January 1970	Susan River	178,300		2

Source:
1. Comprehensive Framework Studies
2. River Basin Staff
3. Corps of Engineers
4. Eagle-Picher Company
5. Nevada State Highway Department

U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE



THIS MAP IS INTENDED FOR GENERAL PLANNING PURPOSES ONLY. THE AREAS DELINEATED ARE APPROXIMATELY THOSE OF THE 100 YEAR FLOOD-PLAIN. THESE AREAS MAY INCLUDE SOME NON-FLOODED LAND AND THE BOUNDARIES SHOWN MAY NOT INCLUDE SOME FLOODED AREAS. ONSITE INVESTIGATIONS SHOULD BE MADE FOR DETAILED PLANNING.

MAP 24

FLOOD PRONE AREAS

CENTRAL LAHONTAN BASIN

ALPINE, EL DORADO, LASSEN, MONO, NEVADA, PLACER, PLUMAS AND SIERRA COUNTIES, CALIFORNIA
CARSON CITY, CHURCHILL, DOUGLAS, LYON, MINERAL, PERSHING, STOREY AND WASHOE COUNTIES, NEVADA

JULY 1975

10 0 10 20 30 MILES

SCALE 1:1,200,000

M7-PN-23142

Table 49 - Estimated average annual flood damage, Central Lahontan Basin

Subbasin and State	Average Annual Ac. Inundated 4/	Flood Damage 1/ ($1,000) Agricultural 2/	Urban 3/	Public Facilities	Totals
Truckee					
California	135	94	639	94	827
Nevada	1,410	230	196	236	662
Totals	1,545	324	835	330	1,489
Walker					
California	240	375	29	2	406
Nevada	390	152	36	55	243
Totals	630	527	65	57	649
Carson					
California	20	13	0	6	19
Nevada	5,180	171	40	107	318
Totals	5,200	184	40	113	337
Calvada					
California	1,675	241	51	39	331
Nevada	25	2	0	1	3
Totals	1,700	243	51	40	334
Central Lahontan Totals	9,075	1,278	991	540	2,809

1/ Damages based on 1965 prices and project conditions.
2/ Agricultural includes forest and range, crop and pasture land, other agriculture, and land.
3/ Urban includes residential, commercial, industrial, and utilities.
4/ Based on major storms of record, 1950-1969.

Source: Comprehensive Framework Studies.

Carson River flood waters inundating agriculture lands in Carson Valley.

Inadequate Water Supply

Droughts

Not only is the total average supply of water in the Basin inadequate, the variations of the annual and seasonal streamflow often create conditions of drought.

Droughts adversely affect whatever uses are being made of water supply. They may result in a loss of fish and other aquatic life, a decrease in agricultural production; a loss of waterfowl and other wildlife through damage to riparian habitat, a loss of recreation opportunities, and health hazard for both the human and animal populations. As most of the streamflow is a result of snowmelt, droughts may be predicted for at least one season based on measurements of the winter snowpack.

Low streamflow records for selected stations using durations from one day to one year were statistically analyzed to determine low rates of flow for various frequencies of occurrence. For a given probability, it can be expected that the flow will be equal to or less than the figure derived from the analysis.

Low flow data was developed for durations of 1, 3, 7, 14, 30, 60, 90, 120, 183, and 365 days. From this data, Table 50 was developed showing the one and ten percent chance low flows for the 7 and 30 day durations. This Table shows, for example, there is a 10 percent chance the flow in Virginia Creek will be equal to or less than 1.53 cfs for a period of seven days in any given year. For better comparability, the period of record shown in each case is 1955 through 1971, or as close to this period as data was available. As regulation by reservoirs and stream diversions has a great effect on low flow volumes, the comments column shows the relative amount of regulation on the stream. If regulation should be utilized in the future to maintain minimum flows, we can expect a different flow in the future than what is shown.

Table 50 Low streamflow at selected locations in the Central Lahontan Basin

USGS sta.no.	Station Name and Location	Period of record	Flow in CFS: Comments	1% Chance 7-day	1% Chance 30-day	10% Chance 7-day	10% Chance 30-day
10-2890	Virginia Cr. nr Bridgeport	55-71	SR	.47	.67	1.53	1.97
10-2895	Green Cr.nr Bridgeport	55-71	SR	2.02	2.38	3.18	3.61
10-2915	Buckeye Cr. nr Bridgeport	55-71	UR	5.63	6.47	8.44	9.48
10-2930	E. Walker R. nr Bridgeport	55-71	R 1/	.97	1.15	2.97	3.25
10-2935	E. Walker R. nr Mason	55-71	UR	4.42	6.59	7.09	9.32
10-2955	Little Walker R. nr Bridgeport	55-71	UR	16.31	18.95	24.86	28.05
10-2965	West Walker R. nr Coleville	55-71	R	21.17	23.18	26.59	29.26
10-3000	West Walker R. nr Hudson	55-71	R	1.74	2.79	8.09	11.57
10-3045	Silver Cr. nr Markleeville	55-67	UR	.96	6.06	1.55	9.87
10-3082	East Fork Carson R. nr Markleeville	62-71	UR	23.42	25.65	33.93	38.53
10-3090	East Fork Carson R. nr Gardnerville	55-71	UR	20.84	23.81	33.26	38.00
10-3100	West Fork Carson R. at Woodfords	55-71	UR	4.84	5.89	8.68	10.34
10-3105	Clear Cr. nr Carson City	49-62	UR	.50	.57	.96	1.07
10-3110	Carson River nr. Carson City	55-71	R	.30	.34	2.98	3.73
10-3120	Carson River nr Ft. Churchill	55-71	R 2/	0	0	0	0
10-3366	Upper Truckee R. nr Meyers	62-71	UR	1.76	1.86	3.01	3.34
10-3375	Truckee R. at Tahoe City	55-71	R 2/	0	0	0	0
10-3385	Donner Cr. at Donner Lake	60-71	R 2/	0	.02	0	.23
10-3420	Little Truckee R. nr Hobart Mills	55-71	SR	1.33	7.06	1.74	8.90
10-3460	Truckee River at Farad	55-71	R	167.50	194.10	226.30	255.30
10-3480	Truckee River at Reno	55-71	R	80.50	401.20	107.40	534.90
10-3500	Truckee River at Vista	60-71	R	146.60	178.40	188.00	220.80
10-3516	Truckee River below Derby Dam	52-71	R 2/	0	.07	.14	.73
10-3517	Truckee River near Nixon	62-71	R	7.23	8.11	14.60	16.80
10-3547	Mill Creek at Milford	65-69	UR	.28	.29	.34	.36
10-3565	Susan River at Susanville	55-71	R 1/	.36	.48	1.22	1.52
10-3585	Willow Creek near Susanville	55-71	SR 1/	7.46	7.56	8.86	9.16

Note: UR- Unregulated, or slight regulation having little affect on data;
SR- Some regulation, data probably effected by regulation;
R- Regulated, irrigation diversions or upstream storage has appreciable effect on data
1/ Statistics adjusted slightly on 7-day duration for consistence
2/ Zero flow at times, data adjusted to include zero flow data.

During late summer months, the West Walker River drops to a very low flow, Walker Subbasin

Low streamflow affects water quality. The values shown for total dissolved solids (TDS) for the different flow rates are taken from a regression analysis of TDS at various flow rates. They represent only one water quality parameter. However, many other water quality parameters follow the same general relationship, i.e., concentrations increase as flows decrease or quality decreases as flow decreases. Low streamflow effects on water quality at two locations on the Carson River are shown in the following tabulation:

Streamflow cfs	TDS mg/l	Percent of time flow is exceeded
East Fork Carson River near Gardnerville		
50	162	95
100	138	66
200	115	42
300	102	32
Carson River at Fort Churchill		
25	355	77.5
50	318	74
100	273	65
200	228	48
300	203	36.3

The third column on the tabulation shows what percent of the time the flow has been exceeded. For example, 50 cfs flow on the East Fork will be exceeded 95 percent of the time.

Competing Demands for Water

Because there is an inadequate supply of water in the Basin to meet all of the demands of water users both natural and human, they must compete for the available supply. Thus there is more land suitable for agricultural crop production than can ever be irrigated with the available supply. There is more potential for urban growth than can be supplied with water and still maintain irrigated agriculture, fisheries habitat and recreational uses. There is more evaporation depletion in the terminal lakes, with their esthetic and recreational value, than can be supplied while maintaining the irrigated agriculture and urban population.

The problem is increased because of the variation in annual streamflow. While the average streamflow of the Carson River at Fort Churchill has been 263,109 acre-feet per year between 1946 and 1970, during four of these years the flow was less than 115,000 acre-feet, and during two years the flow was less than 60,000 acre-feet.

Also adding to the problem is the seasonal distribution of the water supply. As noted in NATURAL RESOURCES, less than 11 percent of the natural streamflow occurs during the months of greatest demands, July and August; mainly for irrigation and municipal water.

Inefficiency in the use of the available water supply also contributes to water shortages. Most seepage losses return to the system. However, some water is lost to phreatophytic vegetation and some to evaporation from free water surfaces. Inefficient distribution and application of water also results in water becoming unavailable by time or place or unusable because of reduced quality to meet a particular demand. Irrigation efficiency basinwide averages about 50 percent.

Irrigated Agriculture

Table 51 shows the average and 80 percent chance supply of irrigation water by month as well as full potential demand by month for most of the major irrigated areas in the Basin. The supply as shown in the table is based on records of actual water diverted into irrigation canals where that data was available. These figures reflect the operation of existing reservoirs and compliance with existing water decrees. In the Carson Valley, Bridgeport Valley, and Susan River area, the supply shown on the table is based on streamflow records. In none of the areas does the supply include availability or present use of ground water.

Full potential irrigation demand, Table 49, is calculated from consumptive use rates for the acreage shown of the present

Table 51- Average and 80 percent chance monthly surface water supply and full potential irrigation water demand for major irrigated areas, Central Lahontan Basin, acre-feet

Area	April	May	June	July	August	Sept	October
	----------	----------	----------	acre-feet	----------	----------	----------
Bridgeport and Antelope Valleys-31,600 acres 1/							
Average Supply	18,100	35,900	45,300	35,200	19,200	11,100	5,200
80% chance supply	12,000	25,600	32,100	20,800	11,600	6,900	2,800
Full potential demand	5,800	16,900	24,100	33,000	28,600	18,700	8,100
Smith Valley- 18,900 acres 2/							
Average supply	6,800	13,900	14,500	15,700	11,400	7,800	2,500
80% chance supply	4,800	9,500	11,300	10,000	7,000	1,000	800
Full potential demand	5,300	11,300	16,300	10,900	16,900	10,500	3,200
Mason Valley-48,400 acres 2/							
Average supply	15,200	31,400	32,000	33,100	23,400	16,100	3,500
80% chance supply	11,000	23,000	25,500	19,000	13,000	6,600	250
Full potential demand	12,300	29,100	40,600	49,300	45,100	26,400	7,800
Truckee Meadows-17,200 acres 2/							
Average supply	6,000	17,300	21,800	23,800	22,700	18,900	11,700
80% chance supply	3,000	8,600	17,000	18,700	20,000	15,500	5,000
Full potential demand	3,800	9,300	13,000	17,500	14,800	9,500	4,100
Susan River area-27,100 acres 1/							
Average supply	20,800	19,500	12,200	9,200	3,000	1,400	3,500
80% chance supply	9,100	8,500	8,100	5,500	1,000	900	1,700
Full potential demand	5,800	15,100	21,500	27,800	22,600	14,800	6,800
Carson Valley-51,500 acres 1/							
Average supply	49,800	92,500	70,300	25,200	9,400	6,100	5,900
80% chance supply	31,800	55,300	29,400	10,700	5,400	3,700	4,200
Full potential demand	8,700	23,800	33,600	44,200	30,400	20,300	8,200
Fallon Area - 68,700 acres 2/							
Average supply		annual 370,000					
80% chance supply		annual 288,000					
Full potential demand		annual 406,000 3/					

1/ Streamgage Records

2/ Diversion Records

3/ USDI 1964 Task Force Report

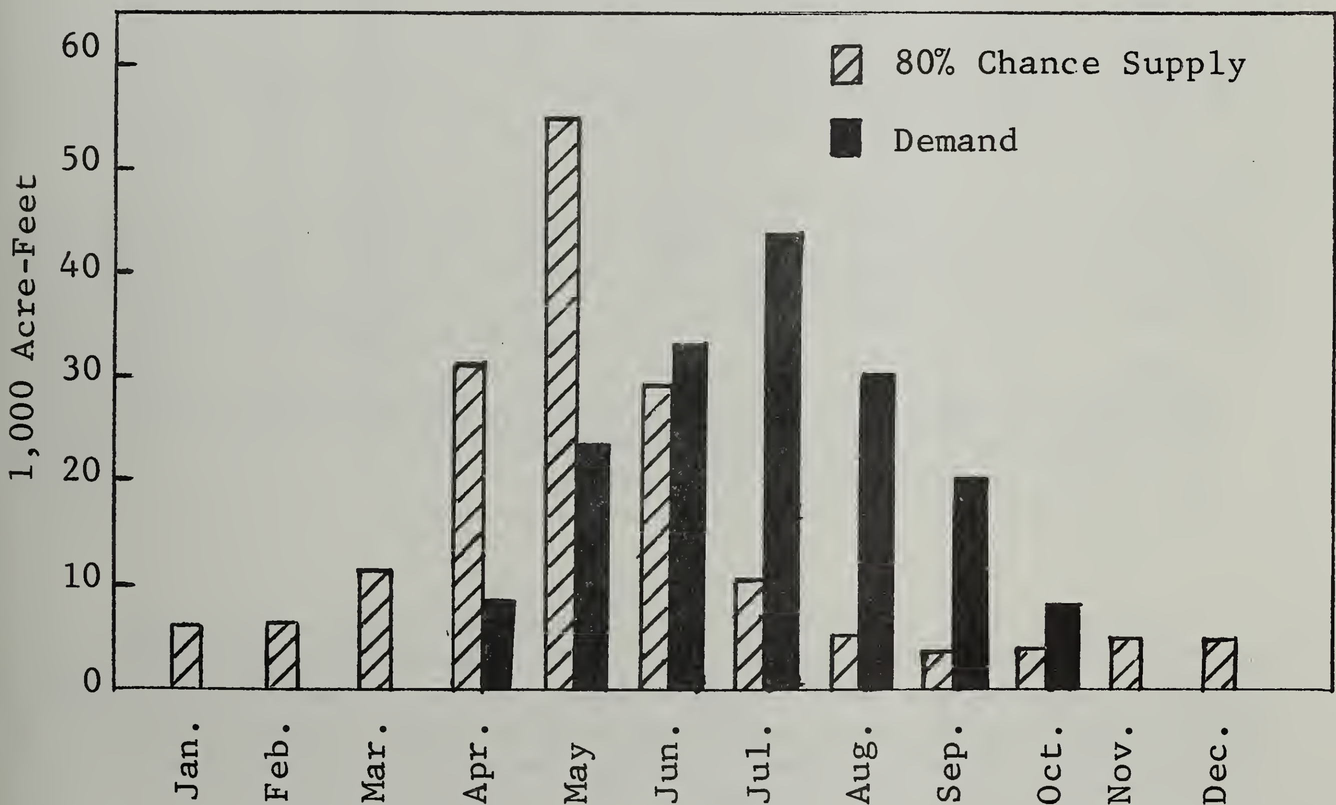
Rock and log irrigation diversion dams are inefficient and costly to maintain.

crops grown assuming that they had a water supply for the full season and an overall efficiency the same as at present.

The monthly figures were not calculated for the Fallon Area. Storage facilities are available for this area which are adequate for distribution during the months of demand. It may be noted that even this area is subject to drought as the 80 percent chance supply is less than the demand. This indicates at least two years out of ten the area is short of water for the acreage shown.

Figure 3 is plotted from data in Table 51. This clearly illustrates the problem of lack of storage facilities to manage the natural seasonal distribution of streamflow.

FIGURE 3 -- 80% Chance Supply and Irrigated Crop Water Demand, Carson Valley



Municipal and Industrial

Seasonal water shortages often exist in some of the municipal water systems. Because of the requirements for lawn irrigation, the varied monthly demand for municipal water is similar to that for irrigated land. The result is that the highest demand coincides with a period of low streamflow. The water demand by month for the Reno-Sparks and Carson City areas as a percentage of the annual demand and water use in 1970 is shown in Table 52.

Table 52 - Water Use and Percent of Annual Demand, 1970

Month	Reno-Sparks		Carson City	
	Water Use acre-feet	Percent	Water Use acre-feet	Percent
Jan	1,550	3.9	113	4.5
Feb	1,518	3.8	93	3.7
Mar	2,051	5.2	90	3.6
Apr	2,472	6.5	157	6.2
May	4,448	11.3	208	8.3
Jun	4,356	11.0	297	11.8
Jul	6,341	16.1	345	13.7
Aug	6,222	15.8	386	15.3
Sep	4,283	10.9	335	13.3
Oct	2,798	7.1	233	9.3
Nov	1,694	4.3	138	5.5
Dec	1,628	4.1	122	4.8
Annual	39,461		2,517	

1/ Sierra Pacific Power Company
2/ Carson City Water Department

To meet the peak seasonal demand in Reno and Sparks deep wells have been utilized. In Carson City, most of the current supply has been from wells. During periods of high demand Carson City has purchased water from the Marlette Lake system. Water rationing has been used during periods of shortage for irrigation.

Hawthorne and the neighboring Naval Ammunition Depot both use surface water supplemented with well water. In years of drought, larger amounts of ground water are utilized. As a result the ground water level is dropping in this area. According to Naval Ammunition Depot information, ground water levels in the area have dropped 55 feet in the past 25 years. Part of the decline is attributed to the decline in Walker Lake. Continued pumping at this rate will probably result in the deterioration of water quality and increased pumping costs because of high lift. Industrial water supplies for other industries at present are generally adequate in the Basin.

Potential pollution from surface water sources is of concern. Ground water quality is a problem in the Fallon Area, and in portions of Honey Lake Valley. Increased density of future development may create problems with overdraft of the shallow aquifers resulting in shortages. Information on deep well potential is generally lacking in the Basin.

Livestock and Rural Domestic

There is a critical shortage of livestock watering facilities on much of the rangeland, particularly in the middle and lower portions of each subbasin. Springs and streams are few and far apart. What water is available for livestock use is generally undeveloped or poorly developed and there are few stockwater wells in areas remote from natural water.

This lack of adequate livestock water has led to serious depletion of the better forage grasses around the existing watering areas. From the lack of adequate plant cover, high erosion areas have developed on lands within one-half to one mile from the watering areas.

Rural domestic water supplies are at present generally adequate. Most rural domestic supplies are from shallow wells.

Terminal Lakes

There are four large terminal lakes in the Basin. These are Pyramid, Walker, Honey, and Eagle Lakes. Terminal lakes are at the end of a river system with no surface water outlet. Therefore water is depleted from Walker, Pyramid, and Honey Lakes by evaporation only. These lakes are in balance with their mean annual inflow. In a period of greater than average inflow their size will increase, and in a period of below average inflow their size will decrease. Over past centuries the levels of the lakes have varied widely with climatic conditions.

As a result of increased use of water upstream, inflow has been reduced; Walker and Pyramid Lakes have been declining. Evaporative losses exceed the present average inflow. They will continue to shrink to smaller sizes if the present trend continues.

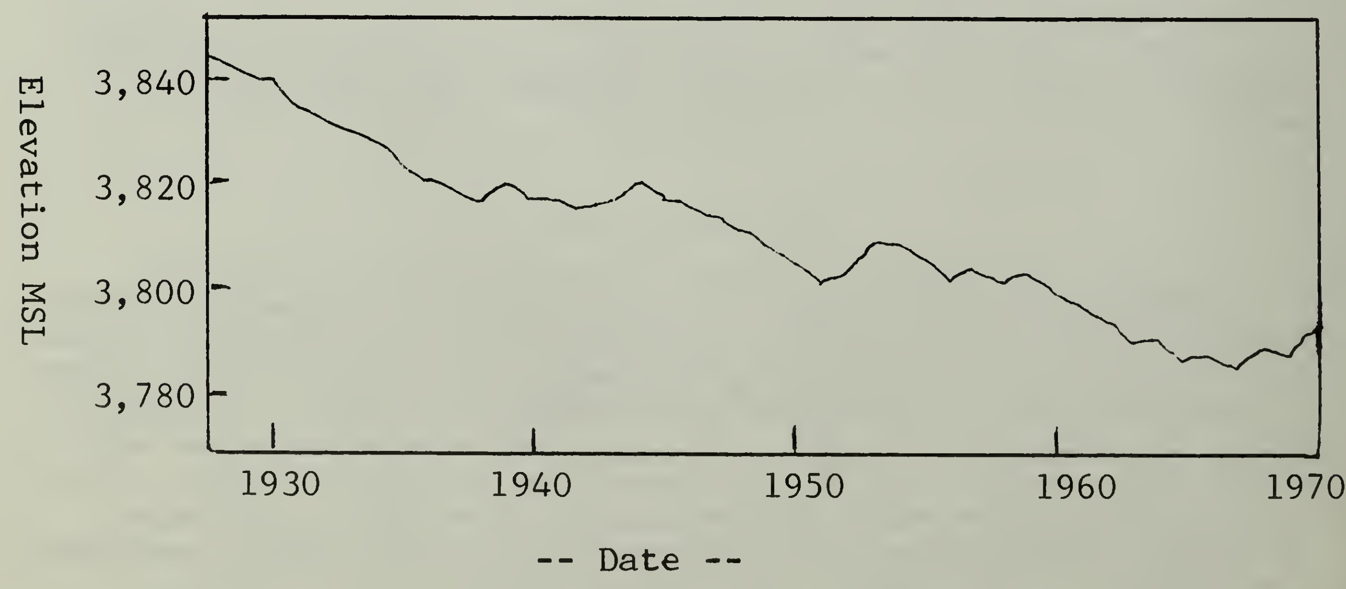
Pyramid Lake is the terminus of the Truckee River. In the Truckee Subbasin the depletions plus the exported water exceed average annual gross yield by 125,000 acre-feet . This is the amount of additional water that would be needed to maintain Pyramid Lake at its 1970 level.

Figure 4 is a plot of the elevation of Pyramid Lake from 1928 to 1972. The total decline during this period has been 50 feet, or an average of 1.1 feet per year.

As the volume of the lake has decreased the concentration of dissolved solids has increased proportionatley. The increase to date has not damaged the Lahontan Trout Fishery and is not expected to do so in the next 100 years at the present rate of decline.

The drop in lake surface elevation has created a delta barrier at the river mouth so that spawning of the Lake's trout in the river has been curtailed. An effort to solve this problem is being made with the construction of Marble Bluff dam and Pyramid Lake fishway.

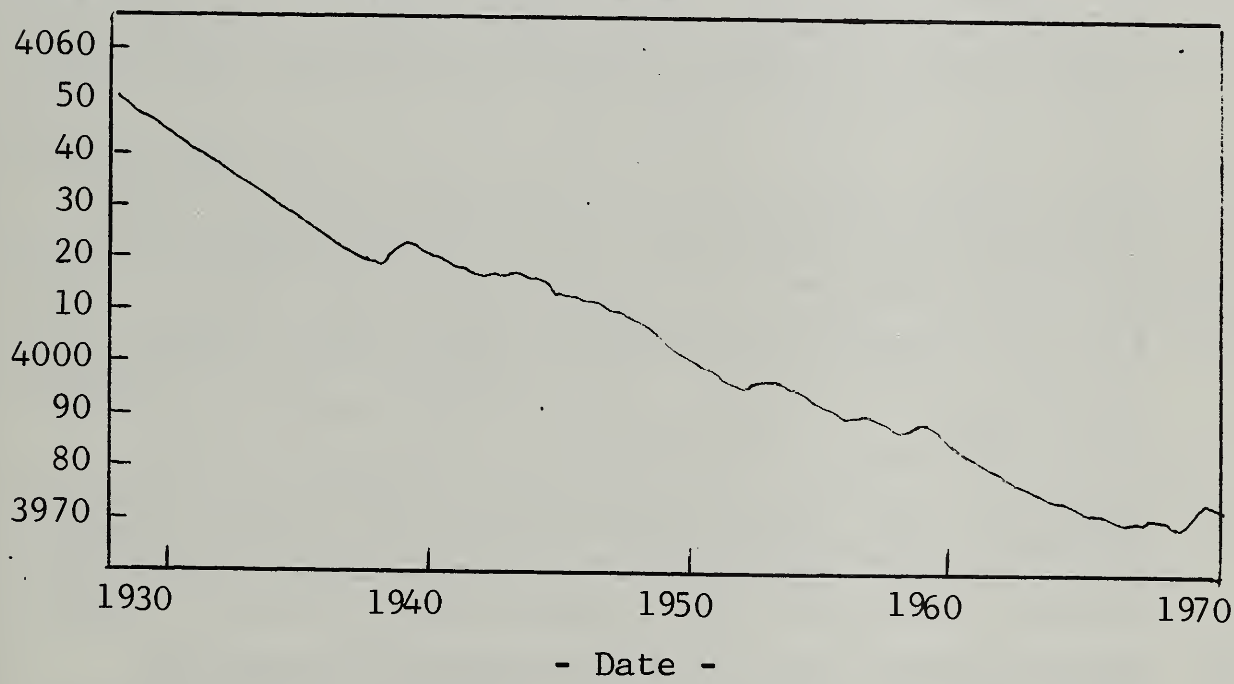
Figure 4 -- Stages of Pyramid Lake by year, 1928-1972



Walker Lake has been experiencing a similiar but more immediately critical decline than Pyramid Lake. With an estimated total average inflow of about 94,000 acre-feet and with the net evaporative losses of 148,000 acre-feet, the annual deficit is about 54,000 acre-feet. Because of the smaller volume of water in Walker Lake as compared with Pyramid Lake, and the greater proportional changes in volume associated with this decline, the concentration of dissolved solids with the present inflow is expected to exceed 20,000 mg/l by the year 2020. (SEE CHAPTER VII.)

A plot of the elevation of Walker Lake from 1928 to 1972 is shown in Figure 5. The total decline during this period has been 82 feet, or an average of 1.8 feet per year.

Figure 5 -- Stages of Walker Lake, by year, 1928-1972



There is no record of the stages of Honey Lake. It has been dry several times in this century. A shallow lake, it supports no fishery. It does however, have scenic value when it contains water. When it is dry it creates a dust hazard. With the present upstream use of water, the periods when the lake is dry should not be much more frequent than in the past although the average level of the lake probably is lower than in the past.

Eagle Lake has had very little upstream development to cause it to decline. Since the tunnel from Eagle Lake to Willow Creek has been essentially closed, the lake has risen to what is probably close to its average long-term elevation. This has caused some problems with shoreline development.

Other Irrigation Problems

In addition to the problem of an inadequate supply of water for irrigation, there are problems associated with conveyance, application, and return systems. These problems result in less efficient irrigation than is possible and lead to unnecessary water depletions as well as lower crop yields.

Some of the principal problems which have been identified as pertaining to one or more areas in the Basin are listed below:

1. Excessive mileage of canals and ditches. In some areas there is a duplication of conveyance facilities, some of which cross each other and parallel each other for extended distances.
2. High seepage losses from canals and ditches due to the high porosity of the bed material of the ditch. Losses of over 40 percent of the ditch capacity have been measured in some sections of canals.
3. Riparian vegetation resulting from a lack of maintenance along ditches. This vegetation may consume large amounts of water and also make current maintenance efforts more difficult.
4. Temporary irrigation diversion structures constructed of logs, rocks, etc., which need annual repairs and if damaged by high streamflow during the irrigation season, can result in a complete loss of water supply.
5. Lack of downstream regulatory storage structures, especially on the lower East Walker River where the time between upstream storage releases and downstream uses makes close control of water diversions impossible.
6. Lack of, or inadequacy of, water control structures and water measurement structures both in canals and on farm systems.
7. Excessive sediment deposition in irrigation systems requiring costly annual maintenance.

8. Aquatic weed growth in canals and ditches which reduce their capacity at a time when the water is most needed.
9. Field surface irregularity making efficient application difficult with surface irrigation methods.
10. Inadequate drainage of irrigated croplands.
11. Amount of water applied and frequency of application not adjusted to plant needs and soils limitations.

Many farmers are doing a commendable job with the water supply, conveyance and control systems they have. The problems of dealing with a variable supply of water, operating with conveyance and control systems which in some cases may be 100 years old and efficiently applying the water to their land, are many. Maintaining and upgrading the systems and the land, requires considerable capital expenditure. The improvements that are being made each year indicate the interest and desire for better systems as well as the economic desirability of improvements.

<u>Phreatophytes</u>

As previously discussed there are more than 530,000 acres of phreatophytes in the Basin which deplete over 438,000 acre-feet of water annually. This is 21 percent of the average water supply. As a major depletor of the water resource they add to the problem of an inadequate supply of water in the Basin.

Major phreatophyte areas are in the northern part of Mason Valley of the Walker Subbasin, the Fallon Area and Churchill Valley of the Carson Subbasin east of Fernley in the Truckee Subbasin, and in Honey Lake Valley, Madeline Plains, and Smoke Creek Desert areas of the Calvada Subbasin.

The major phreatophyte species is black greasewood which comprises 39 percent of the total acreage. The acreage of the major phreatophytes are listed in the following tabulation:

Plant Name	Acres
Black greasewood	211,900
Rubber rabbitbrush	45,700
Quail brush (big saltbush)	14,900
Fremont Poplar (cottonwood)	7,200
Willow	13,100
Tamarisk	6,700
Saltgrass	31,700
Alkali seepweed	47,300
Creeping wildrye	20,200
Others	138,900
Total	537,600

Information on species by subbasin and by evaluation areas as well as water depletions by hydrologic unit plus a location map may be found in APPENDIX II. No attempt was made to indicate how many acres of these phreatophytes are needed or not needed. It is realized that most, if not all, have value for esthetic purposes, wildlife cover, erosion control, tempering wind currents and climatic extremes, and for providing welcome shade in the hot summer months. However, should some percentage of phreatophytes be eliminated, the water salvage from them would then be available for other uses.

Ground Water

Although the Basin has large volumes of ground water in storage in the valley alluvium, there are problems associated with its use in many areas. Nevada has delineated several areas of the Basin as designated ground water basins. These are so designated to allow the State Engineer to establish preferred use of water within such Basins and to limit withdrawals and issue temporary permits to appropriate ground water. Such regulation is necessary to prevent overdraft of the ground water supply.

Another problem restricting the use of ground water is low water well yields. Areas of the valley floors consisting of ingrained deposits with low permeability result in low well yields and high drawdown depths during pumping.

The quality of the ground water is another factor restricting its use. In closed Basins there is a normal buildup of dissolved minerals in the lower topographic depressions. This is the same problem that affects the terminal lakes of the area. Ground water in some locations may be contaminated by thermal water which is generally associated with excessive mineralization. Contamination with man-caused pollutants is not a serious problem in the Basin at this time. However, with increased population density and industrialization it could become a problem.

Environmental Considerations

Fish and Wildlife

Game

Continual increases in the number of subdivisions, improved highways, intensified agriculture, livestock and wild horse competition result in the loss of valuable deer habitat, especially critical winter range. The popularity of the Basin as a recreation area has stimulated the growth of resort communities and permanent residential areas.

The California Department of Fish and Game developed the following tabulation of deer harvest in the California portion of the Lake Tahoe Basin. Since intensive urbanization of the Basin began during the mid-1960's, the harvest figures suggest the impacts of urbanization on the deer resource.

Year	Bucks	Antlerless	Subtotal	*Correction factor	Total
1958	246	0	246 +	122	368
1959	348	0	348 +	174	522
1960	268	21	289 +	144	433
1961	179	21	200 +	100	300
1962	161	14	175 +	86	261
1963	191	24	215 +	107	322
1964	199	27	226 +	112	338
1965	134	20	154 +	76	230
1966	176	36	212 +	106	318
1967	106	33	139 +	69	208
1968	113	0	113 +	56	169
1969	63	13	76 +	38	114
1970	99	5	104 +	52	156
1971	50	7	57 +	38	95
1972	81	3	84 +	42	126

* 25 percent unreported harvest and a 20 percent crippling loss

Deer management efforts have been directed toward a harvest of the annual increment to the herd. Local controversy has hampered management of the deer and deer habitat, resulting in the decline of both critical deer winter ranges and deer numbers.

Many big game ranges are in need of rehabilitation, including control of pinyon-juniper and sagebrush, reseeding to more desirable grasses, forbs and shrubs, and a reduction of competition between livestock, wild horses and big game. Improved management of livestock grazing and wild horse herds should be initiated as a means of improving big game ranges.

Loss of antelope habitat due to human encroachment, competition for forage with domestic livestock, and the restriction of antelope movements with livestock fencing are all factors retarding antelope numbers.

There has been a decline in sage grouse and pheasant numbers. The sage grouse decline is attributed to destruction of habitat by urbanization, overgrazing, and erosion. A change in agricultural is the reason for the pheasant decline.

Valuable waterfowl habitat such as the Upper Truckee River Marsh and Canada goose winter feeding areas in the Truckee Meadows have been converted into housing developments. In addition, many other smaller marshes and wetlands were drained for real estate development or increased agricultural production.

Fisheries habitat has deteriorated since the early settlers began to appropriate, impound and divert the Basin's waters. These diversions and impoundments, coupled with pollution from sediment, sawmill wastes, sewage and mining wastes have had disastrous effects on the fisheries habitat.

The loss of fish habitat from the mineral pollution problem from Leviathon Mine in the Carson Subbasin has previously been described. In 1969 this represented a loss of 391 pounds of trout and 1,464 angler-days use annually, in portions of both Nevada and California. Projected to the year 2000, this loss is expected to be equivalent to 3,658 angler-days.

Phreatophytes have been shown to be heavy water depletors. Many of the phreatophyte areas are also extremely valuable for wildlife. Programs aimed at water salvage from this source must seriously consider the adverse impact on wildlife which could result.

Sources of domestic sewage pollution affecting fisheries are significant at two locations in Nevada. The Truckee River below the Reno-Sparks treatment plant releases fair quality water most of the time, but the quality decreases during peak release periods. The Carson City plant has been a source of poor quality water to the Carson River for many years, but a planned new sewage treatment plant will rectify this situation. In summer, irrigation totally diverts stream sections, killing fish in the dewatered section and blocking migrations of spawning and newly-hatched fish.

Access to certain of the river fisheries, particularly the East and West Walker Rivers in Nevada, is mostly blocked by privately-owned lands. In the Calvada Subbasin, access to about 20,000 acres of public land in the Adams Peak area has been blocked for several years by adjacent private landowners. An access problem to public land in the Walker Subbasin in the northeastern portion of Mono County is also of great concern.

Road Kills

Deer are particularly affected by this problem as deer movement from summer to winter ranges cross many miles of busy highways resulting in road kills. For example, in the Walker Subbasin during the 1970-1972 period, 173 deer were killed on the highways maintained by the Sonora Junction Maintenance Station, a distance of 41.41 miles.

Water Quality

Deterioration of water quality in rivers and lakes is a problem. Problems at present are excessive nutrients in the Truckee River below Reno-Sparks and in the Carson River below Carson City. Salinization is a problem in Walker, Pyramid, Eagle, and Honey Lakes. Excess nutrients, aquatic growth and turbidity is a problem in parts of Lake Tahoe, Bridgeport, and Topaz Reservoirs. There is some evidence of ground water pollution through surface water seepage.

Agricultural return flows from Antelope Valley to the West Walker River and the flows from Mason Valley to the main Walker River have periodically exceeded standards. Return flows from Carson Valley to the Carson River, particularly during the periods of low river flow, have lowered the quality of waters below Carson City. Potential problems from the dairy and livestock feeding operations in each of the Basin's larger irrigated valleys have not yet been fully assessed.

Because of pressures to remove pollutants from the Lake Tahoe Basin, a "cinder cone" is utilized for disposal of primary settled sewage effluent. About 15,000 feet of trenches are used to permit settlement and percolation.

Bitterbrush, the dark shrub in the photo, a prime winter deer forage is being removed to allow for urban and commercial developments.

Pollution Sources

Pollutants affect the Basin's water, land, and air quality, especially near the larger population centers. Sediment, litter, chemical, and biological organisms pollute water. Particulate matter, gas, and noise pollute the air. Chemical, mineral and man-made waste materials pollute the land. Principal sources of water pollutants are return flows of irrigation and municipal water, erosion of disturbed land, and industrial waste. Wind-borne dust and debris, fuel exhaust, and machine noise are the principal air pollutants. Near Reno, Carson City, and occasionally at South Lake Tahoe noise pollution is a problem.

Urban Development

As urbanization has progressed, it has brought greater pressures on the Basin's environment. The area receiving the greatest notoriety has been the Lake Tahoe Basin because of allegations relating urbanization to the euthrophication of the lake. Here, almost every facet of urban development, running the gamut from earth-moving, home building, and road-salting to traffic control, recreation development and sewage disposal are alleged to have been carried on with little concern for the environment.

In other areas, the speculative subdivision trademark of unpaved streets through the sagebrush, squared land parcels, a model home and a salesman's office prominently impact on visual quality. In many cases, during the prolonged development period, these areas turn into dust bowls, sediment sources, weed patches and fire hazards.

Construction of recreation facilities such as ski resorts has presented very serious soil erosion and sedimentation problems, particularly in the Tahoe Basin and at Squaw Valley. Wholesale removal of all vegetation in order to ski on shallow snow depths is becoming a common practice which results in a severe sedimentation problem in the stream below the ski areas.

Most of these described activities have been carried on to some degree in the Basin for many years, but have only caused minimal problems. During the period 1955-1970, however, the advent of larger construction equipment and the apparent rush to capitalize on the desires of the affluent masses, have caused construction work to be carried out which resulted in natural resource impacts never before recognized.

Solid Wastes, Litter, and Vandalism

Unsightly abandonment of personal property of all kinds such as vehicles, mattresses, and furniture occurs in the Basin. Litter, particularly wrapping material and beverage containers, are strewn on the landscape. Destruction of vegetation and property occurs. The degree of these problems is directly related to population density. Accordingly, such abuses are most common to urban fringe areas.

Junkyard and dump area along Truckee River.

CHAPTER VI

ECONOMIC AND SOCIAL PROJECTIONS

Highlight

This chapter provides projections on population and production. Population and economic growth is projected to continue substantially in all areas except commercial forest products.

CONTENTS

Introduction

The projections presented in this chapter are based on OBERS data unless otherwise noted. The OBERS projections are based on Series C birthrates, and assume continuation of trends in regional production shares. They were prepared by the Office of Business Economics (now, Bureau of Economic Analysis); U. S. Department of Commerce; and Economic Research Service, U. S. Department of Agriculture. These data were then adapted to the Basin hydrographic boundaries and base time frame and are hereafter referred to as adjusted OBERS values.

The OBERS projections represent a national economy where production is in balance with estimated future demand. Foreign trade impacts were considered. The assumption was made that rates of import and export may be predictable through a decade or two, but beyond that range, international trade is unpredictable. Foreign trade levels were projected for 1980 and remained at those levels throughout the remainder of the projection period. The projections are a baseline derived from a national base where regional projections sum to national totals. These projections are not predictions of future levels of economic activity.

Population

The adjusted OBERS population projections for the Basin, Table 53, indicate an increase of more than three and a half times present population by the year 2020. These data suggest Basin population density changes presented in the following tabulation:

Year	People per square mile
1970	12.4
1990	23.0
2020	44.8

The Basin population density is very low in comparison to other areas in the western United States. Projected changes in urban and rural population are shown in Table 54.

Table 53 - Adjusted OBERS population projections, by state and subbasin, Central Lahontan Basin

State and Subbasin	Year 1970	1990	2020
Nevada			
Calvada	45	83	162
Truckee	124,988	232,834	452,915
Carson	31,296	58,174	113,163
Walker	12,470	23,219	45,167
Total	168,799	314,310	611,407
California			
Calvada	13,824	22,166	43,117
Truckee	23,513	44,125	85,834
Carson	383	900	1,750
Walker	1,800	2,099	4,082
Total	39,520	69,290	134,782
Basin			
Calvada	13,869	22,249	43,279
Truckee	148,501	276,959	538,749
Carson	31,679	59,074	114,913
Walker	14,270	25,318	49,249
BASIN Total	208,319	383,600	746,190

Table 54 - Adjusted OBERS population projections by urban, rural, and subbasin, Central Lahontan Basin

Subbasin	1990		2020	
	Number	percent	Number	percent
Calvada				
Urban	12,930	58.1	32,460	75.0
Rural	9,320	41.9	10,820	25.0
Total	22,250		43,280	
Truckee				
Urban	224,340	81.0	450,400	83.6
Rural	56,620	19.0	88,350	16.4
Total	276,960		538,750	
Carson				
Urban	44,190	74.8	97,800	85.1
Rural	14,890	25.2	17,20	14.9
Total	59,080		114,920	
Walker				
Urban	9,850	38.9	23,200	47.1
Rural	15,470	61.1	26,050	52.9
Total	25,320		49,250	
Basin Total				
Urban	291,300	74.9	603,860	80.2
Rural	92,300	25.1	142,340	19.8
Total	383,600		746,200	

Future Economy

Total personal income is expected to rise from 695 million dollars in 1970 to 10,453 million dollars by 2020. Table 55 shows employment and income in selected sectors of the Basin economy.

OBERS projections for the Basin are that hay and milk production will increase significantly by 2020.

Table 55 - Adjusted OBERS projections of future economy, Central Lahontan Basin

Employment	1990 number	1990 percent	2020 number	2020 percent
Total Employment	148,388		290,584	
Agriculture, Forestry, fish	1,018	0.6	930	0.3
Mining	1,728	1.2	2,114	0.7
Transportation, Comm. and Util	9,855	6.7	16,200	5.6
Wholesale, retail	23,217	15.7	46,770	16.1
Finance, Ins. Real Estate	7,792	5.3	14,840	5.1
Services	50,516	34.1	105,175	36.2
Government	38,943	26.3	78,225	27.0
Civilian govt.	37,910	-	77,225	-
	---------(Millions of dollars)-------------			
Income-Earnings				
Total Personal income	2,350		10,453	
Total Earnings	1,894		8,119	
Agriculture	13		26	
Mining	22		59	
Trans. Comm. and Util	126		453	
Wholesale, retail	296		1,307	
Finance, Ins. Real Estate	99		415	
Services	645		2,938	
Government	497		2,186	

Crop and Red Meat Projections

Beef and hay are the two principal crop and livestock products in the Basin. OBERS projections are that production is anticipated to increase in all the principal commodities except feed grain, pork, and lamb. The value of 2020 agricultural production will be divided, 62.5 percent for beef and 33.4 percent for milk products. These two products will account for all but about four percent of the crop and livestock production by 2020. Table 56 shows the adjusted OBERS crop and livestock projections for the Basin.

Table 56 - Adjusted OBERS principal crop and red meat projections, Central Lahontan Basin

Commodity	Unit	1990	2020
		- thousands -	
Feed grain	bushel	487	430
Hay	ton	500	738
Wheat	bushel	198	265
Silage	ton	72	96
Meat	pounds		
Beef and Veal		79,540	106,780
Pork		895	350
Lamb		2,005	1,315
Milk	pounds	107,500	221,300

Livestock Forage Projections

The projections for red meat indicate an increasing demand for livestock forage. To meet 2020 requirements, about 231,000 AUMs of forage must be produced over that available in 1970. Table 57 shows range and irrigated pasture production and projections for the Basin, compared with 1970.

Table 57 - Range and irrigated pasture forage production compared with projected need, Central Lahontan Basin

Item	1970	1990	2020
	AUMs		
Range:			
Federal	356,676	356,676	356,676
Nonfederal	154,824	154,824	154,824
Subtotal	511,500	511,500	511,500
Irrigated Pasture:			
Nonfederal	448,660	448,660	448,600
Grand Total	960,160	960,160	960,160
Projected need 1/	960,160	1,016,700	1,191,175
Deficit	0	-56,540	-231,015

1/ Report 8, Water for Nevada Agriculture, Nevada Division of Water Resources, January 1974, adjusted to Basin boundary

State projections were that grazing on Federal and nonfederal rangelands would remain at the 1970 level throughout the period. Under this concept, irrigated pasture is the only grazing resource from which the 2020 requirement could be met.

Commercial Forest Projections

Primary wood product production and related employment is expected to decrease slightly between 1990 and 2020. Economic data concerning this industry are presented in Table 58.

Table 58 - Commercial forest projections[1], Central Lahontan Basin

Item	1990	2020
Capacity of wood processing plants:		
million cubic feet	24	23
million board feet	151	143
Forest management employment, number	320	402
Forest management payroll, $1,000	3,393	3,412
Lumber and wood industry employment, number	625	402
Lumber and wood industry payroll, $1,000	2,416	2,425
Demand for roundwood to meet national share:		
million cubic feet	253	314
million board feet	51	63

1/ U. S. Forest Service

Geologic Commodities Projections

Employment and product value of geologic commodities is expected to increase substantially by 2020. Projection data on total production and employment are presented in Table 59. Iron, copper, and saline playa products will account for most of the increase.

Table 59 - Geologic commodities projections, Central Lahontan Basin

Item and Subbasin	1990	2020
Value of production, $1,000		
Calvada	2,010	4,000
Truckee	6,750	13,450
Carson	31,040	90,935
Walker	65,960	106,805
Basin Total	105,760	215,190
Employment, numbers		
Calvada	64	113
Truckee	225	664
Carson	858	2,242
Walker	1,713	3,219
Basin Total	2,860	6,238
1/ Report 4, Water for Nevada Mining, Nevada Division of of Water Resources, January 1973		

Recreation Projections

The demand for all types of outdoor recreation is expected to increase considerably. Allocation of the total demand by Federal, State, local and private sectors is shown in the following tabulation. Basinwide projections segregated by State are shown in Table 60.

------1,000s Visitor Days------				
Federal	State	Local	Private	Total
35,914	536	294	69,986	106,730

Table 60 - Projected outdoor recreation demand for developed recreation areas by State and time frame1/, Central Lahontan Basin

State	1990 Demand	2020 Demand
	---------1,000s Visitor-Days---------	
California	15,355	26,980
Nevada	36,635	79,750
Totals	51,990	106,730
1/ U. S. Forest Service projections.		

CHAPTER VII

FUTURE NATURAL RESOURCE DEMAND AND ASSOCIATED PROBLEMS

Highlight

The demand for natural resources to accomodate the future changes indicated in Chapter VI are presented in this chapter. Associated problems related to meeting demands under a Without Plan condition are described and deficiencies indicated. Satisfying the demand for additional water requirements without the implementation of planned development can only be achieved at the expense of the terminal lakes and/or irrigated agriculture.

CONTENTS

Future Resource Demand

Introduction

Projected resource demands were determined by the USDA River Basin Staff. They are based on an assessment of available land and water resources, enterprise profitability, and recent trends. They consider the interaction of resource demand and supplies. They represent the staff's opinion about what is likely to occur without implementation of the proposed USDA plan described in this report. The resource demands of irrigated agriculture were determined from linear programming models and are considered to be the Without plan projections. The demands indicated by OBERS projections were used for a comparison purpose where applicable.

Table 61 presents resource demand for minimum water consuming land uses. For these land uses water depletion is negligible. Table 62 presents resource demand for major water consuming land uses and their water requirement. Without Plan data for irrigated agriculture is taken from the linear programming model. Additional requirements for urban and geologic commodity land use is satisfied by reduction in minimum water consuming land use acreage, mostly grazing. Therefore, the net change in land use for these two tables balances. Water-based recreation and fisheries are associated with the largest Basin water consumer, evaporation. This use is not shown in Table 60. To meet the additional demand would require either a loss in terminal lakes (water-based recreation and fisheries) or irrigated agriculture presuming urban and geologic commodity requirements would preempt their needs.

Table 61 - Without plan base data and projected resource demand for minimum water consuming land uses, Central Lahontan Basin

Land Use	Thousands of Acres				
	Base	Demand		Net Change	
	1970	1990	2020	1990	2020
Non-irrigated crops	19	9	6	-10	-13
Grazing	6,945	6,965	6,820	-31	-176
Timber	1,056	1,000	925	-56	-131
Recreation, developed	12	14	22	+2	+10
Wilderness, designated	38	48	70	+10	+32
Fish and wildlife	233	300	340	+67	+107
Watershed, classified	117	123	129	+6	+12
Transportation and Utilities	130	143	156	+13	+26
Miscellaneous land types	924	924	924	0	0
Total	9,525	9,526	9,392	+1	-133

Table 62 - Without plan base data and projected resource demand for major water consuming land uses 1/, Central Lahontan Basin

Land Use	Thousands of Acres, Land				
	Base	Demand		Net Change	
	1970	1990	2020	1990	2020
Irrigated agriculture	364	315	290	-49	-74
Urban and industry 2/	315	330	440	+15	+125
Geologic commodities	37	70	119	+33	+82
Total	716	715	849	-1	+133
	Thousands Acre-Feet Water				
	Base	Demand		Net Change	
	1970	1990	2020	1990	2020
Irrigated agriculture	1,375	792	713	-583	-662
Urban and industry 2/	75	158	315	+83	+240
Geologic commodities	4	25	125	+21	+121
Total	1,454	975	1,153	-479	-301

1/ Excludes water-based recreation, largest consumer. See text.

2/ Includes rural domestic and military use.

Demands for the Terminal Lakes

Resolution of the Pyramid Lake lawsuit will affect Pyramid Lake, and State of Nevada legislative actions relating to the State water plan will determine future conditions in Walker Lake. Since size and water quality of these lakes is determined by the volume of river inflow, the effects of maintaining them under various inflow conditions can be estimated.

Table 63 and Figure 6 show the expected decline in elevation of Pyramid Lake in future years with the present average annual inflow of 250,000 acre-feet, and a projected inflow of 350,000 acre-feet. Figure 6 shows the decrease in surface elevation from the 1970 level, and an increase in total dissolved solids based on the decline in volume and assuming that the inflow concentration remains constant. Table 64 and Figure 7 show similar data for Walker Lake using present average annual inflow of 94,000 acre-feet and a projected future inflow of 120,000 acre-feet. With fish mortality expected to occur with 12,500 mg/l of total disolved solids, it can be expected Walker Lake will no longer be a fresh water fishery in fifty years unless the inflow is reduced significantly below 250,000 acre-feet per year. The conclusion can be made that these lakes will continue to decline even with the projected higher inflows.

Table 63 - Estimated decline of Pyramid Lake for two inflow conditions, Central Lahontan Basin

Year	Average Inflow 250,000 AF			Average Inflow 350,000 AF		
	Decline in feet	Surface area as % of 1970 area	TDS mg/l	Decline in feet	Surface area as % of 1970 area	TDS mg/l
1970	0	100	5,000	0	100	5,000
1990	22	95	5,600	5	99	5,150
2000	32	93	5,950	7	98	5,200
2020	54	89	6,850	12	97	5,400
2040	70	85	7,650	16	96	5,600
2080	99	79	9,550	22	95	5,900

Table 64 - Estimated decline of Walker Lake, Central Lahontan Basin

Year	Average Inflow 94,000 AF			Average Inflow 120,000 AF		
	Decline in feet	Surface area as % of 1970 area	TDS mg/l	Decline in feet	Surface area as % of 1970 area	TDS mg/l
1970	0	100	8,500	0	100	8,500
1990	24	88	12,100	12	94	10,400
2000	34	84	14,500	16	92	11,200
2020	49	77	20,200	24	88	13,000
2040	60	72	26,700	29	86	14,700
2080	71	66	38,500	36	83	17,800

Figure 6

PYRAMID LAKE In 2020 With Variations In Average Annual Inflow

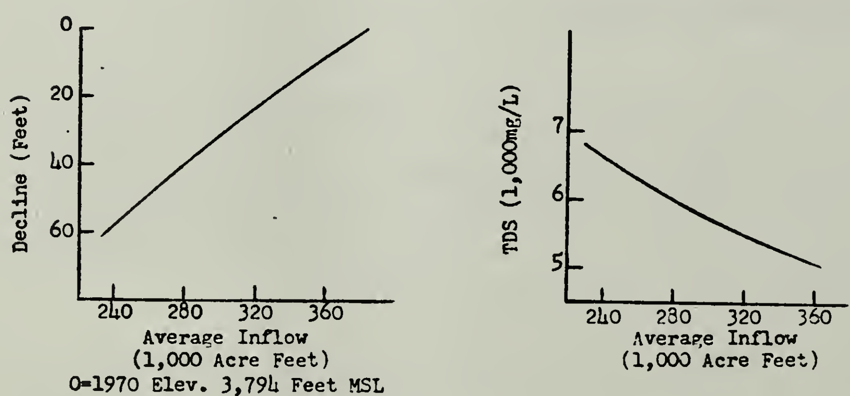
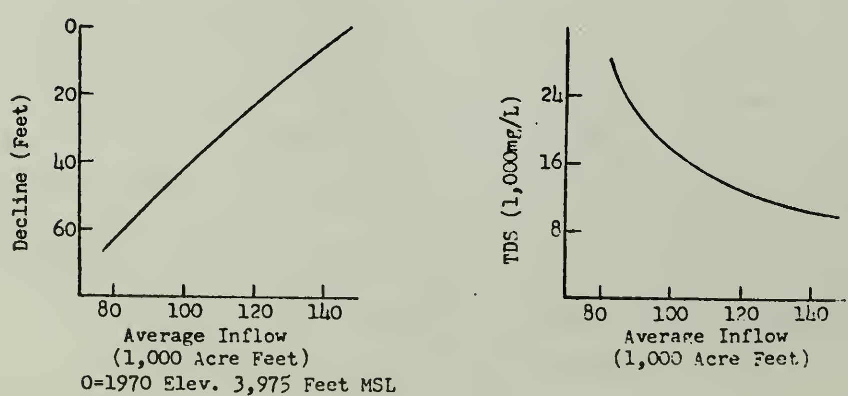


Figure 7

WALKER LAKE In 2020 With Variations In Average Annual Inflow



Without Plan Program and Associated Problems

The Without Plan situation indicates conditions that are expected to prevail if there is no large-scale plan or program designed to alter present trends. The Without Plan conditions are used as a base for comparison with the USDA Plan to evaluate its projected effort. The present or on-going programs for development on the Basin's federal and privately-owned lands are considered to be the Without Plan. In this discussion, these present programs are expected to continue at about the same level of accomplishment in the future as in the past.

Linear programming models of the subbasins were constructed for the years 1990 and 2020. The models included the streamflow during the spring and summer months, the acreages of agricultural land by productivity class, and the resource demands and dollar returns. The models were set to maximize the net returns to agriculture on the total Basin. In the model it was possible to plant the five major agricultural crops and to raise five different form of livestock. The expected Without program increases in irrigation efficiency and productivity and the expected reductions in available acreage and water available to agriculture were included.

In the models the Carson Subbasin was divided into two sections, one above and one below the Lahontan Reservoir.

The results of these linear programming models are taken as the agricultural use and production without the USDA Program. Where applicable they are compared to state and OBERS projections.

The major difference between the USDA Plan and the Without Plan is that the USDA Plan is designed to accelerate the on-going programs. Sustained development and proper management of the Basin's resources can be accelerated to meet a major part ofthe increasing demand. The order of presentation of the following discussion of present and projected "Without Plan" condition does not imply any priorities. It is a listing of problems associated with land and water use which may continue to exist if the present trend is not altered.

Land and Water

The linear program models estimated the amounts of land and water that would be utilized under the Without Plan situation. These are compared with state and OBERS projections for an average water year in the following tabulation:

Without Plan	LP	State	OBERS
	Water-acre feet (1,000s)		
1990	792.4	904.0	1138.1
2020	712.9	966.2	1187.9
		Land-acres	(1,000s)
1990	314.5	287.7	336.7
2020	290.0	314.7	430.3

Livestock and Crop Production

Livestock production is the major agricultural industry and most of the food and forage consumed by the livestock comes from within the Basin. This concept will be continued in the future under the With or Without Plan condition. Also, under either condition agricultural production will disappear from about 46,000 acres of irrigated land by 2020 because of urbanization, industrial, and recreation uses. The remaining land available for irrigated agriculture is shown in Table 65, and reflects the Without Plan condition.

Beef cattle are produced extensively throughout the Basin.

Table 65 - Land available for irrigated agriculture by Subbasin, Without Plan

Subbasin	1990	2020
	---acres---	
Calvada	72,092	71,092
Truckee	20,341	10,197
Carson:		
Lower	69,525	68,175
Upper	48,256	44,296
Walker	120,489	123,787
Totals	330,703	317,547

Table 66 shows estimates of crop production developed from the linear program model that may be expected under the Without Plan condition, and which reflects the anticipated acreage reductions. The data is shown for both the average and 80 percent chance water year.

Table 66 - Estimated crop production, by time frame, Without Plan, Central Lahontan Basin

Crop Yield Unit	1990		2020	
	80% Yr.	Ave Yr.	80% Yr.	Ave Yr.
Alfalfa (tons)	195,987	240,000	277,935	364,072
Wheat (tons)	120,475	180,769	163,575	220,205
Barley (tons)	113,777	77,208	177,465	186,005
Wild hay (tons)	1,747	1,859	910	4,124
Imp. Pasture (AUM)	275,530	428,823	205,480	324,520

Table 67 compares the Without Plan linear program crop estimates with OBERS and State data for three selected crops.

Table 67 - Comparison of LP Model crop data with OBERS and State of Nevada data, Central Lahontan Basin

Crop & Yield Data	1990				2020			
	L. P. Model		OBERS	State	L. P. Model		OBERS	State
	80%	Average			80%	Average		
	---tons---							
Wheat	120,475	180,769	5,162	8,892	163,575	220,205	6,906	17,563
Barley	113,777	77,208	9,659	16,957	177,465	186,005	8,734	24,314
All Hay	197,734	241,859	434,310	316,000	278,845	368,196	641,873	383,000

The divergence between the linear programming model and the OBERS and State projection is largely due to the model's determination that the production of grain would optimize agricultural returns. This could be expected to occur under conditions where water in the summer months is a limiting factor and under varying soil productivity conditions. The OBERS projections are based upon the market share of national production expected to be provided by the Basin. The State of Nevada projections are based upon the projected past trends of agriculture in the State. These have been adapted to apply to the total Basin without consideration of limiting water in the summer months or varying soil productivity.

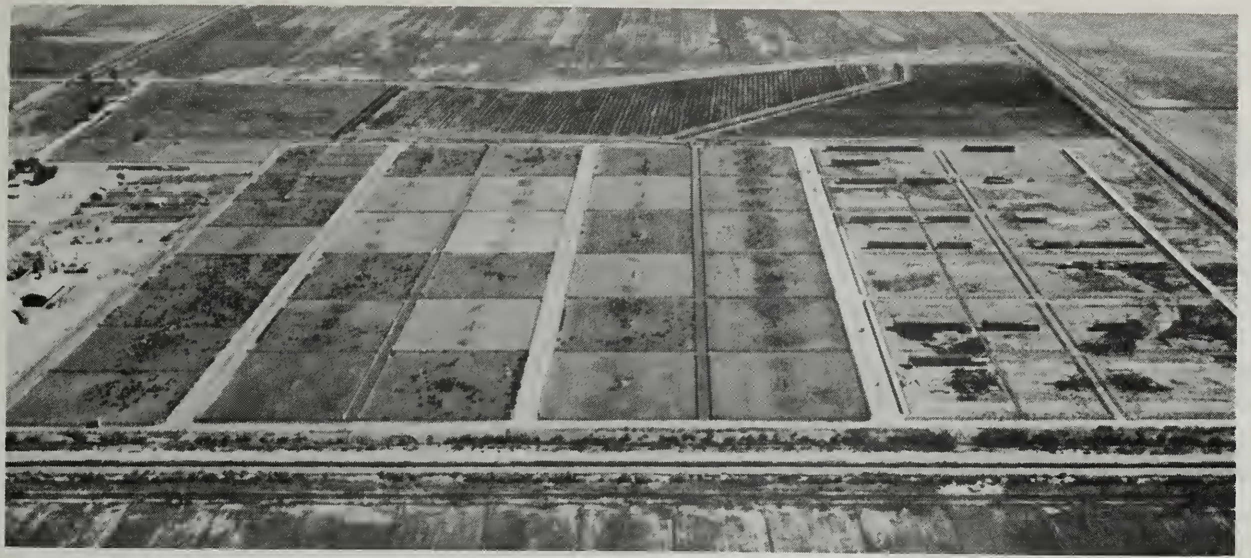
Feeder Cattle

Three types of feeder cattle operations were used in the LP Model. Two of these are "warmup" operations, and the third is "choice finish." All three types are utilized in the Basin. The hay-grain warmup is fed 1.27 tons of alfalfa and wild hay plus .25 tons wheat and barley. The hay-pasture warmup receives .67 tons alfalfa and wild hay plus 3.0 AUMs improved pasture. If the warmup animal is fed wild hay, the model adds a protein supplement to its diet. The animal can then be sold or further processed as choice finish on a diet of .21 tons alfalfa and wild hay plus 1.19 tons wheat and barley.

Under the Without Plan condition, the model estimated the number of head of feeder cattle by the three types that could annually be supported by the Basin's estimated crop production. This was determined for the average and 80 percent chance water year. This data is shown in Table 68.

Table 68 - Without Plan estimates of feeder cattle production by time frame, Central Lahontan Basin

Type of Operation	1990		2020	
	80% yr.	Average yr.	80% yr.	Average yr.
	----------cattle numbers----------			
Hay-grain warmup	89,698	64,368	174,223	199,170
Hay-pasture warmup	91,820	142,924	83,490	108,170
Choice Finish	181,548	207,327	257,765	307,325



Cattle feeding operations are being carried out at several locations in the Basin

Unlined irrigation canals cause inefficiencies in irrigation water use

Conservation Problems

Conservation problems on cropland will be of major importance throughout the Basin under the Without condition. The most significant problems relate to irrigation and include water shortages in the summer and low irrigation efficiencies. The past conservation work in the Basin has resulted in about 20 percent of the cropland being adequately treated. If the same rate continues, it will take 150 years to adequately treat the remainder of the cropland.

Flood Protection

Most of the rivers and streams in the Basin have caused damage by or through flooding. Winter rainstorms on snow or frozen ground, spring snowmelt, and summer convection storms are the principle causes of flooding. The floodwaters wash tons of sediment from the upper reaches to the flood plains below where it is deposited. Since many of the flood plains are being intensively developed, this results in much damage. Average annual flood damage in the Basin is approximately $2.8 million, using 1965 data.

Since the present development trend is expected to continue, the need for flood protection will become more critical. In most cases, water control facilities would fill this need and would provide protection to several thousand acres of agricultural and urban lands whose development would have been restricted by the flooding hazard. Flood plain zoning could prevent losses in relatively underdeveloped areas, but would have little impact on developed areas. Flood-proofing in these latter areas would be possible.

Municipal and Industrial

Within the next 50 years the population in the Basin will more than double. About 240,000 acre-feet of additional water will be required to meet this increase. This will also double the requirements for the necessities of life for additional people. They will need houses, facilities, and water. Most of the Basin has sufficient water available to meet some of the future needs, but will be in competition with those water users whose needs are not being met. Some developed areas in the Basin have water shortages now, and if they are to continue to grow, they will have to locate additional water sources.

Waste disposal is another problem with the increase in population. In many areas the population has grown faster than the treatment facilities. The construction of buildings, new roads, and streets often exposes the soil to erosion during and after construction. Other construction problems include building on unsuitable soils, high water tables, and flood hazards.

Water Quality

Water quality standards have only been in effect Basinwide the past few years. These standards have been violated at a few specific points for short periods of time. The quality of water in the Basin is good.

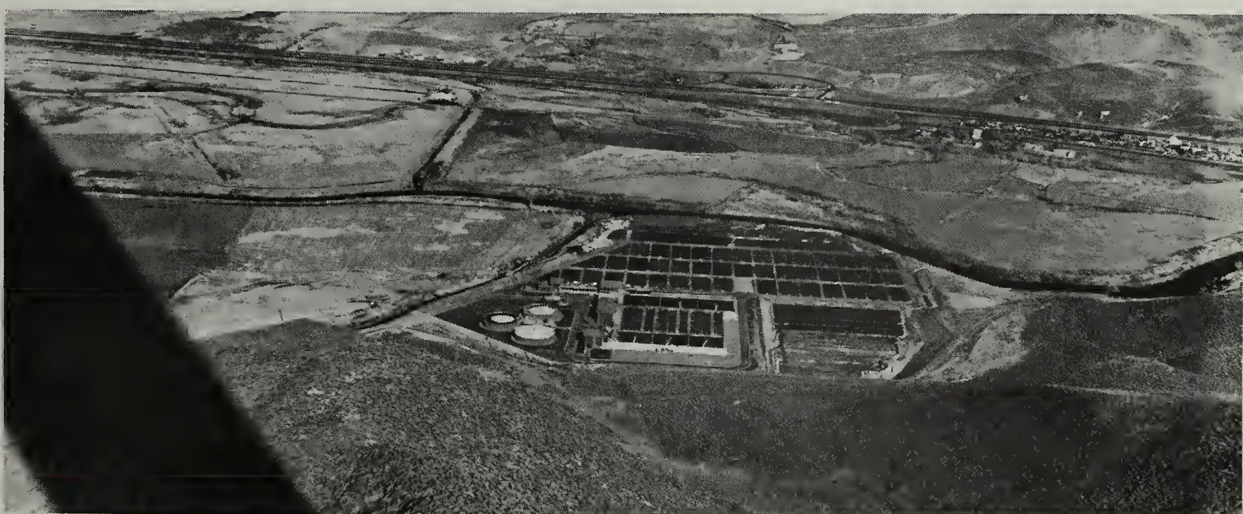
Changes in water quality are not always caused by man. Nature also changes the quality of water. Low summer flows cause high temperatures and high spring flows or sudden flood flows results in high volumes of suspended sediment in the streams. Changes in upstream use have resulted in increased disolved solids in the terminal lakes of the Basin.

Water Supply and Water Use

Average annual gross water yield for the Basin is about 2.05 million acre-feet. About 1.65 million acre-feet of this average annual gross yield flows down the gaged streams. This yield supports 1,270 miles of fishable streams and 334,922 acres of lake and reservoir surface for water based recreation.

There is about 1.8 million acre-feet of reservoir storage capacity in the Basin, much of which is not usable because of sediment and flood detention storage considerations. Some reservoirs fill only on exceptional water years.

The linear program model determined the amount of agricultural water and land that would be utilized during the average and 80 percent chance water year to produce the crops shown on Tables 66 and 68 under the Without Plan condition. The figures reflect these uses only during the March to October growing season, and are shown in Table 69.



The recently constructed Reno-Sparks sewage treatment plant will be at design capacity in very few years.

Table 69 - Without plan linear program estimates of irrigated land and water use by subbasin and time frame, Central Lahontan Basin

Subbasin and Item	1990		2020	
	80% yr.	Ave. yr.	80% yr.	Ave. yr.
Calvada				
Water used - AF	69,549	102,355	65,574	95,246
Water left - AF	13,348	34,830	14,172	35,585
Land used - Ac.	30,101	59,566	28,768	57,095
Land used/land avail.%	42	83	41	80
Truckee				
Water used - AF	54,033	53,930	22,670	22,670
Water left - AF	140,460	235,950	143,170	334,560
Land used - Ac.	20,341	20,341	10,197	10,197
Land used/land avail.%	100	100	100	100
Carson - lower				
Water used - AF	262,300	262,300	237,700	237,700
Water left - AF	14,780	81,200	32,940	99,360
Land used - Ac.	69,525	69,525	68,175	68,175
Land used/land avail.%	100	100	100	100
Carson - upper				
Water used - AF	91,965	169,214	81,786	181,135
Water left - AF	51,760	99,218	53,433	78,776
Land used - Ac.	29,216	47,560	23,531	44,218
Land used/land avail.%	61	99	53	99
Walker				
Water used - AF	129,427	204,577	104,402	176,198
Water left - AF	29,807	57,650	28,326	54,230
Land used - Ac.	85,160	117,716	68,841	110,424
Land used/land avail.%	71	98	56	89
Basinwide				
Water used - AF	607,274	792,376	512,132	712,949
Water left - AF	250,155	508,848	272,041	602,511
Land used - Ac.	234,343	314,708	199,512	290,109
Land used/land avail.%	71	95	63	91

A large portion of the "water left" quantity results from the seasonal streamflow distribution. Excess flows occurring in the spring and early summer pass on downstream and are not available for agricultural use later on in the year. The table shows that the agricultural land use in both the Truckee and Lower Carson Subbasins is 100 percent because the model showed both of these subbasins to have adequate upstream water storage. Portions of the available agricultural land in the other subbasins lacked adequate water during the critical summer months.

Limiting Water Months

The linear programming models determined that the available irrigation water supply in certain months would serve to limit agricultural production in those months. The months vary between the average and 80 percent chance water year. If additional water had been available during those months, the models could have irrigated more acreage.

Table 70 lists projections for the limiting water month by subbasin for the Without Plan condition. The lower Carson and Truckee Subbasins have no limiting water months because of existing irrigation storage facilities.

Table 70 - Without Plan linear program projections for the limiting water months, Central Lahontan Basin

Subbasin	1990		2020	
	80% Yr.	Ave Yr.	80% Yr.	Ave Yr.
Calvada	June July Oct	June - -	June July Oct	June Sept -
Walker	July Aug Sept Oct	July Aug Sept Oct	July Aug Sept Oct	July Aug Sept Oct
Upper Carson	July Aug Sept	Aug Sept -	June July Sept	None - -
Lower Carson	None	None	None	None
Truckee	None	None	None	None

Commercial Timber Land

Federal Land

The present treatment program is aimed primarily at those areas where problems have been recognized. There is a total of 21,326 acres needing treatment. With the present accomplishment rate, it will take 42 years to complete. Only that treated area will reach full productive capacity. This will leave the remaining commercial timber land (536,073 acres) producing at less than full capacity, by approximatley 3,600 bf per acre.

Private Land

There are 10,418 acres of private commercial forest land which have been deforested by fire and are not productive. 487,834 acres of private commercial forest land is producing approximately 1.8 million bd below full capacity. Presently only a few of the larger land holding companies are treating their land to improve production.

Rangeland

Within the Basin's total of 6,995,900 acres of usable range and grazed woodland, about 3,846,500 or 55 percent, were found to be in the low forage production class. Under the Without Plan condition utilizing on-going programs, it will take many years to bring about a significant increase in the production of these lands. For example, on national forest lands, with a total of 589,460 acres of rangeland suitable for improvement, only about 69,000 acres are scheduled for treatment under present programs. At this rate of accomplishment, it will take 61 years to complete the treatment.

The trend of existing programs on BLM lands is similar to those on the National Forest. Intensive grazing management with associated range improvements is being initiated on only one or two allotments a year. At this rate, about 40 years will pass before range condition on all of these lands is noticably improved.

On-going treatment programs on non-federal rangelands, i.e., Indian and privately-owned, are also proceeding at a slow pace. Funds for carrying on this work are difficult to obtain, and under this condition very little improvement can be expected within the immediate future.

Present program levels are geared to range seeding, revegetation of critical burned areas, limted amounts of fencing, and water development for livestock and wildlife. Full potential cannot be realized until large-scale installation of these practices occur, and intensive grazing management plans are in effect on all grazing lands. At the present level of treatment a deficit of approximately 231,000 AUMs will exist by 2020.

Watersheds

Federal Land

The present watershed treatment program is aimed primarily at treating critical areas where severe erosion and sedimentation problems exist. There are areas needing treatment, such as abandoned roads and trails where work needs to be done to restore these areas to proper hydrologic functioning. At the present rate of development, it will take an estimated 50 years to treat the critical areas.

Private Land

Presently there is little treatment being applied to private watershed land. There are limited finances available for cooperative watershed management, and there has not been a comprehensive survey made to detail the total need. It is estimated that about 250,000 acres needs treatment.

Fish and Wildlife

Habitat development activities can be related to the existing range and watershed programs. When range and watershed lands are improved, a portion of the increased forage may be allocated to wildlife. Fisheries habitat improvements are likely to result when programs of erosion control irrigation improvements, and sediment reduction are carried out. Consequently, under present programs, wildlife habitat is expected to receive benefits from the range and watershed improvement programs now underway. Habitat improvement will continue to lag until efforts can be accelerated by the initiation of specifically designed and funded programs to meet the needs.

It is estimated that about 60,000 acres of prime deer winter range, particularly on private lands, are being considered for urban uses. This situation will continue under the Without Plan condition unless planning alternatives can be developed which could effectively control or reduce the scope of these installa tions.

The Lahontan cutthroat trout fisheries in Pyramid and Walker Lakes are being affected by the depletion of upstream waters. When the volume of the two lakes is reduced to the point where inflow equals evaporation loss, both lakes will become totally devoid of a fishery.

Recreation

The present outdoor recreation facility development program has been slow and in some areas is not keeping up with demand. Private development has been geared to overnight camping areas for transient type camping. However, sports areas have been expanding even though there has been sufficient capacity to handle the demand for this recreational activity. Some privately-operated golf courses have been expanded from nine holes to 18 holes.

Local and municipal parks are over-crowded but little or no expansion has been made. Little expansion has been carried out on Class I or II lands. On the Class III lands, primarily public land administered by the Federal government, development has not kept up with demand. On these lands over the past 10-year period, the average annual development rate has been approximately 58,200 visitor-days annually. The demand increase on these lands has been 107,900 visitor-days annually. With this rate of development, it will take 336 years to develop the facilities to accommodate the Basin's potential demand for 106 million visitor-days.

This lack of development has caused overcrowding of existing facilities, and poses problems in site deterioration of facilities and the surrounding areas, and in some specific areas, sanitation and pollution problems.

If future projections of recreation activity on the Basin's Federal developed recreation areas are valid, demand would exceed the 1970 capacity by the amounts shown in the following tabulation:

State	Excess demand above capacity	
	1990	2020
	------1,000s visitor days---	
California	6,675	18,300
Nevada	36,005	79,120
Totals	42,680	98,050

Water based recreation, fisheries and visual quality involving lake surfaces are the largest water consumers in the Basin. Average annual water surface evaporation is 1,047,400 acre-feet; 51.1 percent of the total average annual gross water yield.

Golf courses are expected to gain in popularity and are being included in many recreation complexes in the Basin.

Community-organized tree planting programs are carried on at several locations in the Basin. Forest Service photo.

CHAPTER VIII

STATUS OF RESOURCE DEVELOPMENT

Highlight

This chapter describes the major water and related land resource activities of the Federal, State, and local agencies in the Basin. The status and functional emphasis of the programs are presented.

CONTENTS

Introduction

There are many county, State, and Federal agencies supplying various services to meet the resource conservation and development needs in the Basin. In the Lake Tahoe area alone, there are at least 64 agencies involved with programs, policies, authorities, and regulations dealing with the development, use, and conservation of the natural resources of that area. Basically, programs of the agencies are sufficiently comprehensive to take care of the present water and related land resource needs. However, the present plan of operations, both manpower and funding, of most of the agencies at all levels of government, are below that necessary to fully meet today's resource development needs.

USDA Activities

Soil Conservation Service

The Soil Conservation Service has maintained offices within the Basin since the Service began operations in the State of Nevada in 1938. Headquarters for statewide operations have been located in Reno since that time. Nevada Field offices are located at Reno, Fallon, Yerington, and Minden. Three other offices, located outside the Basin boundary, also provide assistance to selected areas.

SCS operations in the California portion of the Basin are administered from Red Bluff, Sacramento, and Davis through several field offices which, except for Susanville, are located outside the Basin boundaries.

Major activities carried out by SCS under the principle USDA authorities of Public Law 83-566, Public Law 74-46, and Public Law 87-703 are reviewed in the following discussion.

Public Law 83-566

The Watershed Protection and Flood Prevention Act (Public Law 566, 83 Congress, as amended) authorizes USDA technical and financial assistance to local organizations to plan and carry out works of improvement in watersheds of 250,000 acres or less. Projects must have (1) flood prevention, or (2) agricultural water management as the main purposes. Secondary purposes can be any or all of the following: (1) recreation, (2) fish and wildlife, (3) municipal and industrial water, and (4) pollution abatement. Project works of improvement usually include land treatment and structural measures. Individual storage structures may not have more than 12,500 acre-feet of floodwater detention capacity, or a total of more than 25,000 acre-feet of capacity for all purposes.

The local organizations ask for assistance from USDA in the form of a PL-566 application. There have been two applications filed in the Calvada Subbasin, four applications in the Truckee River Subbasin, one application in the Carson River Subbasin, and one application in the Walker River Subbasin.

The status of these applications is described in the following discussion.

CALVADA SUBBASIN - Willow Creek Watershed

Application Date: 1960
Local Sponsors: Lassen-Modoc Flood Control and Water Conservation District, Honey Lake Valley Soil Conservation District
Problem: Periodic flooding and lack of irrigation water in summer months
Project Status: The State of California, Division of Soil Conservation made a detailed study of the Willow Creek Watershed. Their 1969 report found the project proposal was not economically feasible to supply additional irrigation water in the summer months and the project could not reduce flood damage by a significant amount. The application has now been withdrawn.

Susan River Watershed

Application Date: 1968
Local Sponsors: Lassen-Modoc Flood Control and Water Conservation District, and Lassen Irrigation Company
Problems: Periodic flooding and lack of irrigation water in summer months.
Project Status: A preliminary investigation has been made in conjunction with this report and it was found that the flood damage could not be economically reduced. The storage of additional irrigation water for summer months was also uneconomical. However, by lining the main irrigation canal, the seepage could be reduced enough to

supply additional water to the farmers. It was felt that even though the flooding of Susan River could not be reduced economically, flood damage to Susanville from Piute Creek, a tributary of the Susan River, could be economically reduced and should be done under a separate request.

TRUCKEE RIVER SUBBASIN - Peavine Watershed

Application Date: 1955
Local Sponsors: City of Reno
Problems: Periodic flooding, erosion and sediment damage.
Project Status: Completed 1964. The project treatment included both land treatment and structural measures. The land treatment consisted of vegetation establishment and improvement to help reduce the sediment damage. There were three floodwater retarding dams and a floodwater diversion dam and channel in the structural measures to reduce the flood flows and sediment damage to the City of Reno.

Evans Creek (Block N) Watershed

Application Date: March 1964
Local Sponsors: City of Reno
Nevada State Highway Department
North Truckee Soil Conservation District
Problems: Periodic flooding, erosion and sediment damage.
Project Status: The project has had a project work plan completed and submitted to Congress. The work plan called for land treatment to reduce erosion and sediment and structural measures consisting of a multi-purpose structure for both flood prevention and recreation.

Galena Creek Watershed

Application Date: December 1961

Local Sponsors: Washoe Valley Soil Conservation District
Washoe Lake-Galena Creek Ditch Company
Washoe County

Problems: Occasional but severe flooding

Project Status: A preliminary investigation has been made on the watershed and a floodwater retarding structure and channel work looked feasible at the time of the investigation. There was also to be land treatment of the upper watershed. However, the area has developed since the investigation and the project should be reevaluated in this light.

Biddleman Springs Watershed

Application Date: June 1963

Local Sponsors: Storey County
Truckee-Carson Irrigation District
North Truckee Soil Conservation District

Problems: Periodic flooding, erosion, and sediment damage

Project Status: Physical solutions may be available, but some questions arise relative to economic justification and number of beneficiaries.

CARSON RIVER SUBBASIN - Carson City Watershed

Application Date: December 1968 (March 1960)

Local Sponsors: Carson City
Carson Valley Soil Conservation District

Problems: Periodic flooding, erosion, and sediment damage.

Project Status: The watershed has been approved for planning and a detailed study has been made. Five different alternatives were presented to the sponsors for structural and land treatment measures. The sponsors have not taken any action on the alternatives at this time.

WALKER RIVER SUBBASIN - Pumpkin Hollow Watershed

Application Date: September 1965
Local Sponsors: Pumpkin Hollow Flood Control Committee
High Ditch Corporation
Lyon County
Nevada State Highway Department
Problems: Periodic flooding, erosion, and sediment damage and the need for improved irrigation water management
Project Status: Preliminary investigation has shown favorable economic benefits in the project. The sponsors have been actively seeking a planning priority from the State of Nevada.

Public Law 46

In 1935 Congress enacted Public Law 46, which gave authority to the U. S. Department of Agriculture (USDA) to provide technical assistance to land owners and operators in setting up a conservation program on their lands. The USDA set up the Soil Conservation Service (SCS) as its agency to carry out the task. By working through local conservation districts the SCS has worked at the task of getting knowledge of conservation to the land users and getting the conservation applied.

Irrigation water management practices on the land in 1970 are shown on Table 21. Irrigation has only been part of the conservation work done. There also has been work carried out involving conservation tillage practices, range conservation and improvement, forest land conservation, recreation development, and urban assistance. Assistance to units of government such as to State Highway Department in roadbank stabilization, and technical information to cities and counties on soils, their limitations and problems, has been significant. Over the entire Basin, about 20 percent of the needed conservation practices have been applied to date.

Public Law 703

The Food and Agriculture Act of 1962 authorized the USDA

This completed PL-566 flood water detention structure is one of three such structures constructed for the Peavine Watershed Project near Reno

Concrete irrigation water control structures are an important element under the USDA Public Law 46 program.

to give technical and financial help to local groups in Resource Conservation and Development (RC&D) projects. Aim of the projects is to improve economic opportunities in rural areas through speeding up conservation and development of the area's natural resources. SCS has leadership in the program. It works with local, State, and other Federal agencies in assisting project sponsors. In RC&D projects, all segments of the community - rural, suburban, and urban, can work together to solve local problems and improve resource use. Local groups must initiate projects.

The Central Lahontan Basin has two RC&D projects extending into its boundaries. (See map, CHAPTER X). Approximately 60 percent of the Basin is within a project area. The two RC&D projects are the North Cal-Neva and the Carson-Walker.

The North Cal-Neva RC&D Project covers northeastern California and northwestern Nevada. It is composed of about 9.1 million acres of which 2.8 million acres are in the Basin. The Nevada portion includes a segment of Washoe County within the Gerlach Conservation District. It has been in the project area since 1967. The Nevada portion of the project area is sponsored by the Gerlach Conservation District and Washoe County. The California portion is that part of Lassen County that is in the Basin. This area is sponsored by the City of Susanville, Lassen County, and the Honey Lake Valley Resource Conservation District and was added to the RC&D project area in 1971.

Since the RC&D project started, the sponsors have been working toward the area's conservation and resource development. Some of the accomplishments are: development of geothermal heat near Wendel to heat a greenhouse for raising tomatoes; a post peeling operation has been located at Susanville; placement of permanent markers along the Nobles Road from Deep Hole Station to Susanville; and the development of an organized Inter-Agency Range Improvement Program. In addition, there are some proposals that are in the final stages of development. They are: an erosion control and streambank stabilization project on Baxter Creek, a livestock feeding study covering the project area, sewer system improvements in Susanville, the telephone service in Wendel, and 10-15 housing units for Indians to be constructed in Susanville. All of these are to be completed in 1974.

Wildland fire protection programs are available for most of the Basin's watershed lands.

The Bureau of Land Management has developed an extensive recreation area on Indian Creek Reservoir, which is an artificial lake created to hold treated sewage effluent exported from the South Lake Tahoe area.

The Carson-Walker RC&D Project has recently been approved by Congress as a project area (December 1973). The project area includes all of Carson City, Churchill, Douglas, Lyon and Storey counties of which all are in the Central Lahontan Basin, but Churchill extends beyond the Basin boundaries. Of the 5.1 million acres in the project area, 3.7 million acres are in the Basin. The project plan was prepared in 1974 and operations are expected to begin in 1975.

National Forest Development and Multiple Use Programs

The national forest development program is based upon the multiple use concept of management and the utilization of all the various renewable surface resources. In order to identify the management situations of the forest land, basic assumptions for resource uses and activities were developed. These basic assumptions are premises leading to the management directions and related coordination requirements for multiple use management. Since the forest land varies widely in physiography, productivity, and suitability for certain uses, broad management zones were identified. See Map 25. Within each of the zones, management situations and basic assumptions were developed for all the basic renewable resources. The renewable resources include air, soil, water, timber range forage, recreation and esthetics, wildlife and fish, and wilderness. Management situations and basic assumptions were also developed for special land uses, transportation systems, minerals, insect and disease, fire, administrative improvements and research in each zone.

Through the analysis of the management situation and the basic assumptions, management direction and coordinating requirements were developed. These have been completed for all national forest land in the Basin. Implementation of management direction is now being done. The process will never become static.

Each zone will be briefly described and status of development will be presented.

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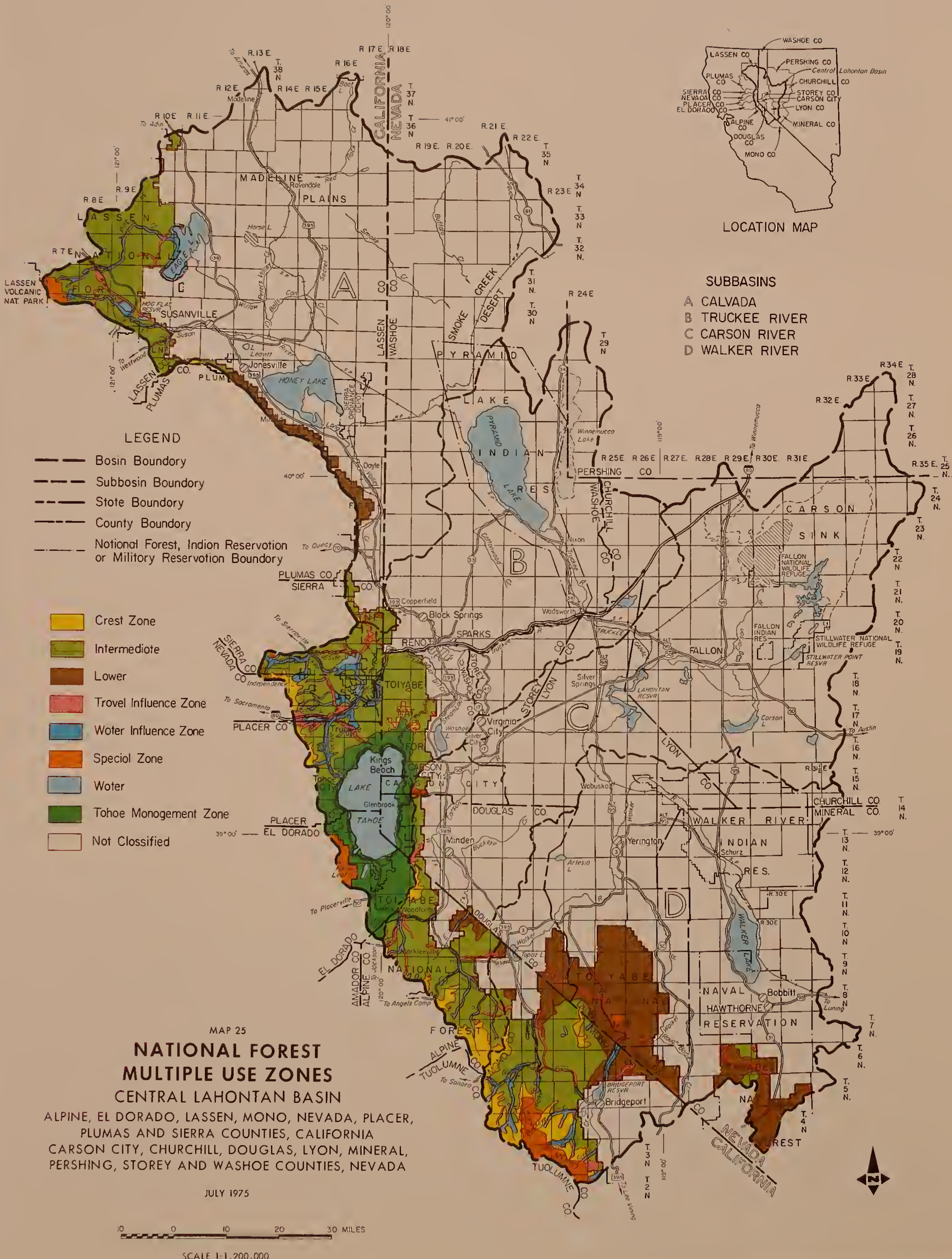

MAP 25

NATIONAL FOREST MULTIPLE USE ZONES

CENTRAL LAHONTAN BASIN

ALPINE, EL DORADO, LASSEN, MONO, NEVADA, PLACER, PLUMAS AND SIERRA COUNTIES, CALIFORNIA
CARSON CITY, CHURCHILL, DOUGLAS, LYON, MINERAL, PERSHING, STOREY AND WASHOE COUNTIES, NEVADA

JULY 1975

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Crest Zone - The terrain in this zone is frequently steep, rocky, has shallow soils, and is often easily disturbed. Elevations range from 8,000 to 12,000 feet in the Basin. About 61 percent of the total crest zone in the Basin is in the Walker Subbasin. The management direction in this zone is to protect and improve the yield of usable water and other watershed values, safeguard or enhance natural beauty and the opportunity for dispersed recreation and maintain and develop fish and wildlife habitat. Within this zone occurs the special zones, which are Designated Wilderness Areas. In the Walker Subbasin it is the Hoover Wilderness; in the Truckee Subbasin it is the Desolation Valley Wilderness; and in the Calvada Subbasin it is the Caribou Wilderness. About 32 percent of this zone has been protected and reserved as wilderness areas. There will be little or no development in this zone. The protection and improvement of watershed values is a continuing program in this zone.

Intermediate Zone - This zone comprises the "Middle Elevation" areas where conditions are most favorable for growing saw timber and livestock forage. It is a significant water producer and provides important wildlife habitat, and opportunity for recreation development. This zone ranges from about 5,000 to 9,000 feet in the Basin. The management direction in this zone is to obtain optimum sustained production of quality timber, livestock forage, and wildlife habitat. This includes maintaining and improving usable water yield, satisfactory watershed, lake, and stream conditions, enhancing natural beauty, and providing opportunity for dispersed recreation. The program to maintain current timber yields is better than 90 percent accomplished. This includes reforestation of old burns, timber stand improvements including thinning, release, and pruning. The program to maintain or enhance range forage production is about 80 percent complete. Other range facilities, such as fences, cattle guards, and water developments are only about 20 percent completed. The wildlife program is a continuing effort relating to habitat protection and improvement. The recreation development based on theoretical capacity in visitor-days per year is 32 percent completed. Watershed treatment is a continuing program. Treatment of problem areas, caused by past misuse, is about 50 percent complete.

Lower Zone - This zone comprises the "Lower-Elevation" relatively arid areas. Often, the sparse ground cover on dry sites leaves soils susceptable to accelerated erosion. Much of this zone produces or can produce vital big-game winter-range forage. Much of the area is suitable for use by domestic livestock. This zone also provides a limited opportunity for dispersed recreation. It is heavily used by hunters and rock hounds. The management direction in this zone is to assure soil stability by maintaining or developing adequate ground cover of perennial plants and organic litter, assure needed winter habitat for big game, and provide optimum forage for domestic livestock on areas suitable for grazing, safeguard natural beauty, and provide limited opportunity for dispersed recreation. The status of development in this zone is that water development for domestic livestock and wildlife is about 30 percent complete, and enhancement of range forage for domestic livestock is about 30 percent complete. Development of recreation facilities in this zone is about 70 percent complete.

Travel Influence Zone - This zone comprises areas of existing or anticipated significant public occupancy, use, and enjoyment for outdoor recreation along existing and planned overland routes of non-water oriented travel. Management direction for this zone is to protect and enhance the esthetic qualities and values; develop and maintain recreation sites and facilities for intensive occupancy, use, and enjoyment by the public; and modify other uses to levels which will best enhance or maintain the outdoor recreation use and environment. Recreation facilities in this zone Visitor Information Service (VIS) Center, observation sites and vista points are 27 percent complete.

Water Influence Zone - This zone comprises areas of existing or anticipated significant public occupancy, use, and enjoyment for outdoor recreation along streams, rivers, around lakes and reservoirs. Managment direction in this zone is to (1) maintain and improve the aquatic and associated environment, (2) protect and enhance water quality and usefulness, (3) develop and maintain recreation sites and facilities for intensive occupancy, use, and enjoyment by the public, (4) develop and maintain fish and wildlife habitat, and (5) modify other uses to levels which will best maintain or enhance the water-oriented outdoor recreation use and aquatic environment. Recreation development, which is 24 percent complete in this zone, includes, swimsites, boat launching facilities, and picnic sites. Enhancement of fish and wildlife habitat is a continuing program.

Tahoe Management Zone - This zone includes the Lake Tahoe Basins in the Truckee Subbasin. The management direction in this zone is to provide for the orderly development and management of the renewable natural resources commensurate with high public use and to preserve the natural beauty of the Basin. A detailed description of this zone may be found at the Lake Tahoe Basin Management Unit office at Meyers, California.

Cooperative State-Federal Programs

The U. S. Forest Service and the State Division of Forestry in Nevada and California are involved in State-Federal Cooperative Forestry Programs. These programs are: (1) fire control, (2) forest management, (3) tree planting, (4) forest products utilization, and (5) insect and disease control.

The State Division of Forestry in Nevada and California is providing fire protection on state and private lands inside the National Forest boundaries. In some areas there are agreements by which the National Forest provides fire protection on private lands and the State Division of Forestry provides fire protection on National Forest land. Mutual Aid areas have been defined whereby either agency will assist the other in initial attack.

The objectives of the state forest management programs are to place the small private woodlands under good forest management and to work with primary processors of timber products to eliminate waste and improve the quality of wood products. The State of Nevada has two service foresters headquartered in Reno. The State of California has service foresters located in Susanville and Nevada City. One output of this cooperative effort is a marketing survey done by the California Division of Forestry. This survey lists markets and market prices (1970) for various forest products.

The tree planting program is designed to supply private land owners with suitable tree stock and seed. This program provides planting stock for establishing windbreaks, shelter belts, forest planting for cropland conversions, land stabilization projects, and other similar projects.

The insect and disease control program involves surveys of insect and disease problems and the treatment of these affected areas.

There is a new State-Federal program just started which will provide assistance to the Nevada Rural Housing Authority. The program will provide plans to the Housing Authority for low cost wood homes and technical assistance and material on new methods of building low cost homes. The plans and material have been developed at various U. S. Forest Service experimental stations throughout the United States.

Other USDA Activities

Cooperative Extension Service

The Federal, State, and County Governments jointly employ county agricultural agents as specialists to help the local people in their agricultural operations. The agents bring the information gathered by USDA and State research efforts to the local people and in turn relate the people's needs and problems to the research results.

Farmers Home Administration

The main assistance of Farmers Home Administration (FmHA) is to make loans oriented toward the family-type farm. Besides farm ownership and operating loans, the FmHA makes funds available for sewer and water systems for rural towns, farm labor housing, rural rental housing, farm-based small business enterprises, and economic opportunity. They also provide emergency loans in time of natural disasters such as floods, droughts, and blizzards. These loans supplement but do not compete with credit from other lenders.

Agricultural Stabilization and Conservation Service

The Agricultural Stabilization and Conservation Service (ASCS) through price support loans, and commodity programs attempts to stabilize the nation's agricultural economy. Also the ASCS has had certain conservation cost-sharing and land retirement programs to promote conservation of the nation's agricultural resources and to reduce pollution from agricultural activities. The present program is the Rural Environmental Conservation Program (RECP) which is administered at the county level by local county committees. This program provides for annual cost-share agreements as well as some long term contracts for conservation measures as authorized by Title 10 of the Agriculture and Consumer Protection Act of 1973. The county committees set up investment plans based on the high priority needs of the county for conservation and pollution control. The cost-share funds are then allocated according to the priorities set forth in the investment plans. Much of the conservation applied in the Basin has been done under the ASCS program.

Other Federal Programs

The Bureau of Land Management is the largest administrator of Federal lands in the Basin (46 percent of total Basin). Their Management Framework Plan concept promotes total resource conservation covering livestock forage production, wildlife habitat, recreation, mining, and watershed protection.

The Bureau of Indian Affairs assists Indians, who have about eight percent of the land in the Basin. Technically coordinated programs are available to assist the Indians to assume their own responsibility in the conservation, use, and management of their land. Education processes pertaining to farm, home, and rural development in the Indian community are also provided.

The U. S. Geological Survey has been cooperating with the States in collecting water resource information through geologic investigations, monitoring of water resource stations, and other surveys. This has resulted in a good base of water resource information for use in the Basin.

The Bureau of Reclamation has two projects in the Basin, the Newlands Project and the Washoe Project. The structures which are a part of these projects are the Truckee Canal, and Lahontan, Derby, Boca, Prosser, and Stampede Dams. Marble Bluff Dam is now under construction. The complete Washoe Project is not implemented.

The Corps of Engineers have completed the Martis Creek Dam and channel improvement on the Truckee River at Reno for flood control as well as providing money for channel clearing of debris along several other rivers in the Basin. There are also other authorized flood studies under way in the Truckee Meadows area.

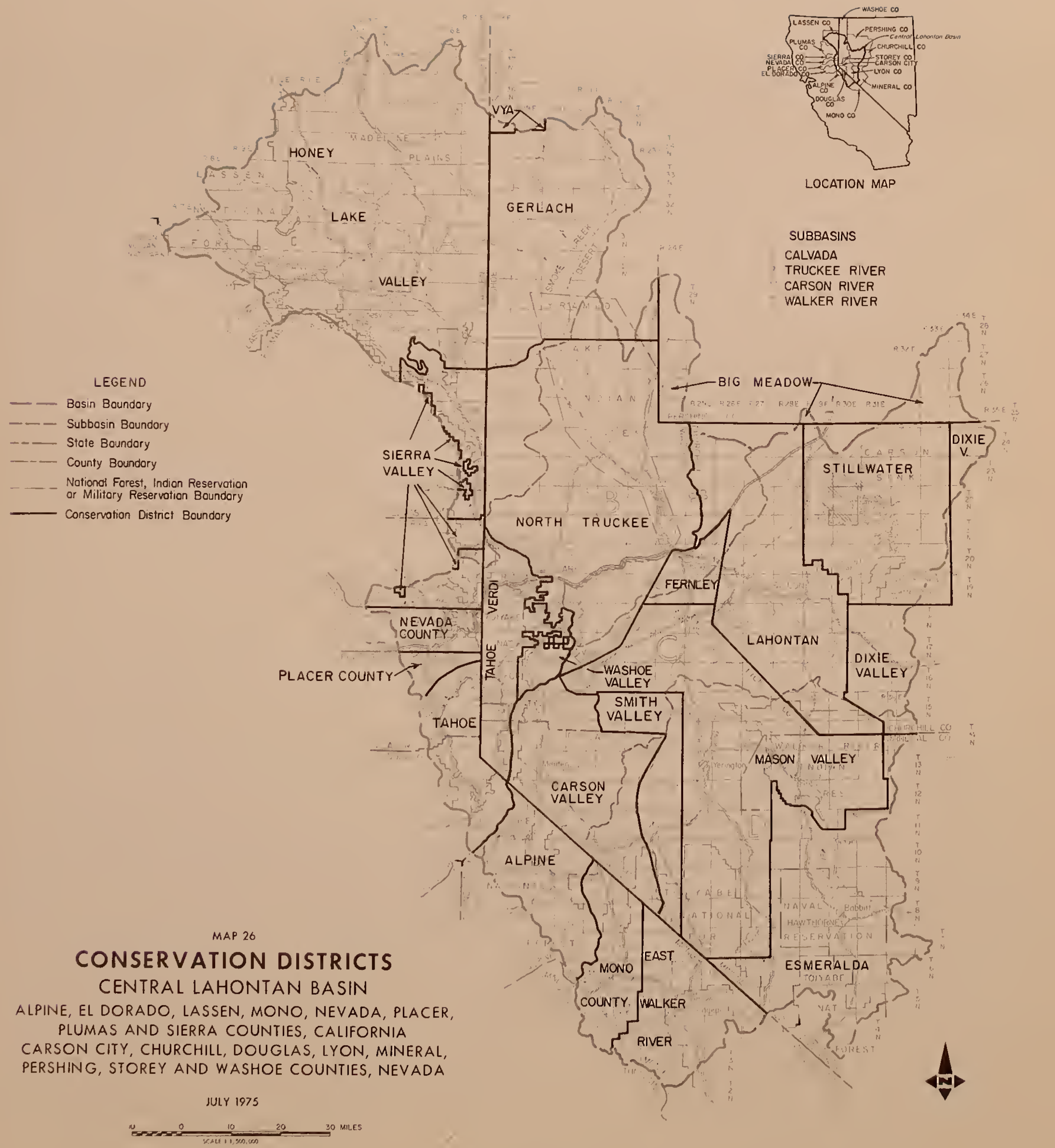
The Fish and Wildlife Service manages the Stillwater, Fallon, and Anaho Island National Wildlife Refuges mainly for waterfowl hunting, fishing, and for migratory bird protection. They also provide fishery assistance to the Pyramid Lake and Walker Lake Indian Reservations, plus maintain the Lahontan National Fish Hatchery at Gardnerville.

State Developments

Conservation Districts

State organizations which have influenced much of the resource conservation in the Central Lahontan Basin are the locally organized conservation districts. These districts are governmental subdivisions of their States charged with the responsibility of resource conservation. There are 24 districts that are wholly or partly within the Basin. The California portion of the Basin has 8 Resource Conservation Districts (RCDs) that are partly within the Basin and Nevada has 14 Conservation Districts (CDs) that are wholly or partly within the Basin, see Map 26.

Smith Valley CD was the first district to be formed in the Basin in 1938, one year after the legislation was enacted in Nevada. Two other Nevada Districts - Mason Valley and Carson Valley - followed Smith Valley and were formed within the same year. California law enabling districts to be formed was passed in 1940 and the first California District to be formed in the Basin was Mono County RCD in 1945. El Dorado County RCD does have a longer history than Mono County RCD; however, Eldorado County RCD did not extend its boundaries into the Basin until 1959. All of the land in the Nevada side of the Basin is in CDs, and about 99 percent of California land in the Basin is in RCDs.



MAP 26

CONSERVATION DISTRICTS

CENTRAL LAHONTAN BASIN

ALPINE, EL DORADO, LASSEN, MONO, NEVADA, PLACER, PLUMAS AND SIERRA COUNTIES, CALIFORNIA
CARSON CITY, CHURCHILL, DOUGLAS, LYON, MINERAL, PERSHING, STOREY AND WASHOE COUNTIES, NEVADA

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Since the first district was formed in the Basin, they have worked with land owners and operators in getting conservation applied to the land. The districts have entered into cooperative agreements with Federal agencies who have supplied the technical and financial assistance in conservation programs. Virtually all of the irrigation practices, listed on Table 11 have been done by district cooperators in cooperation with the U. S. Department of Agriculture. Most of the PL-566 watershed projects have districts as local sponsors. Districts have taken active parts in nearly all the Federal conservation programs.

Districts have promoted conservation by making available to land owners and operators specialized machines and equipment needed to apply the work, by sponsoring demonstrations, field trips, and public information activities. The districts have worked at the task of informing the public of conservation problems and needs. Also districts have worked with schools and youth organizations in educating the youth in resource conservation.

Fish and Wildlife

The California Department of Fish and Game and the Nevada Department of Fish and Game both have maintained an active program of fish and wildlife management. Reservoirs listed under State ownership in Table 20, are operated and managed by the Department of Fish and Game for fish, stream flow management, and fisheries enhancement. Other measures of game management include the construction of wildlife watering facilities, nesting platforms for waterfowl, and several management developments to improve fish and wildlife habitat. As an example of the latter, the East Carson River above its confluence with Wolf Creek has been included in the California Department of Fish and Game Wild Trout Program and will receive special management to optimize wild trout production.

Recreation

It is the responsibility of the state park agencies to acquire, protect, develop, and manage a well-balanced system of outstanding, scenic, recreational, scientific and historic facilities which are important for the inspiration, use, and

Both states have active fish propagation programs for improving the Basin fisheries.

Topaz Lake, in Walker Subbasin, is an irrigation reservoir owned and operated by an irrigation district.

enjoyment of the people. Both States have developed a number of sites throughout the Basin that fall in the above category. The use of these sites in 1970 was up in the millions of visitor-days and is shown in Table 29.

<u>Water Quality Control</u>

Interstate water quality standards were approved in November 1972 between California and Nevada. It has only been since 1967 that any water quality standards have been adopted by the States causing them to establish monitoring stations along the rivers and streams in the Basin. Before 1967 there were no standards and monitoring was only at a few isolated points.

<u>State Water Planning</u>

California

The Department of Water Resources has several programs in the Basin. These include (1) Coordinated Statewide Planning, and (2) Projected Water Demands and Change in Land Use Survey Programs. These programs involve periodic use surveys, projection of future population, land use, water use, and investigation of water conservation measures to supply the projected water demands. The information developed in these programs is published in the DWR Bulletin 160 Series Entitled "Implementation of the California Water Plan."

Nevada

The Division of Water Resources is developing a water plan for Nevada based on the division of the State into six hydrologic areas. The Basin comprises two of these areas, i.e., Area I - The Walker River Region, and Area II - The Carson Truckee Region. The plan is being developed in four phases: Phase I, an inventory of resources; Phase II, forecasts of future water and related land resource requirements; Phase III, development of alternative plans; and Phase IV, formulation of a recommended plan. For Areas I and II, the water plan is about completed through Phase III. Phase IV is planned for development in the near future.

Irrigation Districts and Water Companies

There are ten major irrigation districts or water companies in the Basin that were formed to cooperatively operate and maintain the irrigation storage and/or delivery systems that serve their users. Many of the existing reservoirs in the Basin under private ownership are operated by irrigation districts. In addition, there are numerous small ditch companies that provide irrigation service to small groups of land owners and operators.

Regional Planning Agencies

There are three regional planning agencies in the Basin that coordinate the planning efforts of the local governmental bodies within their boundaries. The three are the Carson River Basin Council of Governments, the Regional Planning Commission of Reno, Sparks, and Washoe County, and the Tahoe Regional Planning Agency.

Carson River Basin Council of Governments includes Carson City, Churchill, Douglas, Lyon, and Storey Counties. The COG has completed several plans for the area which include a Comprehensive Master Plan, Water Supply Plan, Land Use Plan, Drainage Plan, and other studies. They also are providing technical assistance to their members in planning areas.

The Regional Planning Commission of Reno, Sparks, and Washoe Counties include the governments stated in their name. They are mainly concerned with the metropolitan area of Reno and Sparks, and are coordinating the planning efforts of the two cities. They have a master plan and several ordinances and codes to aid in their work.

The Tahoe Regional Planning Agency operates within the Tahoe Basin in both California and Nevada. They have the responsibility of planning and regulating the development of the Tahoe Basin. They have a master plan and several ordinances, including a complex zoning ordinance. The protection of the fragile environment and the maintenance of the high quality of the Lake are a major concern to them.

C H A P T E R I X

RESOURCE POTENTIAL FOR SATISFYING EXISTING AND FUTURE PROBLEMS

Highlight

This chapter discusses resource potentials that can assist in solving or alleviating existing problems discussed in Chapter V and some future resource problems mentioned in Chapter VII. There is adequate suitable and available land though some changes in use are anticipated. The potential for alleviating inadequate water supply, the Basin's basic and greatest problem is emphasized. The on-going, Without Plan, condition will fail to meet all needs.

CONTENTS

Land Availability

There is ample, suitable land within the Basin to meet future demands of the major land uses. Trade-off between present uses will be required to meet future needs. Table E, in the Summary, shows relative changes expected in Basin resource use. Shifts in use are minor considering the total resource. The largest item represents a reduction of 4.4 percent of grazing land to satisfy needs of the expanding population. Some of this land is in private ownership, but some of the needs will have to be satisfied from public land. It is assumed that this will be available. There is a need and potential for further planning with respect to adjustments in the land uses.

Irrigated Crop Production and Water Use

Land

The means existing to satisfy the projected requirements will be discussed in relationship to the physical natural resource base; that is, the amount of land and water available for use. It is assumed that the aggregate base of land and water will remain available in the same quantity in 1990 and 2020 as during the 1970 base period. The water flow will become modified and the mix of uses of land and water will change in time.

Crop production is projected to disappear from 34,000 acres of presently irrigated land by 1990, and from a cumulative total of 46,000 acres by 2020. Table 71 shows this reduction by county, subbasin, and time frame.

Table 71 - Changes in irrigated land available by 1990 and 2020 (acres added or subtracted from 1970 base), Central Lahontan Basin

Subbasin	County	1990	2020
Calvada	Lassen	-500	-1,500
Walker	Lyon	+621	+3,921
Upper Carson	Carson City	-1,418	-1,418
	Douglas	-5,000	-7,960
	Lyon	-2,720	-3,220
Lower Carson	Churchill	-3,362	-4,712
Truckee	Washoe	-18,700	-26,700
	Lyon	-1,800	-2,474
	El Dorado	-220	-460
	Nevada	-750	-1,050
	Placer	-160	-360
	Sierra	-260	-340
TOTAL		-34,269	-46,273

The projected reductions in irrigated crop land will still allow for a substantial irrigated agricultural economy in the Basin.

Projected subtractions from the 1970 base were made for the mining, industrial, and urban uses. The remainder was assumed to be available for agricultural and recreational use. Table 72 shows the remaining available irrigated land by county, subbasin, and time frame.

Table 72 - Irrigated land available for future use by County, subbasin, and time frame, acres, Central Lahontan Basin

Subbasin and County	Time Frame	
	1990	2020
Calvada		
Washoe	2,339	2,339
Lassen	68,198	67,198
Sierra	1,555	1,555
Subtotal	72,092	71,092
Walker		
Douglas	989	987
Lyon	74,160	77,460
Mineral	7,240	7,240
Mono	38,100	38,100
Subtotal	120,489	123,787
Upper Carson		
Carson City	220	220
Douglas	38,219	34,759
Lyon	1,911	1,411
Alpine	7,906	7,906
Subtotal	48,256	44,296
Lower Carson		
Churchill	69,525	68,175
Truckee		
Lyon	2,184	510
Storey	563	563
Washoe	12,349	3,700
Eldorado	1,880	1,640
Nevada	1,500	1,200
Placer	1,325	1,124
Sierra	1,540	1,460
Subtotal	20,341	10,197
TOTAL	330,703	317,547

Water

The average annual gross water yield for the Basin is 2.05 million acre-feet. After use by man's activities, phreatophytes, native vegetation and evaporation from free water surfaces above the streamgages, a portion of this gross yield appears as surface runoff in streams.

This total streamflow by subbasin at gage points upstream from the major agricultural areas for the average annual and 50 percent chance flow is shown in the following tabulation.

Subbasin	Average Annual Flow	80% Chance Flow
	--------------acre-feet-------------	
Calvada	163,100	88,800
Truckee	518,000	338,700
Upper Carson	322,500	203,600
Lower Carson	370,000	288,000
Walker	279,600	180,400

The tabulated figures only account for those water uses above the streamgages and reflect the volumes of streamflow at the gaging points.

Priority of Water Uses

It was assumed that municipal, industrial and urban water users would be able to bid a higher price for their input of water than the price which could be bid by agricultural users. Of the agricultural uses, specialty crops were given priority, even though the volume of water use by specialty crops is negligible. The remainder is expected to be available for other field crops, beef and horse, and dairy cattle production. Table 73 shows the projected average annual streamflow available by subbasin and time frame.

Table 73 - Projections of average annual streamflow from stream gages, by subbasin, Central Lahontan Basin

Subbasin	Stream Flow 1990	2020
Calvada	158,280	153,570
Truckee	463,767	420,807
Lower Carson	343,461	337,071
Upper Carson	299,610	286,840
Walker	236,260	186 560

The amount of water available and demanded varies between subbasins and between months of usage. Figures 8 and 9 indicate the amount of water available to agriculture in the individual months in the future by subbasin.

Ground Water Potential

Ground water is being used both as a sole source and as a supplemental supply of water for various purposes in the Basin. With proper management this use can have tremendous benefits by stabilizing the water supply to meet periods of peak demand not satisfied by surface water.

The potential long term ground water supply which may be utilized is limited to the recharge potential of the area. The major amount of recharge in the valley fill reservoirs is derived from stream channels, ditches, and deep percolation from irrigated fields and flooded areas. Recharge varies from year to year depending on hydrologic factors and antecedent conditions which vary greatly from valley to valley. Data on recharge for some of the valley areas is available through the Nevada or California Division or Department of Water Resources. However, not all of the valley areas have been studied to determine recharge or recharge potential.

Current annual use of this resource is less than the estimated recharge in most of the major ground water reservoirs at this time. Some further development is therefore possible. However, if all of the existing ground water rights in the Table 23 were fully utilized, a depletion of the ground water resource may occur in some areas, and further developments become marginal. Lowering of the water table by pumping in some areas may be desirable because of resulting decreased use by phreatophytes and improved agricultural drainage.

Figure 8 - Stream flow after withdrawal of urban, industrial, geologic commodity, and specialty crop water uses.

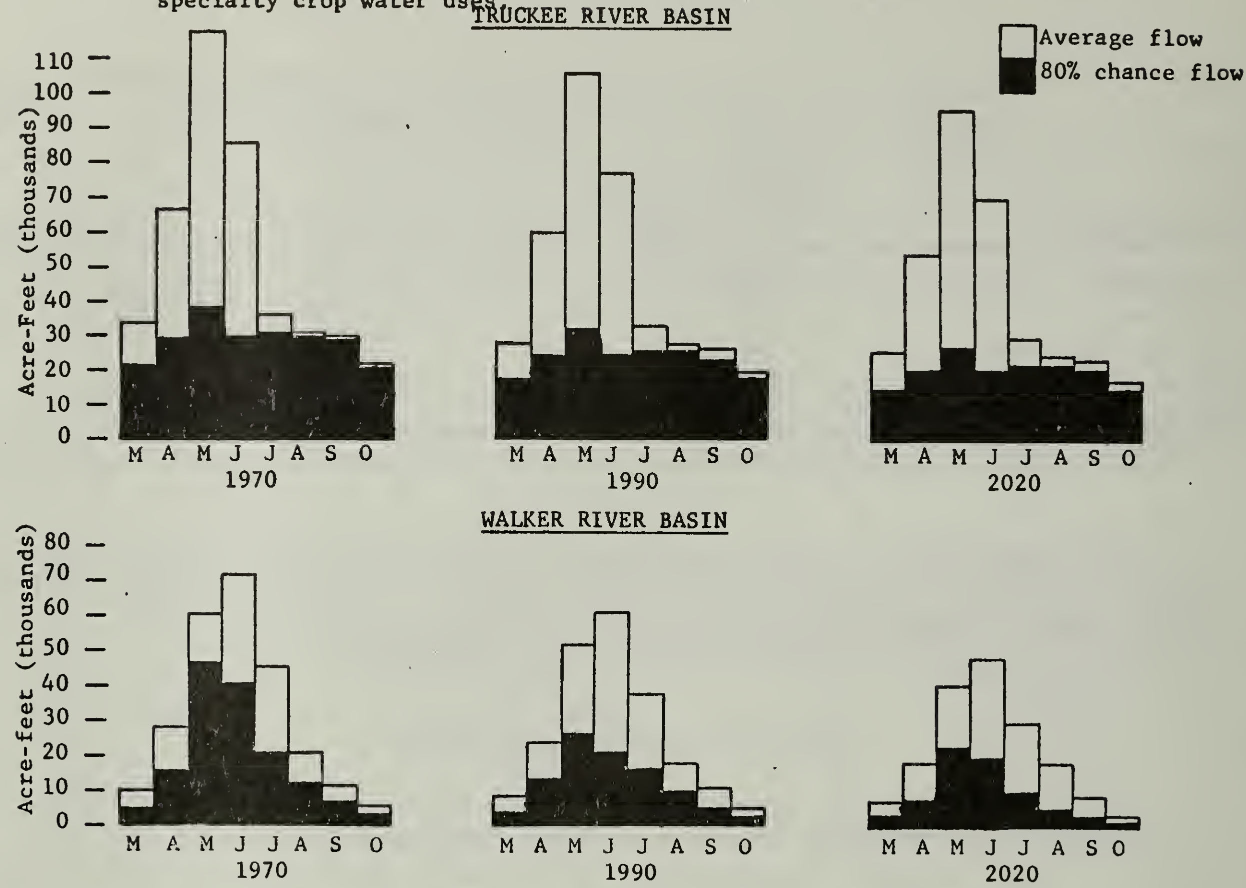
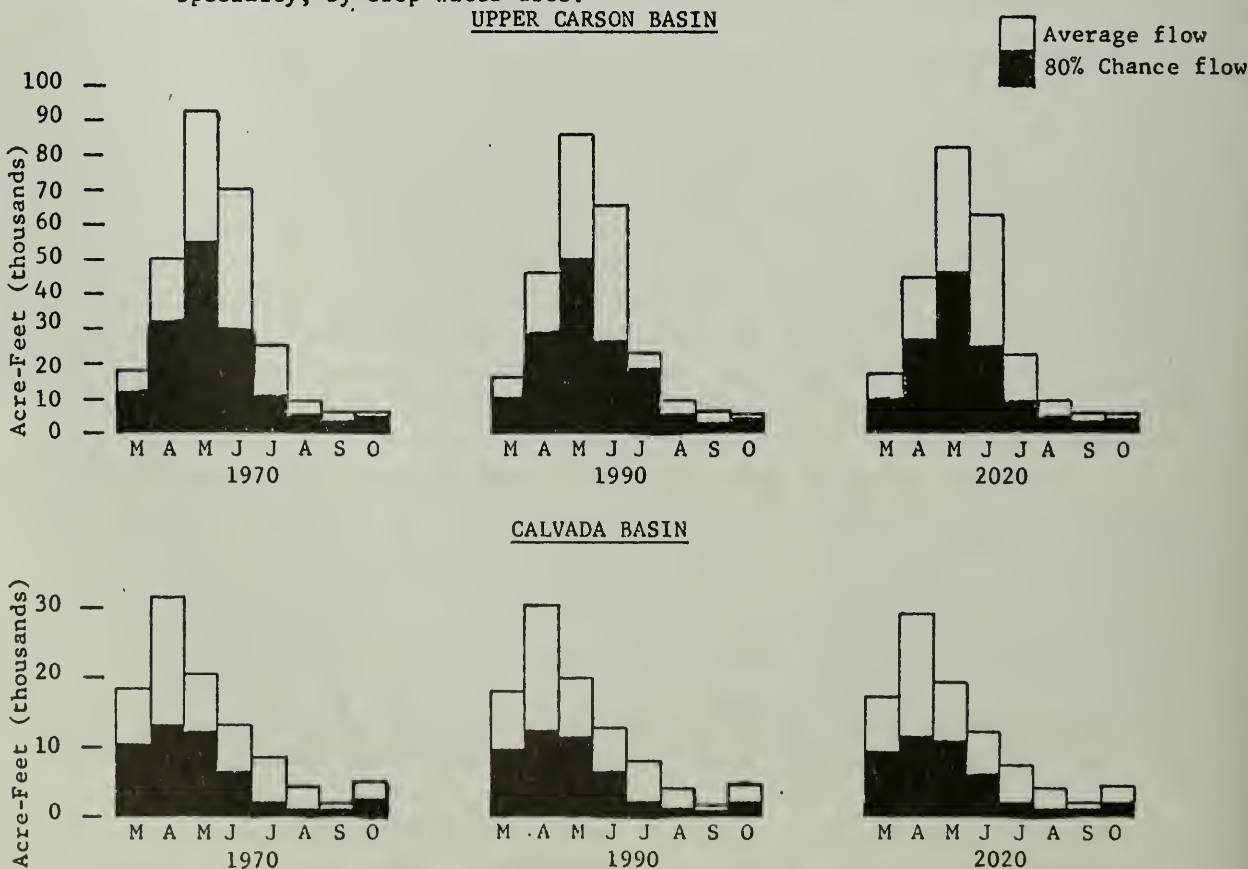


Figure 9 - Stream flow after withdrawal of urban, industrial, geologic commodity, and specialty, by crop water uses.



Water Conservation and Salvage

Irrigation Systems Improvement

Through improved irrigation systems the efficiency of irrigation may be improved. That is, the amount of water diverted from the stream will be less for a given amount consumed by irrigated crops. Water conservation by systems improvements does not necessarily free this water for other uses. Irrigation systems improvements may also result in less depletions from phreatophytes or from water surface evaporation associated with the losses from that location.

Irrigation system improvement needs to be followed by irrigation water management on the individual farms and ranches. The application of irrigation water in accordance with the needs of the soil and crop is essential to achieving total agricultural water management. On-farm installation of properly designed irrigation water management practices can result in significant improvements in irrigation efficiency. Table 74 is a summary of potential land treatment measures for irrigated lands in the Basin. Treatment is separated into conveyance, application, and return systems. Conveyance systems deliver water to the farms. Applications systems are "on farm". They distribute water to individual fields and provide control necessary for application. Return systems provide drainage and water table control; they are both on farm and off farm.

Table 74 - Irrigated Land Treatment potentials, Central Lahontan Basin

Measures	Units	Nevada	California	Total
Conveyance System				
Ditch consolidation	feet	1,012,000	204,600	1,216,600
Ditch realignment	feet	1,159,000	189,000	1,348,000
Ditch lining or piping	feet	505,000	79,400	584,400
Control structures	No.	1,034	72	1,106
Application Systems				
Ditch lining or piping	feet	617,200	725,700	1,342,900
Land leveling or smoothing	acres	65,400	30,800	96,200
Control structures	No.	66,000	33,100	99,100
Water management	acres	187,400	59,900	247,300
Method change	acres	28,500	9,500	38,000
Return Systems				
Open drainage	acres	36,000	30,800	66,800
Closed drainage	acres	54,000	15,200	69,200
Drainage main	feet	264,000	130,000	394,000

The potentials shown on Table 74 are total system needs Some of the measures needed may not be economically feasible on all locations where needed at this time. This is particularly true in areas not having a controlled water supply afforded by reservoir storage. Other measures needed may not be environmentally desirable in specific cases. This is especially true of drainage measures whose impact on downstream water quality should be determined before construction.

The effect of irrigation systems improvements and other water conservation measures on downstream water supply will vary by the location. The Criddle study of potential improvements in the Fallon area showed that an estimated average of 95,000 acre-feet per year could be made available to Pyramid Lake by the reduction of diversions from the Truckee River resulting from the improvements. In the Walker Subbasin it is estimated by the Nevada State Engineer that approximately 50 percent of the reduced diversions in Mason Valley would reach Walker Lake. Improvements in upstream valleys would have a lesser effect on Walker Lake inflow. In Honey Lake Valley irrigation system improvements for the Lassen Irrigation Company system could result in a nearly full season water supply for those lands.

Phreatophyte Control

Water use by phreatophytes may be reduced by either eradicating the plants or by lowering the water table. Eradication may be accomplished by a number of mechanical or chemical means. Because of the relatively low water use per acre of the dominant phreatophyte species in the Basin, large areas would have to be controlled to make a significant impact on the downstream water supply. Areas with the greatest potential for some deliberate means of control could perhaps be in Mason Valley and the Schurz area on the Walker River, and in Churchill Valley on the Carson River. In Mason Valley, control of phreatophytes on 27,000 acres could provide an estimated 16,000 acre-feet of water per year to Walker Lake if the water were allocated to that purpose.

Water savings through water table control might be incidental to improved irrigation with less surface and subsurface runoff, or to increased ground water development for agricultural, municipal, or industrial use. Some of the projected increased use by the mining industry will probably be satisfied in this way. A decrease of phreatophyte use is expected in the Fernley area and in the Lahontan Valley-Carson Sink area as a result of irrigation improvements.

Studies have not been made to determine the economic feasibility of phreatophyte eradication in the Basin. Some phreatophyte control would be accomplished incidental to brush control to improve forage production as well as thorugh the proposed irrigation and drainage practices.

Other Water Conservation and Salvage Measures

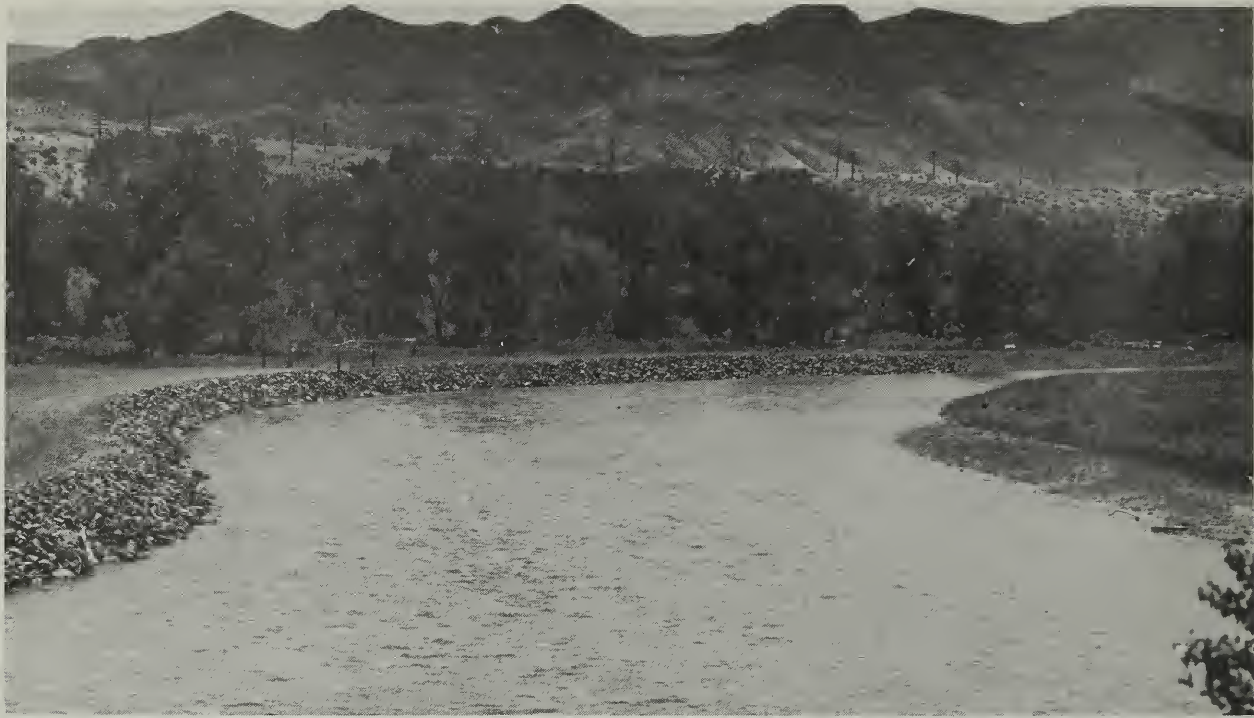
A number of additional proposals, methods, and techniques for augmenting, conserving and salvageing water are available. Some of these are relatively untested or unproven or not economically feasible at this time. Others have proven to be desirable in other areas and should be studied in greater detail for specific cases in the Basin. A brief summary of some of these methods follows.

Evaporation Reduction -- Evaporation from water surfaces may be reduced by reducing the size of the surfaces. This has been proposed for several lakes and reservoirs in the Basin. Detailed studies of the savings and the affects must be made for each individual proposal. Evaporation retardation through various surface coverings is another method of reducing evaporation. At this time, this method is most applicable to small water surface areas and may have potential on some livestock watering facilities in the Basin. Suppression of evaporation from snowpacks may also be possible. The amounts of potential increased runoff and the feasibility of this proposal is currently under study.

Precipitation Management -- Cloud seeding may under certain conditions increase precipitation on the order of 10 to 15 percent. Some of this would be available as increased runoff.

Watershed Management -- Water yields may be increased by conversion of the vegetation on a watershed from a higher to a lower water using type. Conversion from brushland to grassland is a possibility on some lands in the Basin. This will be discussed in greater detail under Land Improvement Measures.

Landscaping for Water Conservation -- About 40 to 50 percent of the water delivered from municipal systems in the Basin is used for the irrigation of lawns. Native vegetation or decorative rock might be used to replace grass on much of this area resulting in considerable water conservation.



Streambank protection such as this on the Truckee River can be carried out on many of the Basin streams and rivers.

This seeded and treated highway fill in the Carson Subbasin will reduce sediment production and erosion. Forest Service photo.

Reuse -- Extensive reuse of water already occurs in the Basin. However, increased reuse will be possible particularly for the agricultural areas using the lower quality return flows from the mining industry and from municipal systems.

Improved Technology -- This is expected to reduce the water requirement of the geologic commodities industry per unit of output and possibly other industries as well. Projections made for the water requirements for geologic commodities (CHAPTER VII) consider the expected effects of improved technology.

Flood Prevention and Sediment Reduction

As described in previous sections, valley areas and some alluvial fan areas in the Basin are subject to frequent floods. These floods have caused costly damages and are a constant threat to human safety. Floods may be prevented by upstream impoundments and land treatment, or they may be controlled by channel improvements and levees. Losses may be reduced by changing existing land use, flood proofing existing buildings and other structures, and by providing emergency warning systems. Future flood losses may be reduced by the prudent location of new buildings and through land use regulations.

Because of the decreasing gradient of mountain streams and rivers as they flow onto the valleys their sediment carrying capacity is reduced. This requires a continual program of channel clearance in some locations to prevent channel aggradation which causes increased flooding. Potential exists for channel improvements and levee construction at some locations on all of the major rivers of the Basin. Improvement of existing levees in some locations is also needed. Such work must always be done with careful consideration for the regime of the stream as well as the weighing of environmental effects of both doing and not doing the work.

Sediment reduction can best be accomplished by those land treatment measures discussed under Land Enhancement. There is also potential for sediment entrapment in all of the proposed impoundments. Proper irrigation water management will reduce sediment from irrigated lands. Construction and mining sites also need controls to reduce sediment production.

Impoundments

Impoundments may serve to satisfy or at least partially satisfy a number of problems and meet a number of needs in the Basin. Reservoir storage may be developed to assist in flood prevention and sediment control. Impoundments are necessary for good water management; they can be used for the regulation of streamflow to meet various needs of downstream users. They may regulate seasonal water supply and may also provide carryover storage to reduce annual variation in flow. The controlled releases may benefit agriculture, municipal and industria users, fish and wildlife, recreation interests, and provide a means of water quality control. The water bodies created by impoundments might be used for recreation, fish, waterfowl, and wildlife.

A number of potential reservoir sites have been identified and are listed on Table 75 and shown on Map 27. The sites shown in some cases provide alternative solutions to problems in the same location. Federal, state, and private interests have proposed and studied various sites for various purposes. Only those sites which have physical potential for PL-566 projects were evaluated for this report. Many of these sites do not possess economic feasibility and are included in this report only to provide physical information and to point out possible use if the need should ever arise. The maximum capacities shown in the table are maximum proposed sizes and may or may not be the maximum size as limited by the site. The major use shown is the proposed use. Future conditions may warrant consideration of the sites for other uses.

There is a high potential for many small reservoir impoundments in the Basin, such as this recreation pond in Carson Subbasin.

Table 75 -- Potential reservoir sites, Central Lahontan Basin

Area	Map No.	Site Name	County	River or Stream	Maximum Surface Area Ac.	Maximum Storage AF	Major Use
CALVADA	1	Said Valley	Lassen	Said Valley Basin	Unknown	3,000	Irr-Rec-FC
	2	Upper Smoke Creek	Lassen	Smoke Creek	1,250	19,450	Irr-Rec-FC
	3	Petes Valley	Lassen	Petes & Willow Cr.	360	25,000	Irr-Rec-FC
	4	McCallister	Lassen	Willow Creek	280	7,900	Irr-Rec-FC
	5	Belfast	Lassen	Willow Creek	142	3,570	Irr-Rec-FC
	6	Piute	Lassen	Piute Creek	80	4,000	FC
	7	Bunnel	Lassen	Susan River	500	2,500	Irr-Rec-FC
	8	Devil's Corral	Lassen	Susan River	50	2,500	Irr-Rec-FC
	9	Poodle Mountain	Washoe	Poodle Canyon	20	210	Irr
	10	Lower Squaw Creek	Washoe	Squaw Creek	75	1,500	Irr-Rec
	11	Buffalo Slough	Washoe	Buffalo Creek	1,700	12,500	Rec-Irr
	12	Smoke Creek	Washoe	Smoke Creek	143	5,790	FC-Rec-Irr
	13	Skedaddle Creek	Washoe	Skedaddle Creek	40	500	Rec-FC
	14	Dry Valley	Washoe	Dry Valley Creek	41	514	FC
	15	Lower Long Valley	Lassen	Long Valley Creek	350	8,830	Irr-Rec-FC
	16	Saralegui	Lassen	Long Valley Creek	585	12,569	Irr-Rec-FC
TRUCKEE	17	Mullen Creek	Washoe	Mullen Creek	290	13,600	FC
	18	Verdi	Washoe	Truckee River	890	37,000	FC-Rec
	19	Dog Creek	Sierra	Dog Creek	29	281	Rec-FC
	20	Bull Ranch	Washoe	Bull Ranch Creek	5	102	FC
	21	West Peavine	Washoe	Unnamed Wash.	26	520	FC
	22	Lawton	Washoe	Truckee River	700	35,000	FC-Rec
	23	Lower Sun Valley	Washoe	Sun Valley Wash	28	300	Rec
	24	Upper Sun Valley	Washoe	Sun Valley Wash	63	1,500	FC-Rec
	25	Biddleman Springs #3	Storey	Unnamed	85	3.560	FC
	26	Biddleman Springs #4	Storey	Unnamed	54	410	FC
	27	Biddleman Springs #2	Storey	Unnamed	42	570	FC
	28	Long Valley Creek	Storey	Long Valley Creek	220	6,390	FC-Rec
	29	Burton Creek	Placer	Burton Creek	24	921	FC-Rec-M&I
	30	Alum Creek	Washoe	Alum Creek	37	810	FC-Rec
	31	Hunter Creek	Washoe	Hunter Creek	8	260	Undetermined
	32	Skyline Wash	Washoe	Skyline Wash	8	126	FC
	33	Golf Course Wash	Washoe	Golf Course Wash	7	164	FC
	34	Evans Creek	Washoe	Evans Creek	42	910	FC-Rec
	35	Lone Tree Wash	Washoe	Lone Tree Wash	7	259	FC
	36	Junkyard Wash	Washoe	Junkyard Wash	11	380	FC
	37	Lower Dry Creek	Washoe	Dry Creek	14	479	FC
	38	Upper Dry Creek	Washoe	Dry Creek	17	621	FC
	39	Thomas Creek	Washoe	Thomas Creek	40	782	FC
	40	Lower Whites Creek	Washoe	Whites Creek	29	500	FC-Rec
	41	Huffaker Hills	Washoe	Steamboat Creek	1,850	17,000	FC-Rec-Irr
	42	Bronco Creek	Washoe	Bronco Creek	8	300	Sediment,Rec
	43	Gray Creek	Nevada	Gray Creek	15	600	Sediment,Rec
	44	Hirschdale	Nevada	Truckee River	520	28,000	FC-Rec
	45	Juniper Creek	Nevada	Juniper Creek.	38	380	Rec
	46	Truckee	Nevada	Truckee River	770	38,000	FC-Rec
	47	Gateway	Placer	Truckee River	320	20,000	FC-Rec
	48	Billy Mack Creek	Nevada	Billy Mack Creek	60	774	FC
	49	Cold Creek	Placer	Cold Creek	56	1,615	FC
	50	Deep Creek	Placer	Deep Creek	19	775	FC
	51	Pole Creek	Placer	Pole Creek	15	647	FC
	52	Silver Creek	Placer	Silver Creek	9	333	FC
	53	Bear Creek	Placer	Bear Creek	52	1,090	FC
	54	Ward Creek	Placer	Ward Creek	83	2,618	FC-Rec
	55	Blackwood Creek	Placer	Blackwood Creek	100	2,186	FC
	56	Meeks Creek	El Dorado	Meeks Creek	70	2,260	M&I-Rec-FC
	57	Lower Griff Creek	Placer	E. Fork Griff Cr.	8	139	FC
	58	Upper Griff Creek	Placer	W. Fork Griff Cr.	12	439	FC-Rec
	59	Second Creek	Washoe	Second Creek	5	124	FC
	60	Third Creek	Washoe	Third Creek	13	225	FC-Rec
	61	Incline Creek	Washoe	Incline Creek	18	400	Rec-FC
	62	Franktown Creek	Washoe	Franktown Creek	160	2,000	FC

Table 75 -- Potential reservoir sites, Central Lahontan Basin

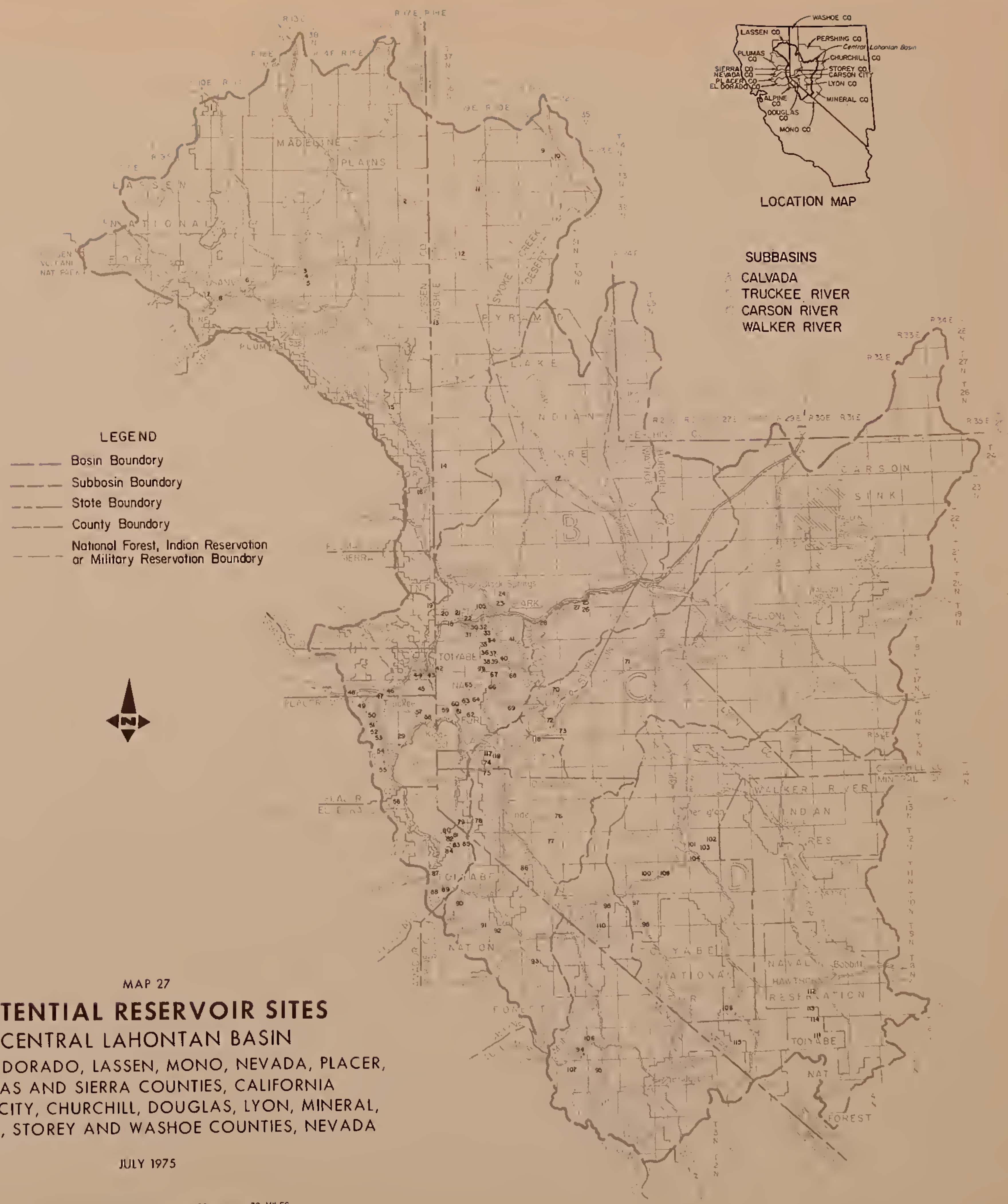
	Map No.	Site Name	County	River or Stream	Maximum Surface Area Ac	Maximum Storage AF	Major Use
	63	Upper Ophir Creek	Washoe	Ophir Creek	24	635	FC-Rec
	64	Lower Ophir Creek	Washoe	Ophir Creek	16	640	FC-Rec
	65	Upper Galena Creek	Washoe	Galena Creek	78	1,300	FC
	66	Brown's Creek	Washoe	Brown's Creek	25	800	Not evaluat
	67	Lower Galena Creek	Washoe	Galena Creek	78	1,300	FC
	68	Bailey Canyon	Washoe	Bailey Canyon	39	1,612	FC
	69	Jumbo	Washoe	Jumbo Creek	23	800	FC
CARSON	70	Six Mile Canyon	Storey	Six Mile Canyon	77	4,110	FC
	71	Ramsey-Silver Springs	Lyon	Ramsey Wash	115	2,300	FC
	72	Gold Canyon	Lyon	Gold Canyon	54	2,520	FC
	73	El Dorado Canyon	Lyon	El Dorado Creek	750	7,150	FC-Rec-Irr
	74	Clear Creek	Carson City	Clear Creek	100	3,180	FC-Rec
	75	Bennett Canyon	Douglas	Unnamed Creek	8	240	M&I-FC
	76	Buckeye Creek	Douglas	Buckeye Creek	96	4,800	FC-Rec
	77	Pine Nut Creek	Douglas	Pine Nut Creek	60	1,820	FC-M&I
	78	Pine Flat	Douglas	Unnamed Creek	13	520	M&I-FC
	79	Edgewood Creek	Douglas	Edgewood Creek	45	1,400	FC-Rec
	80	Upper Truckee-Trout Cr.	El Dorado	Trout Creek	275	600	Sediment Basin
	81	Heavenly Valley Creek	El Dorado	Heavenly Valley Cr	70	850	FC-Rec
	82	Lower Trout Creek	El Dorado	Trout Creek	150	1,500	FC-Rec
	83	Lower Cold Creek	El Dorado	Cold Creek	25	800	FC-Rec
	84	Upper Trout Creek	El Dorado	Trout Creek	200	4,500	FC-Rec
	85	Upper Cold Creek	El Dorado	Cold Creek	80	1,900	FC-Rec
	86	Watashemeau	Douglas	E.Fk. Carson River	1,680	160,000	Rec-Irr-FC
	87	Upper Truckee River #2	El Dorado	U. Truckee River	285	9,400	FC-Rec
	88	Upper Truckee River #1	El Dorado	U. Truckee River	80	2,905	FC-Rec
	89	Big Meadow Creek	El Dorado	Meadow Creek	65	1,092	FC-Rec
	90	Hope Valley	Alpine	W. Fk. Carson River	1,955	100,000	Rec-FC-Irr-M&I
	91	Pleasant Valley	Alpine	Pleasant Valley Cr.	110	3,526	FC
	92	Mount Bullion	Alpine	E. Fk. Carson River	250	20,000	FC
	93	Bagley Valley	Alpine	E. Fk. Carson River	300	12,836	FC
WALKER	94	Leavitt Meadows	Mono	W. Walker River	550	25,000	Irr-FC
	95	Willow Flat	Mono	Little Walker River	226	18,000	Irr-FC
	96	Upper Dalzell Canyon	Lyon	Dalzell Wash	Unknown	2,500	FC
	97	Lower Dalzell Canyon	Lyon	Dalzell Wash	Unknown	935	FC
	98	Hoye	Douglas	W. Walker River	6,200	75,000	Irr-Rec-FC
	99	Upper White's Creek	Washoe	White's Creek	38	1,465	FC-Rec
	100	Moore Lake	Lyon	Saroni Canal	28	275	Rec
	101	Pumpkin Hollow #2	Lyon	Pumpkin Hollow Wash	95	1,400	FC
	102	Pumpkin Hollow #1	Lyon	Pumpkin Hollow Wash	70	700	FC
	103	Pumpkin Hollow #3	Lyon	Pumpkin Hollow Wash	120	1,900	FC-Rec
	104	Strosnider	Lyon	E. Walker River	750	46,000	Irr-FC
	105	Block "N"	Washoe	Evans Creek	27	684	FC-Rec
	106	Pickle Meadow	Mono	W. Walker River	1,550	110,000	I-FC
	107	Roolane	Mono	W. Walker River	500	26,000	I-Rec-FC
	108	Ravenal	Lyon	East Walker River	2,000	40,000	I-FC
	109	Hudson	Lyon	West Walker River	600	42,200	I-FC
	110	Desert Creek	Lyon	Desert Creek	500	1,000	FC-Rec
	111	Alum Canyon	Mineral	Alum Creek	220	1,320	FC
	112	Cory Canyon	Mineral	Cory Creek	500	2,800	FC-M&I
	113	Little Squaw Creek	Mineral	Little Squaw Creek	320	1,920	FC-M&I
	114	North Canyon	Mineral	North Creek	300	1,320	FC
	115	Rough Creek	Mineral	Rough Creek	20	200	I

LEGEND

FC - Flood Control
Irr- Irrigation
M&I- Municipal & Industrial
Rec- Recreation

Potential Reservoir Sites
Central Lahonton Basin

Map No.	Site Name
1.	Sald Valley
2.	Upper Smoke Creek
3.	Pete's Valley
4.	McCallister
5.	Belfast
6.	Piute
7.	Bunnel
8.	Devil's Corral
9.	Poodle Mountain
10.	Lower Squaw Creek
11.	Buffalo Slough
12.	Smoke Creek
13.	Skedaddle Creek
14.	Dry Valley
15.	Lower Long Valley
16.	Saralegui
17.	Mullen Creek
18.	Verdi
19.	Dog Creek
20.	Bull Ranch
21.	West Peavine
22.	Lawton
23.	Lower Sun Valley Creek
24.	Upper Sun Valley Creek
25.	Biddleman Springs #3
26.	Biddleman Springs #4
27.	Biddleman Springs #2
28.	Long Valley Creek
29.	Burton Creek
30.	Alum Creek
31.	Hunter Creek
32.	Skyline Wash
33.	Golf Course Wash
34.	Evans Creek
35.	Lone Tree Wash
36.	Junkyard Wash
37.	Lower Dry Creek
38.	Upper Dry Creek
39.	Thomas Creek
40.	Lower Whites Creek
41.	Huffoker Hills
42.	Bronco Creek
43.	Gray Creek
44.	Hirschdale
45.	Juniper Creek
46.	Truckee
47.	Gateway
48.	Billy Mack Creek
49.	Cold Creek
50.	Deep Creek
51.	Pole Creek
52.	Silver Creek
53.	Bear Creek
54.	Ward Creek
55.	Blackwood Creek
56.	Meeks Creek
57.	Lower Griff Creek
58.	Upper Griff Creek
59.	Second Creek
60.	Third Creek
61.	Incline Creek
62.	Franktown Creek
63.	Upper Ophir Creek
64.	Lower Ophir Creek
65.	Upper Galena Creek
66.	Brown's Creek
67.	Lower Galena Creek
68.	Bailey Canyon
69.	Jumbo
70.	Six Mile Canyon
71.	Ramsey-Silver Springs
72.	Gold Canyon
73.	Eldorado Canyon
74.	Clear Creek
75.	Bennett Canyon
76.	Buckeye Creek
77.	Pine Nut Creek
78.	Pine Flat
79.	Edgewood Creek
80.	Upper Truckee-Trout Creek
81.	Heavenly Valley Creek
82.	Lower Trout Creek
83.	Lower Cold Creek
84.	Upper Trout Creek
85.	Upper Cold Creek
86.	Watasheamu
87.	Upper Truckee River #2
88.	Upper Truckee River #1
89.	Big Meadow Creek
90.	Hope Valley
91.	Pleasant Valley
92.	Mount Bullion
93.	Bagley Valley
94.	Leavitt Meadows
95.	Willow Flat
96.	Upper Dalzell Canyon
97.	Lower Dalzell Canyon
98.	Hoye Canyon
99.	Upper White's Creek
100.	Moore Lake
101.	Pumpkin Hollow #2
102.	Pumpkin Hollow #1
103.	Pumpkin Hollow #3
104.	Strosnider
105.	Block "N"
106.	Pickle Meadows
107.	Koolane
108.	Ravenal
109.	Hudson
110.	Desert Creek
111.	Alum Canyon
112.	Cory Canyon
113.	Little Squaw Creek
114.	North Canyon
115.	Rough Creek
116.	Brunswick
117.	Ash-Kings Canyon
118.	Kings Canyon



MAP 27

POTENTIAL RESERVOIR SITES

CENTRAL LAHONTAN BASIN

ALPINE, EL DORADO, LASSEN, MONO, NEVADA, PLACER, PLUMAS AND SIERRA COUNTIES, CALIFORNIA
CARSON CITY, CHURCHILL, DOUGLAS, LYON, MINERAL, PERSHING, STOREY AND WASHOE COUNTIES, NEVADA

JULY 1975

10 0 10 20 30 MILES
SCALE 1:1,500,000

U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE

M7-PN-23062

Land Improvement Measures

Forage Improvement

It is estimated that out of the Basin's usable range acreage of 6,996,000 acres, about 19 percent or 1,329,000 acres are presently considered to be adequately treated. Estimates of treatment needs still to be applied are shown in Table 76.

Table 76 - Estimates of range management treatment potential on range and grazed woodland by state, Central Lahontan Basin

Item	Nevada	California	Total
	(1,000s acres)		
Total acreage usable range	5,086	1,910	6,996
Adequately treated	1,009	320	1,329
Treatment still needed	4,077	1,590	5,667
Needs protection only	1,589	575	2,164
Needs improvement only	2,011	774	2,785
Brush control and improvement	417	175	592
Reestablishment of vegetative cover	60	66	126
Stockwater developments-number	318	185	503
Fencing - miles	850	370	1,220

Forage Potential

In 1970, the Basin's pasture and rangeland resource was providing about 960,000 AUMs of livestock grazing from about 7.2 million acres of usable range and pasture. About 47 percent of this came from irrigated and semi-irrigated pasture and 53 percent came from the rangelands and grazed woodlands.

A large potential for forage improvement exists in the pinyon-juniper type. The removal of the closely spaced trees followed by seeding of adapted grasses greatly increases forage for livestock and wildlife.

Construction of contour trenches and furrows in burned over wildlands results in reduction of erosion and sedimentation. Forest Service photo.

The Basin's forage resource potential has been calculated to be about 1,362,000 AUMs. Of this total, the pasture resource would provide about 42 percent and the rangelands 58 percent. If this potential was realized, it would result in an overall 42 percent increase in AUMs of forage over that now being provided. Present and potential AUMs of grazing by subbasin are shown in Table 77.

It is estimated that by 2020, about 150,000 acres of usable rangeland and up to 100,000 acres of grazable woodland will be shifted to uses other than grazing. Also, the projected loss of about 46,000 acres of irrigated cropland, of which perhaps 25,000 acres could be irrigated and semi-irrigated pasture would result in a total loss of about 271,000 acres of existing forage producing lands.

Table 77 - Present and potential AUMs of grazing by subbasin and forage resource, Central Lahontan Basin

Subbasin	Present AUMs			Potential AUMs		
	Subbasin Total	Range	Irrigated Pasture	Subbasin Total	Range	Irrigated Pasture
Calvada	301,400	189,200	112,200	433,900	285,000	148,900
Truckee	142,460	102,500	39,960	180,000	152,000	28,000
Carson	253,200	86,200	167,000	405,200	125,200	280,000
Walker	263,100	133,600	129,500	343,200	226,500	116,700
Totals	960,160	511,500	448,600	1,362,300	788,700	573,600

Cropland

About 31 percent of the Basin's tillage rotation lands are adequately treated according to the 1970 Conservation Needs Inventory. Most of the remaining potentials are related to irrigation and drainage which have previously been discussed. Cultural practices are available to reduce problems of wind, sedimentation, poor soil tilth, erosion, and toxic salt reduction. These types of soil improving practices also improve the land appearance, thus enhancing land quality. Means to accomplish this are presently available through various USDA agencies. Table 78 shows the status of the application of major cultural measures relating to cropland that are utilized in the Basin.

Table 78 -- Total lands in tillage rotation, lands adequately treated, and acres with potential for cultural treatment, by county and state, Central Lahontan Basin, 1970-acres.

County	Tillage rotation	Adequately treated	Potential Treatment	
			Cultural measures	Irrigation meas
Churchill	49,281	16,992	4,215	28,074
Carson City	694	207	120	367
Douglas	24,210	3,865	3,612	16,733
Lyon	43,885	17,028	3,772	23,085
Mineral	5,460	800	2,147	2,513
Storey	449	130	76	243
Washoe	21,071	3,582	1,474	16,015
Totals - NV	145,050	42,604	15,416	87,030
Lassen	31,674	14,160	9,720	7,794
Alpine	1,009	266	0	743
Mono	3,687	475	0	3,212
Sierra	2,220	90	0	130
Totals - CA	36,590	14,991	9,720	11,879
Totals-Basin	181,640	57,595	25,136	98,909

The table indicates that about 14 percent of the tillage rotation lands could benefit from cultural measures applied while about 54 percent could benefit from the application of irrigation improvements and improved management.

Watershed Potentials

Land treatment potentials that could improve watershed conditions by reducing erosion and sedimentation and prevent further deterioration of the productive capacity of the soils are:

(1) Critcal sheet erosion stabilization
(2) Gully stabilization
(3) Stream bank stabilization
(4) Rehabilitation of abandoned roads and trails
(5) Mine spoil and borrow area stabilization
(6) Increasing the density of vegetation on areas with deteriorated vegetal cover.

Land treatment potentials that could enhance the water yield capacity of the watersheds are:

(1) Snow pack management in alpine areas
(2) Phreatophyte control
(3) Vegetal manipulation

Management options that would enhance watershed conditions are:

(1) Expanded fire protection forces and facilities
(2) Land uses that are compatible with the land and soil capacities.

Timber Management and Forest Production

The potentials within the Basin to meet the future demand for timber and forest products fall into two categories. One is the biological aspects of contributing to the supply of timber. The other is the industrial aspects of contributing to the supply of wood products to the consumer.

Potentials in the biological contributions to supply are:
(1) Increased area of production
(2) Increased yield per acre
With the increased demand for land for other uses it would appear that the increased yield per acre has the greatest potential for implementation in the Basin.

Potentials in the industrial contribution to supply are:
(1) Utilization of unemployed or underemployed resources
(2) Higher utilization of logging residue
(3) Increased efficiency in log breakdown at the headsaw
(4) Higher utilization of mill residue

Utilization of unemployed and underemployed resources entails development of products and markets for such species as pinyon pine, juniper, and lodgepole pine. Increased efficiency in log breakdown entails some modification of equipment, but mainly it is the use of "thin saws." Thin and ultra thin saws have been developed that reduce saw Kerf to as thin as 3/64". In addition to less Kerf, the thin saws provide much greater accuracy which reduces waste by permitting sawing closer to finished dimensions.

Higher utilization of logging residue entails bringing out and utilizing smaller diameter material and utilizing sound material in defective or what are now considered cull logs.

Increased utilization of logging residue has the potential of increasing the volume output from the same amount of growing stock cut by 4 percent.

Visual Quality

The potential for improving the visual quality of the Basin's land resource is great. Land enhancement techniques have been developed to assist in mitigating the results of man's activities, and have been installed in several locations. Grass seedings on the large earth fills on the Kingsbury Grade Highway; shaping, filling, and seeding of the huge borrow pit which was used for the Washoe Valley freeway, and seeding of ski slopes and highway shoulders in the Lake Tahoe area are some prime examples.

Geologic commodity prospecting and mining as well as untimely land clearing for commercial and residential developments tend to reduce visual quality. Land should not be cleared unless conversion to another use is imminent. Unused borrow and exploration pits should be backfilled and revegetated. Disturbed land should be left with a slope less than the angle of repose. Rubble covering of unused exposed surfaces of tailings or mines will aid native vegetation establishment. This provides an important microenvironment for most plants and in itself obscures the blemish. Convenient receptacles and sites for waste disposal should be provided as well as enforcement of littering laws.

The Basin's farms, ranches, and rural communities generally present a neat appearance. However, there is still a need for ornamental and functional windbreaks, removing unsightly junk and old machinery, and screening other types of rural refuse, such as spoil banks from ditch clearing or drain construction, would add to the attractiveness of the area. There are also many other possibilities that could be listed. Encouraging the community to take such action would result in enhancement of the visual quality of the rural environment.

Fish and Wildlife Development

Potential on Public Lands

The long-term objective should be to provide for optimum fish and wildlife production in keeping with the resource potential. This will involve taking a maximum harvest of fish and wildlife consistent with maintaining healthy, productive populations of the various species. More consideration must also be given to the growing non-consumptive use of fish and wildlife to accomodate the sightseers, photographers and naturalists who wish to view fish and wildlife in their natural habitat.

The land and water resources of the Basin are limited and allocations for consumptive use of these resources should keep in mind the ecological requirements of all fish and wildlife, both game and non-game species. The following discussion relates to planned fish and wildlife habitat objectives and projects which the land management and fish and wildlife management agencies have indicated will be necessary to reach the highest potential for this resource.

Big Game

1. Big game management to be directed toward herd management based on available forage.
2. The wildlife and land-management agencies must improve their methods and techniques in inventory and habitat management.
3. Water development could be considered at every opportunity to meet the needs of wildlife.
4. Zoning ordinances and land withdrawals are needed to prevent the encroachment of subdivisions and other developments on critical big game winter range.
5. Livestock use on critical big game winter range will need to be evaluated and adjusted accordingly to minimize competition.
6. Pinyon-juniper eradication and thinning could be initiated on suitable sites.
7. Improved management, in the form of controlled hunting of both sexes of deer and antelope is needed to balance the populations of these species with range carrying-capacity, particularly winter ranges.
8. Further opportunities for reintroduction to increase the ranges of big horn sheep could be explored.

Upland Game

1. Emphasis could be placed on the development and maintenance of drinking water for upland game.
2. Improvement potentials for sage grouse consist of maintaining critical habitat, protecting existing strutting grounds, developing more water and the restoration and protection of wet meadows.
3. The potential for further introductions of exotic upland game birds such as Himalayan snow partridge, see-see partridge, and turkeys is being explored.
4. There is a potential to improve pheasant habitat on state and federal waterfowl management areas by providing adequate cover and establishing cereal grain food plots.

Waterfowl and Shorebirds

Most of the potential for improving waterfowl and shorebird habitat occurs on lands already dedicated to waterfowl habitat production, i.e., state and federal waterfowl management areas. Improvement is dependent upon more adequate water supplies, improving control over water levels on the management areas and developing or improving waterfowl feeding areas.

Grazing of vegetation adjacent to lakes, streams, marshes, and livestock watering pits, should be regulated to maintain optimum nesting and escape cover. Minimum pools should be maintained in livestock watering pits and reservoirs.

Fish

There is a limited potential for creating new fisheries habitat, therefore efforts should be aimed at maintaining or improving existing habitats. Many streams in the Basin are in need of greater flows, especially in late summer, for optimum fisheries production. There is some potential to build streamflow maintenance dams, where both the quantity and quality of the water released would enhance stream fisheries. There are a few areas where the improvement or construction of fishways would enhance the fishery. A fishway currently being constructed near Pyramid Lake will allow the cutthroat access to spawning areas in the Truckee River. Greater efforts should be made to expand the range of the Lahontan cutthroat trout to waters formerly containg this species.

To prevent stream pollution and sedimentation, stricter controls on logging, grazing, construction, and dumping of sewage are needed. The protection and preservation of floodplains by green-belt or open-space zoning would help to protect the riparian environment and provide adequate fishing opportunities. Many areas are presently in need of streambank stabilization.

Endangered and Non-game Species

Greater emphasis should be given to the management and preservation of endangered species as well as non-game species. The public should be informed of value of all species within the ecosystem so that the ecological requirements of all species can be given consideration during the planning and development of land and water resources.

Fish and Wildlife Development Potential for Privately-Owned Lands

The contribution that privately-owned lands and waters are making or can make to fish and wildlife oriented recreation are included in the appraisal of the Basin's resources. Development on privately-owned lands may be for increased income or for the owner's pleasure.

Fishponds - There is an excellent potential to increase fish production in private ponds.

Fish Production - Many opportunities exist to raise fish commercially in suitable irrigation storage reservoirs and other water impoundments. The size and intensity of the production should be based on projected demands for fish and the available water supply.

Stream Fishing - Some private lands could offer stream fishing or access to public fishing areas. There is some opportunity to improve stream habitat by improving bank cover and installing in-stream structures to create pools and riffles.

Waterfowl - Some potential exists for the development of waterfowl habitat, especially on agricultural lands with alkali or heavy soil texture problems.

Pheasant and Quail - Excellent opportunities exist for increasing pheasant and quail numbers, especially near irrigated land where adequate food and cover can be grown. Pheasant and quail hunting can be offered as part of a recreation package.

Mule Deer and Antelope - Range rehabilitation and grazing management on private lands can benefit both deer and antelope. Properly designed water developments for livestock will benefit big game. Private landowners can offer trespass rights for big game hunting. Lodging and guide services can be offered deer or antelope hunters.

Sage Grouse and Chukar - Trespass rights and services similar to those for deer and antelope hunting can also be offered for sage, grouse, and chukar hunting. Proper management of rangelands will also benefit these species as well as big game.

Ponderosa Ranch, a privately developed recreation facility at Lake Tahoe. Ponderosa Ranch photo.

The sign indicates that these privately owned Walker River bottomlands are open to public fishing through a cooperative agreement with the Nevada Department of Fish and Game.

Recreation

Evaluation of Recreation Land Resources Potential

The Recreation Land Class tabulation showed there are about 7.5 million acres of available land in the Basin that provides some degree of recreation opportunity. The intensity of use these lands can sustain varies greatly between land classes. That is, the 5.6 million acres of Class III natural lands do not support the same intensity of use as the Class I high density recreation lands. The optimum capacity for each land class used in the Basin that will provide a quality recreation experience without site deterioration, by land class, in visitor-days per acre per year is shown in the following tabulation:

Class I	Class II	Class III	Class IV	Class V	Class VI
3,200	1,300	8	1.4	.03	-

The optimum capacity shown in the tabulation can also be referred to as recreational carrying capacity. This is the level of recreation use an area can withstand while providing a sustained quality of recreation. If this carrying capacity is exceeded, site deterioration will occur. In certain areas in the Basin, this is now taking place.

Based on the optimum capacity of visitor-days per acre per year the potential for the lands within the Basin to provide recreation opportunities are listed in the following tabulation:

Vistior Day Per Year by Land Class (1,000s)

I	II	II	IV	V
4,032,438	595,522	45,041	11	4

Private Recreation Potential

It is projected that a large amount of the Basin's recreational needs will have to be met by development of the private sector. About 69 million visitor-days out of the Basin's 2020 demand of 106 million visitor-days will need to be provided by privately developed recreation facilities.

Estimates of potential privately developed recreation activities were made for the Basin's 15 counties based on a numerical rating system developed by the National Association of Conservation Districts. Results of this work are presented in Table 79. Each recreation activity was classed as having low, medium, or high potential. depending on an actual number worked out for each activity.

Table 79 -- Estimate of private recreation potential, by County, Central Lahontan Basin, CA & NV

Activity	NEVADA																				
	Lyon			Mineral			Douglas			Carson City			Storey			Washoe			Churchill		
	H	M	L	H	M	L	H	M	L	H	M	L	H	M	L	H	M	L	H	M	L
Vacation homesites		X			X		X			X			-	-	-		X			X	
Campgrounds	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vacation sites		X			X		X				X		-	-	-		X		X		
Pack Trips			X		X		X				X		-	-	-		X		-	-	-
Transient		X			X		X			X			-	-	-		X				X
Picnic and field game	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sport areas	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Play and Target		X				X	X			X			-	-	-		X			X	
Bicycling		X				X	X				X		-	-	-		X			X	
Picnicking		X				X	X				X			X			X			X	
Fishing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Warm Water		X				X	-	-	-			X	-	-	-		X			X	
Cold Water		X				X		X			X			X			X		-	-	-
Golf Courses	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Standard		X			X		X			X			-	-	-	X				X	
Driving Range			X			X	X			X			-	-	-		X			X	
Hunting	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Small game		X			X			X				X		X			X			X	
Big game		X			X				X	-	-	-		X			X				X
Waterfowl	X					X		X				X	-	-	-		X		X		
Natural, Scenic, and historic areas	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Natural	-	-	-		X		X		X					X		X			X		
Scenic	-	-	-		X		X			X				X		X				X	
Historic	-	-	-		X			X		X			X				X				X
Riding Stables		X2/			X2/		-	-	-	-	-	-	X			X				X	
Shooting Preserves	X				X2/		X			-	-	-	-	-	-	-	-	-		X	
Vacation Farms & Ranches	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Farms	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ranches	-	-	-	-	-	-	X			-	-	-	-	-	-	X			-	-	-
Water Sports	-	-	-			X		X			X		-	-	-		X			X	
Winter Sports			X2/	-	-	-	X				X		-	-	-	X			-	-	-

Activity	CALIFORNIA																							
	Placer			Nevada			El Dorado			Lassen			Sierra			Plumas			Alpine			Mono		
	H	M	L	H	M	L	H	M	L	H	M	L	H	M	L	H	M	L	H	M	L	H	M	L
Vacation homesites	X			X			X			X				X					X				X	
Campgrounds	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-	-	-	-	-	-
Vacation sites	X			X			X			X					X				X				X	
Pack Trips	X				X		X				X		X				No		X			X		
Transient	X			X			X			X				X					X				X	
Picnic and field game	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-	-	-	-	-	-
Sport areas	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-	-	-	-	-	-
Play and Target		X				X		X		X					X		Private			X			X2/	
Bicycling		X				X		X			X				X					X			X2/	
Picnicking	X			X			X			X			X							X			X2/	
Fishing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-	-	-	-	-	-
Warm Water		X			X		X				X						Land		-	-	-	-	-	-
Cold Water	X			X			X			X			X						X				X	
Golf Courses	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-	-	-	-	-	-
Standard		X			X		X				X				X				-	-	-		X2/	
Driving Range		X			X		X				X				X				-	-	-		X2/	
Hunting	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-	-	-	-	-	-
Small game	X1/				X		X1/			X				X					-	-	-		X	
Big game	X				X		X			X				X						X		X		
Waterfowl	X1/			-	-	-		X1/		X					X				-	-	-		X	
Natural, Scenic, and historic areas	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-	-	-	-	-	-
Natural	X			X			X			X				X						X		X		
Scenic	X			X			X			X			X						X			X		
Historic	X			X			X			X				X						X			X	
Riding Stables	X			X			X				X			X						X			X2/	
Shooting Preserves	X1/			X1/			X1/				X				X				-	-	-		X2/	
Vacation Farms & Ranches	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-	-	-	-	-	-
Farms		X1/		-	-	-	X1/			X			-	-	-				-	-	-	-	-	-
Ranches			X		X		X			X				X					X			X		
Water Sports		X		X			X				X		X							X			X	
Winter Sports	X			X			X				X		X						X				X	

H - High Potential, L - Low potential, M - Medium potential 1/ Does not apply to subbasin 2/ Limiting factor

In some cases, as shown in the table, there is no rating given for an activity. This means the potential for this type of activity was so low that it was not rated. In other places, because of a limiting factor, there is no rating. In these cases, there is a key element that prohibits this type of activity, and therefore the activity has no potential until the limiting factor is removed.

The counties comprising the Sierra Nevada-Douglas, Placer, Nevada, El Dorado, Alpine and Lassen-all rate high for vacation cabins, vacation sites, and natural scenic and historic areas. Winter sports rate high in Douglas, Placer, Nevada, El Dorado, and Alpine, while a high rating for water sports is found in Nevada, El Dorado, and Sierra. El Dorado, Washoe, Carson City, and Douglas rate high for standard golf courses. All the California Counties rate high in cold water fishing except for Mono which rates as medium. The Nevada counties rated mostly medium in this category. Shooting preserves rated high in Lyon and Douglas Counties and medium in Lassen County. A high rating for vacation farms and ranches was noted for Douglas, Washoe, El Dorado, Lassen, Alpine, and Mono Counties. Except for high ratings for historic areas and riding stables, Storey County appears to present the lowest potential in the Basin for private recreation development while Mineral County, with no high ratings at all, also reflects a low overall potential.

Planned Non-Federal Developments

Potential recreation facilities and developments to meet the demand have become of increased interest and concern to county, state and city officials, as well as private interests. County officials through the Council of Governments groups or through their own facilities are developing recreation plans to meet the recreational needs of the counties and cities. These plans will set forth recommendations for review and possible action by the city and county governing boards.

Some of the short range general objectives of these plans are:

(1) To acquire land for future recreational development
(2) To establish green belts and open space areas
(3) To develop the present recreation sites

An example of these plans would be the City of Reno annually appropriating 20,000 dollars for beautification of the city-owned lakes. In addition, the long-range plans for Reno and Sparks call for the development of 33 recreational facilities for various activities including community parks, playgrounds, ball fields, a golf course, and tennis courts.

Expansion of the present ski resorts, and development of new areas in the Sierra Nevada are anticipated private developments. The Nevada Division of State Parks plans for the addition of land to Lake Tahoe State Park through purchase of 12,000 acres of land in the Lake Tahoe Basin. The Department of Parks and Recreation in California will expand their State Parks System when circumstances permit the acquisition of suitable areas with park value.

Pyramid Lake Indian Reservation

From past feasibility studies and current observations, Pyramid Lake represents potentially one of the largest and most inviting water-oriented recreational areas in the country. In the Paiute Indian tribe's opinion, the scale of development opportunities appear to dictate negotiation with a substantial, well-financed concern capable of creating facilities which would take advantage of the recreational market possibilities.

Full utilization of the water in the lake requires the building of a fishway up the Truckee River from the lake and construction of marinas, beaches, and other facilities. Full utilizaton of the commercial recreation area requires the building of motels, restaurants and highway business areas.

In the following tabulation, the Bureau of Indian Afairs indicates the potential increased annual land rent and fees that could be generated from total project development on the Pyramid Lake Reservation.

Source	1975 (dollars)	1980 (dollars)	1985 (dollars)
Marinas	9,000	20,000	30,000
Motels	12,500	25,000	60,000
Trailer Parks	1,500	3,000	6,000
Highway Business Areas	15,000	17,500	35,000
Parks and Campsites	15,000	45,000	85,000
Fishway	65,000	95,000	115,000
Shopping Center	-	30,000	100,000
Residential Land	-	10,000	30,000
Agriculture	-	50,000	125,000

Geologic Commodities

The future demand for land and water in the geologic commodities industry can be met only by shifts from other land and water uses. The principal need for additional land and water is in the Yerington area. It is projected that this area will produce about half the revenue and employment for the mining industry. Shifts in present use of resources are essential to accommodate the additional requirements as all land and water is presently being used. This is a complex situation requiring additional study. Any solution will require cooperative planning between agriculture, mining, and the urban community.

USDA could assist the industry in the following activities:

1. Downstream water quality control with better upstream use and management of return flow water used by the industry.
2. Specialized uses of salvaged water to produce high salt-tolerant vegetation.
3. Water conservation landscaping methods. An example would be development of xerophilous plant materials for landscape beautification.
4. Visual quality control through use of plant materials for screening or obscuring purposes.
5. Environmental improvement using plant materials for windbreaks and noise abatement.
6. Resource conservation using erosion control practices.

Other Agencies

The Cooperative Extension Service, the Agricultural Stabilization and Conservation Service, and the Farmers Home Administration have excellent opportunities to assist in the implementation of the USDA Plan by accelerating their programs of technical and financial assistance.

The Extension Service Educational programs are designed to accelerate land treatment programs for cropland and rangeland. Improved methods of planting, harvesting, storage, marketing, and animal feeding are needed to increase the output as projected.

The ASCS County Committee investment plan concept would be very useful in setting county priorities for funding the water conservation and land treatment practices that are projected. County Committees in most of the Basin's counties have been emphasizing these types of practices for several years. Their proposed program for long-term agreements with land owners and operators for conservation work will help insure the continuation of the work in the future.

The FmHA programs will be of great help in the implementation of the RC&D Project measures. Financial and advisory assistance will be needed in the development and marketing of forest products. The planned development of small business and industries, improved community services, and recreational facilities will provide an increasing demand for this type of service.

Watershed Project Potentials

Potentials for PL-566

The Basin was delineated into 63 watersheds, which are shown on Map 28. Significant resource problems in each unit were analyzed to determine if problems could be alleviated by locally-initiated project-type action. Fourteen of these watersheds were determined to have potential for treatment under the provisions of Public Law 566. The watersheds are:

Calvada Subbasin
- Susan River
- Willow Creek
- Piute Creek

Truckee Subbasin
- Southwest Reno
- Sun Valley
- Galena Creek
- Incline Village
- Block N

Carson Subbasin
- West Fork Carson River
- Carson City

Walker Subbasin
- Pumpkin Hollow
- Smith Valley-Desert Creek
- W. Walker-Antelope Valley
- Bridgeport

These fourteen watersheds were studied in moderate detail and benefits and costs were developed. They are discussed in detail as components of the USDA Plan in CHAPTER X.

For the remaining 49 watersheds, only certain significant problem areas were studied. These studies are termed Watershed Study Areas, and present potential measures that could assist in alleviation of the described problem. Benefits and costs were not determined. Watershed Study Areas may not now be suitable for treatment under PL-566, but they may be eligible for treatment under other USDA programs.

Reconnaissance data for the 63 watersheds delineated on the map are shown in Table 80.

U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE

LEGEND

CALVADA

1. Madeline-Grasshopper
2. Red Rock-Buckhorn
3. Ravendale
4. Buffalo Hills
5. Squaw Valley
6. Eagle Lake Area
7. Willow Creek
8. Smoke Creek
9. Secret Valley
10. Smoke Creek Desert Area
11. Susan River
11a. Piute Creek
12. Wendell-Flanigan
13. Baxter Creek
14. Doyle-Milford
15. Upper Long Valley
16. Fish Springs
17. Honey Lake Area

TRUCKEE

18. Pyramid Lake-Fernley Area
19. Warm Springs Valley
20. Sutcliffe
21. Lemmon Valley
22. Spanish Springs Valley
23. Sun Valley
24. Block N
25. Peavine
26. Golden Valley
27. Truckee-Verdi Area
28. Long Valley-Biddleman
29. Southwest Reno
30. Galena Creek
31. Washoe Valley
32. Squaw Valley-Donner Lake
33. Incline Village
34. North Lake Tahoe
35. Tahoe Area
36. West Lake Tahoe
37. South Lake Tahoe

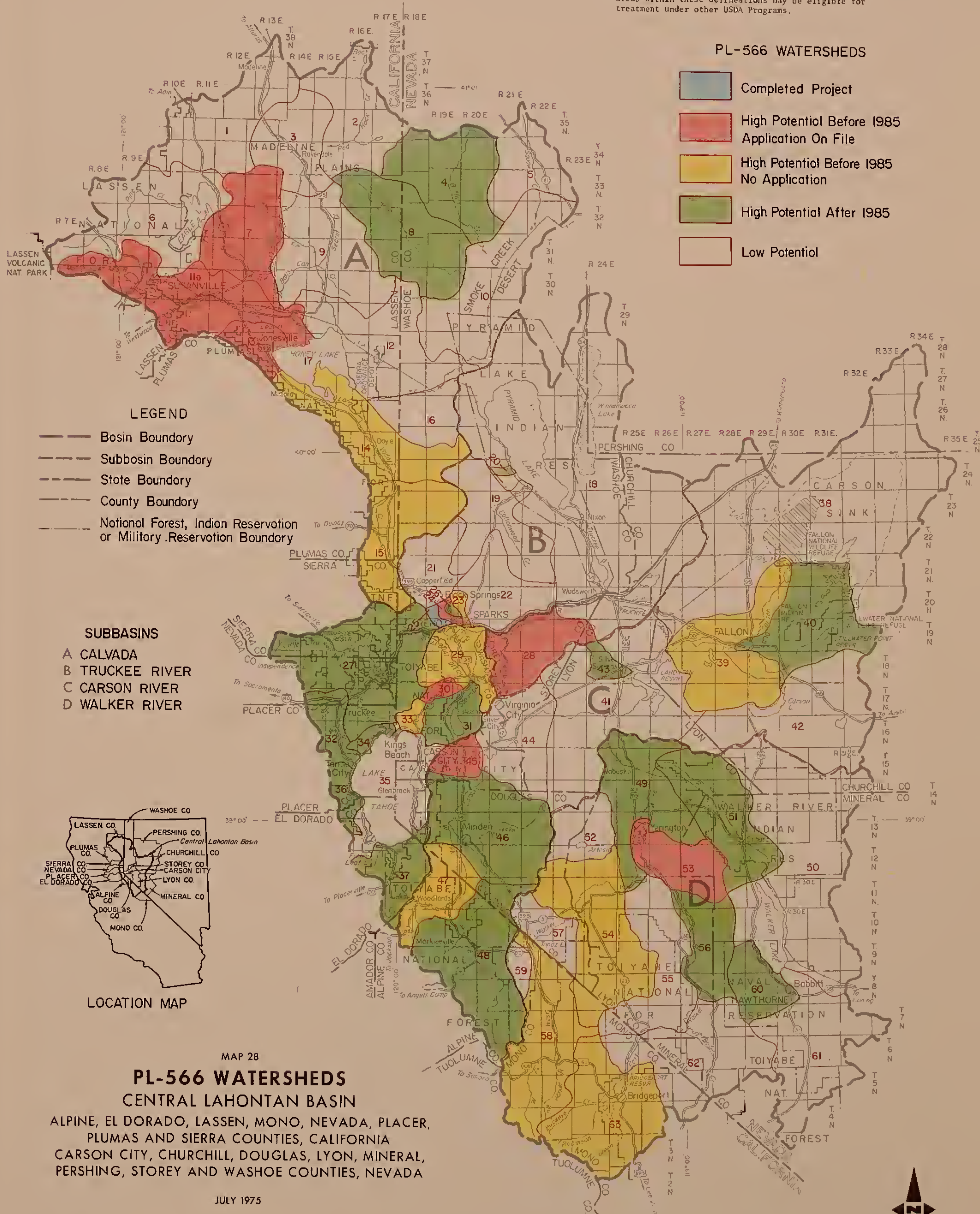
CARSON

38. Carson Sink Area
39. Fallon West
40. Fallon East
41. Lahontan Area
42. Carson Lake
43. Ramsey-Silver Springs
44. Dayton
45. Carson City
46. Carson Valley
47. West Carson
48. East Carson

WALKER

49. Mason Valley
50. Rawhide-Walker Lake
51. Schurz
52. Artesia
53. Pumpkin Hollow-Southwest Mason Valley
54. Smith Valley-Desert Creek
55. Sweetwater
56. Wheeler Pass
57. Antelope Valley, Nevada
58. West Walker-Antelope Valley
59. Slinkard Valley
60. Mt. Grant
61. Whiskey Flat
62. East Walker
63. Bridgeport

Note: Units identified as "Area" are too large or otherwise not suitable for treatment under PL-566. Problem areas within these delineations may be eligible for treatment under other USDA Programs.



MAP 28

PL-566 WATERSHEDS

CENTRAL LAHONTAN BASIN

ALPINE, EL DORADO, LASSEN, MONO, NEVADA, PLACER, PLUMAS AND SIERRA COUNTIES, CALIFORNIA

CARSON CITY, CHURCHILL, DOUGLAS, LYON, MINERAL, PERSHING, STOREY AND WASHOE COUNTIES, NEVADA

JULY 1975

10 0 10 20 30 MILES

SCALE 1:1,200,000

M7-PN-23168

Table 80 - Summary of small watershed reconnaissance data, Central Lahontan Basin

Note: Units identified as "Area" are too large or otherwise not suitable for treatment under PL-566, Problem areas within these delineations may be eligible for treatment under other USDA programs.

1	2	3	4	5	6	7	8	9	10	11	12	13			14
												Potential for project action			
Watershed	Map Number	Acreage total	California acreage	Nevada acreage	Irrigated Land Total	California Irrigated Land	Nevada Irrigated Land	Operating units California	Operating units Nevada	Location County (s) State (s)	Population areas	Before 1985	After 1985	Low to none	Major watershed needs (see codes)
Madeline-Grasshopper	1	214,408	214,408	0	4,115	4,115	0	14	0	Lassen, CA	Madeline, Moon Valley			X	Rec, F&W, L.T.
Red Rock-Buckhorn	2	168,582	166,581	2,001	4,691	4,691	0	9	0	Lassen, CA Washoe, NV	None			X	Irr., S.I. F&W,
Ravendale	3	127,259	127,259	0	1,800	1,800	0	6	0	Lassen, CA	Ravendale, Thermo			X	L.T.
Buffalo Hills	4	204,409	11,368	192,041	515	350	165	1	1	Lassen, CA Washoe, NV	None		X		F.P., Irr. W.S., Rec. L.T.
Squaw Valley	5	123,590	0	123,590	384	0	384	0	4	Washoe, NV	None			X	Irr., W.S. Rec., Er.C
Eagle Lake Area	6	256,772	256,772	0	1,650	1,650	0	2	0	Lassen, CA	Eagle Lake resorts			X	L.T.
Willow Creek	7	170,261	170,261	0	11,865	11,865	0	7	0	Lassen, CA	None	X1/			Irr. W.S., S.I., Rec. Er.C.
Smoke Creek	8	214,630	102,941	111,689	1,360	440	920	0	1	Lassen, CA Washoe, NV	None		X		Irr. W.S., Rec., ..T. Er.C.
Secret Valley	9	233,427	233,427	0	2,390	2,390	0	7	0	Lassen, CA	Karlo			X	Irr. W.S., Irr. S.I., Rec., Er.C
Smoke Creek Desert Area	10	261,043	0	261,043	131	0	131	0	1	Washoe, NV	None			X	F&W
Susan River	11	189,229	189,229	0	23,761	23,761	0	145	0	Lassen, CA Plumas, CA	Susanville, Johnstonville, Litchfield Standish	X1/			F.P., Irr. W.S., Irr. S.I., Dr., L.T.
Puite Creek	11a	23,059	23,059	0	296	296	0		0	Lassen, CA	Susanville	X			F.P.

Table 80 - Continued

1	2	3	4	5	6	7	8	9	10	11	12	13			14
												Potential for Project Action			
Watershed	Map Number	Acreage Total	California Acreage	Nevada Acreage	Irrigated Land Total	California Irrigated Land	Nevada Irrigated Land	Operating Units California	Operating Units Nevada	Location County (s) State (s)	Population Areas	Before 1985	After 1985	Low to None	Major watershed needs (see codes)
Wendell - Flanigan	12	249,526	169,785	79,741	4,210	4,210	0	0	0	Lassen, CA Washoe, NV	Sierra Army Depot			X	F.P., Rec. F&W
Baxter Creek	13	28.500	28,500	0	4,140	4,140	0	14	1	Lassen, CA Plumas, CA	Janesville, Buntingville	X1/			F.P., Irr. W.S., F&W, L.T., Er.C.
Doyle - Milford	14	213,499	164,341	49,158	7,772	7,672	100	17	1	Lassen, CA Plumas, CA Washoe, NV	Doyle, Herlong, Milford	X			Irr.S.W., Irr.S.I., Rec., F&W, L.T., Er.C
Upper Long Valley	15	166,887	88,638	78,249	3,870	3,616	254	6	2	Lassen, Plumas, Sierra CA, Washoe NV	Hallelujah Jct. Rancho Haven	X			Irr.S.I., Irr.W.S., Rec., F&W, L.T., Er.C
Fish Springs	16	85,131	15,743	69,388	385	0	385	0	1	Lassen, CA Washoe, NV	None			X	L.T., Er.C
Honey Lake	17	58,198	58,198	0	0	0	0	0	0	Lassen, CA	---			X	---
TOTALS		2,988,410	2,021,510	966,900	72,592	70,253	2,339	234	11						
TRUCKEE			0												
Pyramid Lake-Fernley Area	18	961,076	0	961,076	4,110	0	4,110	0	65	Churchill, Lyon, Storey Washoe, NV	Nixon, Fernley, Wadsworth			X	L.T.
Warm Springs Valley	19	183,990	0	183,990	800	0	800	0	4	Washoe, NV	None			X	L.T., ER.C.
Sutcliffe	20	7,980	0	7,980	0	0	0	0	1	Washoe, NV	Sutcliffe		X		F.P., Er.C.
Lemmon Valley	21	81,700	0	81,700	200	0	200	0	3	Washoe, NV	Lemmon Valley			X	L.T.
Spanish Springs Valley	22	114,580	0	114,580	2,680	0	2,680	0	7	Washoe, NV	None			X	L.T.
Sun Valley	23	15,540	0	15,540	0	0	0	0	0	Washoe, NV	Sun Valley, Sparks	X			F.P., L.T., Er.C.
Block N	24	2,990	0	2,990	100	0	100	0	1	Washoe, NV	Reno	X1/			F.P., L.T.
Peavine	25	6,300	0	6,300	0	0	0	0	0	Washoe, NV	Reno	comp.			
Golden Valley	26	5,700	0	5,700	0	0	0	0	0	Washoe, NV	Golden Valley Lemmon Valley		X		F.P.
Truckee - Verdi Area	27	288,950	227,906	61,004	6,170	5,250	920	17	14	Nevada, Placer, Sierra, CA Washoe, NV	Truckee, Verdi		X		Er.C.,
Long Valley - Biddleman	28	106,200	0	106,200	1,610	0	1,610	0	5	Lyon, Storey, NV	Clark Sta. Lockwood	X1/			F.P., Er.C.

1	2	3	4	5	6	7	8	9	10	11	12	13			14
Southwest Reno	29	84,700	0	84,700	17,622	0	17,622	0	110	Washoe, NV	Reno, Truckee Meadows	X			F.P., L.T.
Galena Creek	30	12,563	0	12,563	870	0	870	0	5	Washoe, NV	Pleasant Valley	X1/			F.P., Er.C. L.T.
Washoe Valley	31	59,400	0	59,400	4,500	0	4,500	0	30	Washoe, NV	Washoe City, New Washoe City		X		Irr.S.I., Irr.W.S., F&W, F.P.
Squaw Valley-Donner Lake	32	49,820	49,820	0	100	100	0	2	0	Nevada, Placer, CA	Squaw Valley, Alpine Meadows, Donner Lake		X		F.P., Er.C.
Incline Vil.	33	14,000	0	14,000	40	0	40	0	0	Washoe, NV	Incline Village	X			F.P., Er.C.
North Lake Tahoe	34	18,650	18,650	0	0	0	0	3	0	Placer, CA	Kings Beach		X		F.P., Ec.C.
Tahoe Area	35	176,780	111,569	65,211	680	230	450	7	5	ElDorado, Placer, CA Carson City, Douglas, Washoe, NV	Glenbrook, Zephyr Cove			X	Er.C.
West Lake Tahoe	36	34,670	34,670	0	180	180	0	5	0	ElDorado Placer, CA	Sunnyside, Meeks Bay		X		Er.C.
South Lake Tahoe	37	79,860	75,360	4,500	1,920	1,870	50	5	1	Alpine, El Dorado, CA Douglas, NV	So.Lake Tahoe, Stateline		X		F&W, Er.C.
TOTALS -		2,305,449	517,975	1,787,474	41,582	7,630	33,952	39	251						
CARSON Carson Sink Area	38	814,169	0	814,169	2,300	0	2,300	0	2	Churchill, Lyon, Pershing, NV	None			X	F&W
Fallon West	39	222,800	0	222,800	25,600	0	25,600	0	416	Churchill, NV	Fallon	X			Irr.S.I.
Fallon East	40	190,380	0	190,380	41,400	0	41,400	0	294	Churchill, NV	Fallon Navy Base, Fallon		X		Irr.S.I., F&W
Lahontan Area	41	347,472	0	347,472	1,150	0	1,150	0	5	Churchill, Douglas, Lyon, Storey NV	Weeks			X	Er.C.
Carson Lake Area	42	298,056	0	298,056	3,650	0	3,650	0	3	Churchill, Lyon, NV	None			X	F&W, Er.C.
Ramsey - SilverSprings	43	30,803	0	30,803	515	0	515	0	15	Lyon, NV	Silver Springs		X		F.P, Er.C.

Table 80 - Continued

1	2	3	4	5	6	7	8	9	10	11	12	13			14
												Potential for Project Action			
Watershed	Map Number	Acreage Total	California Acreage	Nevada Acreage	Irrigated Land Total	California Irrigated Land	Nevada Irrigated Land	Operating Units California	Operating Units Nevada	Location County (s) State (s)	Population Areas	Before 1985	After 1985	Low to None	Major water-shed needs (see codes)
Dayton	44	144,623	0	144,623	1,902	0	1,902	0	14	Carson City, Douglas, Storey, NV	Dayton, Gold Hill, Silver City, Virginia City			X	F.P., Irr., W.S., ErC.
Carson City	45	30,220	0	30,220	1,700	0	1,700	0	8	Carson City, NV	Carson City	X1/			F.P., Rec., M&I, Er.C., L.T.
Carson Valley	46	232,117	4,480	227,637	37,038	0	37,038	0	78	Carson City, Douglas, NV	Genoa, Minden, Gardnerville		X		F.P., Irr. S.I., DR., Er.C., L.T.
West Carson	47	95,438	81,370	14,068	12,916	5,796	7,120	20	15	Alpine, CA Douglas, NV	Woodfords	X			F.P., Irr. WS, Rec., F&W, Er.C.
East Carson	48	227,832	204,280	23,552	2,110	2,110	0	5	10	Alpine, CA Douglas, NV	Markleeville		X		F.P., Irr. WS, Rec., Er.C., F&W
TOTALS -		2,633,910	290,130	2,343,780	130,281	7,906	122,375	25	860						
WALKER															
Mason Valley	49	188,790	0	188,790	30,781	0	30,781	0	106	Lyon, NV	Weed Hts., Wabuska, Mason		X		F.P., DR.
Rawhide - Walker Lake Area	50	559,622	0	559,622	0	0	0	0	0	Churchill, Lyon, Mineral, NV	NAD industrial area			X	F.P.
Schurz	51	175,545	0	175,545	6,280	0	6,280	0	53	Lyon, Mineral, NV	Schurz		X		F.P., Irr. WS
Artesia	52	82,974	0	82,974	3,850	0	3,850	0	8	Douglas, Lyon, NV	None			X	F.P., Irr. W.S.
Pumpkin Hollow-Southeast Mason Valley	53	96,500	0	96,500	13,480	0	13,480	0	90	Lyon, Mineral, NV	Yerington	X1/			F.P., Irr. S.I., Rec.
Smith Valley - Desert Creek	54	240,389	24,755	215,634	18,559	0	18,559	0	83	Mono, CA Douglas, Lyon, NV	Wellington, Smith	X			F.P., Irr. S.I., Rec.
Sweetwater	55	186,796	15,416	171,380	2,811	0	2,811	0	6	Mono, CA Lyon, NV	None			X	F.P.
Wheeler Pass	56	98,885	0	98,885	2,824	0	2,824	0	6	Mineral, Lyon, NV	None		X		F.P.
Antelope Valley	57	73,576	0	73,576	1,090	0	1,090	0	3	Douglas, NV	Topaz Lake Holbrook Jct.			X	F.P.
West Walker-Antelope Valley	58	220,762	220,762	0	16,760	16,760	0	38	0	Mono, CA	Coleville, Topaz Lake, Walker USMC-MWTC	X			F.P., Irr. W.S.&S.I., Rec., Dr., L.T.

1	2	3	4	5	6	7	8	9	10	11	12	13			14
Slinkard Valley	59	19,351	19,351	0	320	320	0	2	0	Mono, CA	None			X	F.P.
Mt. Grant	60	146,370	0	146,370	40	0	40	0	1	Mineral, NV	Hawthorne BabbittNAD		X		F.P., M&I
Whiskey Flat	61	161,145	0	161,145	100	0	100	0	2	Mineral, NV	NAD industrial Area			X	F.P., L.T.
East Walker	62	246,263	78,728	167,535	1,953	0	1,953	0	4	Mono, CA Douglas, Mineral, NV	Bodie Fletcher			X	F.P., Rec.
Bridgeport	63	236,688	236,688	0	21,020	21,020	0	22	0	Mono, CA	Bridgeport Twin Lakes	X			F.P., Irr. S.I., Rec., Dr, L.T.
TOTALS - WALKER		2,733,656	595,700	2,137,956	119,868	38,100	81,768	62	362						
TOTALS - BASIN		10,661,425	3,425,315	7,236,110	364,323	123,894	240,429	360	1,484	1/ Application on file					

* Projects discussed in detail in CHAPTER X

Codes for Needs of Watersheds

DR.- Drainage
Er.C.- Erosion Control
F&W - Fish and Wildlife Enhancement
F.P. Flood Protection
Irr.S.I.- Irrigation System Improvement
Irr.W.S.- Irrigation Water Storage
L.T.- Land Treatment
M&I - Municipal and Industrial Water
Rec.- Water Based Recreation

Watershed Study Areas

Calvada Subbasin

Baxter Creek

Baxter Creek watershed covers about 28,500 acres in the southern portion of Lassen County. The creek flows into Honey Lake. Approximately 4.2 miles upstream from Honey Lake, Baxter Creek divides and forms two channels known as "Deep Cut" and "Old Baxter Creek." The gradient of Deep Cut channel is much steeper than Old Baxter Creek and a serious channel and streambank erosion problem exists along it. In the three year period of 1969-1972, an estimated 28,500 cubic yards have been eroded from one section of channel.

Flood damage occurs about fifty percent of the time. Structural improvements are needed which can reduce the damage. No reservoir sites were found which could assist in alleviating these problems.

To reduce the erosion, sediment and flood problems, a series of drop structures and associated measures are needed to stabilize the creek channel. A project measure, developed for the North Cal-Neva RC&D Project, indicates that these problems can be alleviated by installation of ten drop structures, 6,800 feet of rip-rap, 5,800 feet of low levee, 32,500 feet of willow plantings and twenty acres of grass plantings.

Upper Long Valley

This watershed covers 166,887 acres in Nevada and California involving the Long Valley Creek drainage in Lassen, Sierra, and Washoe Counties. Problems are streambank erosion and degradation of the main channel from uncontrolled high flows and sediment deposition. Irrigation water shortages on the croplands, and lack of water-based recreation developments in the immediate area are also problems. All of these problems could be reduced by installation of a water storage structure at the Saralegui dam site on Long Valley Creek. This structure would control about 170 square miles of drainage, provide 12,569 acre-feet of total storage, and form a lake with a maximum surface of 585 acres. Supplemental irrigation water could be furnished to about 3,000 acres of existing cropland below the damsite. Studies at the proposed reservoir site have shown that major wildlife problems may be encountered.

Smoke Creek

This watershed covers about 215,000 acres bordering the west edge of the Smoke Creek Desert. It includes the Smoke Creek and Rush Creek drainages which head in California and course southeasterly into Nevada. Both creeks are mostly perennial with the largest flows occurring in the winter and spring months. They yield about 12,000 acre-feet of streamflow annually, much of which eventually evaporates from the Smoke Creek Desert playa. About 1,300 acres of meadowland are irrigated by this streamflow, which is supplemented in the summer by a 1,200 acre-foot reservoir. A 5,790 acre-foot dam site has been located on the lower reaches of Smoke Creek. This dam and reservoir could provide a spectacular flat water recreation development in an area almost totally devoid of this type of resource, and also provide flood protection to a large block of private land below the site. The reservoir surface would cover 143 acres. The dam would control 242 square miles of drainage area, and would provide beneficial use of a water resource that is at present only slightly utilized.

Buffalo Hills

This watershed centers around Buffalo Creek which, like Smoke Creek, is perennial and contributes a significant annual flow to the Smoke Creek Desert playa where it is lost through evaporation. The watershed covers about 204,000 acres and the estimated annual flow is in the neighborhood of 10,000 acre-feet. Less than 200 acre-feet per year are now being used for irrigation. An excellent dam site has been located that would store most of the annual runoff, provide flood protection, irrigation water, and an excellent recreation development. The dam would control 162 square miles of drainage and has a potential to store 17,460 acre-feet. Maximum pool behind the dam could be 291 acres.

Truckee Subbasin

South Lake Tahoe

The South Lake Tahoe watershed is located in the southern portion of the Tahoe Basin. Besides the two principal streams, Trout Creek and the Upper Truckee River, with all their many tributaries-the area also includes Bijou, Taylor, Glen Alpine, and Edgewood Creeks. Total acreage in the watershed is approximately 79,860.

Most of the private land has been or is being subdivided for homesites, businesses, and recreational development. Recreation is the major source of economic acitivity, with gaming and the associated accommodations and vendors the largest private industry.

Erosion, sedimentation, low and inconsistent streamflows, and flooding are the major problems in the watershed. Streamflow regulation, particularly in Taylor Creek, would materially enhance the food supply and the migration and spawning runs of various species of fish which inhabit Lake Tahoe.

Surveys and priliminary designs were prepared for nine water storage structures. These structures could control 118 square miles of drainage area, and provide storage for 15,547 acre-feet of floodwater and sediment. Portions of this water could also be available for recreation streamflow regulation, or municipal and industrial uses.

The streamflow characteristics of Glen Alpine and Taylor Creeks could be improved for fishery purposes by construction or enlargement of eight small dams on eight natural lakes located in the upper reaches of these drainage systems. It is estimated the sediment yield to Lake Tahoe from this watershed area could be reduced by 67 percent by the installation of the structural program and needed land treatment measures.

It is possible that reducing the amount of sediment entering Lake Tahoe could have an adverse affect on the lake's beaches by reducing the amount of sands available to them. Additional environmental studies are needed to determine if this reduction would create an adverse impact.

West Lake Tahoe

The West Lake Tahoe watershed is located on the west side of Lake Tahoe, and includes the Meeks Creek drainage and all streams north to and including Ward Creek. Other main streams are McKinney, Blackwood, and General Creeks. Total area of the watershed is about 34,670 acres.

All of the shoreline of Lake Tahoe in the watershed is urbanized, except for the lands inside Sugar Pine Point State Park. Many of the houses are located along the streambanks or on alluvial fans near the mouths of the streams, and are subject to overflow and flooding from periodic high streamflows.

The flooding and destruction of homes, roads, and other improvements near the stream courses, along with erosion and sediment yield to Lake Tahoe, are the major watershed problems. About 5,300 cubic yards (6,400 tons) of sediment are deposited in Lake Tahoe annually from this watershed area.

A reduction in flood runoff and sediment yield to Lake Tahoe can be accomplished by: (1) the installation of three flood and sediment control dams, which would control 26.8 square miles of drainage area, and provide storage for 7,064 acre-feet of water; (2) the strict control of future logging, mining, and grazing plus the initiation and enforcement of flood plain regulations and zoning; and (3) land treatment. These measures could reduce the sediment yield to the lake by 65 percent.

It is possible that reducing the amount of sediment entering Lake Tahoe could have an adverse effect on the lake's beaches by reducing the amount of sands available to them. Additional environmental studies are needed to determine if this reduction would create an adverse impact.

North Lake Tahoe

The watershed is located on the north side of Lake Tahoe, mostly west of the California-Nevada State line. Total area of the watershed is approximately 18,650 acres. Most of the area along Lake Tahoe's shoreline is occupied by homes and various businesses.

Major problems in the watershed area are erosion and sedimentation, and floodwater damage to homes and businesses built in the flood plain areas of Burton and Griff Creeks. In addition, streams in this watershed area are contributing an estimated 4,700 cubic yards (5,700 tons) of sediment to Lake Tahoe.

Control of floodwaters and the reduction of sediment yield to Lake Tahoe can be accomplished by the construction of three water storage structures on Burton and on both forks of Griff Creeks. These structures would control 8.1 square miles of drainage area and provide storage for 1,496 acre-feet of floodwater and sediment. A portion of this water could also be available for recreation or municipal and industrial purposes. Additional sediment reduction could result from land treatment measures throughout the watershed area.

The upper Long Valley watershed, Calvada Subbasin, presents severe streambank erosion problems.

The Truckee-Verdi watershed, Truckee Subbasin, includes the Gray Creek drainage, which is a very high sediment contributor to the Truckee River.

It is possible that reducing the amount of sediment entering Lake Tahoe could have an adverse effect on the lakes beaches by reducing the amount of sands available to them. Additional environmental studies are needed to determine if this reduction would create an adverse impact.

Squaw Valley-Donner Lake

This watershed study area includes all the drainages to the Truckee River between the Lake Tahoe outlet and Truckee, California. Total area of the watershed is approximately 53,400 acres. Many of these drainages have experienced periods of high flow, as evidenced by the large amount of debris, rocks, and sediment accumulated in and along their channels, as well as by the still active channel degradation.

The sediment, debris, and rocks carried by the streams have for the most part been deposited in the Truckee River. Presently, this watershed study area is the principal source of damaging Truckee River flood flows which affect the Reno-Sparks area.

Preliminary designs and surveys for floodwater and sediment control dams were completed for six of the major drainages. These structures would control 23.4 square miles of drainage area, and provide for storage of 5,234 acre-feet of floodwater and sediment. Additional storage for recreation may also be possible. Installation of these structures plus needed land treatment work would reduce the estimated sediment yield to the Truckee River to one-half of the present amount. They could also help reduce flooding in the Reno-Sparks area.

Truckee-Verdi

This study area encompasses that reach of the Truckee River between Truckee, California, and Reno, Nevada, and includes all the tributary drainages on both sides of the river between those points. Total area in the watershed is approximately 281,800 acres.

High flows from this reach of the Truckee River which have caused previous flooding in the Reno-Sparks area have been greatly reduced by land treatment and structural works. However, several streams still remain uncontrolled. These watersheds are in poor condition because of excessive logging, overgrazing, and uncontrolled wildfires. Gray, Bronco, and Bull Ranch Creeks, while not large contributors of floodwaters to the Truckee River, do discharge unusually large sediment loads to the river.

Preliminary surveys and designs were made for six storage structures to control sediment yield to the Truckee River. From the installation of these structures plus necessary land treatment measures, the annual sediment yield to the Truckee River from a 59 square mile part of the watershed could be reduced by an estimated 57 percent. The structures would provide 2,183 acre-feet of storage for floodwater, sediment, and recreation purposes.

Washoe Valley

The Washoe Valley study area includes that portion of the Truckee Subbasin above Little Washoe Lake, plus Brown's Creek, which is a separate drainage to the north of the Little Washoe Lake outlet. However, water from Brown's Creek is diverted to Washoe Valley. Total area of the watershed is 63,600 acres.

Flooding has been one of the major watershed problems common to most of the drainages. Only Jumbo Creek has not yet noted a severely damaging flood occurrence. However, the potential for future floodwater damages is high because of the present urbanization of the flood plain at the mouth of the Jumbo Canyon.

Another serious problem is the fluctuating lake level of the two Washoe lakes. The Washoe Valley wetlands are one of the best Canadian goose nesting areas in the State. When the lake level rises, the water destroys countless numbers of nests and eggs. A concrete dam at the north end of Little Washoe Lake controls the water level of the top seven feet.

Preliminary surveys and designs were prepared for four water storage structures to control the flood and sediment problems. Additional storage could also be incorporated into several of the proposed structures to assist in regulating the water level of Little Washoe Lake.

These structures could control 26.8 square miles of drainage area, and provide 4,240 acre-feet of floodwater, sediment and recreation storage.

Long Valley-Biddleman Springs

Long Valley Creek (Lagomarsino Canyon) and Biddleman Springs drainages are located east of Reno, and lay entirely south of the Truckee River approximately midway between Reno and Wadsworth, Nevada. The combined acreage of the two watersheds is approximately 106,200 acres.

Flooding, erosion, and sedimentation are the principal watershed problems. Biddleman Springs drainage is mainly a dry wash, but does occasionally flow water during spring runoff or from summer rainstorms.

Preliminary surveys and designs for four water storage structures to control flooding and sedimentation were prepared. These structures would control 223.2 square miles of drainage area, and provide storage for 10,930 acre-feet of water. A portion of this storage would be available for recreation. Sediment yield to the Truckee River would be greatly reduced, and flood protection to Clark's Station and the improvements at the mouth of Long Valley Creek would be provided.

Golden Valley

The Golden Valley watershed is located about five miles north of Reno, Nevada. Total area of the watershed is approximately 5,700 acres. There are about 380 homes in the watershed (1969) not including those located on the flood plain extending into Lemmon Valley.

The Golden Valley subdivisions, including those located along the flood plain in Lemmon Valley, are too new to have a history of flood or sediment damage. However, there is a potential for moderate to severe damage to recently constructed residential homes, particularly in Lemmon Valley.

Potential flood and sediment problems can be solved by one of two alternatives. These are: (1) the diversion of floodwaters from the natural drainage to an adjacent drainage channel, which could carry the floodwaters directly to the playa lake; or (2) the installation of a concrete-lined open channel or underground conduit, beginning at the natural outlet for Golden Valley and extending beyond the residential area in Lemmon Valley.

Sutcliffe

The Sutcliffe watershed study area is located on the west side of Pyramid Lake, and includes the small community of Sutcliffe, Nevada. Hardscrabble Creek is the principal stream. Total area of the watershed is about 7,980 acres, and it lies entirely within the boundaries of the Pyramid Lake Indian Reservation. There is one small ranch within the watershed boundaries, but the chief economic activity is providing services for fisherman seeking cutthroat trout in Pyramid Lake.

The settlement of Sutcliffe has been built on the alluvial fans at the mouth of Hardscrabble Creek and a small watershed to the north. Flood and sediment damages to the settlement from these watersheds have occurred many times, principally from intense rainstorms. Slight to severe erosion is present in the watershed area, particularly in the small drainage to the north of Hardscrabble Creek. This small drainage is the major contributor of flood damage to the Sutcliffe settlement.

The most feasible solutions to the problems are: (1) divert the flow from the unnamed drainage north of Hardscrabble Creek by an earth diversion dike to Hardscrabble Creek; and (2) route the floodwaters in a lined channel through Sutcliffe to Pyramid Lake, with adequate erosion control structure.

Carson Subbasin

Carson Valley

This watershed covers 232,117 acres, and includes most of Carson Valley with adjacent tributaries, plus the Clear Creek drainage near Stewart. Problems are (1) potential floodwater and sediment damage to urbanizing areas located near Stewart and on the east and west sides of Carson Valley, (2) sewage effluent pumped from the Tahoe Basin is being dumped in the Carson River, (3) water shortages for municipal and industrial uses, local recreation, and limited agricultural uses, and (4) irrigation water supply problems at several locations not involving the Carson River.

Potential water storage sites were located on Clear Creek, Pine Nut Creek, Buckeye Creek, Bennett Canyon, and Pine Flat. These sites would be suitable for limited floodwater and sediment detention, recreation, irrigation, and effluent storage. In total, these sites would provide control to 117 square miles of drainage and 5,790 acres of flood plain, store up to 10,560 acre-feet of water, and provide a maximum of 277 acres of water surface for recreation.

Irrigation improvement measures were identified on Luther Creek, Sheridan Creek, and Cottonwood Slough. These comprised 6,000 feet of irrigation pipeline, new irrigation canals, ditch consolidation, and new concrete water control structures. There would be 33 landowners with about 5,000 acres benefiting from this work.

East Carson

There are 227,832 acres in this watershed. Proposed measures here could serve as an alternative to the Watashemeau Dam Project but benefits would be considerably less. However, the smaller measures could provide flood protection, sediment control, and flatwater recreation on certain upper reaches of the East Carson that are not provided by the Watashemeau Project. Storage sites have been located in Bagley Valley, Pleasant Valley, and on the main river at Mt. Bullion and Horseshoe Bend. The Horseshoe Bend site is also the Watashemeau site. These sites would provide 61,362 acre-feet of total storage with 39,362 acre-feet for flood protection and 22,270 acre-feet for other uses. Maximum water surface could total 1,380 surface acres. With these structures in place, average annual acreage inundated in Carson Valley from the East Carson River could be reduced 69 percent.

Dayton

This watershed covers 144,623 acres including most of Dayton Valley. The Comstock dam site on the Carson River, two miles upstream from Dayton, could store up to 63,000 acre-feet of water for irrigation, flood protection and recreation. It could also include power generation. This project would exceed the limits of PL-566. Smaller structure sites were located on Gold Canyon, Six-Mile Canyon, and El Dorado Canyon that would provide flood protection and water for other uses to the community of Dayton and to other low density urbanizing areas in the valley. An existing 570 acre-foot reservoir in El Dorado Canyon would have to be enlarged to provide adequate flood storage from this 53 square mile drainage. The three structures would control floodwater from 91 square miles of drainage, provide 13,780 acre-feet of total storage with 11,618 acre-feet being floodwater and sediment, and 2,162 acre-feet being available for other uses. Water surface would total 233 acres, and 1,635 acres of flood plain would be benefited.

Ramsey-Silver Springs

The Silver Springs area is a low density urban community located west of Lahontan Reservoir. Ramsey Wash, a 49 square mile drainage to the north, runs through Silver Springs en-route to the reservoir. The Wash has intermittent flow, and has frequently contributed damaging floods to the 2,475 acre flood plain. A floodwater detention site has been located on Ramsey Wash that would store 2,300 acre-feet of floodwater and sediment, thus preventing future flood damages from this source.

Fallon West, Fallon East

These two watersheds, containing 222,800 acres and 190,380 acres, respectively, were identified in the 1970 Conservation Needs Inventory as having potential for intensive agricultural water management improvement measures. This area includes the largest block of land developed for irrigation (67,100 acres) in the Central Lahontan Basin, and is identified as the Carson Division of the Newlands Project. Irrigation water is provided from Lahontan Reservoir. This project is a Bureau of Reclamation project operated by the Truckee-Carson Irrigation District (TCID). TCID operates and maintains the very extensive irrigation distribution and drainage facilities, but the 700 plus farms and ranches of all sizes operate and maintain their own on-farm systems.

Since the project is, in essence, a federal entity, it was not considered to be eligible for treatment under the provisions of PL-566. The 1971 Pyramid Lake Task Force report described many intensive improvement measures that could be made to TCID facilities saving up to 85,000 AF of water which could be salvaged for use at Pyramid Lake. These measures would be federally funded, but actions to implement them are still undergoing review.

Considerable opportunity does exist for accelerating the application of irrigation water management measures on the individual farms and ranches. During past years, over 50,000 acres of the irrigated lands have been levelled and relevelled and in excess of 35 miles of concrete ditch lining installed. Many thousands of water control structures and miles of field irrigation ditches have also been constructed.

Estimates are that about 120 miles of ditch lining along with additional irrigation improvements to 40,000 acres of irrigated cropland will be necessary to increase the on-farm irrigation efficiency from the present 48 percent to a projected 60 percent. This would involve about 350 individual farm irrigation systems. This efficency increase would permit the salvage of about 15,000 AF of water which could be made available for other uses, and also provide other land enhancement and soil improvement benefits.

Technical and financial assistance for implementing these measures is presently available through USDA authorities of PL-46, PL-703 (RC&D), and other financial programs of ASCS and FmHA.

Walker Subbasin

Mt. Grant

This watershed is located in Mineral County, Nevada, and includes all the drainages of the Wassuk Range from Cottonwood Creek, near the Naval Ammunition Depot northern boundary, to another Cottonwood Creek 12 miles to the south. The watershed contains 146,370 of which eighty-three percent is administered by Federal agencies, 13 percent is owned by Mineral County, and 4 percent is privately owned. Most of the Federal land is controlled by the Naval Ammunition Depot (NAD). The watershed size has been increased since the acreage shown in Table 80 when it was noted that the problem area exceeded the original delineation.

Both the Mineral County Water Company and NAD have mountain water systems which are subject to damage when heavy runoff occurs. Erosion takes place on the steep watershed slopes and produces sediment which fills reservoirs and clogs heading structures. Access roads are washed out, hampering water system repair and replacement. Another problem is sediment damage to NAD facilities, highways, and roads. A system of channels and dikes on the NAD has not proved satisfactory in controlling or stopping flood damage.

Reconnaissance survey of North Canyon, Alum Creek, and Squaw Creek indicated sites for flood control dams which could control the two percent floods from these drainages. Local residents feel that if these three drainages could be controlled, most of the NADs sediment and erosion problems in this area would be overcome.

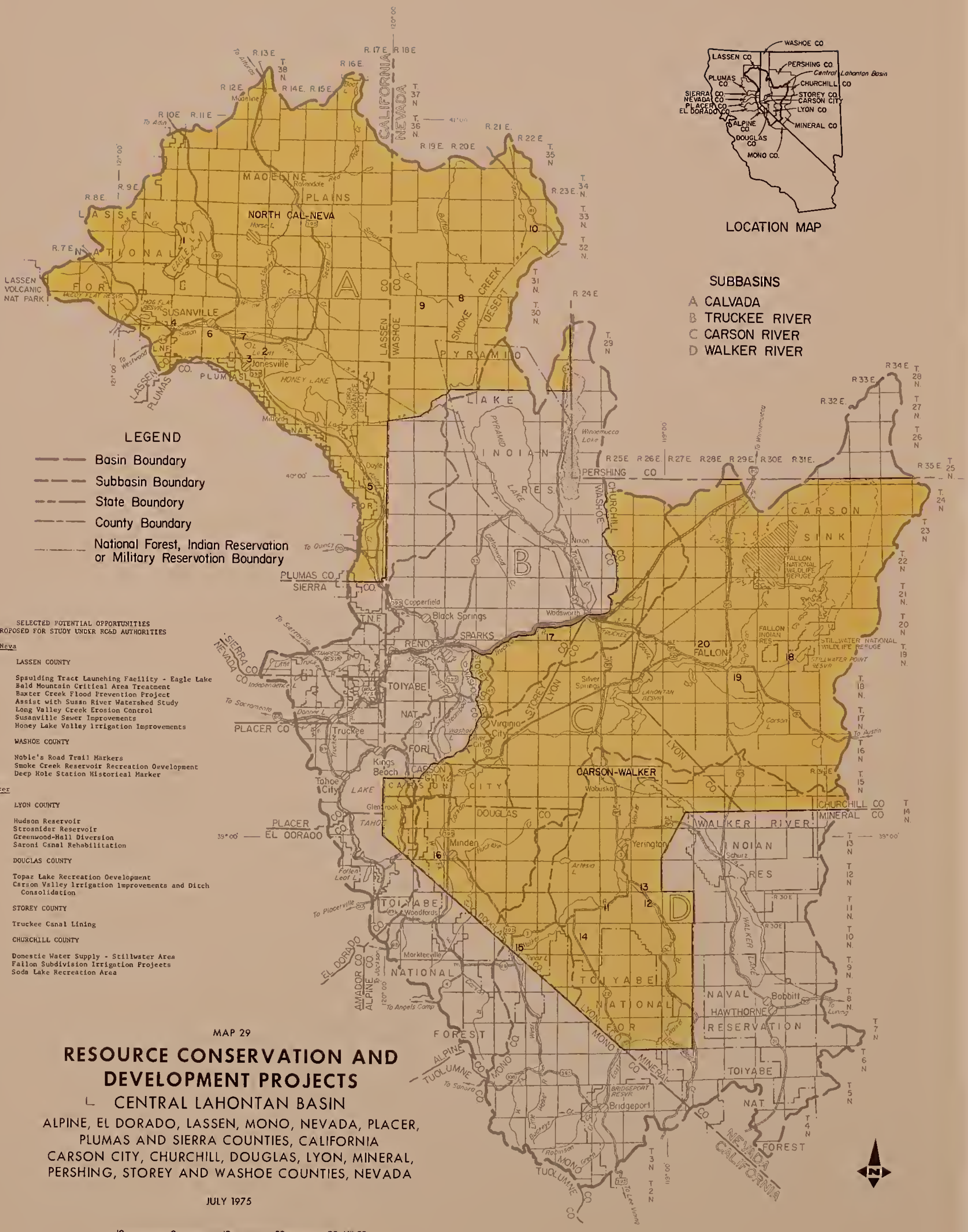
In 1953, the Department of the Navy requested the Soil Conservation Service to prepare an erosion control and conservation plan for the NAD. The flood control measures included enlargement and new construction of floodchannels, debris basins, a large settling basin, and diversion dikes. These measures were designed to provide protection for the 10 percent chance flood event. To date, these measures have not been installed. They are still needed.

Resource Conservation and Development Programs

The RC&D goals are to improve economic, environmental, and social conditions. The potentials for development of natural and human resources of the two RC&D areas in the Basin are great. Adequate inventories of the resources help the local people and interested agencies to work together in the planning and development process. Some of the development potentials are:

1. Develop agriculture with emphasis on desirable land use changes, livestock improvement, better crop and hay land management, crop improvement, and improvement of associated processing and marketing industries.
2. Prevent damaging floods and develop an efficient use of water resources for all purposes in the RC&D areas.
3. Plan, develop, and manage public and private ranges for balanced use with emphasis on watershed improvement, livestock grazing and wildlife habitat to provide the greatest economic, recreational, and esthetic value.
4. Optimize production from commercial forest lands while protecting environmental and esthetic values and assure maximum processing within the RC&D areas. Expand the use of lodgepole pine, pinyon and juniper in the areas.
5. Develop an area-wide recreation-tourism program to include associated businesses, public and private visitor facilities, beautification through a coordinated program, and location, interpretation, and protection of scenic, natural and historic sites.
6. Improve the viability of towns and communities by developing opportunities for clean and attractive job producing small businesses and industries.
7. Improve community services including roads, airports, common carriers, power, telephones, water, sewer, and solid waste disposal facilities.
8. Improve educational and training programs and facilities reduce health hazards, improve medical and health care, and provide better living conditions through cultural recreational, and housing improvements.

Map 29 shows a few of the development potentials for each RC&D area in the Basin.



SELECTED POTENTIAL OPPORTUNITIES
PROPOSED FOR STUDY UNDER RC&D AUTHORITIES

North Cal-Neva

Map Number	LASSEN COUNTY
1	Spaulding Tract Launching Facility - Eagle Lake
2	Bald Mountain Critical Area Treatment
3	Baxter Creek Flood Prevention Project
4	Assist with Susan River Watershed Study
5	Long Valley Creek Erosion Control
6	Susanville Sewer Improvements
7	Honey Lake Valley Irrigation Improvements
	WASHOE COUNTY
8	Noble's Road Trail Markers
9	Smoke Creek Reservoir Recreation Development
10	Deep Hole Station Historical Marker

Carson-Walker

	LYON COUNTY
11	Hudson Reservoir
12	Strosnider Reservoir
13	Greenwood-Hall Diversion
14	Saroni Canal Rehabilitation
	DOUGLAS COUNTY
15	Topaz Lake Recreation Development
16	Carson Valley Irrigation Improvements and Ditch Consolidation
	STOREY COUNTY
17	Truckee Canal Lining
	CHURCHILL COUNTY
18	Domestic Water Supply - Stillwater Area
19	Fallon Subdivision Irrigation Projects
20	Soda Lake Recreation Area

MAP 29

RESOURCE CONSERVATION AND DEVELOPMENT PROJECTS

CENTRAL LAHONTAN BASIN

ALPINE, EL DORADO, LASSEN, MONO, NEVADA, PLACER, PLUMAS AND SIERRA COUNTIES, CALIFORNIA
CARSON CITY, CHURCHILL, DOUGLAS, LYON, MINERAL, PERSHING, STOREY AND WASHOE COUNTIES, NEVADA

JULY 1975

C H A P T E R X

USDA PLAN

H i g h l i g h t

This chapter presents a USDA plan which could assist in meeting the identified long term water and related land resource needs of the Basin. The plan components are those programs presently available under existing USDA authorities. Acceleration of these programs is the main thrust of the plan which utilizes many of the potentials discussed in CHAPTER IX. Impacts of the plan are summarized in a With Plan display, which can be compared to the Without Plan condition described in CHAPTER VII. CHAPTER X also presents economic analyses of several selected project plans suitable for implementation under other than USDA authorities.

CONTENTS

Proposed Program and Its Impact

The purpose of the Department of Agriculture's participation in the Basin survey is to contribute to future comprehensive plans for the orderly and coordinated development, management, and use of the water and related land resources of the Basin. Such plans could utilize information from this survey to develop long-range programs concerning specific projects or programs of improvement which will produce the highest level of benefits to the people of the Basin, adjacent communities, and to the nation.

The USDA plan presents proposals and possibilities that could be utilized under USDA authorities to accelerate or otherwise assist in solving many of the Basin's resource problems. The plan is not formulated to emphasize the multi-objectives of national economic development (NED), regional development (RD), or evironmental quality (EQ). However, the effects of the USDA plan for each subbasin are arrayed to the four-account system which includes the NED, RD, EQ, and Social well-being accounts.

Public Involvement

The State of Nevada has been developing its State Water Plan during the 1973-74 period. Phase III, alternative plans development, is about complete and Phase IV, development of the recommended plan, is to be completed by 1975. During Phase III, alternative plans for water planning areas I and II, which comprise the Nevada portion of the Basin, were reviewed at public hearings held in Hawthorne, Yerington, Minden, Carson City, Fallon, Virginia City, and Reno. Several USDA proposals were selected as components for the various plans to meet State objectives of Economic Efficiency and Environmental Quality. Included as Economic Efficiency components were the following potential PL-566 projects: Bridgeport, Pumpkin Hollow, Carson City, Incline Village, Block "N", Southwest Reno, and Galena Creek. Environmental Quality components included: establishing scenic vistas and wilderness areas, improving streams, promoting watershed management programs, designating and establishing recreation sites, and modernizing existing irrigation facilities. Several other USDA proposals were not included as alternative plan components because of adverse environmental impact or low benefit-cost ratios. They were, however, included as potentials for future consideration.

Results of the public hearings were documented by the State of Nevada, and from the comments received, a recommended plan for the Areas I and II will be developed.

Components of the USDA Plan

Significant opportunity exists in the Basin for the initiation of new activities, and the strengthening of existing soil and water resource management programs and operations. The USDA Plan discusses projects and programs that will assist in solving many of the resource problems previously described. It will also focus on the resource requirements that must be met so that a realistic and orderly development of the Basin can continue.

The following plan proposals should not be interpreted as the only developments needed, or supported by public, state, and federal entities. Legal and administrative constraints may prevent implementation of some opportunities in some areas.

Table 81 briefly summarized the costs of the projects and programs of the USDA Plan by subbasin. More specific data concerning benefits and costs for individual items within the various programs is contained in the tables and narrative for each subbasin.

The USDA plan will improve agricultural production and enhance the quality of life for the Basin's population.

Table 81 Summary of USDA Plan - Projects, Programs, and Costs by Subbasin[1], Central Lahontan Basin

Project or Program	Calvada Subbasin		Carson River Subbasin		Truckee River Subbasin		Walker River Subbasin		Central Lahontan Basin	
	Visitor Days or Acres	Average Annual Cost	Visitor Days or Acres	Average Annual Cost	Visitor Days or Acres	Average Annual Cost	Visitor Days or Acres	Average Annual Cost	Visitor Days or Acres	Average Annual Cost
Watershed Investigation Reports										
Susan River Watershed	189,229	93,930	-	-	-	-	-	-	189,229	93,930
Piute Creek Watershed	23,059	45,933	-	-	-	-	-	-	23,059	45,933
Willow Creek Watershed	170,240	100,216	-	-	-	-	-	-	170,240	100,216
Evans Creek (Block "N") W/S	-	-	-	-	2,990	162,090	-	-	2,990	162,090
Incline Village Watershed	-	-	-	-	14,000	342,300	-	-	14,000	342,300
Galena Creek Watershed	-	-	-	-	12,563	97,240	-	-	12,563	97,240
Southwest Reno Watershed	-	-	-	-	84,700	952,150	-	-	84,700	952,150
Sun Valley Watershed	-	-	-	-	15,540	131,500	-	-	15,540	131,500
Carson City Watershed	-	-	30,220	156,830	-	-	-	-	30,220	156,830
West Fork Carson River W/S	-	-	95,438	197,301	-	-	-	-	95,438	197,301
Pumpkin Hollow-Southwest Mason Valley Watershed	-	-	-	-	-	-	95,500	90,376	95,500	90,376
Bridgeport Watershed	-	-	-	-	-	-	236,700	25,764	236,700	25,764
West Walker-Antelope Valley W/S	-	-	-	-	-	-	220,760	360,455	220,760	360,455
Smith Valley-Desert Cr. W/S	-	-	-	-	-	-	240,400	18,815	240,400	18,815
Forest Service Programs										
Timber Program	157,854	1,454,450	100,751	940,743	56,184	551,186	35,655	378,208	353,444	3324,587
Range Improvement Program	3,693	43,777	8,890	66,682	572	3,260	51,628	101,510	64,783	215,229
Wildlife Program	650	28,016	1,440	4,283	1,067	30,797	6,641	35,899	9,798	98,995
Recreation Development	4,567,900[2]	2,048,943	1,440,400[2]	727,166	8,769,870[2]	5,247,083	1,082,780[2]	474,715	15,860,950[2]	8,497,907
Watershed Treatment Program	10,822	62,980	7,221	75,156	1,465	89,903	78,304	939,858	97,812	1,167,897
Accelerated Conservation Treatment-Private Lands										
Irrigated Cropland Improvements	19,951	161,004	38,245	419,548	3,848	33,939	23,096	253,132	85,140	867,623
Rangeland Improvements	32,300	9,293	22,300	7,501	27,900	12,399	10,000	3,155	92,500	32,348
TOTAL MONETARY COSTS[3]	-	4,048,542	-	2,595,210	-	7,653,847	-	2,681,889	-	16,979,486
TOTAL MONETARY BENEFITS	-	10,410,121	-	3,515,601	-	24,929,166	-	3,212,343	-	42,067,231
NET MONETARY BENEFITS[3]	-	6,361,579	-	920,391	-	17,275,319	-	530,456	-	25,087,745

1/ Additional information on projects and programs can be found in the narrative and display tables for each subbasin.
2/ Visitor days.
3/ Does not equal net NED monetary costs or benefits because of inclusion of Forest Service Wildlife Program.

Land Use Planning

The following quote is from the Secretary of Agriculture's memorandum on Land Use Policy, issued October 26, 1973: "The Department's research, educational, technical, and financial assistance services are available in every county and state of the nation. Its agencies now assist all levels of government in land use planning and implementation efforts." This report is a result of this policy and indicates USDA interest in orderly development of natural resources to assure the greatest benefit to all who use them.

This chapter deals specifically with the opportunities for USDA involvement within an integrated plan for the region. The data and conclusions reached are intended for general planning purposes. For operational planning, more detailed data may be required. An opportunity exists, therefore, for additional USDA land use planning assistance.

Table 82 shows the status of regional planning for selected elements in Nevada portion of the Basin. The counties, cities, and regional planning agencies have frequently made use of USDA planning assistance, but there are still broad areas where USDA natural resource data would be helpful in development of future plans.

Table 82 -- Status of regional planning for selected elements, Nevada portion, Central Lahontan Basin

Planning Body	Selected planning elements											
	Master Plan	Zoning Ordinance	Subdivision Ordinance	PUD Ordinance	Site Plan Review	Conservation Zoning	Flood Plain Zoning	Land Use Intensity	State Subdivision Standards	Local Subdivision Standards	Env. Impact Review	Erosion and Sedimentation Controls
Carson City	X	X	X	X	X	O	O	O	X	X	O	O
Churchill	X	X	X	X	X	X		X	X	X		
Fallon	X	X	X	O	O	O	O	O	X	O	O	O
Douglas	X	X	X	X	X	O	X		X	X		
Lyon	X	X	X									
Yerington	X	X	X									
Mineral	X	X	X									
Pershing	O		X									
Storey	O	X	X									
Washoe	X	X	X	X	X					X		
Reno	X	X	X	X	X					X		
Sparks	X	X	X	X	X					X		
Carson River Basin Council of Govt.	X											
Regional Planning Comm. of Reno, Sparks and Washoe County	X	X	X	X	X				X	X	X	
Tahoe Regional Planning Agency	X	X	X	X	X	X						X

X Adopted or in effect
O In progress
Note: Regulations and plans may only be partial in coverage

Timber and Wood Products

In addition to increased demand based on population increases, the trend and projections indicate that the current per capita demand for timber and wood products was 58 cubic feet. By 1990, it is projected to go to 60 cubic feet and by 2020 it is expected to be 64 cubic feet.

The planned measures to satisfy this demand fall into two categories: the biological contribution to supply and the industrial contribution to the supply. The Forest Service programs address solutions and participation in both of these categories.

National forest programs involve using special construction and logging techniques to minimize ecological disturbance. This helicopter is placing ski lift towers in forested lands within the Truckee Subbasin. Chapman Wentworth photo

Biological Contribution to Supply

Within the Basin there are approximately 1,056,000 acres classed as commercial forest land. Most of these lands are not under intensified management; all land is not being treated in accordance with its needs. Specific treatment measures to be carried out are listed in Table 83.

Table 83 -- Land treatment measures on commercial forest land in acres

	Reforestation		Timber Stand Improvement	
Subbasin	Federal	Nonfederal	Federal	Nonfederal
Calvada	900	3,600	1,200	33,000
Truckee	5,894	6,219	9,770	14,200
Carson	3,147	371	1,575	16,800
Walker	1,746	228	1,488	3,500
TOTAL	11,687	10,418	14,033	67,500

Full stocking implementation is a program by which the optimum number of trees per acre are provided. In about 90 percent of the commercial forest areas, stocking is below optimum. The average yield at harvest under present management is 9,600 board-feet per acre. When the full stocking program is implemented, the average yield at harvest will be 13,200 board-feet per acre. Even with this improved yield, the projected demand for roundwood to meet the national share will not be met. Land treatment measures by ownership on commercial forest land for full stocking implementation are shown in the following tabulation:

State	Federal	Nonfederal
	---------- Acres ----------	
California	547,000	420,000
Nevada	8,000	76,000
TOTAL	555,000	496,000

Industrial Contribution to Supply

Improved industrial methods can contribute significantly to the supply. This program includes higher utilization of logging residue, higher utilization of mill residue and changes in manufacturing techniques to reduce the amount of raw material consumed or wasted in primary processing.

Changes in or modifications of milling equipment will allow for smaller logs to be handled economically. This will reduce the logging residue. Modification of the head saw to use thin and ultra-thin saws will reduce the amount of raw material that ends up as sawdust. Changes in kiln drying techniques will reduce losses from over or under dried lumber which will increase lumber available to the consumer.

State and Private Cooperative Programs

There are cooperative programs to improve the state and private forest and woodlands. The objective of state and private forestry programs is to further the protection, sound management, and wise use of nonfederal forest and certain nonforested watershed lands. The major portions of these private forest lands are in small ownerships which are presently producing less than the larger private or public holdings and are generally in poorer conditions from a watershed standpoint. Federal programs providing assistance to forest land owners are administered through the State Forester.

National Forest Rangeland

The USDA Plan increases the rangeland forage production on National Forest land. The implementation of the plan entails fencing, cattleguard installations, and water developments to facilitate control and better distribution of livestock. The increase attributed to the program will be 11,085 AUM per year. In some areas of the Basin there would be no increase in AUMs at this time. In these areas the increase in forage production will allow the grazed areas to better satisfy the present obligation. In addition to rangeland improvement there will be benefits to the watershed in increased vegetal density and reduced erosion and sediment. APPENDIX II provides a detailed analysis of range improvements for each subbasin. Table 84 lists planned measures for National Forest land for rangeland improvements.

Table 84 -- National Forest rangeland measures Central Lahontan Basin

Description		
Cover manipulations	acres	35,407
Rangeland seeding	acres	24,505
Fertilizer applications	acres	2,595
Fence construction	miles	535
Cattleguard installation	each	144
Control of undesirable forbs (poisonous plants)	acres	4,025
Control of undesirable and noxious weeds	acres	2,466
Water developments (springs)	each	158
(wells)	each	15
(reservoirs)	each	38

Interest and Purpose of Programs Available

The following existing programs are important components of the USDA Plan:

Cooperative Fire Control

This program provides Federal Aid to states in protection of forested and cut-over lands for the purpose of timber protection and on forested watersheds on navigable streams.

Cooperative Forest Management

This program is designed to encourage better forest practices. There is no restriction on size of ownership, but assistance is directed mainly at small forest owners and small processors of forest products. Federal cooperation is restricted to State Forester or equivalent state official.

Cooperative Forestation

This program is directed to assist states in the production of planting stock for reforestation of state and private lands.

Cooperative Forest Insect and Disease Control

This program provides federal financial aid for state and private land for insect and disease control.

Cooperative Watershed Management

This program is covered by several public laws. These laws provide the authority for federal partnerships with state and private landowners in watershed rehabilitation projects, watershed planning efforts, flood prevention measures and coordinated river Basin planning.

Recreation

Planned outdoor recreation facilities on Federal lands include many types of developments for water based and non-water based recreation. It also includes wilderness facilities. These developments are shown on Table 85. When this program is complete there will be an additional 16 million visitor-day capacity in the Basin. Including the nine million visitor-day capacity existing in 1970, this will provide a total of 25 million visitor-days by 2020. This will not meet the allocated Federal land demand of 35 million visitor-days projected for that date. APPENDIX II has a detailed breakdown on type of facilities by subbasin.

Table 85 - Number of facilities by type, for the Central Lahontan Basin

Type of facility	Number	Capacity visitor-days/Yr(1,000s)
Campgrounds	10,928 ea	10,532.6
Picnic Sites	3,016 ea	1,338.0
Swim Sites	15 ea	1,032.4
Boat Launching Sites	6 ea	277.7
VIS Centers	5 ea	237.4
Observation Sites	16 ea	226.0
Trailer Park	48 ea	26.4
Winter Sports area	1,272 Ac	606.3
Resorts	1 ea	158.4
Group & Organizational Sites	16 ea	1,455.1
Historic sites	1 ea	15.0
Interpretive site	1 ea	15.0
Wilderness Falilities:		
Trailhead facilities	1 ea	12.0
Backcountry campsites	17 ea	26.2
	Total	15,958.6

Fish and Wildlife

Planned fish and wildlife developments include preserving winter deer ranges, browse planting, pinyon-juniper control for deer, water developments for wildlife, and stream habitat improvement for fisheries. The great majority of these will be carried out on publicly owned lands, and little is expected on the private lands. On National Forest lands, the planned measures are identified in the following tabulation:

Planned National forest logging techniques include small clear cut areas as shown here by the small white blocks in background, Walker Subbasin. Forest Service photo.

Campground in a developed national forest recreation area. Forest Service photo.

Item	Units	Quantities
Seeding and plantings for wildlife	acres	3,290
Wildlife area protection - fencing	miles	36
Release of wildlife forage plants	acres	5,060
Planting waterfowl food plants	acres	90
Permanent wildlife openings	acres	1,306
Stream channel improvement structures	each	1,219
Stream channel stabilization	miles	62

National Resource Lands are presently being inventoried by BLM and wildlife improvement measures will be set forth in their Management Framework Plan.

Watersheds

Planned watershed treatment includes measures to stabilize erosion activity, reduce sedimentation, and reduce flooding. Other resource programs such as rangeland and timber land treatment, will have a spin-off benefit from watershed improvement. Planned watershed treatment measures for National Forest land are listed in Table 86

Table 86 - Planned Watershed stabilization and water-yield enhancement on National Forest Land, Central Lahontan Basin

Description	Units	Quantities
Watershed Stabilization		
Gully stabilization	miles	569
Sheet erosion control	acres	79,305
Stabilization of borrow pits	acres	170
Rehabilitation of abandoned roads & trails	miles	441
Mine restoration, i.e., dumps, tailings, etc.	acres	5,588
Sediment basin construction	each	1
Streambank stabilization	miles	106
Lake and reservoir shore stabilization	miles	1
Stream channel clearing	miles	44
Lake and reservoir shore clearing	acres	147
Water-yield enhancement		
Type conversion, (alpine zone)	acres	12,715
Riparian vegetation management	acres	384
Water spreading (recharge)	acres	650
Deep percolation and infiltration	acres	5,510
Snow pack management (snow fence)	miles	172

Private Land Programs

Cropland Resource Programs

It has been estimated that 125,000 acres need treatment on their conveyance systems, 271,000 acres need application systems treatment, and 136,000 acres need drainage. Of this amount, some of the cropland has need of one or more of the three types of treatment mentioned. Acres suitable and planned for treatment are shown in the following tabulation:

Subbasin	Land Needing Treatment	Potential PL-566 Treatment	Potential PL-46 Treatment	Areas planned for Accelerated Treatment
	acres			
Walker	120,267	50,980	46,191	23,096
Carson	114,734	------	76,489	38,245
Truckee	11,540	------	7,692	3,848
Calvada	68,906	9,053	39,902	19,951
TOTAL	315,447	60,033	170,274	85,140

If planned PL-566 projects are implemented and PL-46 continue at the present rate, there will still be 85,140 acres untreated in 1990. It is planned to accelerate the PL-46 program by 50 percent to meet the treatment need. The accelerated land treatment program will cost $897,623 annually; an average of about $10.55 an acre. The average benefits from such treatment would be $11.21 per acre.

Rangeland Resource Program

Of the 5,667,000 acres of rangeland needing treatment in the Basin, about 1.1 million acres are privately-owned. Within the private lands, 277,500 acres are planned for treatment. Treatment of the privately-owned lands involves about 39,300 acres of reestablishment of vegetative cover, 238,200 acres of brush management, 270 miles of fencing, and 108 stockwater developments.

If PL-46 technical assistance programs are continued at the present rate, there will still be 92,500 acres untreated by 1990. It is planned to accelerate the Pl-46 work by 50 percent to meet the treatment need.

The private rangeland planned for treatment and the program that will meet the needs are listed in the following tabulation:

Subbasin	Land Needing Treatment	Potential PL-46 Treatment	Acres planned for Accelerated Treatment
Walker	30,000	20,000	10,000
Carson	66,900	44,600	22,300
Truckee	83,700	55,800	27,900
Calvada	96,900	64,600	32,300
Total	277,500	185,000	92,500

It is estimated that it will cost $32,348 annually to carry out and maintain the accelerated land treatment. The treatment will supply an additional 29,711 AUMs of forage annually, at an average annual cost of $1.09 per AUM.

Recreation, Fish and Wildlife

About one-fourth of future recreation demand will be satisfied through developments on Federal land. This provides a large potential for private recreation developments which should be encouraged by the USDA.

Watershed Investigation Reports

The fourteen watersheds listed in CHAPTER IX were determined to have potential for treatment under the provisions of PL-566. They are all included as components of the USDA Plan. Watershed investigation reports were prepared for each watershed. These reports are included in APPENDIX II. Four WIR's, Willow Creek, Galena Creek, Sun Valley, and Smith Valley - Desert Creek, are not economically feasible. However, they are included in the USDA Plan because of high local interest, near feasiblity, and for the value they might have to local planners and individuals. Summaries of each WIR are presented in this chapter.

Plan Evaluation

The USDA Plan has been evaluated by the Four Account System, in keeping with the Principles and Standards for Planning Water and Related Land Resources set forth by the Water Resources Council. The Four Accounts are the National Economic Development (NED) account, the Environmental Quality (EQ) account, the Regional Development (RD) account, and the Social Well-Being (SWB) account. Both beneficial and adverse effects may be of a monetary or nonmonetary nature, and thus they may be expressed in dollars or in physical, biological, or other quantitative units or qualitative terms as appropriate.

The National Economic Development Account

The benefits and cost consideration within this account focus upon economic efficiency and are measured in terms of changes in national income. NED benefits and costs are divided into two categories based on their incidence: (1) the value to project users, and (2) the value of external effects upon parties other than users.

The Environmental Quality Account

A water and land use plan may have a variety of effects, beneficial and adverse, on the environment. While monetary effects do occur, generally, effects on the environment are characterized by their nonmonetary nature. In either case, they provide important evidence for judging the value of proposed plans. Environmental quality beneficial effects are contributions resulting from the management, preservation, or restoration of one or more of the desirable environmental characteristics of an area under study. Adverse environmental quality effects are consequences of proposed actions that result in the deterioration of environmental characteristics of an area.

The Regional Development Account

The evaluation of beneficial effects and adverse effects for the components of the RD account are measured in monetary and nonmonetary terms. In addition to benefits and cost directly affecting the region under consideration, the RD account includes effects on the rest of the nation.

The Social Well Being Account

An analysis of social factors is and must be primarily, although not exclusively, nonmonetary in character. Economic factors are involved in analysis of social factors. They are, for this account, subsidiary to attitudes values, beliefs, and expectations of individuals, groups, and communities of people impacted directly and indirectly by the development of water resources.

Four Account System

The display of the USDA Plan in the Four Account System is to give decision-makers a comparison between this plan and other plans presented in the same format. There are a total of 22 different projects and programs analyzed in the Basin by the Four-Account System. A summary of the plan for each subbasin follows; including the display of the four accounts by subbasin. Separate displays for each project and program are found in APPENDIX II.

Calvada Subbasin

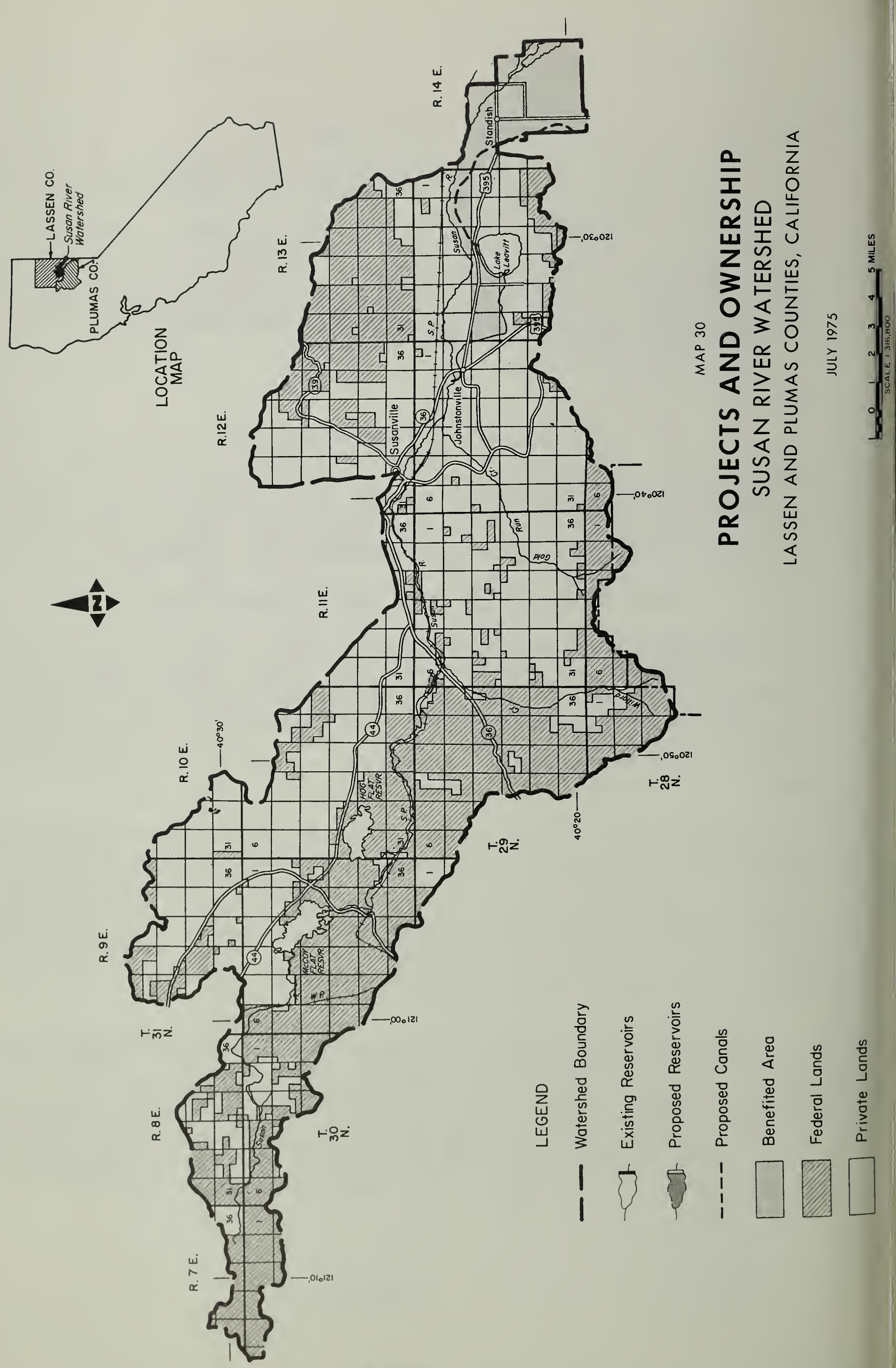
The USDA Plan for the subbasin consist of the Susan River, Piute Creek, and Willow Creek watershed investigations, the National Forest programs and the accelerated conservation programs on private lands. A brief summary of each component of the plan is included in the following pages. The detailed reports of the projects and programs are in APPENDIX II.

Susan River Watershed Investigation Report

The watershed contains about 189,229 acres and is located in southern Lassen and northern Plumas Counties, California. Susan River heads on the eastern slopes of the Cascade Range and Sierra Nevada and drains into Honey Lake. The elevation ranges from 7,761 to about 4,060 feet. Approximately 58 percent of the watershed is privately owned and 42 percent is federally administrated land.

Susanville is the largest town within the watershed area. Livestock and forest production are the two main industries of the watershed. There are about 16,900 acres of irrigated land in the watershed. Forage and feed for livestock are the crops grown. The water-supply for irrigation has been historically short in the late summer months. The irrigation distribution system has a high seepage loss that reduces the amount of water delivered to the farms.

The proposed project is improvement of the Lassen Irrigation Company's irrigation distribution system. Lining 17 miles of canal and other related structures in the canal could reduce seepage loss. The estimated cost of project installation is $1,306,200. There are other major needs but evaluations determined they were not economically feasible. The average annual cost is $93,930 and the average annual benefits are $110,500.



U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE

M7-OL-23

Flooding from Susan River, Calvada Subbasin

The Piute Creek flood channel through Susanville, Calvada Subbasin, will be protected by a floodwater detention structure above the city.

Piute Creek Watershed Investigation Report

The watershed consists of 23,059 acres, and is located in southern Lassen County, California. Elevation ranges from 7,609 feet on the top of the Roop Mountain to about 4,180 in Susanville. Piute Creek originates near the top of Roop Mountain and flows in a southeasterly direction for about 12 miles where it enters the Susan River at Susanville. About 96 percent of the watershed is privately owned land and 4 percent is under federal administration. Susanville is the only town in the watershed and is the major trade center of the area. The forest industry is one of the area's major industries and most of the watershed is commercial forest land. There are about 100 acres of irrigated meadow land in the watershed.

The major problem in the watershed is periodic floods in the lower reach of Piute Creek. The channel is relatively small as it passes through Susanville and causes damage to streets, bridges, residences, and commercial property. A proposed structure located about four miles upstream from the confluence with Susan River would control about 70 percent of the runoff from Piute Creek. The estimated project installation cost is $759,533.00. The average annual cost is $45,933 and the average annual benefits are 60,100.

Willow Creek Watershed Investigation Report

The watershed contains about 266 square miles or 170,240 acres and is located approximately six miles northeast of Susanville in Lassen County, California. Willow Creek originates on the eastern slopes of the Sierra Nevada, immediately east of Eagle Lake. Elevations range from 7,940 to about 4,007 feet. Litchfield is the only town in the watershed. The main industry of the watershed is agriculture. There are 5,300 acres of land under cultivation in the watershed; 4,100 dry-farmed and 1,200 partially irrigated. The crops are forage and feed for livestock. Water supply for irrigation has been historically short in summer months. This limits the production of the crops and does not allow for the full potential yields. The proposed project includes an irrigation water storage reservoir and distribution system. Also included is the lowering of Horse Lake outlet into Petes Creek.

LEGEND

Watershed Boundary

Proposed Reservoirs

Benefited Area

Federal Lands

Private Lands

MAP 31

PROJECTS AND OWNERSHIP

PIUTE CREEK WATERSHED

LASSEN COUNTY, CALIFORNIA

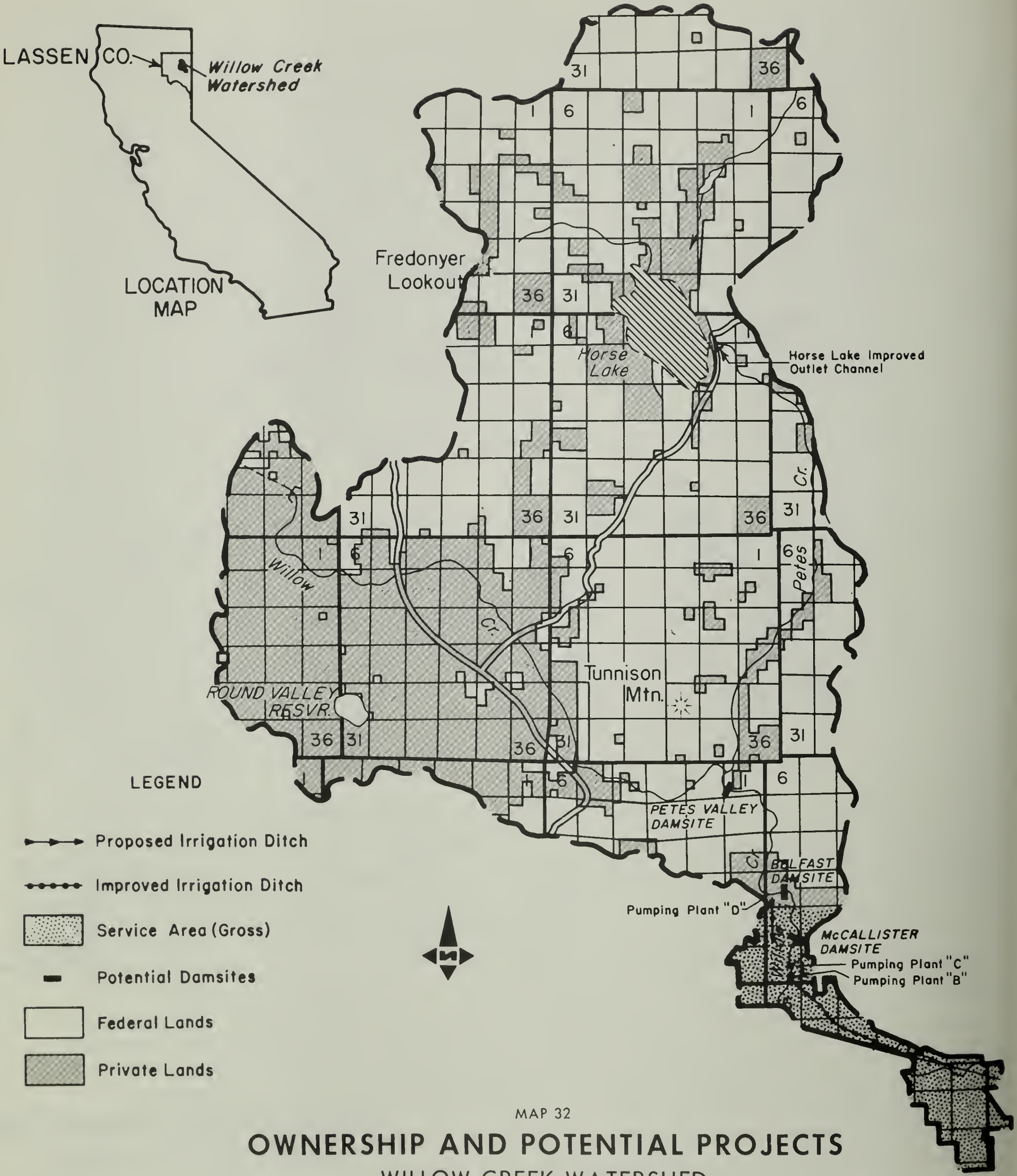
JULY 1975

1 0 1 2 3 MILES

SCALE 1:96,000

U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE USDA-SCS-PORTLAND, OREG. 1979

M7-OL-23171A



MAP 32

OWNERSHIP AND POTENTIAL PROJECTS

WILLOW CREEK WATERSHED

LASSEN COUNTY, CALIFORNIA

JULY 1975

1 0 1 2 3 4 5 MILES

SCALE 1:253,440

U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE

M7-L-23177

The reservoir will supply an average annual yield at the farm headgates of 7,700 acre-feet. The distribution system includes three pumping plants and 34,700 feet of canal. Estimated cost of the project installation is $1,329,400.00. Average annual cost is $100,216 and average annual benefits are 65,400.

Other Components

Summaries of planned treatment measures on National Forest and privately owned lands are shown in Tables 87 and 88. Costs, program responses, and benefits are indicated. Development of the values for costs and responses are in APPENDIX II.

The National Forest summary includes measures for timber, range improvement, recreation development, watershed treatment, and fish and wildlife.

The accelerated treatment summary for privately owned land indicates costs and benefits for accelerating the installation of improvement measures on irrigated cropland and privately owned rangeland. Units shown reflect that portion of the total cropland and rangeland treatment needs that could be treated to achieve a 50 percent increase over the present rate of treatment. Costs, benefits from increased returns, and net benefits are displayed.

Water control structures such as this drop structure on Baxter Creek are important in the Calvada Subbasin.

TABLE 87

CENTRAL LAHONTAN BASIN
Cost and Responses of Proposed Forest Service Timber Program
Calvada Subbasin

Treatment and/or Development	Units	Cost/Unit Installation $	Cost/Unit O&M $	Amortization Period Total Installation Cost $	Amortization Period @ 7% Yrs	Average Annual Cost Installation $	Average Annual Cost O&M $	Total Average Annual Cost $	Program Responses Increase Fiber Yield MBF/Yr	Program Responses + or - Water Yield AF/Yr	Program Responses + or - Sediment Yield CY/Yr
Biological Contribution											
Reforestation*	300 ac	128	--	38,400	100	2,691	--	2,691	--	-25	Not Avail.
Release*	600 ac	25	--	15,000	30	1,208	--	1,208	--	--	--
Thin*	500 ac	25	--	12,500	30	1,007	--	1,007	--	--	--
Full Stocking Implementation	157,854 ac	130	0.70[1]	20,521,000	100	1,327,616	110,497	1,438,113	505,132	--	Not Avail.
Industrial Contribution											
Logging Residue Reduction*	37.2 mmbf	806	--	30,000	3	11,431	--	11,431	1,116[3]	(Value of Stumpage)	$39,450[4]
Mill Residue Reduction*	37.2 mmbf	Not Avail.	Not Avail.	Not Avail.	--	--	--	--	3,720[3]	(Value of Lumber)	$587,834[5]
Total Installation Cost				20,521,020							
Installation Cost Breakdown					Total	1,343,953	110,497	1,454,450			
Private				--							
Federal				20,521,020							
Equipment				6,361,516							
Skilled Labor				1,641,681							
Unskilled Labor				12,517,823							

Program Responses		Increase Fiber Yield MBF/Yr	+ or - Water Yield AF/Yr	+ or - Sediment Yield CY/Yr
Program Responses	+ or - Units	+505,132	-25	Not Avail.
	+ or - Dollars	+150,720[2]	+245	--

TABLE 87

CENTRAL LAHONTAN BASIN
Cost and Responses of Proposed Forest Service Range Improvement Program
Calvada Subbasin

Treatment and/or Development	Units	Cost/Unit		Amortization Period		Average Annual Cost		Total Average Annual Cost $	Program Responses		
		Installation $	O&M $	Total Installation Cost $	@ 7% Yrs	Installation $	O&M $		Forage Increase Pounds/Yr	Increased AUM Capacity Annual	+ or - Sediment Yield CY/Yr
Cover Manipulations	65 ac	3.80[6/]	--	247	10	35	--	35	22,750	See Foot-note 7	-71
Range Seeding -	3,520 ac	6.50[6/]	--	22,880	30	1,843	--	1,843	880,000		-1,936
Fertilizer Application	70 ac	15[6/]	--	1,050	3	400	--	400	--		
Fence Construction	164 mi	2,000[6/]	5	328,000	30	26,430	820	27,250	--		
Cattleguard Installation	74 ea	1,500	20	111,000	100	7,778	1,480	9,258	--		
Noxious and Undesirable Forbs Control	38 ac	15	--	570	15	62	--	62	--		
<u>Water Development</u>											
Spring	16 ea	500	20	8,000	25	686	320	1,006	--		
Well	11 ea	1,680	40	18,480	100	1,295	440	1,735	--		
Reservoirs	15 ea	1,500	25	22,500	30	1,813	375	2,188	--		
	Total Installation Cost			512,727	Total Fed.	40,342	3,435	43,777			
	Installation Cost Breakdown										
	Private										
	Federal			512,727	Program Responses	+ or - Units			+907,125	+ 3,519[7/]	-2,007
	Equipment			374,032		+ or - Dollars			--	+15,589[8/]	+ 863[9/]
	Skilled Labor			37,423							
	Unskilled Labor			101,272							

TABLE 87

CENTRAL LAHONTAN BASIN
Cost and Responses of Proposed Forest Service Recreation Development
Calvada Subbasin

Treatment and/or Development	Units	Cost/Unit: Installation $	Cost/Unit: O&M $	Amortization Period: Total Installation Cost $	Amortization Period: @ 5.875 Yrs	Average Annual Cost: Installation $	Average Annual Cost: O&M $	Total Average Annual Cost $	Program Responses: Capacity Increase Visitor Days Annual	Program Responses: Annual Benefit Value $	Program Responses: Consumptive Water Use AF/Yr
Campgrounds	3,260 ea	2,868 ea	90 ea	9,349,680	20	806,877	293,400	1,100,277	3,912,000	5,868,000	25.3
Picnic Sites	30 ea	1,874 ea	90 ea	56,220	20	4,851	2,700	7,551	30,900	46,350	.1
Swim Sites	1 ea	568/cap.	.30/cap.	568,000	20	49,018	33,000	82,018	110,000	165,000	8.4
Boat Launching Sites	1 ea	1,136/cap.	.30/cap.	1,136,000	50	70,818	33,360	104,178	111,200	194,600	.8
VIS Centers	2 ea	113/cap.	.76/cap.	33,900	50	2,113	28,424	30,537	37,400	56,100	.6
Observation Sites	6 ea	37/cap.	.05/cap.	22,200	50	1,383	3,300	4,683	66,000	99,000	.2
Trailer Park	48 ea	3,000 ea	90 ea	144,000	20	12,427	4,320	16,747	26,400	39,600	2.8
Winter Sports Area 10/	672 ac	1,400/cap.	11/	4,200,000	50	261,828	420,000	681,828	330,000	2,970,000	6.0
Group and Organizational Sites 10/	2 ea	568/cap.	.32/cap.	113,000	50	7,044	14,080	21,124	44,000	264,000	3.3
	Total Installation Cost			15,623,000							
	Installation Cost Breakdown				Total Fed.	947,487	398,504	1,345,991			
	Private			4,313,000	Private	268,872	434,080	702,952			
	Federal			11,310,000							
	Equipment		Private	3,019,100	Program Responses	+ or - Units			+4,567,900	--	-48.4
			Federal	7,917,000							
	Skilled Labor		Private	944,547		+ or - Dollars			--	+ 9,702,650	-474
			Federal	2,262,000							
	Unskilled Labor		Private	349,533							
			Federal	1,131,000							

TABLE 87

CENTRAL LAHONTAN BASIN
Cost and Responses of Proposed Forest Service Watershed Treatment Program
Calvada Subbasin

Treatment and/or Development	Units	Cost/Unit		Amortization Period		Average Annual Cost		Total Average Annual Cost $	Program Responses	
		Installation $	O&M $	Total Installation Cost $	@ 7% Yrs	Installation $	O&M $		+ or - Sediment Yield CY/Yr	+ or - Water Yield AF/Yr
Gully Erosion Control	25.5 mi	5,000	--	127,500	100	8,935	--	8,935	-8,160	--
Sheet Erosion Control	200 ac	130	--	26,000	100	1,822	--	1,822	-440	--
Stabilization of Barrow Pits	5 ac	340	--	1,700	100	119	--	119	-11	--
Rehabilitation of Abandoned Roads and Trails	86 mi	1,100	--	94,600	100	6,629	--	6,629	-774	--
Stream Channel Cleaning	12 mi	1,200	--	14,400	100	1,009	--	1,009	--	--
Lake and Reservoir Shore Cleaning	22 ac	250	--	5,500	100	385	--	385	--	--
Streambank Stabilization	6 mi	11,300	113	67,800	100	4,751	678	5,429	-420	--
Water Yield Improvement										
Type Conversion	10,500 ac	39	--	409,500	20	38,652	--	38,652	--	+3,465
Water Spreading 12/	150 ac	Not Avail.	Not Avail.	--	20	--	--	--	--	--
Deep Percolation and Infiltration 12/	10 ac	Not Avail.	Not Avail.	--	50	--	--	--	--	--
	Total Installation Cost			747,000	Total Fed.	62,302	678	62,980		
	Installation Cost Breakdown									
	Private			--						
	Federal			747,000	Program Responses	+ or - Units			-9,805	+3,465
	Equipment			522,900						
	Skilled Labor			163,593	Program Responses	+ or - Dollars			+4,216 13/	+33,957 14/
	Unskilled Labor			60,507						

TABLE 87

CENTRAL LAHONTAN BASIN
Cost and Responses of Proposed Forest Service Wildlife Program 15/
Calvada Subbasin

Treatment and/or Development	Units	Cost/Unit Installation $	Cost/Unit O&M $	Amortization Period: Total Installation Cost $	Amortization Period: @ 7% Yrs	Average Annual Cost: Installation $	Average Annual Cost: O&M $	Total Average Annual Cost $	Program Responses: Hunter or Fisherman Day Use Effect + or -	Program Responses: Effect on Wildlife & Fisheries Population + o -	Program Responses: + or - Sediment Yield CY/Yr	Program Responses: Increase in Wildlife Forage Lbs/Yr
Installation of Nesting Facilities	1 ea	100	10	1,600	5	390	160	550	+	+	--	--
Seeding and Planting	600 ac	15	--	900	20	849	--	849	+	+	-	150,000
Area Protection, Fencing	5 mi	3,000	50	15,000	50	1,086	250	1,336	--	+	--	--
Create Permanent Wildlife Openings	50 ac	35	10	1,750	20	165	500	665	+	+	--	+
Wildlife Watering Facilities	33 ea	1,500	10	49,500	50	3,586	3,300	6,886	+	+	--	--
Channel Stabilization and Improvements	23 mi	11,000	--	253,000	100	17,730	--	17,730	+	+	-1,610	--
	Total Installation Cost			321,750	Total	23,806	4,210	28,016				
	Installation Cost Breakdown											
	Private			--	Program Responses		+ or - Units		+	+	-1,610	+378DMU 16/
	Federal			321,750								
	Equipment			--			+ or - Dollars		+	+	+692	--
	Skilled Labor			--								
	Unskilled Labor			--								

CENTRAL LAHONTAN BASIN
Footnotes for Table 87 - Calvada Subbasin

* Indicates items not used in the NED account of the Four Account Display.

1. This includes cost of doing business in timber plus fire protection.
2. Based on value in 100 years discounted to present worth.
3. The benefits of the additional 4.8 million board feet of lumber to the consumer and to the economic activity of the subbasin were not calculated.
4. Value based on $35.35 per MBF.
5. Value based on $158.02 per MBF.
6. Source of cost is <u>Range Management Practices: Investment Cost 1970</u>, Agriculture Handbook No. 435.
7. Based on an estimate by the subunit manager that the total range program will increase the capacity to 125 percent of the existing capacity.
8. Value based on $4.42/AUM.
9. Value based on $0.43/CY.
10. Cost to be borne by private developers or investors.
11. Estimated to be 10 percent of construction cost.
12. This is expected to have a beneficial effect on the ground water reservoir.
13. Value based on $0.43/CY.
14. Value based on $9.80/AF.
15. Data not used in the NED account of the Four Account Display; expected responses were considered in the EQ account.
16. DMU is Deer-Months Use.

Improvements to cropland and increasing forage production on low forage producing rangelands are components of the accelerated program in Calvada Subbasin.

Table 88 - Accelerated conservation treatment on privately owned lands., Calvada Subbasin

Type and Quantity of Treatment	Average Annual Cost or Benefit
Irrigated cropland improvements:	
19,951 acres suitable for treatment	
Benefits, increased return	$167,588
Costs - Installation	128,883
OM&R	32,121
Total	$161,004
Net benefits	$ 6,584
Rangeland improvements:	
32,300 acres suitable for treatment	
Benefits, increased forage and sediment reduction	$ 11,531
Costs - Installation	4,930
O&M	4,363
Total	$ 9,293
Net benefits	$ 2,238

Four Account Display

The projects and programs for the subbasin have been summarized and displayed in the Four Account System in Table 89. Beneficial and adverse effects have been shown for each account. The accounts show the impacts that the projects and programs will have on the nation, the environment and the Basin.

Table 89 - Four Account Display, USDA Plan, Calvada Subbasin
CALVADA SUBBASIN SUMMARY
National Economic Development Account

Components	Measures of Effects (Average Annual Dollars)
Beneficial Effects:	
A. The value to users of increased outputs of goods and services	
(1) Flood Prevention	
(a) Urban Present Damage	27,300
(b) Urban Future Damage	22,300
(c) Sediment	41,715
(d) Indirect	5,000
(2) Recreation	
(a) Federal	6,468,650
(b) Private	3,234,000
(3) Forage Supply	24,441
(4) Irrigation	320,624
(5) Wood Supply	150,720
B. The value of outputs resulting from external economies	
Indirect and induced assn. with increased net returns from irrigation.	85,219
C. Utilization of unemployed and underemployed resources	30,152
TOTAL Beneficial Effects	10,410,121
Adverse Effects:	
A. The value of resources required for the plan	
(1) Multipurpose reservoir and recreation facilities	
(a) Project Installation	2,995,640
(b) Project OM&R	999,421
(c) Project administration	25,465
B. Losses in output resulting from external diseconomies	
TOTAL Adverse Effects	4,020,526
NET Beneficial Effects	6,389,595

Tabel 89 Continued
CALVADA SUBBASIN SUMMARY
Environmental Quality Account

Beneficial and Adverse Effects

Components	Measures of Effects
A. Areas of Natural-Beauty.	1. Two reservoirs will be created with a maximum surface area of 1788 acres and have a permanent pool of 360 acres. 2. About 1810 acres of open space will be taken up by the reservoirs and structures and preserved in this state. 3. Reservoirs will provide a total of 28,105 acre-feet of storage, 20,000 acre-feet for irrigation, 4,000 acre-feet for stream mitigation, 2,709 acre-feet for flood detention, and 1,396 acre-feet for sediment storage. 4. Willow Creek Reservoir will inundate 6.25 miles of perennial stream out of a total of about 42 miles in the Willow Creek Watershed. 5. Piute Creek Reservoir will inundate about one mile of Piute Creek, an intermittant stream, when the creek has flood flows, otherwise the reservoir will have no pool area. 6. Willow Creek permanent pool will have an area of 360 acres and will have about 4.5 miles of shoreline. 7. Evaporation from the Willow Creek Reservoir will be about 3,600 acre-feet a year, but the evaporation from Horse Lake will be reduced. 8. Elevation of Horse Lake will be lowered about four feet and will yield an average annual amount of 4,700 acre-feet of water. 9. About 25 acres will be required for 34,700 feet of new and improved irrigation canal and associated facilities. 10. Stream flow in Susan Rivcr will be increased during summer months when flows are normally low due to a slower rate of release from the irrigation reservoirs. 11. Treatment of the cropland will enhance the natural beauty by creating a green belt in a semi-arid area. 12. Range seeding and brush spraying will have a noticable effect on the natural beauty until the vegetation is reestablished. 13. Fencing will detract from the natural beauty of the open space of the Subbasin. 14. Seeding and spraying will restore the vegetation to be nearer the pristine condition. 15. Designation of 5,548 acres as non-urban parks for recreation purposes. 16. Increase in public amenities through development of 2,234 camping units, 30 picnic units, a swim site, a boat launching facility, 2 visitor information centers, 6 observation sites, and the development of 672 acres for a winter sports area. Increase the public facilities at Eagle Lake with a 1,026 unit complex and a 48 unit trailer park. 17. Set aside 2,858 acres around the facility development to be used as a buffer zone.

Table 89 Continued
CALVADA SUBBASIN SUMMARY
Environmental Quality Account

Beneficial and Adverse Effects

Components	Measures of Effects
A. Areas of Natural-Beauty. (continued)	18. Will restrict other resourcesuses on the Buffer Zone such as timber harvest, grazing, and mineral exploration.
	19. There will be an intrusion on the visual quality of the natural setting by the construction of 3,338 family recreation units.
	20. There will be an increase in human use and create an adverse impact on the non-urban areas through utilization of the additional recreation facilities development. Much of the increased use will come from non-resident users.
	21. Channel improvement on 41 miles of stream to restore proper hydrologic functioning and reduce erosion action creating an estimated 420 cubic yards of sediment annually.
	22. There will be an 11,812 cubic yard reduction annually of the sediment load that has a potential of reaching the lakes in the Subbasin through the National Forest Land treatment program.
	23. There will be a degradation of the visual quality and sound quality of the natural setting of Eagle Lake due to increased recreation use.
	24. Enhance 22 acres of shoreline by cleaning and protection.
	25. Enhance 26 acres of shoreline at Eagle Lake by developing swimming and boat launching facilities.
	26. The development of the facilities will increase present theoretical annual capacity of the beaches and shores by 221,200 visitor days.
	27. There will be a temporary degradation of the visual, sound, and odor quality of the natural setting caused by the construction equipment during the implementation period.
	28. The "Escarpment", an area along the east slopes of the Sierra Nevada, from Janesville to Hallelujah Junction, has been reclassified as marjional for timber production and as such, only sanitation and salvage type of timber harvest will be conducted in this area. This will reduce the allowable cut in the Subbasin in the future.
B. Biological Resources and Selected Ecological Systems.	1. The range improvements will increase the forage production on 134,016 acres of rangeland by 9,203 AUM's annually.
	2. Reforest 300 acres of non-productive commercial forest land.
	3. Increase vegetative cover density on 600 acres of wildlife habitat for food and cover.
	4. Enhance vegetative cover density on 1,210 acres of problem areas to control erosion and sediment.

(comtinued)

Table 89 Continued
CALVADA SUBBASIN SUMMARY
Environmental Quality Account

Beneficial and Adverse Effects

Components	Measures of Effects
B. Biological Resources and Selected Ecological Systems. (continued)	5. Fencing and water developments will bring about better livestock distribution and forage use. 6. Fencing will restrict the movement of antelope. 7. The 38 water developments will provide water for livestock and wildlife. 8. The area within a quarter of a mile around the water developments may deteriorate from constant use if not carefully managed. 9. The ecosystem will be changed as the plant cover goes from sagebrush to grass, which will reduce the food and cover for certain wildlife that may be dependent on sagebrush habitat. 10. Reduction of wildlife food and cover may reduce some species of wildlife, particularly deer and sage grouse. 11. The increase of the forage production by 130,000 pounds annually on the treated wildlife habitat area will support 328 additional deer-months use. 12. Improve waterfowl nesting facilities at Eagle Lake. 13. Improve 23 miles of fisheries habitat, which will increase fish population and fisherman success in treated areas. 14. Preserve and improve the ecosystems of 157,451 acres of forest and woodland, 3,655 acres of rangeland and 41 miles of streams in the National Forest. 15. Will change 1,887 acres of forest and woodland ecosystem to developed areas for recreational use. 16. Will change 35,227 acres of shrub and brush land ecosystem to predominant range and grass land ecosystem through cover manipulation. 17. The consolidation and realignment of irrigation ditches and canals will reduce the riparian vegetation and associated wildlife habitat. 18. Reduced pumping of irrigation water will result in an energy savings. 19. Will increase crop production by providing a full irrigation supply to 9,053 acres. 20. Drainage of some class 1&2 wetlands will reduce the food supply for canadian geese in the spring, but increase the upland game habitat on the land drained. 21. The open drains will increase the riparian vegetation and associated wildlife habitat. 22. The increased agricultural production will also increase the food and cover for wildlife.

(continued)

Table 89 Continued
CALVADA SUBBASIN SUMMARY
Environmental Quality Account

Beneficial and Adverse Effects

Components	Measures of Effects
B. Biological Resources and Selected Ecological Systems.	23. Willow Creek reservoir will inundate about 1,680 acres destroying the present Juniper-sage vegetation which is used now by livestock, deer (winter range), upland game birds and other non-game animals.
	24. The periodic flooding of the Piute Creek reservoir pool area will change 108 acres from a conifer-browse-grass vegetation into mountain meadow vegetation.
	25. Willow Creek reservoir will fluctuate in size between an area of 1,680 to 360 acres and create a wetland environment which will provide a feeding and resting area for waterfowl.
	26. The change in the vegetation in the reservoir pool areas will result in a change also in the wildlife inhabiting the area.
	27. A minimum release of 10 cubic feet per second from the Willow Creek reservoir will maintain the fish life below the reservoir.
	28. Willow Creek reservoir will block migration of fish to upstream spawning beds from below the reservoir as well as destroying 6.25 miles of stream channel spawning beds.
	29. Water coming from Horse Lake may be of such quality that itcould have a detrimental effect on fishlife.
C. The quality of water, land, air, and sound resources.	1. There will be a temporary degradation of the water quality during program implementation.
	2. Land treatment will reduce erosion and resulting sediment by 22,460 cubic feet annually.
	3. Water developments will provide higher quality of water to livestock and wildlife.
	4. Improved vegetal cover will reduce wind and water erosion.
	5. Runoff from sprayed land may cause some down stream plants to be poisioned by the spray being washed down, particularly aquatic plants.
	6. Consolidation and realignment of the ditches and cannals will reduce the seepage loss.
	7. Treatment of the irrigated land will reduce the erosion and resulting sediment from irrigation.
	8. Some of the land now used for canals and ditches could be brought into production after consolidation and realignment.
	9. Treatment of the irrigated land and proper management of the land treatment will increase the irrigation efficiency from 40 percent to 67 percent.

(continued)

Table 89 Continued
CALVADA SUBBASIN SUMMAR
Environmental Quality Account

Beneficial and Adverse Effects

Components	Measures of Effects
C. The quality of water, land, air, and sound resources. (continued)	10. Water quality will be increased in the summer months by the increased flow in the streams. 11. The addition of irrigation water to 9,053 acres will improve the quality of the land. 12. The 1,396 acre-feet of sediment that can be trapped by the reservoirs over their life will improve the quality of water released below the structures providing better fish habitat. 13. Reduction of flood flows will reduce erosion and land damage caused by the water force. 14. Installation of a natural filter system will reduce the present biological pollution delivery to Eagle Lake. 15. Installation of "pit-pump" toilets at all recreation developments not served by septic system will reduce biological pollution of ground water and streams. 16. Maintaining a buffer zone of 100 to 200 feet along streams in timber harvest areas will lower stream temperatures. 17. Higher utilization of forest products and mill residue will produce less waste to be burned. 18. Increased efforts to adopt an urban and environmental forestry program will reduce the noise level, filter the air and lower maximum temperatures in urban areas. 19. Land treatment will improve productivity and quality of range and forest lands. 20. Reducing timber harvest will maintain the visual quality of the "Escarpment". 21. Establishing irregular, or free-form boundaries on timber harvest areas will imporve visual quality. 22. Intrusion of the visual quality of the natural setting by man made structures and recreation facilities.
D. Irreversible commitments of resources to future users	23. Reservoir drawdown will result in reduction of visual quality. 1. The project will commit land, labor, and capitol by the installation and operation of the structures and facilities. 2. About 377,900 cubic yards of rock and earth will be displaced and subjected to an ecological change as a result of project construction. 3. Natural vegetation will be destroyed and changed to lake bed environment on about 1,788 acres.

Table 89 Continued
CALVADA SUBBASIN SUMMARY
Environmental Quality Account

Components	Beneficial and Adverse Effects Measures of Effects
D. Irreversible commitments of resources to future users.	4. The project pumping plants will commit energy to the project operation. 5. Commit 1,887 acres of forest land to developed recreation area.

Table 89 Continued
CALVADA SUBBASIN SUMMARY
Regional Development Account

Components	Measures of Effects: Central Lahontan Basin	Measures of Effects: R.O.N.
	(Average Annual)	
1. Income Beneficial Effects:		
A. The value of increased output of goods and services to users residing in the region		
(1) Flood Prevention		
(a) Urban Present Damage	27,300	------
(b) Urban Future Damage	22,300	------
(c) Sediment	41,715	------
(d) Indirect	5,000	------
(2) Recreation		
(a) User		
(1) Federal	1,293,730	5,174,920
(2) Private	646,800	2,587,200
(b) Increased net income to business and recreational supplies from non-resident expenditures	9,397,975	-9,397,975
(3) Forage Supply	24,441	------
(4) Irrigation	320,624	------
(5) Wood Supply	150,720	------
B. The value of outputs to users residing in the region from external economies		
(1) Indirect and Induced effects from non-resident expenditures	2,824,974	-2,824,974
(2) Indirect and induced activities associated with increased net returns	64,972	20,247
C. Utilization of unemployed and under employed resources		

Components	Measures of Effects: Central Lahontan Basin	Measures of Effects: R.O.N.
	(Average Annual)	
1. Income Adverse Effects:		
A. The value of resources contributed from within the region.		
(1) Project installation	444,285	2,551,355
(2) Project OM&R	486,307	513,114
(3) Project administration	7,640	17,825
B. Losses in output from external diseconomies	-----	-----
C. Loss of assistance payments	-----	-----
D. Loss of displaced resources	-----	-----

Table 89 Continued
CALVADA SUBBASIN SUMMARY
Regional Development Account

Components	Measures of Effects		Components	Measures of Effects	
	Central Lahontan Basin	R.O. N.		Central Lahontan Basin	R.O.N.
	Average Annual Dollars			Average Annual Dollars	
(1) Project Installation	34,423	-19,128			
(2) Project OM&R	18,241	-18,241			
(3) Externalities of OM&R	4,236	- 4,236			
(4) Farm Labor	44,165	-29,308			
D. Additional wages and net income occuring from construction and implementation of the plan and induced activities					
(1) Project installation	1,142,792	-1,142,792			
(2) Project OM&R	664,551	-664,551			
(3) Externalities of OM&R	154,373	-154,373			
(4) Non-resident recreation	17,149,176	-17,149,176			
Total Beneficial Effects:	34,032,508	-23,622,387	Total Adverse Effects:	938,232	3,082,294
			Net Beneficial Effects:	33,089,871	-26,700,276

Table 89 Continued
CALVADA SUBBASIN SUMMARY
Regional Development Account

Components	Measures of Effects	
	Central Lahontan Basin	Rest of Nation
II. Employment Beneficial Effects: A. Increase in the number and type of jobs in the region		
(1) Project Installation	Creates during project installation period: 387.4 man years of skilled employment 1,805.5 man years of unskilled employment	During project installation period -366.8 man years of skilled employment.
(2) Project OM&R	Creates during project evaluation period: 105.5 man years of unskilled employment	
(3) Farm Labor	Creates during project evaluation period: 68.5 man years of semi-skilled employment	
(4) Non-resident recreation	Creates during project evaluation period: 6,606.0 man years of seasonal unskilled employment.	
(5) Indirect and induced effects from:		
(a) Project OM&R and farm labor	Creates during project evaluation period: 98.5 man years of fulltime unskilled employment.	
(b) Non-resident recreation	1,459.7 man years of seasonal unskilled employment.	
Total Beneficial Effects:	2,192.9 man years of employment during project installation period: 272.5 man years of permanent fulltime employment during project evaluation period:	-366.8 man years of employment during project installation period:

*Total man years during project installation period.

Table 89 Continued
CALVADA SUBBASIN SUMMARY
Regional Development Account

Components	Measures of Effects: Central Lahontan Basin	Measures of Effects: Rest of Nation
	8.065.7 man years of permanent seasonal employment during project evaluation period.	
Adverse Effects: A. Decrease in number and type of jobs in the region	------------	------------
NET Beneficial Effects:	2,192,9 man years of employment during project installation period. 272.5 man years of permanent fulltime employment during project evaluation period. 8,065.7 man years of permanent employment during project evaluation period.	-366.8 man years of employment during * project installation period.
III. Population Distribution Beneficial and Adverse Effects:	Creates 8,338.2 permanent jobs supporting a population of 12,853.0 people in an area with a high rural population.	------------
IV. Regional Economic Base and Stability Beneficial and Adverse Effects:	Creates 275.8 permanent fulltime jobs 8,065.7 permanent seasonal jobs during project evaluation period, creates during project installation period 2,192,9 man years of employment, provides 4,346,700 visitor days of general outdoor recreation and 221,200 visitor days of water based recreation, will reduce sediment by 20,453 cubic yards. increase forage supply by 9,203 AUM'S, increase cropland production on 29,004 acres, increase wood supply by 505,132 MBF, and reduce flood damage by $54,600 annually.	------------
V. Regional Environmental Conditions Beneficial and Adverse Effects:	------------	------------

* Total man years during project installation period.

Table 89 Continued
CALVADA SUBBASIN SUMMARY
Social Well-being Account

Components	Measures of Effects		
A. Real Income Distribution			
(1) Beneficial Effects:	Income Class (Dollars)	Adjusted Gross Income By Class (Percent)	Benefits in Class (Percent)
	(Distribution of $46,671,044 in benefits to the Calvada Subbasin)		
	Less than 3,000	08.3	06.6
	3,000 to 10,000	41.4	38.4
	More than 10,000	50.3	55.0
(2) Adverse Effects:	Income Class (Dollars)	Adjusted Gross Income By Class (Percent	Cost in Class (Percent)
	(Distribution of $981,836 in cost to be borne by the Calvada Subbasin		
	Less than 3,000	08.3	06.6
	3,000 to 10,000	41.4	38.4
	More than 10,000	50.3	55.0
B. Life, Health, and Safety: Beneficial and Adverse Effects:	Provide flood protection at 100-year level to Susanville Piute Creek Drainage.		
C. Educational, Cultural, and Recreational Opportunities: Beneficial and Adverse Effects:	Provide 4,346,700 visitor days of general outdoor recreation and 221,200 visitor days of water based recreation, 25 percent of National Forest gross receipts paid to counties.		
D. Emergency Preparedness: Beneficial and Adverse Effects:	Decrease usable water yield by 277 acre-feet annually in the Basin.		

Truckee River Subbasin

The USDA Plan for the subbasin consists of the Evans Creek (Block "N"), Incline Village, Galena Creek, Southwest Reno, and Sun Valley watershed investigations. The National Forest programs and the accelerated conservation programs on private lands. A brief summary of each component of the plan is included in the following pages. The detailed reports of the projects and programs are in APPENDIX II.

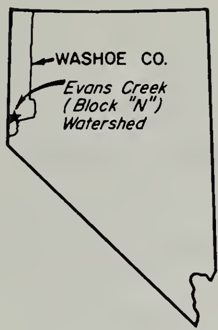
Evans Creek (Block "N") Watershed Investigation Report

The watershed contains 2,990 acres on the north side of the Truckee River. Evans Creek runs through the City of Reno, Nevada, and the University of Nevada campus. About one percent of the watershed is university land, 75 percent is privately-owned and about 24 percent is federal land under the Bureau of Land Management. The elevation ranges from 4,500 to 5,450 feet.

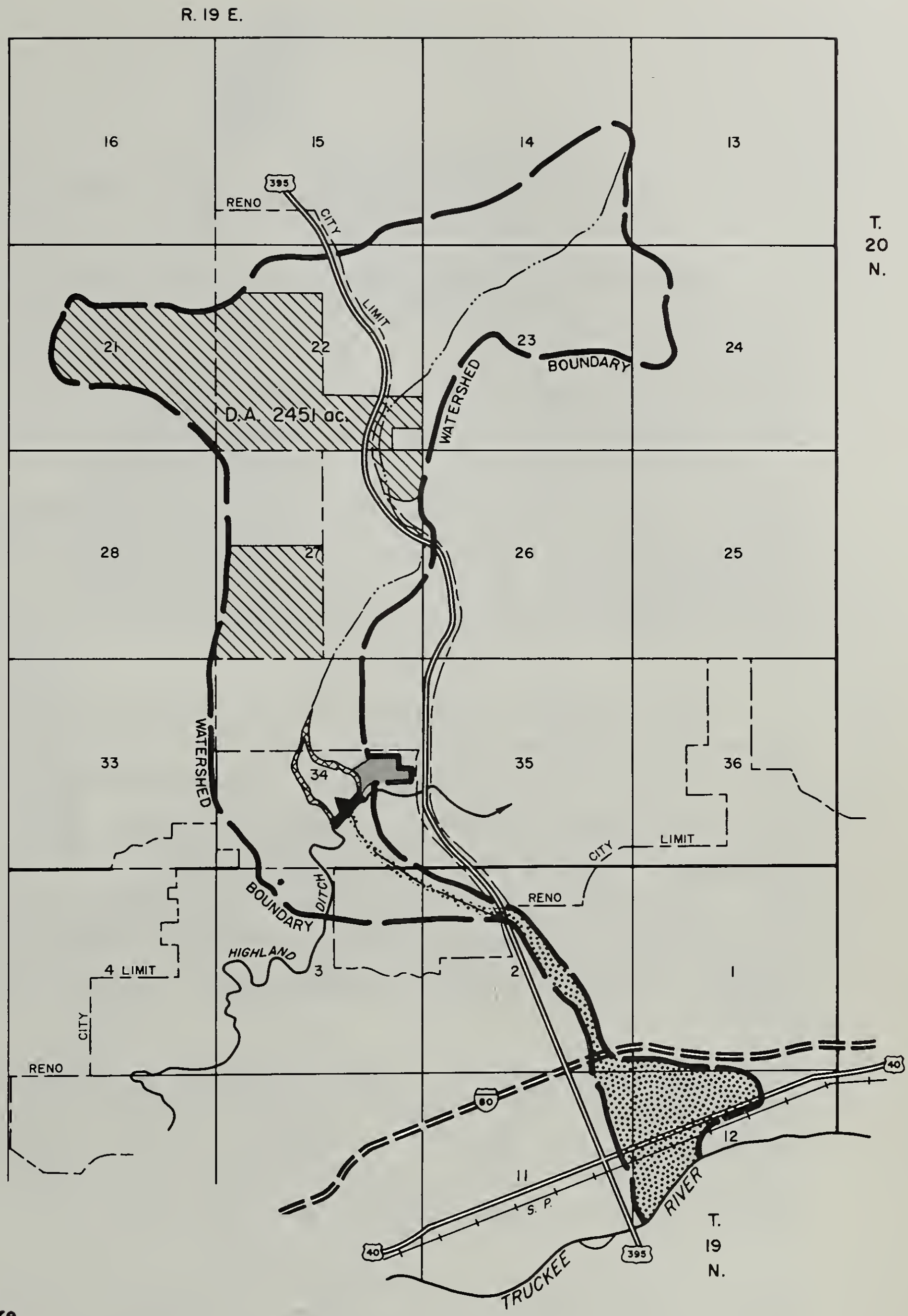
Fires and livestock grazing have left the watershed with very little vegetal cover to protect it from erosion. This results in deposition and flooding on city and university lands. Recreation facilities are also needed in the area.

A PL-566 work plan has been prepared and submitted. This plan was withdrawn in 1973 because some criteria was not acceptable. The plan called for a multi-purpose structure for both flood prevention and recreation. The project installation cost was estimated to be $1,882,715. Estimated average annual cost was $162,090 and average annual benefits $305,125.

Evans Creek, foreground, runs directly into the University of Nevada, Reno Campus.



LOCATION MAP



LEGEND

Proposed Structure

Proposed Recreation Development Area

Area Benefited

Federal Land

MAP 33

OWNERSHIP AND POTENTIAL PROJECTS
EVANS CREEK BLOCK "N" WATERSHED
WASHOE COUNTY, NEVADA

JULY 1975

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SCALE 1:63,360

EPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE USDA-SCS-PORTLAND, OREG. 1975

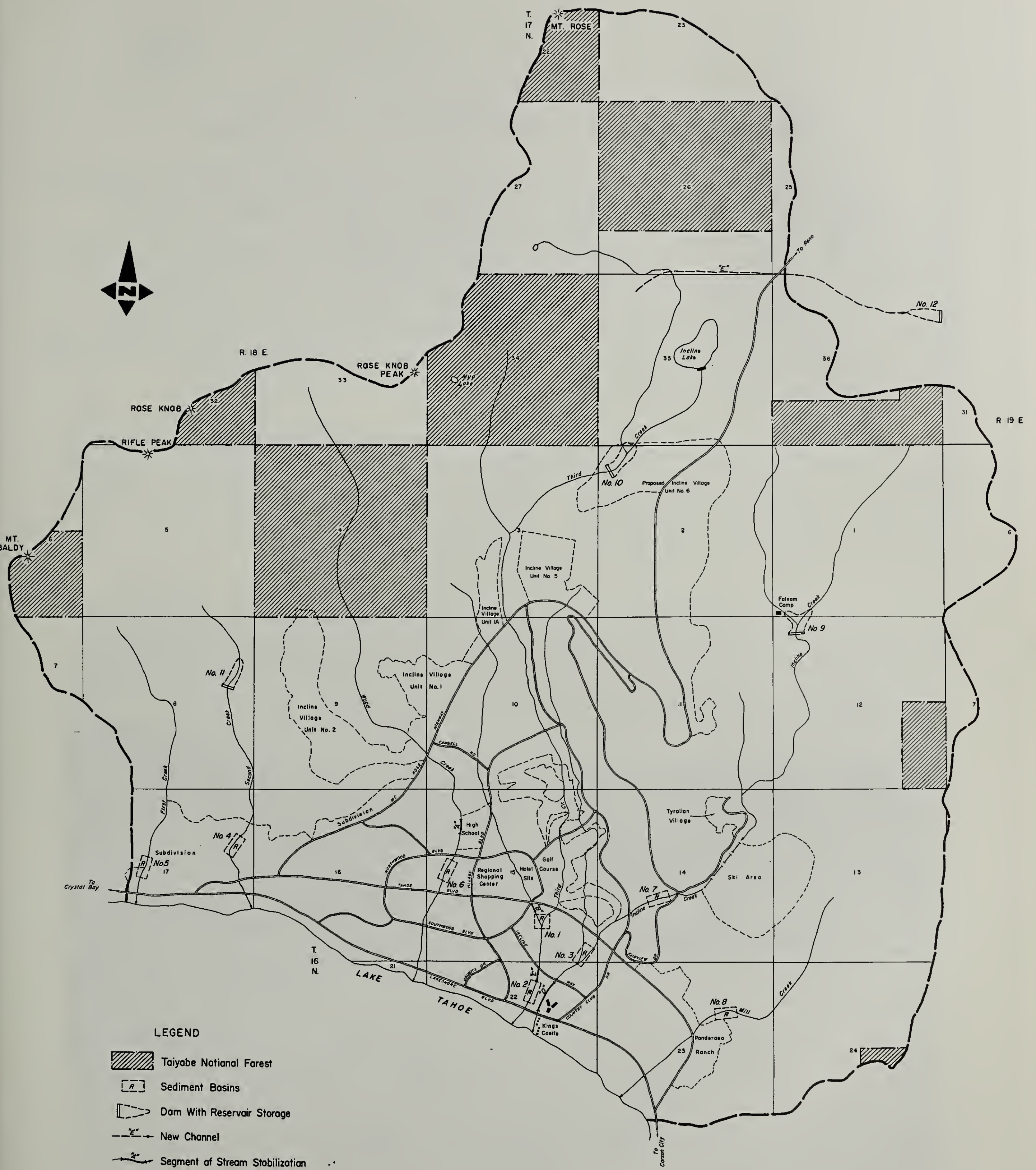
Incline Village Watershed Investigation Report

The watershed has a drainage area of about 14,000 acres located on the northeast side of Lake Tahoe. Approximately 83 percent of this is privately-owned and 17 percent is federally-administered land under the U. S. Forest Service. The watershed ranges in elevation from 6,229 at Lake Tahoe to over 10,000 feet at the top of Mt. Rose. Incline Village is the population center of the watershed. The area in and around the watershed has been long noted for its natural beauty, and attracts many thousands of people each year to both summer and winter recreation.

The steep slopes of the watershed cause rapid runoff and this has caused erosion of the slopes. Incline Village gets most of the sediment with the remainder of the sediment entering Lake Tahoe. The sediment not only damages Incline Village, but also blocks the mouth of the creeks and restricts the spawning fish movement and adds undesirable nutrients to Lake Tahoe. There is a need for additional recreation facilities to help meet the demands during the summer.

It is possible that reducing the amount of sediment entering Lake Tahoe could have an adverse effect on the lakes beaches by reducing the amount of sands available to them. Additional environmental studies are needed to determine if this reduction would create and adverse impact.

A floodwater retarding structure, and three multiple purpose structures for flood retardation and recreation, are recommeded. Land treatment is needed on areas that are a high source of sediment. The estimated cost of the project installation is $4,284,800. The average annual cost is $342,300 and the average annual benefits are $518,500.



MAP 34

OWNERSHIP AND POTENTIAL PROJECTS

INCLINE VILLAGE WATERSHED

WASHOE COUNTY, NEVADA

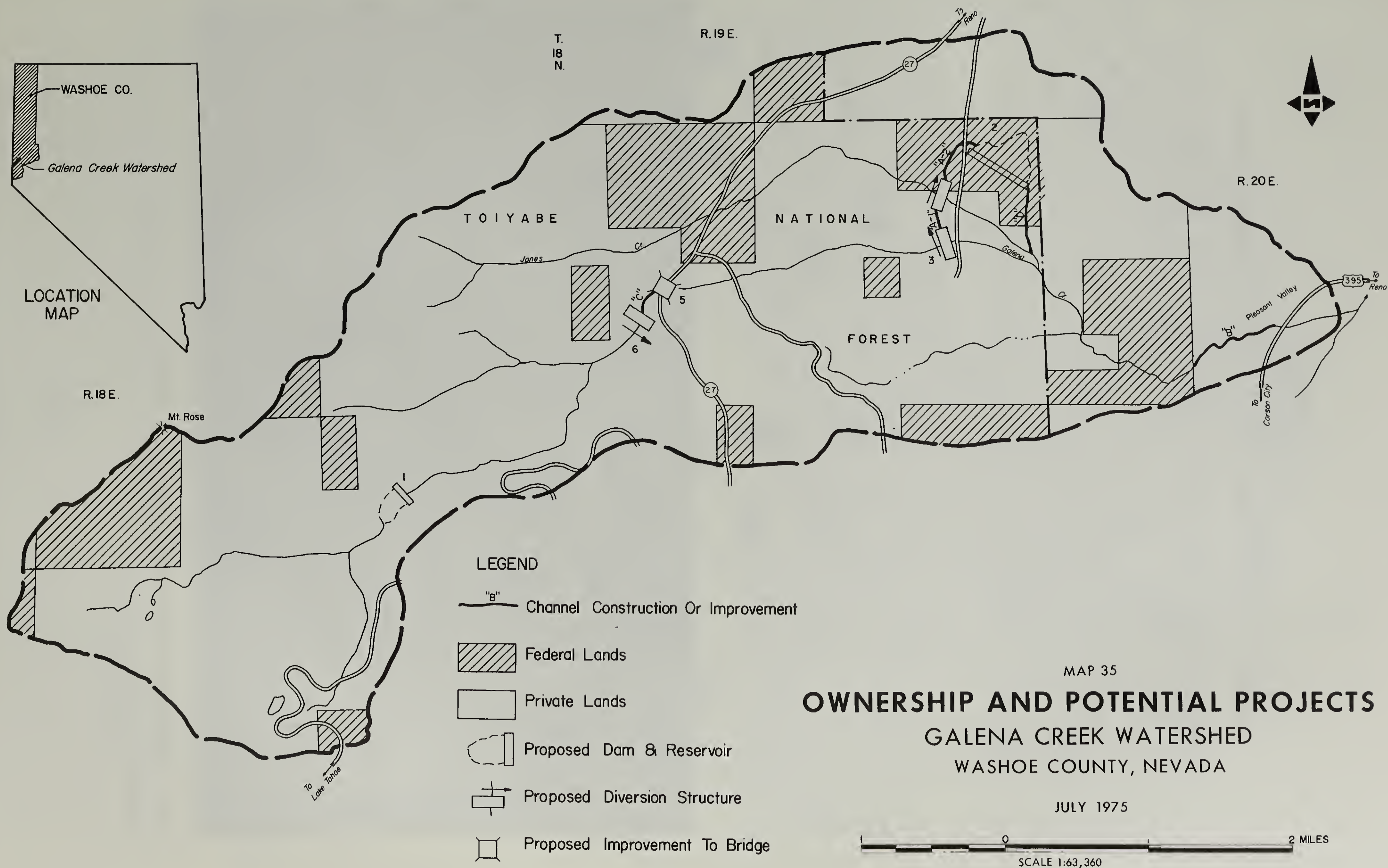
JULY 1975

Galena Creek Watershed Investigation Report

The watershed has an area of 12,563 acres and is located 15 miles south of Reno, Nevada. About 80 percent of the watershed is privately-owned and 20 percent is federal land. Elevation of the watershed ranges from 10,778 at the top of Mt. Rose to 4,760 feet in Pleasant Valley. The watershed has a long flood history causing many thousands of dollars in damage and some loss of life. Urbanization in the flood plain has accentuated the hazard.

A floodwater retarding structure and channels will help meet the needs of the flood problem. Land treatment is also planned to reduce erosion. The estimated project cost for installation is $1,299,100. The average annual cost is $97,240 and the average annual benefits are $73,200.

Flooding from Galena Creek Watershed



MAP 35

OWNERSHIP AND POTENTIAL PROJECTS

GALENA CREEK WATERSHED

WASHOE COUNTY, NEVADA

JULY 1975

Southwest Reno Watershed Investigation Report

The watershed has approximately 84,700 acres located on the eastern slopes of the Carson Range, and Bailey Canyon in the Virginia Range. The city of Reno, Nevada, is on the northern end of the watershed. About 96 percent of the watershed is privately owned and 4 percent administered by the U.S. Forest Service. The elevation ranges from a high of about 10,770 to a low of about 4,380 feet. Most of the lower watershed has been urbanized and is either part of Reno or among its suburbs. There is still some irrigated pasture in the watershed for livestock and horses.

The watershed has had both wet-mantle and dry-mantle floods which have caused serious damage. There is also a need for more recreation facilities. There is a proposal to build eight floodwater retarding structures, four multi-purpose structures for flood prevention and recreation, and 6,600 feet of channel and dikes. Land treatment is needed in the upper watershed. The estimated project installation cost is $12,396,200.00. The average annual cost is $952,150 and the average annual benefits are $1,188,000.

The rapidly urbanizing area southwest of Reno is in a flood prone area.

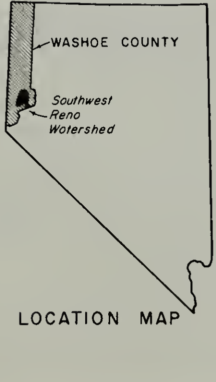
MAP 36

OWNERSHIP AND POTENTIAL PROJECTS

SOUTHWEST RENO WATERSHED

WASHOE COUNTY, NEVADA

JULY 1975



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Sun Valley Watershed Investigation Report

The watershed has 15,540 acres located on the north side or the Truckee River. The communities of Sparks and Sun Valley are in the watershed. About 94 percent of the watershed is privately-owned and the other 6 percent is federal land under the management of the Bureau of Land Management. The elevation of the watershed ranges from 5,860 for a high, to a low of 4,380 feet. Most of the watershed is urban areas in Sun Valley or Sparks. Both communities have flooding and erosion problems. These problems result from sparse vegetal cover on the upper slopes of the watershed. The communities have a need for recreation.

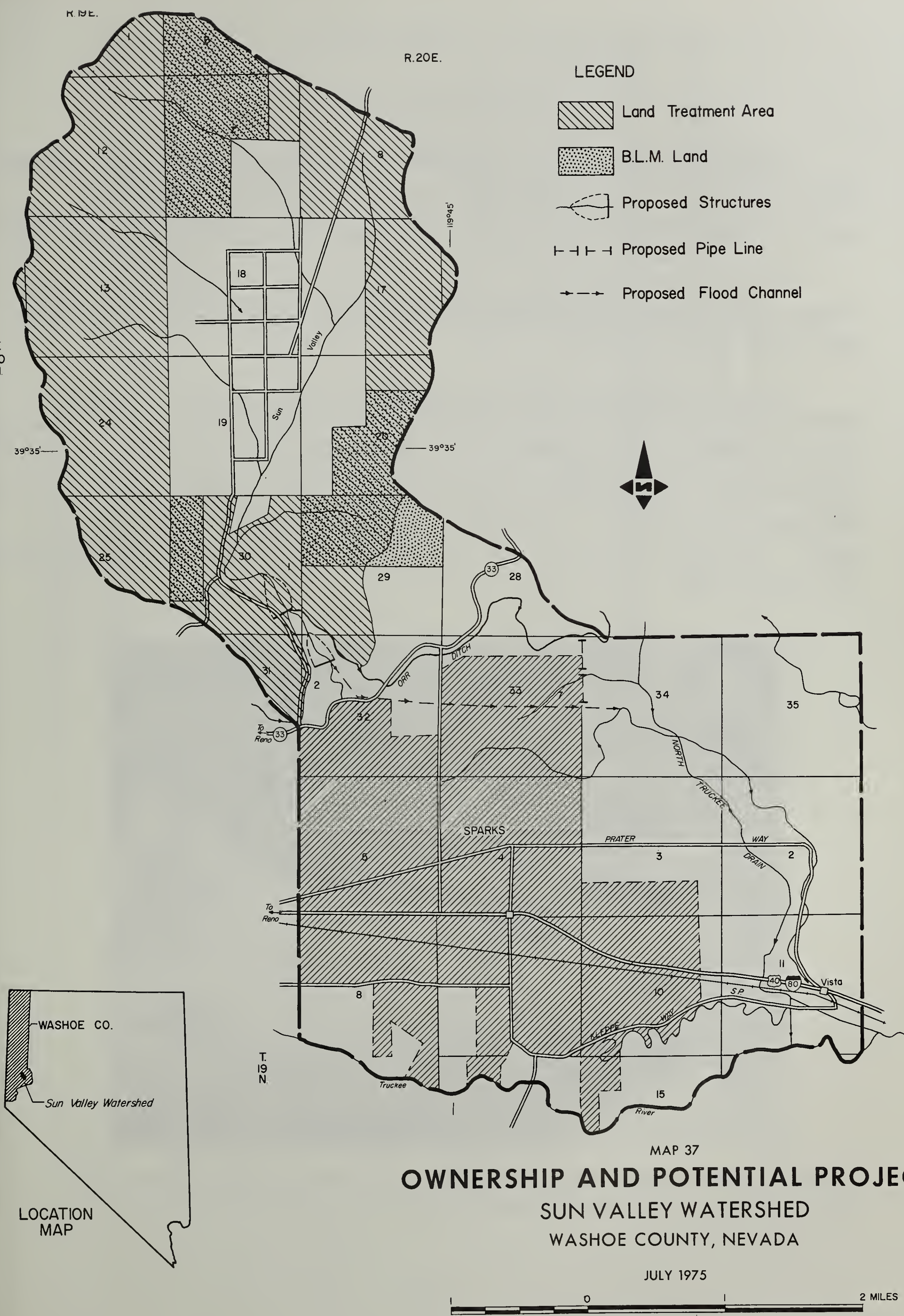
Potential solutions to the flooding and sedimentation problems in the watershed have been evaluated under three alternative proposals. These proposals are all physically feasible but only alternative 1 was completely evaluated because it appears to be the most feasible, but not necessarily the most desirable.

Alternative 1 - One 1,500 AF storage structure for floodwater detention and recreation.
-17,000 linear feet of channel improvement

Alternative 2 - One 1,100 AF storage structure for floodwater detention and recreation.
-17,000 linear feet of channel improvement
-3,700 acres contour trenching

Alternative 3 - -13,700 linear feet concrete flood channel
-3,700 acres contour trenching

Land treatment of the slopes will help improve the vegetal cover. The project installation cost for Alternative 1 is $1,550,300. The average annual cost is $131,500 and the average annual benefits are $107,600.



MAP 37

OWNERSHIP AND POTENTIAL PROJECTS

SUN VALLEY WATERSHED

WASHOE COUNTY, NEVADA

JULY 1975

Other Components

Summaries of planned treatment measures on National Forest and privately owned lands are shown in Tables 90 and 91 Costs, program responses, and benefits are indicated. Development of the values for costs and responses are in APPENDIX II.

The National Forest summary includes measures for timber, range improvement, recreation development, watershed treatment, and fish and wildlife.

The accelerated treatment summary for privately owned land indicates costs and benefits for accelerating the installation of improvement measures on irrigated cropland and privately owned rangeland. Units shown reflect that portion of the total cropland and rangeland treatment needs that could be treated to achieve a 50 percent increase over the present rate of treatment. Costs, benefits from increased returns, and net benefits are displayed.

Large increases in all types of recreation facilities are planned for Truckee Subbasin.

TABLE 90

CENTRAL LAHONTAN BASIN
Cost and Responses of Proposed Forest Service Timber Program
Truckee Subbasin

Treatment and/or Development	Units	Cost/Unit: Installation $	Cost/Unit: O&M $	Amortization Period: Total Installation Cost $	Amortization Period: @ 7% Yrs	Average Annual Cost: Installation $	Average Annual Cost: O&M $	Total Average Annual Cost $	Program Responses: Increase Fiber Yield MBF/Yr	Program Responses: + or - Water Yield AF/Yr	Program Responses: + or - Sediment Yield CY/Yr
Biological Contribution											
Reforestation*	2,330 ac	128	--	298,240	100	20,900	--	20,900	--	-194	Not Avail.
Release*	5,500 ac	25	--	137,500	30	11,079	--	11,079	--	--	--
Thin*	3,730 ac	25	--	93,250	30	7,510	--	7,510	--	--	--
Prune*	80 ac	40	--	3,200	100	224	--	224	--	--	--
Full Stocking Implementation	56,184 ac	130	.70/ac 1/	7,303,920	100	511,858	39,328	551,186	202,262	--	Not Avail.
Industrial Contribution											
Logging Residue Reduction*	12.8 mmbf	1,562	--	19,993	3	7,618	--	7,618	384 3/ (Value of stumpage		$ 13,574) 4/
Mill Residue Reduction*	12.8 mmbf	Not Avail.	Not Avail.	--	--	--	--	--	1,280 3/ (Value of lumber		$202,266) 5/
		Total Installation Cost		7,303,920							
		Installation Cost Breakdown			Total	511,858	39,328	551,186			
		Private		--							
		Federal		7,303,920	Program Responses	+ or - Units			+202,262	-194	--
		Equipment		2,264,215							
		Skilled Labor		584,313		+ or - Dollars			69,975 2/	-2,132	--
		Unskilled Labor		4,455,392							

TABLE 90

CENTRAL LAHONTAN BASIN
Cost and Responses of Proposed Forest Service Range Improvement Program
Truckee Subbasin

Treatment and/or Development	Units	Cost/Unit: Installation $	Cost/Unit: O&M $	Amortization Period: Total Installation Cost $	Amortization Period: @ 7% Yrs	Average Annual Cost: Installation $	Average Annual Cost: O&M $	Total Average Annual Cost $	Program Responses: Forage Increase Pounds/Yr	Program Responses: Increased AUM Capacity Annual	Program Responses: + or - Sediment Yield CY/Yr	Program Responses: + or - Water Yield AF/Yr
Cover Manipulations	347 ac	3.80 6/	--	1,318	10	187	--	187	87,750	See Footnote 7	-110	+36.1
Fertilizer Application	200 ac	15 6/	--	3,000	3	1,143	--	1,143	12,500			
Fence Construction	4 mi	1,000 6/	5	4,000	30	322	20	355	--			
Cattle Guard Installation	5 ea	3,000	20	15,000	100	1,051	100	1,151	--			
Noxious and Undesirable Forbs Control	25 ac	15	--	375	15	41	--	41	--			
Water Development												
Springs	4 ea	500	20	2,000	25	171	80	251	--			
Reservoir	1 ea	1,500	25	1,500	30	120	25	145	--			
	Total Installation			27,193	Total Fed.	3,035	225	3,260				
	Installation Cost Breakdown											
	Private			--	Program Responses	+ or - Units			+100,250	+868 7/	-110	+36.1
	Federal			27,193		+ or - Dollars			--	+3,662 8/	+328 9/	+397 10/
	Equipment			20,793								
	Skilled Labor			1,596								
	Unskilled Labor			4,804								

TABLE 90

CENTRAL LAHONTAN BASIN
Cost and Responses of Proposed Forest Service Recreation Development
Truckee Subbasin

Treatment and/ Development	Units	Cost/Unit Installation $	Cost/Unit O&M $	Amortization Period Total Installation Cost $	Amortization Period @ 5.875 Yrs	Average Annual Cost Installation $	Average Annual Cost O&M $	Total Average Annual Cost $	Program Responses Capacity Increase Visitor Days Annual	Program Responses Annual Benefit Value $	Program Responses Consumptive Water Use AF/Yr
Campgrounds	5,180 ea	2,868 ea	90 ea	14,856,240	20	1,282,090	466,200	1,748,290	4,662,000	6,993,000	191.0
Picnic Sites	2,170 ea	1,876 ea	90 ea	3,980,900	20	343,550	195,300	538,850	983,730	1,475,595	45.3
Swim Sites	12 ea	568/cap.	.76/cap.	5,600,480	20	483,320	674,424	1,157,744	887,400	1,331,100	40.8
Boat Launching Sites	3 ea	1,136/cap.	.76/cap.	1,090,559	50	67,985	99,917	167,902	131,520	230,160	1.0
VIS Centers	4 ea	113/cap.	.76/cap.	361,600	50	22,542	152,000	179,542	200,000	300,000	12.6
Observation Sites	6 ea	37/cap.	.05/cap.	27,750	50	1,730	3,000	4,730	60,000	90,000	.5
Winter Sports Area 11/	600 ac	1,400/cap.	13/	3,249,400	50	202,567	324,900	527,467	276,320	2,486,880	5.8
Group and Organizational Sites 11/	14 ea	568/cap.	.32/cap.	3,223,400	50	200,946	451,360	652,306	1,410,500	8,463,000	86.6
Resorts 11/	1 ea	12/	14/	1,296,000	50	80,792	194,460	276,252	158,400	1,108,800	9.7
	Total Installation Cost			33,686,329	Total Fed.	2,201,217	1,590,841	3,792,058			
	Installation Cost Breakdown										
	Private			7,768,800	Private	484,305	970,720	1,455,025			
	Federal			25,917,529							
	Equipment		Private	5,438,160	Program Responses		+ or - Units		+8,769,870	--	-393.30
			Federal	18,142,270							
	Skilled Labor		Private	1,701,367			+ or - Dollars		--	+22,478,535	-3,630
			Federal	5,701,856							
	Unskilled Labor		Private	629,273							
			Federal	2,073,403							

TABLE 90

CENTRAL LAHONTAN BASIN
Cost and Responses of Proposed Forest Service Watershed Treatment Program
Truckee Subbasin

Treatment and/or Development	Units	Cost/Unit Installation $	Cost/Unit O&M $	Amortization Period Total Installation Cost $	Amortization Period @ 7% Yrs	Average Annual Cost Installation $	Average Annual Cost O&M $	Total Average Annual Cost $	Program Responses + or - Sediment Yield CY/Yr	Program Responses + or - Water Yield AF/Yr
Gully Erosion Control	49.5 mi	5,000	--	247,500	100	17,344	--	17,344	-15,840	--
Sheet Erosion Control	1,005 ac	130	--	130,650	100	9,155	--	9,155	-2,211	--
Stabilization of Barrow Pits	165 ac	340	--	56,100	100	3,931	--	3,931	-363	--
Rehabilitation of Abandoned Roads and Trails	59 mi	1,100	--	64,900	100	4,548	--	4,548	-531	--
Mine Restoration	240 ac	130	--	31,200	100	2,186	--	2,186	-528	--
Sediment Basin Construction	1 ea	Not Avail.	Not Avail.	--	100	--	--	Not. Avail.	(-14,517)[17]	--
Stream Bank Stabilization	61.7 mi	11,300	--	697,210	100	48,860	--	48,860	-4,319	--
Stream Channel Cleaning	12 mi	1,200	--	14,400	100	1,009	--	1,009	-180	--
Lake and Reservoir Shore Clearing	22 ac	250	--	5,500	100	385	--	385	--	--
Water Yield Improvement										
Riparian Vegetation Management	33 ac	32	--	1,056	10	150	--	150	--	+198
Snow Pack Management, Snow Fence	27.5 mi	500	50	13,700	100	960	1,375	960	--	[18]

Total Installation Cost	1,262,216	Total Fed.	88,528	1,375	89,903		
Installation Cost Breakdown							
Private	--	Program Responses		+ or - Units		-23,872	+198
Federal	1,262,216						
Equipment	883,552			+ or - Dollars		+62,067[19]	+1,821[20]
Skilled Labor	276,425						
Unskilled Labor	102,239						

TABLE 90

CENTRAL LAHONTAN BASIN
Cost and Responses of Proposed Forest Service Wildlife Program[21/]
Truckee Subbasin

Treatment and/or Development	Units	Cost/Unit: Installation $	Cost/Unit: O&M $	Amortization Period: Total Installation Cost $	Amortization Period: @ 7% Yrs	Average Annual Cost: Installation $	Average Annual Cost: O&M $	Total Average Annual Cost $	Program Responses: Hunter or Fisherman Day Use Effect + or -	Program Responses: Effect on Wildlife & Fisheries Population + or -	Program Responses: + or - Sediment Yield CY/Yr	Program Responses: Increase in Wildlife Forage Lbs/Yr
Plant Waterfowl Food Plots	45 ac	40	--	1,800	15	197	--	197	+	+	--	+
Installation of Nesting Facilities	18 ea	100	10	1,800	5	439	180	619	--	+	--	--
Wetland Habitat - Pot Holes	1 ea	Not Avail.	Not Avail.	--	--	--	--	--	--	+	--	+
Seeding and Plantings	50 ac	15	--	750	20	70	--	70	+	+	-	12,500
Area Protection, Fencing	.5 mi	3,000	50	1,500	50	25	133	--	--	+	--	--
Create Permantent Wildlife Openings	900 ac	35	10	31,500	20	2,973	9,000	11,973	+	+	--	+
Wildlife Watering Facilities	1 ea	1,500	10	1,500	50	108	10	118	+	+	--	--
In-Channel Improvement, Structures	217 ea	Not Avail.	Not Avail.	--	--	--	--	--	+	+	--	--
Barrier Removal, Channel	1.1 mi	5,000	--	5,500	25	471	--	471	+	+	--	--
Fish Ladder	1 ea	Not Avail.	Not Avail.	--	--	--	--	--	+	+	--	--
Channel Stabilization and Improvement	21.8 mi	11,000	--	239,800	100	16,805	--	16,805	+	+	-1,526	--
Fertilization and Weed Control, Lakes	72 ac	15	--	1,080	3	411	--	411	+	+	--	+
	Total Installation Cost			285,230	Total	21,582	9,215	30,797				
	Installation Cost Breakdown											
	Private			--								
	Federal			285,230	Program Responses			+ or - Units	+	+	-1,526	+31 DMU 22/
	Equipment			--								
	Skilled Labor			--	Program Responses			+ or - Dollars	--	--	+3,965	--
	Unskilled Labor			--								

CENTRAL LAHONTAN BASIN
Footnotes for Table 90 - Truckee Subbasin

* Indicates items not used in the NED account of the Four Account Display.
1. This includes cost of doing business in timber plus fire protection.
2. Based on value in 100 years discounted to present worth.
3. The benefits of the additional 1.5 million board feet of lumber to the consumer and to the economic activity of the subbasin were not calculated.
4. Value based on $35.35/MBF.
5. Value based on $158.02/MBF.
6. Source of cost, <u>Range Management Practices: Investment Cost 1970</u>, Agriculture Handbook No. 435.
7. Based on an estimate by the subunit manager that the total range program will increase the capacity to 125 percent of the existing capacity.
8. Value based on $4.21/AUM.
9. Value based on $2.98/CY.
10. Value based on $10.99/AF.
11. Cost to be borne by private developers or investors.
12. Estimated to be $30.00/square foot of facility.
13. Estimated to be 10 percent of construction cost.
14. Estimated to be 15 percent of construction cost.
15. Based on past use surveys, 80 percent of this use is expected to come from outside the basin.
16. Value based on $9.23/AF.
17. Not included in the Program response as no cost was available for this item.
18. This will retard snow melt and result in reduced peak flows and extend higher stream flows into the irrigation season.
19. Value based on $2.98/CY.
20. Value based on $10.99/AF.
21. Data not used in the NED account of the Four Account Display; responses were considered in the EQ account.
22. DMU is Deer-Months Use.

Table 91 - Accelerated conservation treatment on privately owned lands, Truckee River Subbasin

Type and Quantity of Treatment	Average annual Cost or Benefit
Irrigated Cropland Improvements:	
3,848 acres suitable for treatment	
Benefits, Increased return	$39,172
Costs: Installation	27,013
OM&R	6,926
Total	$33,939
Net Benefits	5,233
Rangeland Improvements:	
27,900 acres suitable for treatment	
Benefits, Increased forage and sediment reduction	$30,625
Costs: Installation	6,577
O&M	5,822
Total	$12,399
Net Benefits	$19,226

Four Account Display

The projects and programs for the subbasin have been summarized and displayed in the Four Account System in Table 92 Beneficial and adverse effects have been shown for each account. The accounts show the impacts that the projects and programs will have on the nation, the environment and the Basin.

Table 92 - Four Account Displays, USDA Plan, Truckee River Subbasin

TRUCKEE RIVER SUBBASIN SUMMARY
National Economic Development

Components	Measures of Effects
	(Average Annual Dollars)
Beneficial Effects:	
A. The value to users of increased outputs of goods and services	
(1) Flood Prevention	
(a) Urban	1,141,885
(b) Roads and Bridges	81,990
(c) Agriculture	6,000
(d) Sediment	121,345
(e) Indirect	194,035
(2) Recreation	
(a) Federal	10,419,855
(b) Private	12,799,785
(3) Forage Supply	24,797
(4) Irrigation	39,172
(5) Wood Supply	69,975
B. The value of outputs resulting from external economies indirect and induced associated with increased net returns	30,327
TOTAL Beneficial Effects:	24,929,166
Adverse Effects:	
A. The value of resources required for the plan	
(1) Project Installation	4,669,086
(2) Project OM&R	2,799,837
(3) Project Administration	154,127
B. Losses in output resulting from external diseconomies	
TOTAL Adverse Effects:	7,623,050
NET Beneficial Effects:	17,306,116

Table 92 Continued
TRUCKEE RIVER SUBBASIN SUMMARY
Environmental Quality Account

BENEFICIAL AND ADVERSE EFFECTS

Components	Measures of Effects
A. Areas of Natural Beauty	1. Nineteen reservoirs will be created with 517 acres maximum surface area and, including sediment pools, about 180 acres of stable pools in good geographic locations. 2. Of the 19 reservoirs, 9 will be built directly on perennial streams and will inundate 1.6 miles of stream, one on an off-stream site, 2 adjacent to irrigation supply canals, and 7 on intermittent or dry channels. 3. The 19 reservoirs will provide a total of 12,974 acre-feet of storage, including 9,691 acre-feet of floodwater dentention, 1,401 acre-feet of sediment detention, and 1,882 acre-feet of other storage at locations where flatwater is lacking. 4. The planned permanent pool storage will provide 5.8 miles of shoreline and the sediment pools, until full of sediment, will have 6 miles of shoreline. 5. The net evaporation loss from the ermanent pools is estimated to be about 360 acre-feet annually. 6. There will be 24,578 acres designated as non-urban recreation areas and 946 acres reserved for future recreation use. 7. Sixty acres around the reservoirs will have recreation facilities. 8. Environmental deterioration may occur through development on the National Forest of 5,180 family camping units, 2,170 picnic units, 12 swim sites, 3 boat launching facilities, 4 visitor information centers and 6 observation points, in cooperation with private developers, institutions, and organized groups, develop oen resort area, 14 group and organization sites, and a 600 acre winter sport area. 9. 16,541 acres will be set aside around the recreation facilities for buffer zone and not used for another use, such as forest products harvesting, grazing, and mineral exploration 10. There will be an increase in human use and adverse impact on non-urban areas through utilization of the additional recreation facility development. 11. Channel improvements on 115.3 miles of stream to restore proper hydrologic functioning and reduce erosion activity. 12. There will be a 81,887 cubic yard reduction annually in sediment load that has a potential of reaching the lakes and streams. The reduction is from the total land treatment program. 13. Channel improvement and stabilization will reduce an estimated 20,542 cubic yards of sediment annually.

Table 92 Continued
TRUCKEE RIVER SUBBASIN SUMMARY
Environmental Quality Account

BENEFICIAL AND ADVERSE EFFECTS

Components	Measures of Effects
A. Areas of Natural Beauty (continued)	14. Enchance 166 acres of shoreline by cleaning and protection and development of swimming and boat launching facilities. 15. Increase the present theoretical annual capacity of lakes and reservoirs beaches and shores by 1,512,990 visitor-days through development. 16. Installation of a permit system to limit the number of visitors at one time in the desolation Valley Wilderness Area to preserve the natural setting. 17. The moratorium on timber harvesting in the Tahoe Basin will preserve the natural setting of the area but will lower the timber production of the Basin. 18. Fencing will detract from the natural beauty ofthe open space in the Subbasin. 19. Treatment of the cropland will enhance the beauty of the agricultural green belt. 20. Seeding and brush spraying will restore the vegetation to be nearer the pristine condition of the original landscape. 21. There will be an intrusion of the visual and sound quality of the natural setting by the construction and use of the planned projects. 22. There will be a temporary degradation of the visual, sound, and odor quality of natural setting from construction equipment during implementation of the program.
B. Historical and Biological Resources and Selected Ecological Systems	1. Bailey Canyon structure will obliterate 0.5 miles of the Old Gieger Grade wagon road. 2. Perennial grass seeding, brush control, and contour trenching on 28,768 acres of sparcely vegetated land will restore grassland communities, increase forage production, and reduce erosion. 3. Reforest 2,330 acres of non-productive commercial forest land by planting approximately 1,000,000 trees. 4. Fencing and water developments will bring about better livestock distribution and forage use. Wildlife will also benefit from additional food, cover and water. 5. The seeding, brush spraying, contour trenching, and facility development will cause ecosystem changes in floral and fauna communities. Some communities will be enhanced; some will not.

Table 92 Continued
TRUCKEE RIVER SUBBASIN SUMMARY
Environmental Quality Account

BENEFICIAL AND ADVERSE EFFECTS

Components	Measures of Effects
B. Historical and Biological Resources and Selected Ecological Systems (continued)	6. An Additional 310 acres in the floodwater pools will be converted from natural small shrub and riparian ecosystems to annual weeds and bare ground. 7. The consolidation and realignment of irrigation ditches and canals will reduce the riparian vegetation and associated wildlife habitat. 8. The drainage of some class 1 & 2 wetlands will reduce the food supply for Canadian geese in the spring, but increase the upland game habitat on the land drained. 9. The open drains will increase the riparian vegetation and associated wildlife habitat. 10. Increase the forage production by 19,000 pounds annually on wildlife habitat area. This will support an additional 48 deer months use. 11. Improve waterfowl nesting facilities on two small lakes. 12. Improve 23.9 miles of fisheries habitat that may increase the fish numbers and fisherman success in area treated.
C. The quality of Water, Air, Land and Sound Resources	1. Connecting all sanitary facilities in the Tahoe Basin to the municipal sewer systems will reduce the amount of effluent that would be discharged into the Tahoe Basin. 2. Installing "pit-pump" toilets at all recreation developments not served by a sewer system will reduce biological pollution of ground water and streams. 3. Maintaining a buffer zone of 100 to 200 feet along streams will reduce contamination potential and lower water temperature. 4. Cooler water temperatures in the reservoirs over that in small streams will enhance the fishery and lake ecosystem. 5. During spring snowmelt, when all streams are quite turbid, the reservoirs will contribute greatly toward reducing this esthetically undesirable phenomenon. 6. The 10 water developments will provide higher quality of water to livestock and wildlife. 7. Runoff from the sprayed land may cause some downstream problems. 8. Land treatment of the irrigated land will reduce erosion and sediment and seepage loss.

Table 92 Continued
TRUCKEE RIVER SUBBASIN SUMMARY
Environmental Quality Account

BENEFICIAL AND ADVERSE EFFECTS

Components	Measures of Effects
C. The quality of Water, Air, Land and Sound Resources (continued).	9. Some of the land now used for canals or ditches could be brought into production after consolidation and realignment. 10. The floodwater pools, when dry, may be subject to wind erosion, thus lowering air quality in adjacent areas. 11. Provide 100 year flood protection and reduce land damage to 6,585 acres of urban land and 1,340 acres of irrigated pastureland, involving about 67,000 people. 12. Provide technical assistance to saw mills to increase utilization of forest products and reduce mill waste, thus reduce the amount of burning of mill waste. 13. The adapting of an urban and environmental forestry program will reduce noise level, filter air and lower maximum temperature in the urban area. 14. Establish, irregular or free-form boundaries on forest product harvest areas. 15. There will be a temporary degradation of water, land and air quality during construction of the programs. 16. Establishment of landscape guidelines for all transportation and utility corridors on national forest lands will enhance visual quality. 17. Reservoir drawdown will result in reduction of visual quality.
D. Irreversible Commitments of Resources to Future Users	1. Programs will commit labor, capital, and materials to the implementation of the projects. 2. About 6 million cubic yards of earth and rock will be displaced and subjected to total ecological change. 3. Moderate to heavy recreation impacts will affect recreation sites which heretofore sustained only rare instances of man's intrusions. 4. Some 8,529 acres of natural flora and associated ecosystems would be lost through reservoir inundation and recreation facilities. However, natural vegetation would become established along the reservoir shorelines and in the recreation facilities area to offset a portion of this loss. 5. 1.8 miles of perennial stream channnel will be lost in reservoir pools. 6. Two residences and their occupants would have to be relocated because they are at present located in the pool area behind the Sun Valley structure.

Table 92 Continued
TRUCKEE RIVER SUBBASIN SUMMARY
Regional Development Account

Components	Measures of Effects: Central Lahontan Basin	Measures of Effects: R.O.N.
	(Average Annual) -dollars-	
I. Income		
Beneficial Effects:		
A. The value of increased output of goods and services to users residing in the region		
(1) Flood Prevention		
(a) Urban	1,141,885	-----
(b) Roads and Bridges	81,990	-----
(c) Agriculture	6,000	-----
(d) Sediment	121,345	-----
(e) Indirect	194,035	-----
(2) Recreation		
(a) User		
(1) Federal	2,083,971	8,335,884
(2) Private	2,890,774	9,909,011
(b) Increased net income to business and recreational supplies from non-resident expenditures	18,492,403	18,492,403
(3) Forage Supply	24,797	-----
(4) Irrigation	39,172	-----
(5) Wood Supply	69,975	-----
B. The value of outputs to users residing in the region from external economies		
(1) Indirect and induced effects from non-resident expenditures	6,043,898	-6,043,898
(2) Indirect and induced activities associated with increased net returns	22,496	7,831

Components	Measures of Effects: Central Lahontan Basin	Measures of Effects: R.O.N.
	(Average Annual) -dollars-	
I. Income		
Adverse Effects:		
A. The value of resources contributed from within the region.		
(1) Project Installation	806,422	3,862,664
(2) Project OM&R	1,168,068	1,636,769
(3) Project Administration	20,086	134,041
B. Losses in output from external diseconomies	-----	-----
C. Loss of assistance payments	-----	-----
D. Loss of displaced resources	-----	-----

Table 92 Continued
TRUCKEE RIVER SUBBASIN SUMMARY
Regional Development Account

Components	Measures of Effects: Central Lahontan Basin	Measures of Effects: R.O.N.	Components	Measures of Effects: Central Lahontan Basin	Measures of Effects: R.O.N.
	Average Annual - dollars-			Average Annual -dollars-	
C. Utilization of unemployed and employed resources					
(1) Project Installation	6,785	-6,785			
(2) Project OM&R	6,374	-6,374			
(3) Externalities of OM&R	1,408	-1,408			
(4) Farm Labor	12,811	-12,811			
D. Additional wages and net income occuring from construction and implementation of the plan and induced activities					
(1) Project installation	700,339	-700,339			
(2) Project OM&R	2,030,480	2,030,480			
(3) Externalities of OM&R	470,850	-470,850			
(4) Non-resident recreation	40,051,463	-40,051,463			
TOTAL Beneficial Effects:	74,493,251	-49,564,085	TOTAL Adverse Effects:	1,994,576	5,628,474
			NET Beneficial Effects:		-55,192,559

Table 92 Continued
TRUCKEE RIVER SUBBASIN SUMMARY
Regional Development Account

Components	Measures of Effects	
	Central Lahontan Basin	Rest of Nation
II. Employment Beneficial Effects: A. Increase in the number and type of jobs in the region		
(1) Project Installation	Creates during project installation period. 740.6 man years of skilled employment 704.1 man years of unskilled employment	During project installation period * -735.6 man years of skilled employment.
(2) Project OM&R	Creates during project evaluation period 280.1 man years of unskilled employment	
(3) Farm Labor	Creates during project evaluation period 15.4 man years of semi-skilled employment	
(4) Non-resident recreation	Creates during project evaluation period 15,527,5 man years os seasonal unskilled employment.	
(5) Indirect and induced effects from:		
(a) Project OM&R and farm labor	160.6 man years of fulltime unskilled employment	
(b) Non-resident recreation	2,593.4 man years of seasonal unskilled employment.	
TOTAL Beneficial Effects:	1,444.7 man years of employment during project installation period. 476.1 man years of permanent fulltime employment during project evaluation period. 18,120.9 man years of permanent seasonal employment during project evaluation period.	-735.6 man years of employment during project installation period.

* Total man years for project installation period

Table 92 Continued
TRUCKEE RIVER SUBBASIN SUMMARY
Regional Development Account

Components	Measures of Effects	
	Central Lahontan Basin	Rest of Nation
Adverse Effects: A. Decrease in number and type of jobs in the region.	----------	-------------
NET Beneficial Effects:	1,447.7 man years of employment during* project installation period. 476.1 man years of permanent fulltime employment during project evaluation period. 18,120.9 man years of permanent seasonal employment during project evaluation period.	-735.6 man years of employment during* project installation period.
III. Population Distribution Beneficial and Adverse Effects:	Creates 18,597 permanent jobs supporting a population of 28,577 people in the region	------------
IV. Regional Economic Basin and stability Beneficial and Adverse Effects:	Creates 476.1 permanent fulltime jobs, 18,120.9 permanent seasonal jobs during project evaluation period. Creates during project installation period 1,444.7 man years of employment, provides 7,750,950 visitor days of general outdoor recreation and 1,512,990 visitor days of water based recreation. Will reduce sediment by 81,887 cubic yards annually, increase forage supply by 20,651 AUMs, increase production on 3,848 acres of cropland, increase wood supply by 402,192 MBF, and reduce flood damge by $1,490,220 annually.	--------------
V. Regional Environmental Conditions Beneficial and Adverse Effects:	-----------	-------------

* Total man years for project installaton period.

Table 92 Continued
TRUCKEE RIVER SUBBASIN SUMMARY
Social Well-being Account

Components	Measures of Effects		
A. Real Income Distribution			
(1) Beneficial Effects:	Income Class	Adjusted Gross Income By Class	Benefits in Class
	(dollars)	(percent)	(percent)
	(Distribution of $83,245,186 in benefits to Truckee River Subbasin)		
	Less than 3,000	08.3	08.3
	3,000 to 10,000	41.4	40.4
	More than 10,000	50.3	51.3
(2) Adverse Effects:	Income Class	Adjusted Gross Income By	Cost in Class
	(dollars)	(percent)	(percent)
	(Distribution of $2,073,120 in cost to be borne by Truckee River Subbasin)		
	Less than 3,000	08.3	08.3
	3,000 to 10,000	41.4	40.4
	More than 10,000	50.3	51.3
B. Life, Health, and Safety: Beneficial and Adverse Effects:	Provide flood protection at 100 year level to an urban areas with a population of approximately 67,000 people.		
C. Educational, Cultural, and Recreational opportunities Beneficial and Adverse Effects:	Provide 7,750,950 visitor days of general outdoor recreation and 1,512,990 visitor days of water based recreation, 25 percent of National Forest gross receipts paid to counties.		
D. Emergency Preparedness Beneficial and Adverse Effects:	Decrease water yield by 3,413 acre-feet annually in the Subbasin		

Carson River Subbasin

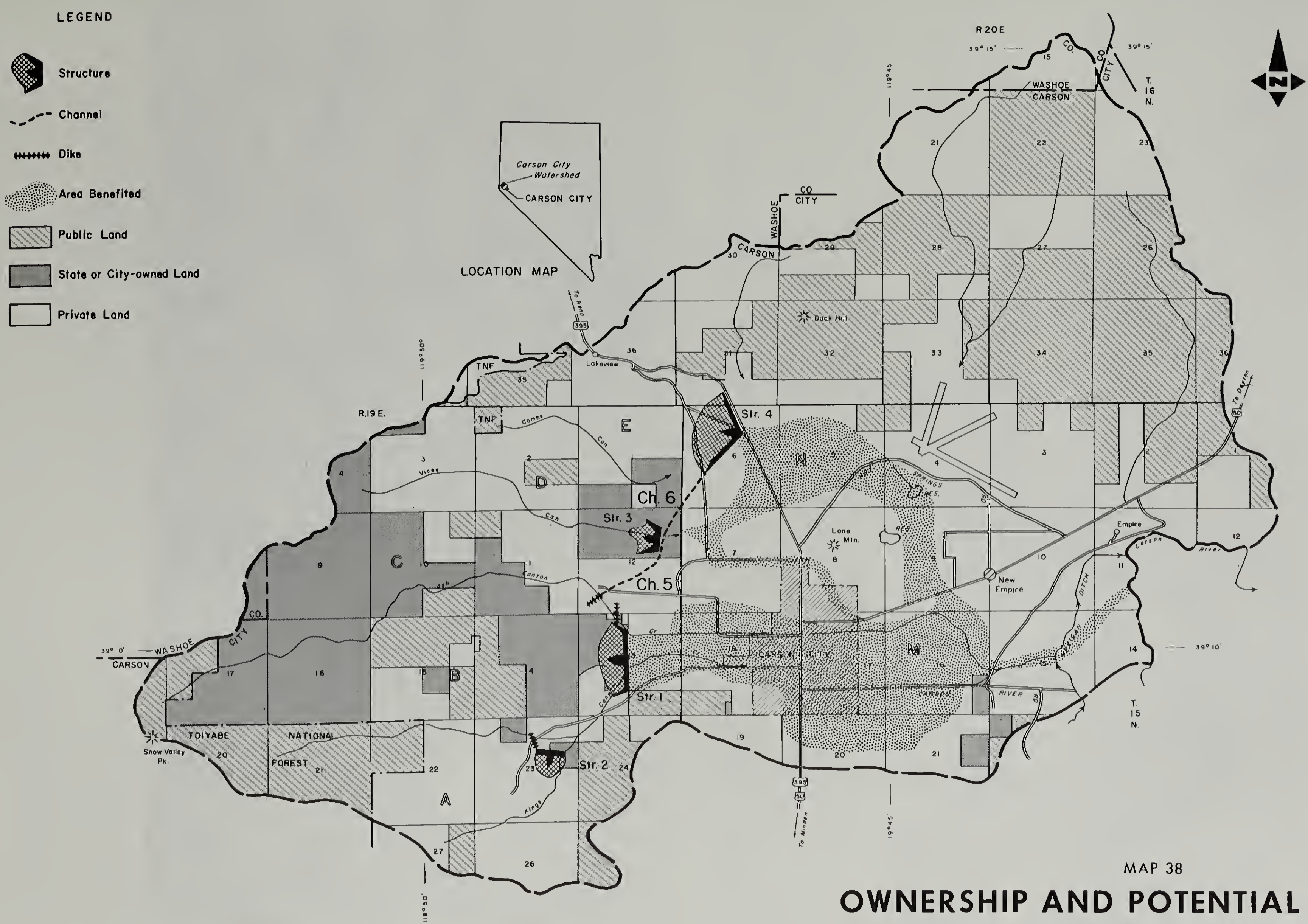
The USDA Plan for the subbasin consists of the Carson City and the West Fork Carson River watershed investigations, the National Forest programs, and the accelerated conservation programs on private lands. A brief summary of each component of the plan is included in the following pages, The detailed reports of the projects and programs are in APPENDIX II.

Carson City Watershed Investigation Report

There are about 30,220 acres within the watershed. The watershed is located on the eastern slopes of the Carson Range. Carson City, the capitol of Nevada, is the population center. Seventy-one percent of the land is privately-owned and 29 percent is federally-owned. The elevation ranges from 9,214 on the top of Snow Valley Peak to a low of 4,600 feet.

The watershed problems have been studied under PL-566 and five proposals were analyzed. The proposal with the best benefit-cost ratio is a floodwater retarding structure and related dike to hold back the floodwaters and sediments of Ash and King Canyons. The estimated project installation cost is $2,147,440. The average annual cost is $156,830 and the average annual benefits are $240,675.

Flood protection measures for the Carson City Watershed include floodwater detention on Kings Canyon (left) and Ash Canyon (right)



MAP 38

OWNERSHIP AND POTENTIAL PROJECTS

CARSON CITY WATERSHED

CARSON CITY, NEVADA

JULY 1975

1/2 0 1 MILE

SCALE 1:96,000

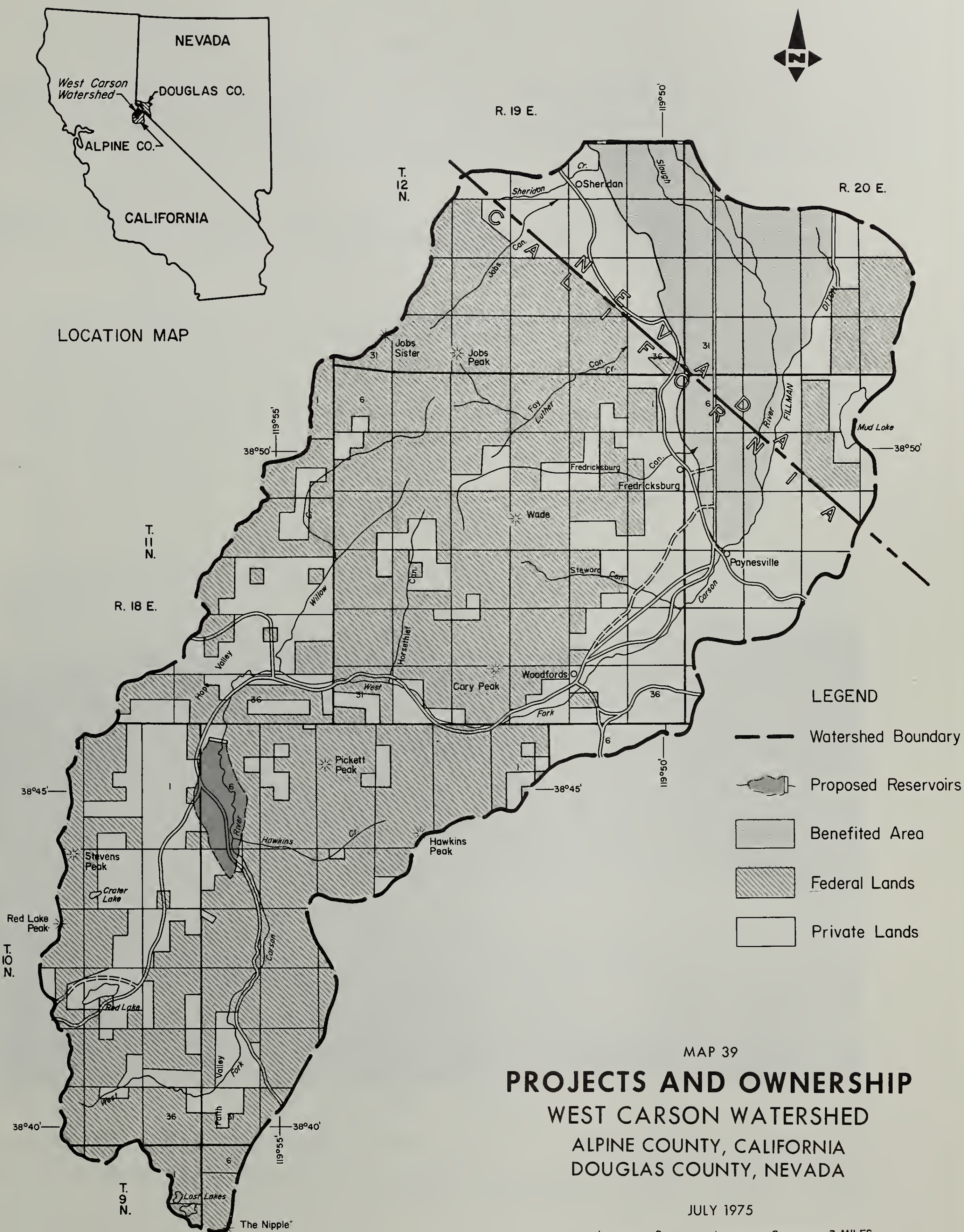
West Fork Carson River Watershed Investigation Report

The watershed contains about 95,438 acres and is located on the eastern slope of the Carson Range of the Sierra Nevada, in both California and Nevada. About 58 percent of the watershed is privately owned land and about 42 percent of the land is federally owned. The elevation ranges from 10,881 as a high to about 4,706 feet for a low. The watershed has recreation as an important economic activity in the upper reaches. Agriculture is the important activity in the lower reaches. Woodfords, California is the largest population area in the watershed.

The watershed has had some severe floods in the past, causing damage to the farms and roads in the flood plain. The farms have problems with short water supplies in late summer when additional water is needed. Recreation development is needed in the upper watershed.

A multi-purpose structure has been proposed for flood protection, irrigation storage, and recreation. Land treatment is proposed to also be a part of the plan to reduce erosion and improve irrigation efficiencies. The cost of installation of the project is $2,365,088.00. The average annual cost is $197,301 and the average annual benefits are $316,601.

Flood damage from West Fork Carson River, Carson Subbasin.



NEVADA
West Carson Watershed
DOUGLAS CO.
ALPINE CO.
CALIFORNIA
LOCATION MAP
N
R. 19 E.
R. 20 E.
R. 18 E.
T. 12 N.
T. 11 N.
T. 10 N.
T. 9 N.
119°50'
119°55'
38°50'
38°45'
38°40'
Sheridan
Jobs Sister
Jobs Peak
Fredricksburg
Wade
Paynesville
Woodfords
Cary Peak
Pickett Peak
Hawkins Peak
Stevens Peak
Crater Lake
Red Lake Peak
Red Lake
Lost Lakes
The Nipple
Mud Lake
Hope Valley
Carson River
West Fork
CALIFORNIA
NEVADA
LEGEND
Watershed Boundary
Proposed Reservoirs
Benefited Area
Federal Lands
Private Lands
MAP 39
PROJECTS AND OWNERSHIP
WEST CARSON WATERSHED
ALPINE COUNTY, CALIFORNIA
DOUGLAS COUNTY, NEVADA
JULY 1975
1 0 1 2 3 MILES
SCALE 1:158,400

Other Component

Summaries of planned treatment measures on National Forest and privately owned lands are shown in Tables 93 and 94. Costs, program responses, and benefits are indicated. The values for costs and responses are in APPENDIX II.

The National Forest summary includes measures for timber, range improvement, recreation development, watershed treatment, and fish and wildlife.

The accelerated treatment summary for privately owned land indicates costs and benefits for accelerating the installation of improvement measures on irrigated cropland and privately owned rangeland. Units shown reflect that portion of the total cropland and rangeland treatment needs that could be treated to achieve a 50 percent increase over the present rate of treatment. Costs, benefits from increased returns, and net benefits are displayed.

Increasing the number of developed recreation areas on National Forest lands will reduce the use on undeveloped areas, such as shown above. Forest Service photo.

TABLE 93

CENTRAL LAHONTAN BASIN
Cost and Responses of Proposed Forest Service Timber Program
Carson Subbasin

Treatment and/or Development	Units	Cost/Unit		Amortization Period		Average Annual Cost		Total Average Annual Cost $	Program Responses		
		Installation $	O&M $	Total Installation Cost $	@ 7% Yrs	Installation $	O&M $		Increase Fiber Yield MBF/Yr	+ or - Water Yield AF/Yr	+ or - Sediment Yield CY/Yr
Biological Contribution											
Reforestation	776 ac	128	--	99,328	100	6,960	--	6,960	--	--	Not Avail.
Release	291 ac	25	--	7,275	30	586	--	586	--	--	--
Thin	134 ac	25	--	3,350	30	269	--	269	--	--	--
Prune	1,150 ac	40	--	46,000	100	3,223	--	3,223	--	--	--
Full Stocking Implementation	98,400 ac	130	.45/ac[1]	12,792,000	100	896,463	44,280	940,743	354,240	--	Not Avail.
Industrial Contribution											
Logging Residue Reduction	18.1 mmbf	276	--	4,995	2	2,763	--	2,763	543[3]	(Value of stumpage	$ 19,195)[4]
Mill Residue Reduction	18.1 mmbf	Not Avail.	Not Avail.	--	--	--	--	--	1,810[3]	(Value of lumber	$286,016)[5]
		Total Installation Cost		12,792,000	Total	896,463	44,280	940,743			
		Installation Cost Breakdown									
		Private			Program Responses	+ or - Units			+354,240	--	--
		Federal		12,792,000		+ or - Dollars			61,632[2]	--	--
		Equipment		3,965,000							
		Skilled Labor		1,023,360							
		Unskilled Labor		7,803,120							

TABLE 93

CENTRAL LAHONTAN BASIN
Cost and Responses of Proposed Forest Service Range Improvement Program
Carson Subbasin

Treatment and/or Development	Units	Cost/Unit Installation $	Cost/Unit O&M $	Amortization Period Total Installation Cost $	Amortization Period @ 7% Yrs	Average Annual Cost Installation $	Average Annual Cost O&M $	Total Average Annual Cost $	Program Responses Forage Increase Pounds/Yr	Program Responses Increased AUM Capacity Annual	Program Responses + or - Sediment Yield CY/Yr
Cover Manipulations											
Tall Brush	2,210 ac	25[6/]	--	55,250	10	7,865	--	7,865	773,500	515	-2,431
Low Brush	1,735 ac	3.80[6/]	--	6,539	10	938	--	938	433,750	289	-954
Range Seeding	2,110 ac	11[6/]	--	23,210	30	1,870	--	1,870	--	--	-2,321
Fertilizer Application	2,235 ac	12[6/]	--	27,900	3	10,631	--	10,631	--	--	--
Fence Construction	160 mi	3,000[6/]	5	480,000	30	38,678	800	39,478	--	--	--
Cattle Guard Installation	26 ea	1,500	20	39,000	100	2,733	520	3,253	--	--	--
Noxious and Undesirable Forbs Control	600 ac	15	--	9,000	15	988	--	988	--	--	--
Water Development											
Springs	12 ea	500	20	6,000	25	514	240	754	--	--	--
Reservoirs	6 ea	1,500	25	9,000	30	725	150	875	--	--	--
	Total Installation Cost			655,899	Total Fed.	64,972	1,710	66,682			
	Installation Cost Breakdown										
	Private			--							
	Federal			655,899	Program Responses	+ or - Units			1,167,251	+804[7/]	-5,706
	Equipment			373,862							
	Skilled Labor			98,384		+ or - Dollars			--	+3,360[8/]	+2,454[9/]
	Unskilled Labor			183,653							

TABLE 93

CENTRAL LAHONTAN BASIN
Cost and Responses of Proposed Forest Service Recreation Development
Carson Subbasin

Treatment and/or Development	Units	Cost/Unit: Installation $	Cost/Unit: O&M $	Amortization Period: Total Installation Cost $	Amortization Period: @ 5.875 Yrs	Average Annual Cost: Installation $	Average Annual Cost: O&M $	Total Average Annual Cost $	Program Responses: Capacity Increase Visitor Days Annual	Program Responses: Annual Benefit Value $	Program Responses: Consumptive Water Use AF/Yr
Campgrounds	1,501 ea	2,868 ea	90 ea	4,304,868	20	371,510	135,090	506,600	1,130,800	1,696,200	8.6
Picnic Sites	499 ea	1,874 ea	90 ea	1,431,132	20	123,506	44,910	168,416	199,600	299,400	1.5
Swim Sites	1 ea	568/cap.	.76/cap.	113,600	20	9,803	15,200	25,003	20,000	30,000	1.5
Boat Launching Sites	1 ea	1,136/cap.	.76/cap.	170,400	50	10,622	11,400	22,022	15,000	26,250	.1
Observation Sites	2 ea	11,100 ea	.05/cap.	22,200	50	1,383	3,000	4,383	60,000	90,000	.2
Historic Sites	1 ea	5,500 ea	.76/cap.	5,500	20	342	11,400	11,742	15,000	22,500	.1
	Total Installation Cost			6,047,500	Total Fed.	517,166	210,000	727,166			
	Installation Cost Breakdown				Private	--	--	--			
	Private			--							
	Federal			6,047,500							
	Equipment	Private		--	Program Responses	+ or - Units			+1,440,400	--	-12.0
		Federal		4,233,250		+ or - Dollars			--	+2,137,350	-117
	Skilled Labor	Private		--							
		Federal		1,324,402							
	Unskilled Labor	Private		--							
		Federal		489,848							

TABLE 93

CENTRAL LAHONTAN BASIN
Cost and Responses of Proposed Forest Service Watershed Treatment Program
Carson Subbasin

Treatment and/or Development	Units	Cost/Unit: Installation $	Cost/Unit: O&M $	Amortization Period: Total Installation Cost $	Amortization Period: @ 7% Yrs	Average Annual Cost: Installation $	Average Annual Cost: O&M $	Total Average Annual Cost $	Program Responses: + or - Sediment Yield CY/Yr	Program Responses: + or - Water Yield AF/Yr
Gully Erosion Control	6 mi	5,000	--	30,000	100	2,102	--	2,102	-1,920	--
Sheet Erosion Control	2,300 ac	130	--	299,000	100	20,953	--	20,953	-5,060	--
Rehabilitation of Abandoned Roads and Trails	56 mi	1,100	--	61,600	100	4,316	--	4,316	-504	--
Mine Restoration	2,280 ac	130	--	296,400	100	20,771	--	20,771	-5,016	--
Lake and Reservoir Shore Cleaning	75 ac	250	--	18,750	100	1,314	--	1,314	--	--
Stream Bank Stabilization	4 mi	11,300	113	45,200	100	3,167	452	3,619	-280	--
Water Yield Improvement										
Type Conversion	2,215 ac	39	--	86,385	20	8,153	--	8,153	-2,436	11/
Riparian Vegetation Management	351 ac	32	--	11,231	10	1,598	--	1,598	--	+2,106
Snow Pack Management, Snow Fence	145 mi	500	50	72,500	100	5,080	7,250	12,330	--	12/
	Total Installation Cost			921,066						
	Installation Cost Breakdown				Total Fed.	67,454	7,702	75,156		
	Private			--						
	Federal			921,066	Program Responses	+ or - Units			-15,216	+2,106
	Equipment			644,747						
	Skilled Labor			201,713		+ or - Dollars			+6,080[13/]	+24,682[14/]
	Unskilled Labor			74,606						

TABLE 93

CENTRAL LAHONTAN BASIN
Cost and Responses of Proposed Forest Service Wildlife Program[15]
Carson Subbasin

Treatment and/or Development	Units	Cost/Unit Installation $	Cost/Unit O&M $	Amortization Period Total Installation Cost $	Amortization Period @ 7% Yrs	Average Annual Cost Installation $	Average Annual Cost O&M $	Total Average Annual Cost $	Program Responses: Hunter or Fisherman Day Use Effect + or -	Effect on Wildlife & Fisheries Population + or -	+ or - Sediment Yield CY/Yr	Increase In Wildlife Forage Lbs/Yr
Release of Wildlife Forage Plants	1,440 ac	15	--	21,600	20	2,038	--	2,038	+	+	--	360,000
Area Protection, Fencing	8.4 mi	3,000	50	25,200	50	1,825	420	2,245	+	+	--	+
	Total Installation Cost			46,800	Total	3,863	420	4,283				
	Installation Cost Breakdown											
	Private			--	Program Responses		+ or - Units		+	+	--	+727 DMU 16/
	Federal			46,800			+ or - Dollars		--	--	--	--
	Equipment			--								
	Skilled Labor			--								
	Unskilled Labor			--								

CENTRAL LAHONTAN BASIN
Footnotes for Table 93 - Carson Subbasin

* Includes items not used in the NED account of the Four Account Display.
1. This includes cost of doing business in timber plus fire protection.
2. Based on value in 100 years discounted to present worth.
3. The benefits of the additional 2.4 million board feet of lumber to the consumer and the economic activity to the subbasin were not calculated.
4. Value based on $35.35/MBF.
5. Value based on $158.02/MBF.
6. Source of cost, Range Management Practices: Investment Cost 1970, Agriculture Handbook No. 435.
7. AUM increase based on 40 percent utilization factor.
8. Value based on $4.18/AUM.
9. Value based on $0.43/CY.
10. Value based on $9.75/AF.
11. It is estimated there will be no signficant yield increase because the area to be treated is below 25" of annual precipitation.
12. This will retard spring snow melt and result in reduced peak flows and extend higher stream flows into the irrigation season.
13. Value based on $0.43/CY.
14. Value based on $11.72/AF, the value of irrigation water in Carson Valley.
15. Data not used in the NED account of the Four Account Display; responses were considered in the EQ account.
16. DMU is Deer-Months Use.

Table 94 - Accelerated conservation treatment on privately owned lands, Carson River Subbasin

Type and Quantity of Treatment	Average annual cost or benefit
Irrigated Cropland Improvements:	
38,245 acres suitable for treatment	
Benefits, Increased return	$492,978
Costs: Installation	344,970
OM&R	74,578
Total	$419,548
Net Benefits	$ 73,430
Rangeland Improvements:	
22,300 acres suitable for treatment	
Benefits, Increased forage and sediment reduction	$ 18,685
Costs: Installation	3,979
O&M	3,522
Total	$ 7,501
Net Benefits	$ 11,184

Four Account Display

The projects and programs for the subbasin have been summarized and displayed in the Four Account System in Table 95. Beneficial and adverse effects have been shown for each account. The accounts show the impacts that the projects and programs will have on the nation, the environment and the Basin.

Concrete ditches (above) and sprinkler systems (below) will improve irrigation water use efficiency on the irrigated lands.

Table 95 - Four Account Displays, USDA Plan, Carson River Subbasin, Central Lahontan Basin
CARSON RIVER SUBBASIN SUMMARY
National Economic Development Account

Components	Measures of Effects
	(Average Annual dollars)
Beneficial Effects:	
A. The value to users of increased outputs of goods and services	
(1) Flood Prevention	
(a) Urban	204,034
(b) Agricultural	8,498
(c) Roads and Bridges	22,213
(d) Sediment	42,599
(e) Indirect	32,832
(2) Recreation	
(a) Federal	2,137,350
(b) Private	97,650
(3) Forage Supply	20,158
(4) Irrigation	664,090
(5) Wood Supply	157,632
B. The value of outputs resulting from external economies indirect and induced associated with increased net returns	128,545
TOTAL Beneficial Effects	3,515,601
Adverse Effects:	
A. The value of resources required for the plan	
(1) Project Installation	2,185,760
(2) Project OMBR	382,347
(3) Project Administration	22,820
B. Losses in output resulting from external diseconomics	
TOTAL Adverse Effects:	2,590,927
NET Beneficial Effects:	924,674

Tabel 95 Continued
CARSON RIVER SUBBASIN SUMMARY
Environmental Quality Account

BENEFICIAL AND ADVERSE EFFECTS

Components	Measures of Effects
A. Areas of Natural Beauty	1. Two reservoirs will be created with a maximum surface area of 671 acres, and one will maintain a minimum pool of 139 surface acres for recreation use.
	2. Associated with the recreation reservoir will be a 136 acre park with recreation facilities.
	3. The reservoirs will be able to retain 18,721 acre-feet of water of which 2,838 acre-feet will be for flood prevention, 1,000 acre-feet for recreation 14,600 acre-feet for irrigation, and 283 acre-feet for sediment at locations where flat water surface is lacking.
	4. The Hope Valley reservoir will inundate about one mile of perennial stream and 598 acres of meadow and woodland and create about four miles of shoreline around the pool.
	5. The 824 acres of the reservoirs and park will be set aside and held in open space in an area that would otherwise be developed and use of the public would be denied.
	6. Water released from the Hope Valley reservoir will be at a time when normal stream flow is low, and it would raise the quality and quantity of the stream.
	7. The Carson City reservoir will inundate a maximum of 73 acres of meadowland in periods of flooding, but will otherwise be dry.
	8. The development of the Carson City reservoir may encourage urban development in the flood plain and thus decrease open space.
	9. There will be 1,478 acres designated as non-urban recreation area and a buffer zone around it of 854 acres of national forest.
	10. Environmental deterioration may result through development of 1,501 family camping units, 499 picnic units, 1 swin site, 1 boat launching facility, 2 observation sites, and 1 historical site on national forest lands.
	11. Restrict other resource use such as forest product harvesting, grazing, and mineral exploration on the 854 acre buffer zone.
	12. Channel improvements on 4 miles of stream to restore proper hydrologic functioning and reduce erosion and sediment estimated to be 280 cubic yards annually.
	13. There will be an estimated 48,773 cubic yard reduction annually in sediment load that has a potential of reaching the lakes and streams. This reduction will be through the total land treatment program.
	14. Enhance 75 acres of shoreline by cleaning and protection and 4.4 acres of shoreline by developing a swimming and boat launching facility.
	15. Reservoir drawdown will result in reduction of visual quality.

Table 95 Continued
CARSON RIVER SUBBASIN SUMMARY
Environmental Quality Account

BENEFICIAL AND ADVERSE EFFECTS

Components	Measures of Effects
A. Areas of Natural Beauty (continued)	16. Increase the present theoretical annual capacity of water based recreation by 100,100 visitor-days through program implementation. 17. Establishment of the Carson Iceberg Wilderness Area of 53,820 acres which will reduce the land available for forest products harvest by about 24,583 acres. 18. There will be a temporary degradation of the visual, sound, and odor quality of the natural setting by construction equipment during the installation period. 19. There will be an intrusion on the visual quality of the natural setting by the construction of man made structures. 20. The seeding and spraying will restore the vegetation to be nearer the pristine condition. 21. The treatment of the cropland will enhance the beauty of the agricultural green belt.
B. Historical and Biological Resources with Selected Ecological Systems	1. The Hope Valley Reservoir will flood one mile of the old Carson River Emigrant's Trail of the 1840's and 1850's. 2. The present vegetation of the reservoir pool area (671 acres) will be changed from natural meadow and woodland to wet meadow destroying natural habitat of some wildlife. 3. The Hope Valley Reservoir will inundate one mile of natural fish spawning and hatching area, however, it will support more fish than the flooded stream. 4. The reservoir will provide feeding and resting area for waterfowl. 5. The fish habitat will be enhanced below the reservoir as the water level will be raised in times of normal low flow. 6. Increase vegetative cover and forage on 310,000 acres of rangeland, reforest 1,387 acres of non-productive commercial forest land by planting about 625,000 trees, and increase vegetative cover density on 4,580 acres of problem area to control erosion and sediment. 7. Treat 4,025 acres of rangeland for poisonous plant control. 8. Increase the forage production by 180 tons annually on wildlife habitat to provide an additional 909 deer-months use. 9. The land treatment will change the ecosystem of the vegetative cover and will result in an associated chance in the wildlife. This will reduce habitat of some species and increase habitat for other species. 10. The consolidation and realignment of irrigation ditches and canals will reduce the riparian vegetation and associated wildlife. 11. The drainage of some class 1&2 wetlands will reduce the food supply for Canadian geese in the spring, but increase upland game habitat on the drained land.

Table 95 Continued
CARSON RIVER SUBBASIN SUMMARY
Environmental Quality Account

BENEFICIAL AND ADVERSE EFFECTS

Components	Measures of Effects
B. Historical and Biological Resources with Selected Ecological Systems (continued)	12. The open drains will increase the riparian vegetation and the associated wildlife habitat.
C. The Quality of Water, Land, Air, and Sound Resources	1. The Reservoirs will trap 283 acre-feet of sediment over the life of the project that would have been deposited on the floodplain or entered into the Carson River.
	2. The release of stored water in times of normal low flow will increase the water quality by lowering the temperature of the water and dilute the pollutant in the water.
	3. The concentration of visitors in the recreation areas will decrease the quality of air, land, water, and sound by their presence.
	4. Installing "pit-pump" toilets at all recreation developments not served by sewer systems will reduce biological pollution of ground water and streams.
	5. Maintaining a buffer zone of 100 to 200 feet along streams in forest products harvest area and other concentrated uses will lower temperature.
	6. Increase utilization of forest products will reduce mill waste that would have been burned.
	7. The adoptation of an urban and environmental forestry program will reduce the noise level, filter the air, and lower maximum temperature in urban area.
	8. Land treatment will improve the quality and production of the treated crop, range, and forest lands.
	9. Establishment of irregular and free form boundaries on forest products harvest areas will improve visual quality.
	10. Establishment of landscape guidelines for all transportation and utility corridors on National Forest land will improve visual quality.
	11. Runoff from the sprayed land may cause some downstream problems.
	12. Irrigation improvements will reduce seepage loss and erosion and sedimation from irrigation.
	13. Some of the land now used for canals or ditches could be brought into production after consolidation and realignment.
	14. The treatment of the irrigated land and proper management of the treated land will increase the irrigation efficiencies from 50 percent to 67 percent in the Upper Carson and from 60 percent to 75 percent in the Lower Carson.
	15. Reservoir drawdown will result in reduction of visual quality.

Table 95 Continued

CARSON RIVER SUBBASIN SUMMARY
Environmental Quality Account

BENEFICIAL AND ADVERSE EFFECTS

Components	Measures of Effects
D. Irreversible Commitments of Resources to Future Users	1. The project will commit labor, capital, and materials to the implementation of the program. 2. About 1,099,310 cubic yards of earth and rock will be displaced as a result of project construction. 3. The development of recreation facilities on 624 acres of forest and woodland will change the vegetation and wildlife habitat. 4. The natural vegetation of the reservoirs and area around the recreation sites will be disturbed and in some areas destroyed by the construction and continuous use of the areas.

Table 95 Continued
CARSON RIVER SUBBASIN SUMMARY
Regional Development Account

Components	Measures of Effects: Central Lahontan Basin	Measures of Effects: R.O.N.
	(Average Annual) -dollars-	
I. Income		
Beneficial Effects:		
A. The value of increased output of goods and services to users residing in the region		
(1) Flood Prevention		
(a) Urban	204,034	-----
(b) Agricultural	8,498	-----
(c) Roads and Bridges	22,213	-----
(d) Sediment	42,599	-----
(e) Indirect	32,832	-----
(2) Recreation		
(a) User		
(1) Federal	1,774,000	363,350
(2) Private	81,050	16,600
(b) Increased net income to business and recreational supplies from non-resident expenditures	658,199	-658,199
(3) Forage Supply	20,158	-----
(4) Irrigation	664,090	-----
(5) Wood Supply	157,632	-----
B. The value of outputs to users residing in the region from external economies		
(1) Indirect and induced effects from non-resident expenditures	215,494	-215,494
(2) Indirect and induced activities associated with increased net returns	114,156	14,389

Components	Measures of Effects: Central Lahontan Basin	Measures of Effects: R.O.N.
	(Average Annual) -dollars-	
I. Income		
Adverse Effects:		
A. The value of resources contributed from within the region		
(1) Multipurpose reservoir and recreation facilities		
(a) Project installation	349,485	1,836,275
(b) Project OM&R	118,655	263,692
(c) Project administration	5,903	16,917
B. Losses in output from external diseconomies	-----	-----
C. Loss of assistance payments	-----	-----
D. Loss of displaced resources	-----	-----

Table 95 Continued
CARSON RIVER SUBBASIN SUMMARY
Regional Development Account

Components	Measures of Effects		Components	Measures of Effects	
	Central Lahontan Basin	R.O.N.		Central Lahontan Basin	R.O.N.
	(Average Annual) -dollars-			(Average Annual) -dollars-	
C. Utilization of unemployed and under-employed resources					
(1) Project installation	78,072	-78,072			
(2) Project OM&R	54,827	-54,827			
(3) Externalities of OM&R	12,736	-12,736			
(4) Farm labor	108,982	-108,982			
D. Additional wages and net income occuring from construction and implementation of the plan and induced activities					
(1) Project installation	709,300	-709,300			
(2) Project OM&R	189,084	-189,084			
(3) Externalities of OM&R	43,923	-43,923			
(4) Non-resident recreation	822,987	-822,987			
TOTAL Beneficial Effects:	6,014,866	-2,499,265	TOTAL Adverse Effects:	474,043	2,116,884
			NET Beneficial Effects:	5,540,823	-4,616,149

Table 95 Continued
CARSON RIVER SUBBASIN SUMMARY
Regional Development Account

Components	Measures of Effects	
	Central Lahontan Basin	Rest of Nation
II. Employment Beneficial Effects: A. Increase in the number and type of jobs in the region		
(1) Project Installation	Creates during project installation period: 301.3 man years skilled employment 1,156.3 man years of unskilled employment	During project installation period -250.5 man years of skilled employment.
(2) Project OM&R	Creates during project evaluation period 38.0 man years of unskilled employment	
(3) Farm Labor	Creates during project evaluation period 131.3 man years of semi-skilled employment	
(4) Non-resident Recreation	Creates during project evaluation period 323.3 man years of seasonal unskilled employment	
(5) Indirect and induced effects from: (a) Project OM&R and Farm Labor (b) Non-resident Recreation	Creates during project evaluation period 84.0 man years of fulltime unskilled employment 54.4 man years of seasonal unskilled employment	
TOTAL Beneficial Effects:	1,457,6 man years of employment during project installation period 253.3 man years of permanent full time employment during project evaluation period 377.7 man years of permanent seasonal employment during project evaluation period.	-250.5 man years of employment during project installation period.

Table 95 Continued
CARSON RIVER SUBBASIN SUMMARY
Regional Development Account

Components	Measures of Effects	
	Central Lahontan Basin	Rest of Nation
Adverse Effects: A. Decrease in number and type of jobs in the nation	------------	------------
NET Beneficial Effects	1,457.6 man years of employment during project installation period. 253.3 man years of permanent full time employment during project evaluation period. 377.7 man years of permanent seasonal employment during project evaluation period.	-250.5 man years of employment during * project installation period.
III. Population Distribution Beneficial and Adverse Effects:	Creates 631 permanent jobs supporting a population of 1,326.4 people in an area with a high rural population.	------------
IV. Regional Economic Base and Stability Beneficial and Adverse Effects:	Creates 253.3 permanent fulltime jobs, 377.7 permanent seasonal jobs during project evaluation period. Creates during project installation period 1,457.6 man years of employment, provides 1,405,400 visitor-days of general outdoor recreation and 100,100 visitor-days of water based recreation. Will reduce sediment by 48,773 cubic yards annually, increase forage supply by 8,949 AUM'S and increase production on 52,845 acres of cropland, increase wood supply by 354,240 MBF, and reduce	------------

* Total man years for project installation period.

Table 95 Continued
CARSON RIVER SUBBASIN SUMMARY
Regional Development Account

COMPONENTS	Measures of Effects	
	Central Lahontan Basin	Rest of Nation
	annually flood damage by $268,512	
V. Regional Environmental Conditions Beneficial and Adverse Effects:	------------	------------

Table 95 Continued
CARSON RIVER SUBBASIN SUMMARY
Social Well-being Account

Components	Measures of Effects		
A. Real Income Distribution			
(1) Beneficial Effects:	Income Class (dollars)	Adjusted Gross Income By Class (percent)	Benefits in Class (percent)
	(Distributions of $5,988,510 in benefits to Carson River Subbasin)		
	Less than 3,000	08.3	07.3
	3,000 to 10,000	41.4	42.6
	More than 10,000	50.3	50.1
(2) Adverse Effects:	Income Class (dollars)	Adjusted Gross Income By Class (percent)	Cost in Class (percent)
	(Distribution of $474,043 in cost to be borne by Carson River Subbasin		
	Less than 3,000	08.3	07.3
	3,000 to 10,000	41.4	42.6
	More than 10,000	50.3	50.1
B. Life, Health, and Safety: Beneficial and Adverse Effects:	Provide flood protection at 100-year level to Carson City including the State Capitol complex and Carson Valley West Fork area.		
C. Educational, Cultural, and Recreational Opportunities: Beneficial and Adverse Effects:	Provide 1,405,400 visitor days of general outdoor recreation and 100,100 visitor days of water based recreation, 25 percent of National Forest gross receipts paid to counties.		
D. Emergency Preparedness: Beneficial and Adverse Effects:	Decrease water yield by 611 acre-feet annually in the Subbasin.		

Walker River Subbasin

The USDA Plan for the subbasin consists of the Pumpkin Hollow, Bridgeport, West Walker-Antelope Valley, and Smith Valley-Desert Creek watershed investigations, the National Forest programs, and the accelerated conservation programs on private lands. A brief summary of each component of the plan is included in the following pages. The detailed reports of the projects and programs are in APPENDIX II.

Pumpkin Hollow-Southeast Mason Valley Watershed Investigation Report

Pumpkin Hollow-Southeast Mason Valley Watershed comprises 96,500 acres located near Yerington, in the southeast portion of Mason Valley. Approximately 80 percent of the land is federally administered, and 20 percent is privately-owned.

There are approximately 90 private land ownerships in the watershed area, excluding the town of Yerington and small ownerships. The average farm unit is 200 acres in size. Population within the watershed is about 2,800 persons.

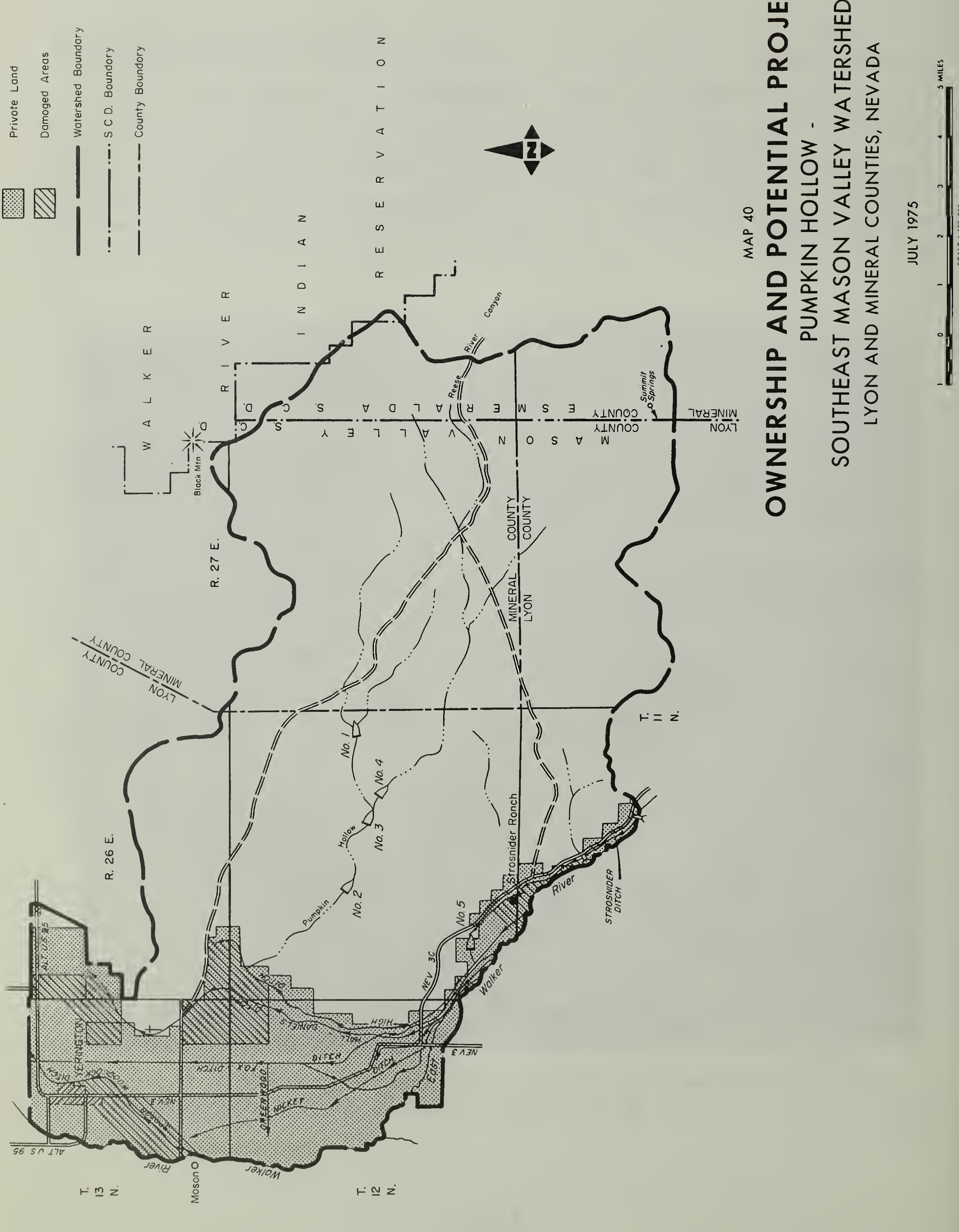
Water service to the area is furnished by five independent ditch companies and one privately-owned facility, all of which divert their irrigation supply from the East and main Walker Rivers at five different diversion points. The supply ditches total about 100 miles in length.

Ditch consolidation and concrete lining of the High Ditch would:

1. Eliminate approximately 55 miles of ditches and improve delivery efficiency.
2. Lower evaporation and seepage losses.
3. Provide sufficient water to irrigate 1,443 more acres.
4. Reclaim 160 acres presently used for ditches.
5. Reduce maintenance and flood damage to ditches and diversions.

Periodic flooding of the Pumpkin Hollow drainage has caused damage in the past. Flood protection could be provided by either a system of reservoirs and release channels or a spreader dike-contour ditch system. Flood control would protect the proposed ditch consolidation and concrete lining from flood damage, and reduce flood hazard to facilities. The estimated cost of project installation is $1,219,800. The average annual cost is $90,376 and the average annual benefits are $216,163.

Irrigation improvements and flood protection to a portion of Mason Valley are the major components in the Pumpkin Hollow WIR.



MAP 40

OWNERSHIP AND POTENTIAL PROJECTS

PUMPKIN HOLLOW -

SOUTHEAST MASON VALLEY WATERSHED

LYON AND MINERAL COUNTIES, NEVADA

JULY 1975

Bridgeport Watershed Investigation Report

The Bridgeport Watershed, consisting of about 236,700 acres of private and federal lands, is located mostly south and west of Bridgeport Reservoir in Mono County California. Bridgeport is the only town in the watershed and has a permanent population of 550 persons in 1967. This population usually doubles during the summer recreation season.

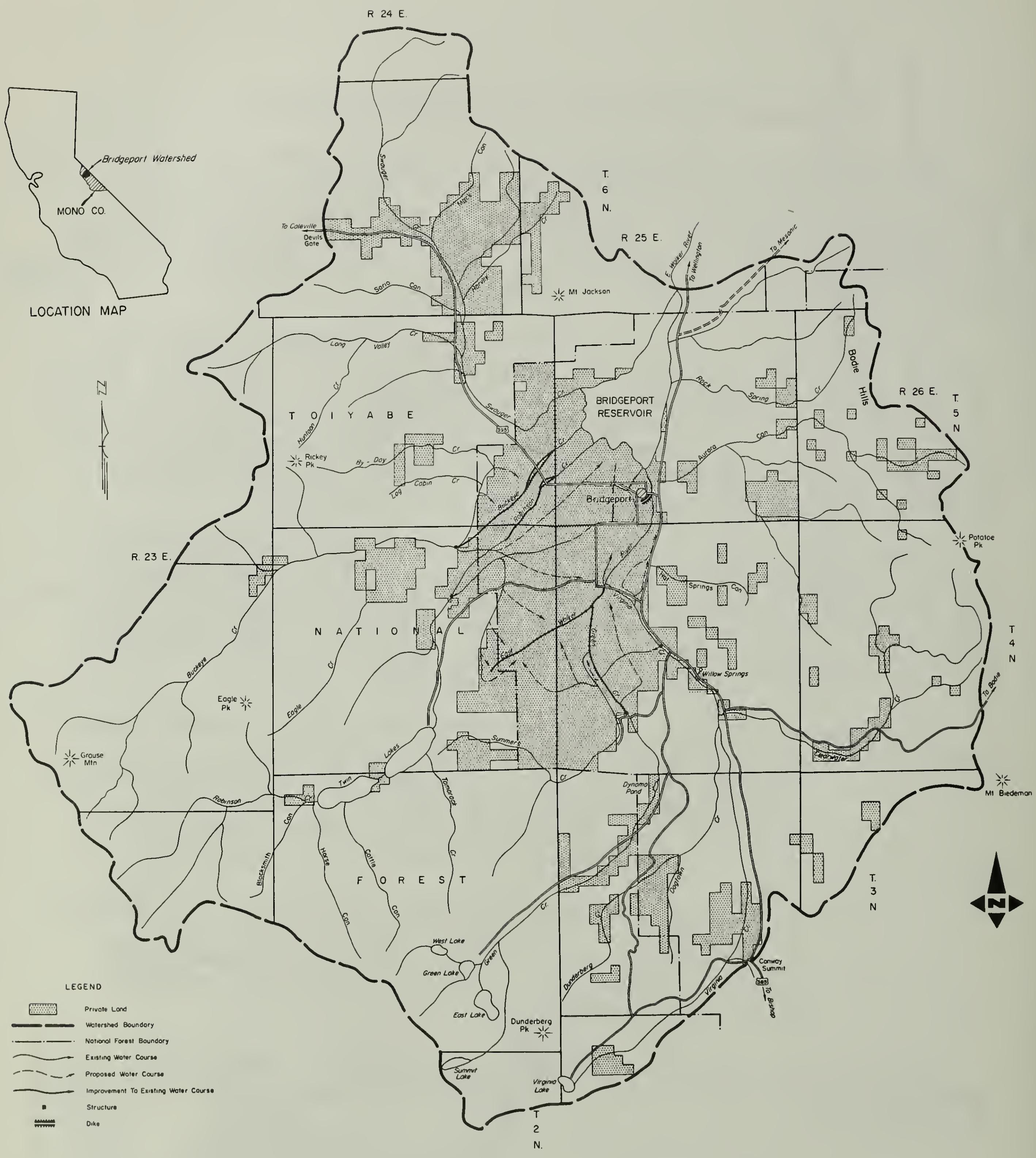
The main agricultural product is the growing of spring, summer, and fall pasture and range forage for livestock, which is carried on commercially by approximately 25 ownership units. There are over 21,000 acres, primarily native pasture currently being irrigated. Recreation is an important enterprise in the watershed, with the main activities being fishing, boating, hunting, hiking, horseback riding, and camping.

Improvements on 15,000 acres of irrigated pasture land can be accomplished through such items as land smoothing, the extensive installation of several water management practices, contour ditches, new diversion structures, limited drainage, channel clearance and straightening, improved grass species, and improved irrigation water management.

Bridgeport is subject to periodic flooding. Flood control for the one percent event can be accomplished by:

1. Channel clearing and widening at Bridgeport on the east Walker River below the U. S. 395 Bridge.
2. An earth dike extending from the East Walker River at Bridgeport to high ground south of town.
3. Interceptor channel systems to collect and dispose of runoff from the fields southwest of town.
4. Installing another bridge on U. S. Highway 395, west of Bridgeport, to help dispose of runoff water from meadowlands.

The project installation cost estimate is $338,270.00. Average annual cost is $25,764 and the average annual benefits are $200,287



MAP 41

OWNERSHIP AND POTENTIAL PROJECTS

BRIDGEPORT WATERSHED

MONO COUNTY, CALIFORNIA

JULY 1975

1 0 1 2 3 4 5 MILES

SCALE 1:250,000

U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE USDA-SCS PORTLAND, OREG 1975

M7-SL-18858

West Walker-Antelope Valley Watershed
Investigation Report

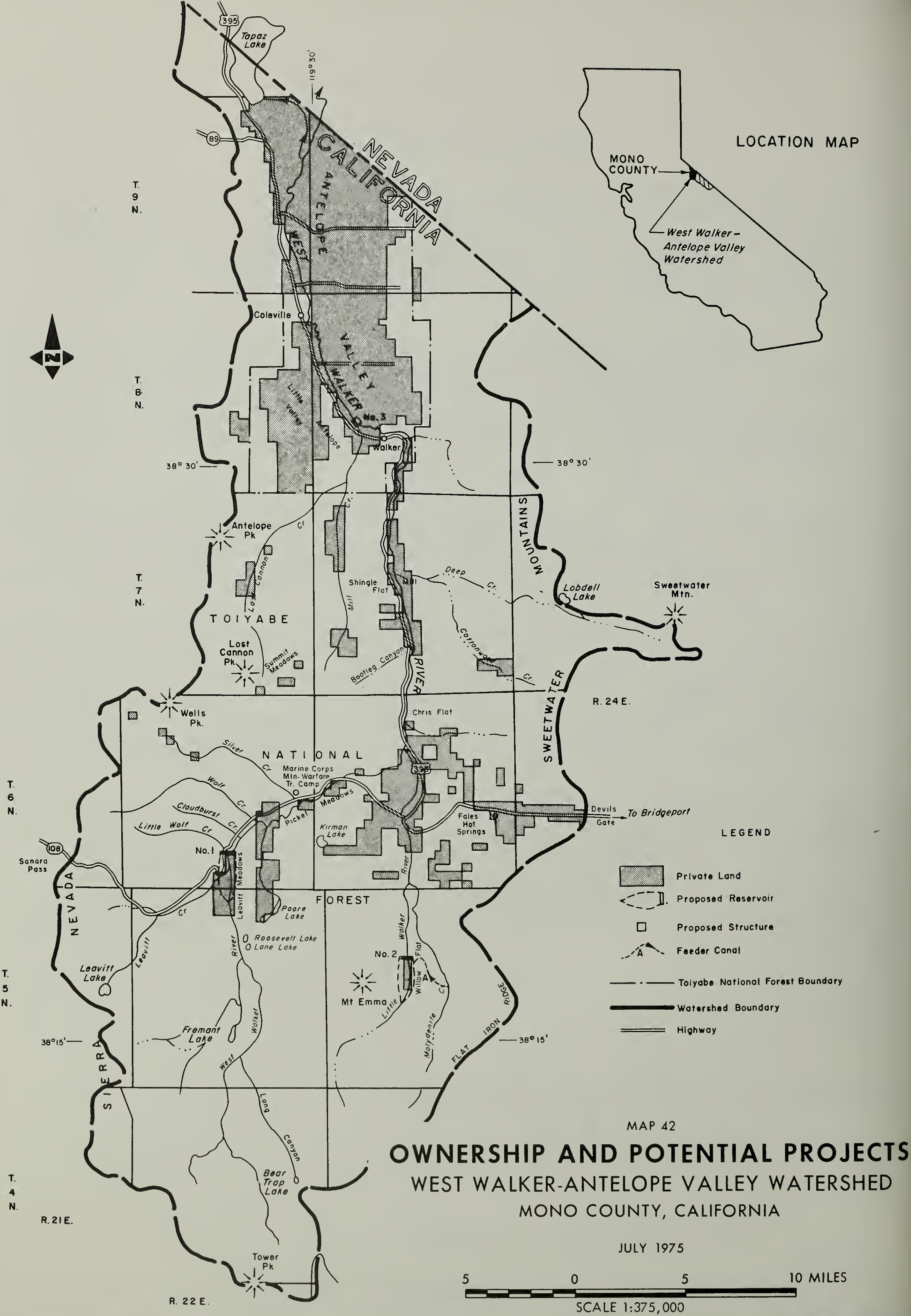
The West Walker-Antelope Valley Watershed contains 220,760 acres, of which 16 percent is private and 84 percennt is federal, and is located in northwestern Mono County, California. Elevation above sea level varies from about 5,000 to over 11,740 feet. Most of the agricultural land is confined to antelope Valley.

Agriculture and recreation are the main economic activities within the watershed. Approximately 38 operating farm and ranch units have a total of 15,870 acres of cropland and pasture which is used chiefly to support livestock enterprises. The recreation industry provides vacationers with lodging, supplies, pack animals, and guides.

Areas within the watershed are subject to both wet and dry-mantel flooding. Approximately 13,000 acre-feet of floodwater storage, in two proposed reservoirs, would be required to provide protection in the West Walker River Canyon and Antelope Valley from a four percent chance flood flow in the river.

Natural flows of the West Walker River are insufficient to supply full water rights to Antelope Valley users during the latter part of the irrigation season. The two proposed reservoirs could provide 30,000 acre-feet of irrigation water storage. A proposed concrete diversion structure in the West Walker River at Big Slough will alleviate diversion problems for a major share of the Antelope Valley water users.

Although unevaluated, considerable recreational benefits would result from the proposed reservoirs. A maximum surface area of 745 acres from irrigation water storage could provide approximately 13,000 visitor-days of recreation use. The estimated project installation is $4,911,057.00. The average annual cost is $360,455 and the average annual benefits are $485,810.



MAP 42

OWNERSHIP AND POTENTIAL PROJECTS

WEST WALKER-ANTELOPE VALLEY WATERSHED

MONO COUNTY, CALIFORNIA

JULY 1975

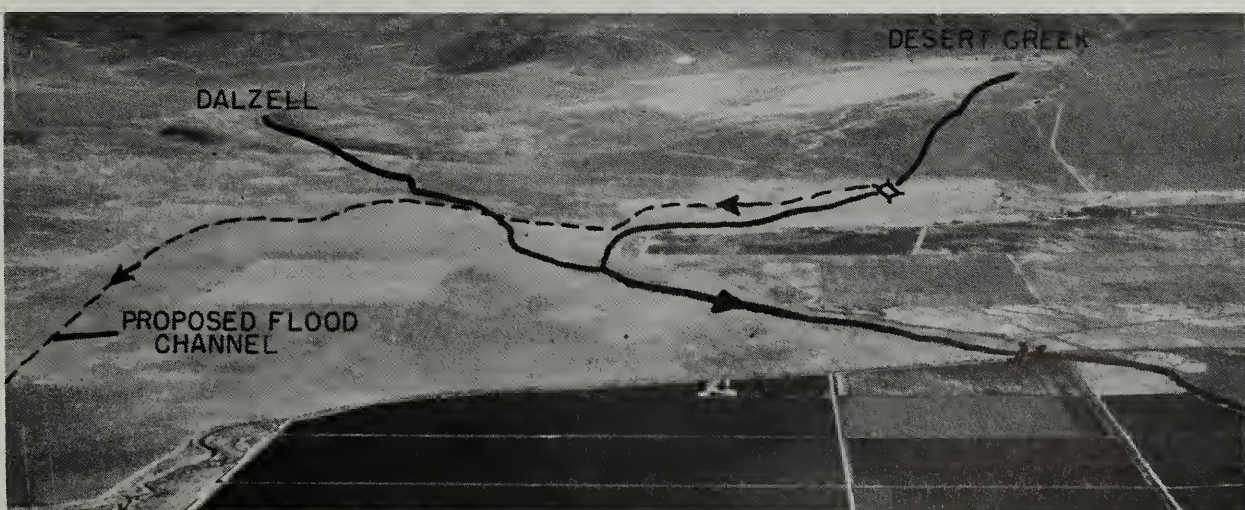
M7-EL-18973A

Smith Valley-Desert Creek Watershed
Investigation Report

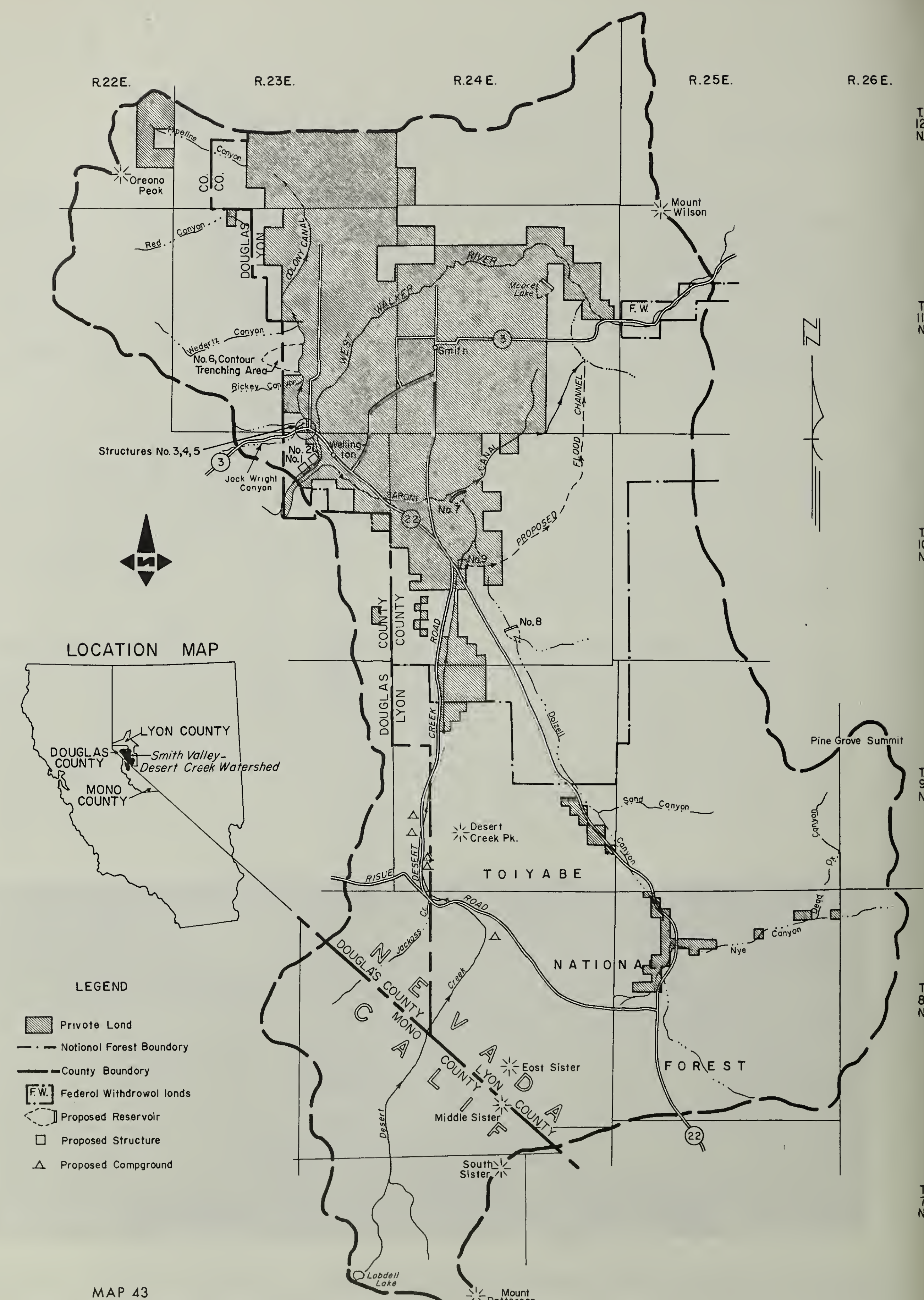
The Smith Valley-Desert Creek Watershed contains about 240,400 acres, of which 20 percent is private and 80 percent is Federal, and is located in portions of Lyon and Douglas Counties, Nevada, and Mono County, California. Elevation above sea level varies from about 4,700 feet to over 11,670 feet. Most of the agricultural land is confined to Smith Valley. Agriculture is the main economic activity within the watershed. Approximately 83 operating farm and ranch units have a total of 18,559 acres of pasture and cropland.

Flood flows from Desert Creek, Dalzell Canyon, Jack Wright Grade and several other small drainages have caused damage to main irrigation canals, crops, cropland, ditches, and roads. A series of overshot structures would be needed to pass flood flows over the irrigation canal and into the West Walker River. Two road bridges will allow the floodwater to pass under Nevada Highway 3 and the Colony Road.

Water-based recreational opportunities in the watershed are limited. The proposed Moore Lake development would provide residents a local lake for flatwater recreation. Moore Lake would consist of two adjacent water bodies with a total surface area of 57 acres. Proposed campgrounds for the watershed's national forest lands are shown on the map. The estimated cost of project installation is $242,500. The average annual cost is $18,815 and the average annual benefits are $15,902.



This proposed flood channel will carry floodwaters from Desert Creek around the irrigated lands in Smith Valley.



MAP 43

OWNERSHIP AND POTENTIAL PROJECTS

SMITH VALLEY-DESERT CREEK WATERSHED

DOUGLAS AND LYON COUNTIES, NEVADA
MONO COUNTY, CALIFORNIA

JULY 1975

Other Components

Summaries of planned treatment measures on National Forest and privately owned lands are shown in Tables 95 and 96. Costs, program responses, and benefits are indicated. The values for costs and responses are in APPENDIX II.

The National Forest summary includes measures for timber, range improvement, recreation development, watershed treatment, and fish and wildlife.

The accelerated treatment summary for privately owned land indicates costs and benefits for accelerating the installation of improvement measures on irrigated cropland and privately owned rangeland. Units shown refect that portion of the total cropland and rangeland treatment needs that could be treated to achieve a 50 percent increase in rate over the present rate of treatment. Costs, benefits from increased returns, and net benefits are displayed.

Rangeland seeding are planned to improve forage production for livestock and wildlife in the Walker Subbasin. BLM photo

TABLE 96

CENTRAL LAHONTAN BASIN
Cost and Responses of Proposed Forest Service Timber Program
Walker Subbasin

Treatment and/or Development	Units	Cost/Unit		Amortization Period		Average Annual Cost		Total Average Annual Cost $	Program Responses		
		Installation $	O&M $	Total Installation Cost $	@ 7% Yrs	Installation $	O&M $		Increase Fiber Yield MBF/Yr	+ or - Water Yield	+ or - Sediment Yield CY/Yr
Biological Contribution											
Reforestation	1,387 ac	128	--	177,536	100	12,441	--	12,441	--	--	Not Avail.
Release	277 ac	25	--	6,925	30	580	--	580	--	--	--
Thin	736 ac	25	--	18,400	30	1,482	--	1,482	--	--	--
Prune	475 ac	40	--	19,000	100	1,331	--	1,331	--	--	--
Full Stocking Implementation	35,780 ac	130	1.46[1]	4,651,400	100	325,970	52,238	378,208	128,808	--	Not Avail.
Industrial Contribution											
Logging Residue Reduction	5.7 mmbf	877	--	4,998	2	--	--	--	171[3]	(Value of stumpage	$ 6,044)[4]
Mill Residue Reduction	5.7 mmbf	Not Avail.	Not Avail.	--	--	--	--	--	570[3]	(Value of lumber	$90,071)[5]

Total Installation Cost	4,651,400	Total	325,970	52,238	378,208			
Installation Cost Breakdown								
Private	--	Program Responses	+ or - Units			+128,808	--	--
Federal	4,651,400		+ or - Dollars			+ 64,224[2]	--	--
Equipment	1,441,934							
Skilled Labor	372,112							
Unskilled Labor	2,837,354							

Table 96

CENTRAL LAHONTAN BASIN
Cost and Responses of Proposed Forest Service Range Improvement Program
Walker Subbasin

Treatment and/or Development	Units	Cost/Unit Installation $	Cost/Unit O&M $	Amortization Period Total Installation Cost $	Amortization Period @ 7% Yrs	Average Annual Cost Installation $	Average Annual Cost O&M $	Total Average Annual Cost $	Program Responses Forage Increase Pounds/Yr	Program Responses Increased AUM Capacity Annual	Program Responses + or - Sediment Yield Cy/Yr
Cover Manipulations											
Tall Brush	3,200 ac	25[6/]	--	80,000	10	11,389	--	11,389	1,120,000	455	-3,520
Low Brush	27,850 ac	3.80[6/]	--	105,830	10	15,067	--	15,067	6,962,000	2,812	-15,317
Range Seeding											
Desert Shrub Ecosystem	7,890 ac	12[6/]	--	94,680	30	7,629	--	7,629	2,761,500	1,115	-8,679
Desert Grasslands Ecosystem	10,910 ac	14[6/]	--	152,740	30	12,307	--	12,307	3,818,500	1,542	-12,001
Fence Construction	149 mi	3,000[6/]	5	447,000	30	36,019	745	36,764	--	--	--
Cattle Guard Installation	35 ea	1,500	20	52,500	100	3,679	700	4,379	--	--	--
Noxious and Undesirable Forbs Control	1,778	15	--	26,670	15	2,928	--	2,928	--	--	--
Water Development											
Springs	126 ea	500	20	63,000	25	5,406	2,520	7,926	--	--	--
Wells	4 ea	2,100	50	8,400	100	588	200	788	--	--	--
Reservoirs	16 ea	1,500	25	24,000	30	1,933	400	2,333	--	--	--
	Total Installation Cost			1,054,820	Total Fed.	96,945	4,565	101,510			
	Installation Cost Breakdown										
	Private										
	Federal			1,054,820	Program Responses	+ or - Units			+14,662,500	+5,894	-39,517
	Equipment			613,059							
	Skilled Labor			157,697		+ or - Dollars			--	+24,822	+15,807[2/]
	Unskilled Labor			284,064							

TABLE 96

CENTRAL LAHONTAN BASIN
Cost and Responses of Proposed Forest Service Recreation Development
Walker Subbasin

Treatment and/or Development	Units	Cost/Unit: Installation $	Cost/Unit: O&M $	Amortization Period: Total Installation Cost $	Amortization Period: @ 5.875 Yrs	Average Annual Cost: Installation $	Average Annual Cost: O&M $	Total Average Annual Cost $	Program Responses: Capacity Increase Visitor Days Annual	Program Responses: Annual Benefit Value $	Program Responses: Consumptive Water Use AF/Yr
Campgrounds	987 ea	2,868 ea	90 ea	2,830,716	20	244,290	88,830	333,120	827,790	1,241,685	6.1
Picnic Sites	317 ea	1,874 ea	90 ea	594,058	20	51,267	28,530	79,797	126,800	190,200	.9
Swim Sites	1 ea	568/cap.	.76/cap.	68,160	20	5,882	16,400	22,282	15,000	22,500	.7
Boat Launching Site	1 ea	1,136/cap.	.76/cap.	136,320	50	8,498	15,200	23,698	20,010	35,000	.2
Observation Site	2 ea	37/cap.	.05/cap.	14,800	50	922	2,000	2,922	40,000	60,000	.1
Interpretive Site	1 ea	113/cap.	.36/cap.	11,300	20	975	5,400	6,375	15,000	22,500	.2
Wilderness Facilities											
Trailhead Facilities Site	1 ea	22,000 ea	900 ea	22,000	20	1,898	900	2,798	12,000	9,000	--
Backcountry Campsite	17 ea	800 ea	150 ea	13,600	20	1,173	2,550	3,723	26,190	19,642	--
	Total Installation Cost			3,690,954	Total Fed.	314,905	159,810	474,715			
	Installation Cost Breakdown										
	Private			--							
	Federal			3,690,954							
	Equipment	Private		--	Program Responses	+ or - Units			+1,082,780	--	-8.2
		Federal		2,583,668							
	Skilled Labor	Private		--		+ or - Dollars			--	+1,600,527	-80.0
		Federal		808,318							
	Unskilled Labor	Private		--							
		Federal		298,968							

TABLE 96

CENTRAL LAHONTAN BASIN
Cost and Responses of Proposed Forest Service Watershed Treatment Program
Walker Subbasin

Treatment and/or Development	Units	Cost/Unit Installation $	Cost/Unit O&M $	Amortization Period Total Installation Cost $	Amortization Period @ 7% Yrs	Average Annual Cost Installation $	Average Annual Cost O&M $	Total Average Annual Cost $	Program Responses + or - Sediment Yield CY/Yr	Program Responses + or - Water Yield AF/Yr
Gully Erosion Control	489 mi	5,000	--	2,445,000	100	171,345	--	171,345	-156,480	--
Sheet Erosion Control	75,200 ac	130	--	9,854,000	100	690,568	--	690,568	-166,760	--
Rehabilitation of Abandoned Roads and Trails	240.5 mi	1,100	--	264,550	100	18,539	--	18,539	-2,164	--
Mine Restoration	3,104 ac	130	--	403,520	100	28,278	--	28,278	-6,828	--
Stream Bank Stabilization	34.4 mi	11,300	113	388,720	100	27,241	3,887	31,128	-2,408	--
	Total Installation Cost			13,355,790	Total Fed.	935,971	3,887	939,858		
	Installation Cost Breakdown									
	Private			--	Program Responses		+ or - Units		-334,640	--
	Federal			13,355,790						
	Equipment			9,349,053			+ or - Dollars		+133,856[10/]	--
	Skilled Labor			2,924,918						
	Unskilled Labor			1,081,819						

TABLE 96

CENTRAL LAHONTAN BASIN
Cost and Responses of Proposed Forest Service Wildlife Program[11/]
Walker Subbasin

Treatment and/or Development	Units	Cost/Unit Installation $	Cost/Unit O&M $	Amortization Period Total Installation Cost $	Amortization Period @ 7% Yrs	Average Annual Cost Installation $	Average Annual Cost O&M $	Total Average Annual Cost $	Program Responses Hunter or Fisherman Day Use Effect + or -	Program Responses Effect on Wildlife & Fisheries Population + or -	Program Responses + or - Sediment Yield CY/Yr	Program Responses Increases in Wildlife Forage Lbs/Yr
Release of Wildlife Forage Plants	3,600 ac	15	--	54,000	20	5,097	--	5,097	+	+	--	900,000
Plant Waterfowl Food Plants	45 ac	40	--	1,800	20	169	--	169	+	+	--	--
Install Nesting Facilities	25 ea	100	--	2,500	5	609	--	609	+	+	--	--
Seeding and Planting	2,640 ac	15	--	39,600	20	3,737	--	3,737	+	+	-7,920	924,000
Area Protection (Fencing)	22.3 mi	3,000	50	66,900	50	4,846	1,115	5,961	--	+	--	--
Create Permanent Wildlife Openings	356 ac	35	10	12,460	20	1,176	3,560	4,736	+	+	--	--
Wildlife Watering Facilities	19 ea	1,500	10	28,500	20	2,064	190	2,254	--	+	--	--
In-Channel Improvement, Structures	1,002 ea	Not Avail.	Not. Avail.	--	--	--	--	--	+	+	--	--
Channel Stabilization and Improvements	17.3 mi	11,000	--	190,300	100	13,336	--	13,336	+	+	-1,211	--
Total Installation Cost				396,060								
Installation Cost Breakdown				--	Total	31,034	4,865	35,899				
Private				--								
Federal				396,060	Program Responses		+ or - Units		+	+	-9,131	+3,684 DMU
Equipment				--								
Skilled Labor				--	Program Responses		+ or - Dollars		--	--	+3,926	--
Unskilled Labor				--								

CENTRAL LAHONTAN BASIN
Footnotes for Table 96 - Walker Subbasin

* Indicates items not used in the NED account of the Four Account Display.
1. This includes cost of doing business in timber plus fire protection.
2. Based on value in 100 years discounted to present worth.
3. The benefits of the additional 741,000 board feet of lumber to the consumer and the economic activity to the subbasin was not calculated.
4. Value based on $35.35/MBF.
5. Value based on $158.02/MBF.
6. Source of costs <u>Range Management Practices: Investment Cost 1970</u>, Agriculture Handbook No. 735.
7. Value based on $4.19/AUM.
8. Value based on $0.43/CY.
9. Value based on $9.76/AF.
10. Value based on $0.43/CY.
11. Data not used in the NED account of the Four Account Display; responses were considered in the EQ account.
12. DMU is Deer-Months Use.

Table 97 - Accelerated conservation treatment on privately owned lands, Walker River Subbasin

Type and Quantity of Treatment	Average Annual Cost or Benefit
Irrigated Cropland Improvements:	
23,096 acres suitable for treatment	
Benefits, Increased return	$261,677
Costs: Installation	203,245
OM&R	49,887
Total	$253,132
Net Benefits	$ 8,545
Rangeland Improvements:	
10,000 acres suitable for treatment	
Benefits, Increased forage and sediment reduction	$ 8,824
Costs: Installation	1,674
O&M	1,481
Total	$ 3,155
Net Benefits	$ 5,669

Four Account Display

The projects and programs for the subbasin have been summarized and displayed in the Four Account System in Table 98. Beneficial and adverse effects have been shown for each account. The accounts show the impacts that the projects and programs will have on the nation, the environment and the Basin.

Table 98 - Four Account Displays, USDA Plan, Walker River Subbasin, Central Lahontan Basin
WALKER RIVER SUBBASIN SUMMARY
National Economic Development Account

Components	Measures of Effects
Beneficial Effects:	(Average Annual dollars)
A. The value to users of increased outputs of goods and services	
(1) Flood Prevention	
(a) Flood Water	84,894
(b) Sediment and Erosion	152,047
(2) Recreation	
(a) Federal	1,600,527
(b) Private	22,579
(3) Forage Supply	31,262
(4) Irrigation	815,635
(5) Wood Supply	166,224
B. The value of outputs resulting from external economies	
Indirect and induced associated with increased net returns	339,175
TOTAL Beneficial Effects:	3,212,343
Adverse Effects:	
A. The value of resources required for the plan	
(1) Project Installation	2,291,587
(2) Project OM&R	296,898
(3) Project Administration	57,503
B. Losses in output resulting from external diseconomies	
TOTAL Adverse Effects:	2,645,989
NET Beneficial Effects:	566,355

Table 98 Continued
WALKER RIVER SUBBASIN SUMMARY
Environmental Quality Account

BENEFICIAL AND ADVERSE EFFECTS

Components	Measures of Effects
A. Areas of Natural Beauty	1. Six reservoirs will be created with a maximum surface area of 1,037 acres. The two reservoirs for Smith Valley-Desert Creek are recreation reservoirs of 57 surface acres, two reservoirs at Pumpkin Hollow are flood prevention reservoirs of 165 acres, and the two for West Walker-Antelope Valley are for both irrigation storage and flood prevention reservoirs of 815 surface acres. 2. The six reservoirs will inundate a maximum of 1,037 acres of range and pasture land, commit 1,164 acres to open space. and have about 10.6 miles of shoreline. 3. The reservoirs will have maximum storage capacity of 45,375 acre-feet; 13,770 acre-feet floodwater detention, 1,330 acre-feet sediment dentention, 30,000 acre-feet for irrigation and 275 acre-feet for recreation at locations where flatwater is lacking. 4. The Smith Valley-Desert Creek recreation reservoirs will have 87 acres of land set aside for park and recreation areas around the reservoirs. 5. The two reservoirs in the West Walker-Antelope Valley will inundate 4.2 miles of perennial stream of 241 miles in the subbasin. 6. About 2 miles of channel will be built in the West Walker-Antelope Valley across an area that will detract from the area's natural beauty. 7. The channel in the West Walker-Antelope Valley will dry up or reduce the quality of 2.4 miles of Molybdenite Creek, a perennial stream of 7 miles. 8. The canal overpass structures and flood channels will allow more water to reach the Walker River, but will carry more sediment in the water. 9. The flood channels and feeder channels to the reservoir will commit 46 acres of rangeland to channel rights of way. 10. The deeping and straightening of natural channels of Buckeye Creek, Robinson Creek, Green Creek, and the East Walker River may be esthetically unpleasing to some. 11. The flood channels at Bridgeport will affect 6 miles of perennial streams and 1.7 miles of existing channel on perennial streams out of 214 miles of perennial streams in the subbasin. 12. The Bridgeport Dike will commit 2 acres of pasture land to the use of the dike and will detract from the natural beauty of the view from town. 13. Designation of 1,271 acres as non-urban parks for recreation purposes on the National Forest.

Table 98 Continued

WALKER RIVER SUBBASIN SUMMARY
Environmental Quality Account

BENEFICIAL AND ADVERSE EFFECTS

Components	Measures of Effects
A. Areas of Natural Beauty (continued)	14. Environmental deterioration may result through development of 987 camp units, 317 picnic sites, 1 swim site, 1 boat launch facility, 2 observation sites, 1 interpretive site, 3 trail head facilities, and 17 back country camps in the Hoover Wilderness Area.
	15. Set aside 734 acres around facility development to be used as a buffer zone.
	16. Preserve an additional 56,908 acres by addition to the Hoover Wilderness Area as open space.
	17. Restrict other resource uses, such as timber, grazing, and mineral exploration, on 734 acres of buffer zone and 56,908 acres of the wilderness extension.
	18. Channel improvements on 61.7 miles of stream in the National Forest to restore proper hydrologic functioning and reduce erosion by an estimated 3,619 cubic yards annually.
	19. There will be an estimated 344,158 cubic yard reduction annually of sediment that has a potential of reaching the lakes in the Subbasin, This reduction is through the total land treatment program.
	20. Enhance 5 acres of shoreline with swim beaches and boat launching facilities.
	21. Increase the present theoretical annual capacity of water based recreation by 38,207 visitor-days through program implementation.
	22. There will be a temporary degradation of the visual, sound, and odor quality of the natural setting during program implementation.
	23. The land treatment and structures will have a noticable effect on the natural beauty of the Subbasin.
	24. The establishment period will expose soil and increase the erosion hazard which will increase sediment in the streams.
	25. The fencing will detract from the natural beauty of the open space of the Subbasin.
	26. The seeding and spraying will restore the vegetation to be nearer the pristine condition.
	27. The treatment of the cropland will enhance the beauty of the agricultural green belt.
B. Historical and Biological Resources with Selected Ecosystems	1. The reservoir at Leavitt Meadows will inundate about 2 miles of the emigrant trail of the 1850's and about 5 miles of the Sonora and Mono Wagon Road, which is now State Highway 108 and will have to be relocated. The reservoir will also inundate the Leavitt Meadows Pack Station.
	2. The reservoirs of Smith Valley-Desert Creek and West Walker-Antelope Valley will inundate 872 acres destroying the native vegetation and changing the terrestrial

Table 98 Continued
WALKER RIVER SUBBASIN SUMMARY
Environmental Quality Account

BENEFICIAL AND ADVERSE EFFECTS

Components	Measures of Effects
B. Historical and Biological Resources with Selected Ecosystems (continued)	environment to a Marine environment. 3. The reservoirs of Smith Valley-Desert Creek and West Walker-Antelope Valley will create and improve fish habitat in and below the reservoirs and provide feeding and resting area for waterfowl. 4. Construction of the reservoirs and channels will destroy about 1,137 acres of native vegetation for sites and borrow area. 5. Contour trenching will help increase plant growth on 300 acres of land that is now sparsely covered by vegetation. 6. The reservoirs, flood channels, and dike will provide flood protection to the valleys below the structures and will reduce erosion and resulting sediment. 7. The Bridgeport flood channels will reduce the quality of fish habitat in 6 miles of stream. 8. Increase vegetative cover and forage production on 110,207 acres of rangeland, 6,240 acres of wildlife habitat, and 80,828 acres of problem area to control erosion and sediment. 9. Reforest 1,387 acres of non-productive commercial forest land with approximately 600,000 trees. 10. Increase the forage production by 912 tons annually on wildlife habitat land to support 4,606 additional deer-months use. 11. Addition of 45 acres of waterfowl food plants and improve fisheries habitat along 28.4 miles of stream. 12. The 22 water developments will provide water livestock and wildlife and bring about better distribution and forage use. 13. The fencing will restrict the movement of antelope. 14. The ecosystems will be changed in the land treatment from brush to grass and will result in changes in the animal species as their habitat changes. This may reduce the deer and sagegrouse particularly. 15. The consolidation and realignment of irrigation ditches and canals will reduce the riparian vegetation and associated wildlife habitat. 16. The drainage of some class 1&2 wetlands will reduce the food supply for Canadian geese in the spring, but increase the upland game habitat on the drained land. 17. The open drains will increase the riparian vegetation and associated wildlife habitat.

Table 98 Continued
WALKER RIVER SUBBASIN SUMMARY
Environmental Quality Account

BENEFICIAL AND ADVERSE EFFECTS

Components	Measures of Effects
C. The Quality of Water, Land Air, and Sound Resources	1. The reservoirs will remove 1,330 acre-feet of sediment over the life of the project. 2. The canal overpass structures and the Desert Creek flood channel will reduce sediment deposits on cropland and reduce hazard of interruption of irrigation services to 10,760 acres of cropland during peak irrigation season. 3. Contour trenching will reduce erosion on 300 acres with a severe erosion hazard and reduce sediment deposits in Colony Canal and cropland. 4. The releases from the West Walker-Antelope Valley reservoirs will improve the quality of water in times of low normal stream flow. 5. The realignment of the Pumpkin Hollow irrigation system miles will save 10,800 acre-feet of water annually from seepage, phreatophyte growth, and evaporation. This will supply 1,443 acres of semi-irrigated cropland, a full season's supply. 6. 160 acres of Pumpkin Hollow land will be changed in use from ditches and canals to cropland. 7. 5.7 miles of concrete ditch lining will save 2,300 acre-feet of water annually from seepage and phreatophyte growth in Pumpkin Hollow. 8. The irrigation systems and drains of Bridgeport will lower the water table and improve the quality of the pasture land. 9. Installing "pit-pump" toilets at all recreation developments not served by a sewer system will reduce biological pollution of ground water streams. 10. Maintaining a buffer zone of 100 to 200 feet along streams in which only limited use is permitted will reduce potential contamination and maintain a lower maximum temperature. 11. Increased utilization of forest products will reduce logging residue and mill waste that would be burned. 12. Establish irregular or free form boundaries on timber harvest areas will improve visual quality. 13. Runoff from sprayed lands may cause some downstream problems. 14. The treatment of the irrigated land and proper management of the treated lands will increase the irrigation efficiency from 50 percent to 67 percent. 15. Reservoir drawdown will result in reduction of visual quality.
D. Irreversible Commitments of Resources to Future Users	1. The installation will commit labor, capital, materials to the construction and implementation of the project. 2. The construction of the project will cause 4.3 million cubic yards of earth and rock.

Table 98 Continued

WALKER RIVER SUBBASIN SUMMARY
Environmental Quality Account

BENEFICIAL AND ADVERSE EFFECTS

Components	Measures of Effects
D. Irreversible Commitments of Resources to Future Users (continued)	to be moved from its original position and committed to the dams, channels, ditches and dike. 3. The development of recreation structures of 537 acres of forest and woodland will disturb and destroy natural vegetation.

Table 98 Continued
WALKER RIVER SUBBASIN SUMMARY
Regional Development Account

Components	Measures of Effects: Central Lahontan Basin	Measures of Effects: R.O.N.
	(Average annual dollars)	
1. Income		
Beneficial Effects:		
A. The value of increased output of goods and services to users residing in the region		
(1) Flood Prevention		
(a) Flood Water	84,894	-----
(b) Erosion and sediment	152,047	-----
(2) Recreation		
(a) User		
(1) Federal	1,328,437	272,090
(2) Private	20,291	2,288
(b) Increased net income to business and recreational supplies from non-resident expenditures	473,386	-473,386
(3) Forage Supply	31,262	-----
(4) Irrigation	815,635	-----
(5) Wood Supply	166,224	-----
B. The value of outputs to users residing in the region from external economies		
(1) Indirect and Induced effects from non-resident expenditures	180,820	-180,820
(2) Indirect and induced activities associated with increased net returns	604,511	-265,336

Components	Measures of Effects: Central Lahontan Basin	Measures of Effects: R.O.N.
	(Average annual dollars)	
1. Income		
Adverse Effects:		
A. The value of resources contributed from within the region.		
(1) Project installation	354,388	1,937,199
(2) Project OM&R	76,398	220,500
(3) Project administration	25,479	32,024
B. Losses in output from external diseconomies	-----	
C. Loss of assistance payments	-----	-----
D. Loss of displaced resources	-----	-----

(continued)

Table 98 Continued

WALKER RIVER SUBBASIN SUMMARY
Regional Development Account

Components	Measures of Effect		Components	Measures of Effect	
	Central Lahontan Basin	R.O.N.		Central Lahontan Basin	R.O.N.
C. Utilization of unemployed and under employed resources					
(1) Project installation	182,841	-182,841			
(2) Project OM&R	25,683	-25,683			
(3) Externalities of OM&R	583,766	-583,766			
(4) Farm Labor	58,060	-58,060			
D. Additional wages and net income occuring from construction and implementation of the plan and induced activities					
(1) Project installation	441,748	-441,748			
(2) Project OM&R	150,849	-150,849			
(3) Externalities of OM&R	35,041	- 35,041			
(4) Non-resident recreation	600,974	-600,974			
TOTAL Beneficial Effects:	5,936,469	-2,724,126	TOTAL Adverse Effects:	456,265	2,189,723
			NET Beneficial Effects:	5,480,204	-4,913,849

(continued)

Table 98 Continued
WALKER RIVER SUBBASIN SUMMARY
Regional Development Account

Components	Measures of Effects	
	Central Lahontan Basin	Rest of Nation
II. Employment Beneficial Effects: A. Increase in the number and type of jobs in the region		
(1) Project installation	Creates during project installation period 482.9 man years of skilled employment 243.0 man years of semi-skilled employment. 718.2 man years of unskilled employment.	During project installation period.* -453.1 man years of skilled employment.
(2) Project OM&R	Creates during project evaluation period 27.2 man years of unskilled employment.	Creates during project evaluation period. 20.8 man years of skilled employment 46.6 man years of semi-skilled employment.
(3) Farm Labor	Creates during project evaluation period 98.7 man years of semi-skilled employment	
(4) Non-resident recreation	Creates during project evaluation period 231.5 man years of unskilled seasonal employment.	
(5) Indirect and induced effects from:		
(a) Project OM&R AND Farm Labor	Creates during project evaluation period 207.3 man years of unskilled fulltime employment.	
(b) Non-resident recreation	38.7 man years of unskilled seasonal employment.	
TOTAL Beneficial Effects:	1,444.1 man years of employment during project installation period. 333.2 man years of permanent fulltime employment. During project evaluation period. 270.2 man years of permanent seasonal	-453.1 man years of employment during project installation period. 67.4 man years of permanent fulltime employment during project evaluation period.

* Total man years for project installation period.

Table 98 Continued
WALKER RIVER SUBBASIN SUMMARY
Regional Development Account

Components	Measures of Effects: Central Lahontan Basin	Measures of Effects: Rest of Nation
	employment during project evaluation period.	
Adverse Effects: A. Decrease in number and types of jobs in the region. (1) Project installation	Decreases during project installation* period. -121.0 man years of semi-skilled employment	------------
(2) Project OM&R	------------	Decreases during project evaluation period. -20.8 man years of skilled employment -46.6 man years of semi-skilled employment.
(3) Farm Labor	------------	
TOTAL Adverse Effects:	-121.0 man years of employment during project installation period.	-67.4 man years of employment during project evaluation period.
NET Beneficial Effects:	1,323.1 man years of employment during project installation period. 333.2 man years of permanent fulltime employment during project evaluation period. 270.2 man years of permanent seasonal employment during project evaluation period.	-453.1 man years of employment during project installation period.

* Total man years for project installation period

Table 98 Continued
WALKER RIVER SUBBASIN SUMMARY
Regional Development Account

Components	Measures of Effects	
	Central Lahontan Basin	Rest of Nation
III. Population Distribution Beneficial and Adverse Effects:	Creates 603.4 permanent jobs supporting a population of 1,404.9 people in an area with a high rural population.	------------
IV. Regional Economic Base and Stability Beneficial and Adverse Effects:	Creates 333.2 permanent fulltime jobs and 270.2 permanent seasonal jobs during project evaluation period. Creates during project installation period. 1,444,1 man years of employment, provides 1,047,780 visitor days of general outdoor recreation and 57,579 visitor days of water based recreation, will reduce sediment by 344,158 cubic yards annually, increase forage supply by 10,059 AUM'S, and increase production on 74,076 acres of cropland, increase wood supply by 128,808 MBF, and reduce annual flood damage by $84,894.	------------
V. Regional Environmental Conditions Beneficial and Adverse Effects:	------------	------------

Table 98 Continued
WALKER RIVER SUBBASIN SUMMARY
Social Well-being Account

Components	Measures of Effects		
A. Real Income Distribution			
(1) Beneficial Effects:	Income Class (dollars)	Adjusted Gross Income By Class (percent)	Benefits in Class (percent)
	(Distribution of 5,936,469 in benefits to the Walker River Subbasin		
	Less than 3,000	08.3	07.9
	3,000 to 10,000	41.4	44.8
	More than 10,000	50.3	47.3
(2) Adverse Effects:	Income Class (dollars)	Adjusted Gross Income By Class (percent)	Cost in Class (percent)
	(Distribution of $456,265 in cost to be borne by the Walker River Subbasin)		
	Less than 3,000	08.3	07.9
	3,000 to 10,000	41.4	44.8
	More than 10,000	50.3	47.3
B. Life, Health, and Safety: Beneficial and Adverse Effects:	Provide flood protection at 100 year level to an rural area.		
C. Educational, Cultural, and Recreational Opportunities: Beneficial and Adverse Effects:	Provide 1,047,780 visitor days of general outdoor recreation and 57,579 visitor days of water based recreation, 25 percent of National Forest gross receipts to counties.		
D. Emergency Preparedness: Beneficial and Adverse Effects:	Decrease water yield by 257 acre-feet annually in the Subbasin.		

With Plan Resource Use

Land and Water

This section considers resource use assuming the implementation of the USDA Plan. It represents staff projections considering interaction of resource supplies and demand under With Plan conditions. Table 99 summaries changes in land use acreage for minimum water consuming land uses. Table 100 provides a summary of expected changes in both land and water use for major water consuming land uses. These tables may be compared with tables 61 and 62 which show demand and changes anticipated under Without Plan conditions.

The net change in total acreage shown on the resource use tables balances. Evaporation, the largest water consumer which seriously affects terminal lakes (water-based recreation and fisheries) is not shown. Therefore, any increase in net water requirement must be at the expense of terminal lakes or other uses shown. With Plan resource use accommodates all needs with a small surplus of water to 2020. Losses in land use of less than 13 percent are indicated for irrigated agriculture, grazing, and timber.

Table 99 - With Plan base data and projected resource use for minimum water consuming land uses, Central Lahontan Basin

Land Use	Thousands of Acres, Land				
	Base	Demand		Net Change	
	1970	1990	2020	1990	2020
Non-irrig. crop	19	9	6	-10	-13
Grazing	6,996	6,824	6,544	-172	-452
Timber	1,056	981	979	-75	-77
Recreation, dev	12	27	49	+15	+37
Wilderness, designated	38	82	149	+44	+111
Fish, wildlife	233	324	368	+91	+135
Watershed, Class	117	129	140	+12	+23
Transportation, utilities	130	151	162	+21	+32
Miscellaneous land types	924	924	924	0	0
TOTAL	9,525	9,451	9,321	74	-204

Table 100 - With Plan base data and projected resource use for major water consuming land uses 1/, Central Lahontan Basin

Land Use 1/	Thousands of Acres, Land				
	Base	Demand		Net Change	
	1970	1990	2020	1990	2020
Irrig. agriculture	364	338	318	-26	-46
Urban and industry 2/	315	350	447	+35	+132
Geologic commodities	37	102	155	+65	+118
TOTAL	716	790	920	+74	+204
Water Use	**Thousands Acre-Feet Water Requirement**				
	Base	Demand		Net Change	
	1970	1990	2020	1990	2020
Irrig.agriculture	1,375	778	658	-597	-717
Urban and industry 2/	75	155	337	+80	+262
Geologic commodities	4	28	127	+24	+123
TOTAL	1,454	961	1,122	-493	-332

1/ Excludes evaporation, the largest water consumer, therefore fisheries and water-based recreation use.
2/ Includes rural domestic and military use.

Irrigated Agriculture

From projections of the amounts of land necessary in the future for urban and industrial growth, and in accordance with acreages added by the USDA Plan, the following acreage is expected to be available for agriculture in the future.

Table 101 - With Plan projections of land available for irrigated agriculture by subbasin, Central Lahontan Basin

Subbasin	1990	2020
Calvada	76,092	76,092
Truckee	20,341	10,197
Carson:		
Lower	69,525	68,175
Upper	48,256	44,296
Walker	128,489	133,787
TOTALS	342,703	332,547

Analysis of the Agricultural Portion of the USDA Plan

Linear Program Model

During the development of the basic data for the Central Lahontan Basin, ERS with the assistance of the University of Nevada implemented a linear programming model. Back-up data and assumptions for this program are available in APPENDIX II. By utilizing this model based on the input data for the Basin, economic analysis of the effect of various recommended programs could be made on a computer. The following discussion illustrates the results of this type of analysis when applied to several selected proposals involving changes in water resource use. The tabulated values that are shown are an illustration of the use of the linear programming model for economic evaluation of alternatives.

Total USDA Agricultural Plan (from LP Model)

If the total of the preceding USDA programs were initiated in the Basin, the following results would be expected in the future as projected by the LP Model. These are shown in Tables 102, 103, and 104. The increase in total value to agriculture is not a simple summation of the segments of the Plan in that the various programs impact upon each other.

Table 102 - Projections and Crop Production with Total USDA Plan, from LP Model, Central Lahontan Basin

	1990		2020	
	80% 1/	Average Yr.	80% 1/	Average Yr.
Alfalfa (tons)	174,003	291,439	353,947	393,534
Wheat (tons)	136,489	196,679	179,375	264,205
Barley (tons)	131,201	103,381	222,745	168,395
Wild hay (tons)	2,116	4,326	910	3,755
Imp. Pasture (AUM)	308,820	463,070	233,277	359,700

Table 103 - Projections of Cattle Production with Total USDA Plan from LP Model, Central Lahontan Basin

	1990		2020	
	80% 1/	Average Yr.	80% 1/	Average Yr
Hay Grain Warmup	107,268	87,260	221,452	207,730
Hay Pasture Warmup	102,920	154,328	77,759	119,901
Choice finish	210,225	241,585	299,205	327,685

1/ The 80 percent chance flow is that flow which will be met or exceeded in 8- percent of the years when considered on a long time basis.

Significant increases in alfalfa hay (above) and grain production (below) could result from implementation of the USDA plan.

Table 104- With Plan linear program projections of irrigated land and water use by subbasin and time frame

Subbasin and Item	1990		2020	
	80% Yr 1/	Ave. Yr.	80% Yr 1/	Ave. Yr.
Calvada				
Water used - AF	72,482	101,823	68,700	96,908
Water left - AF	14,316	39,252	19,449	37,820
Land used - Ac.	39,594	72,293	38,822	72,675
Land used/land avail%	52	95	51	96
Truckee				
Water used - AF	53,930	53,930	22,670	22,670
Water left - AF 2/	141,360	332,800	143,960	335,360
Land used - Ac.	20,341	20,341	10,197	10,197
Land used/land avail%	100	100	100	100
Carson - lower 2/				
Water used - AF	246,000	246,000	220,800	220,800
Water left - AF	34,860	101,300	51,620	118,000
Land used - Ac.	69,525	69,525	68,175	68,175
Land used/land avail%	100	100	100	100
Carson - upper				
Water used - AF	118,944	185,214	104,998	158,177
Water left - AF	39,507	97,934	44,932	116,460
Land used - Ac.	41,581	48256	28,967	44,146
Land used/land avail%	86	100	05	98
Walker				
Water used - AF	123,349	191,381	100,735	159,670
Water left - AF	29,159	64,129	26,719	63,906
Land used - Ac.	97,649	127,965	93,162	122,460
Land used/land avail%	76	100	70	92
Basinwide				
Water used - AF	614,705	778,348	517,903	658,225
Water left - AF 2/	259,202	635,415	286,680	671,546
Land used - Ac.	268,690	338,380	239,323	317,656
Land used/land avail%	78	99	72	96

1/ The 80 percent chance flow is that flow which will be met or exceeded in 80 percent of the years when considered on a long time basis.

2/ Water left figures in Truckee and Basinwide reflect flow in Truckee River before any diversion to the lower Carson. Average annual diversions to the lower Carson were 188,000 acre-feet, 1970 base.

Value of Agricultural Production

The projected value of the With Plan agricultural program is shown in the following tabulation:

Value of Agricultural Production	1990		2020	
	80% Yr 1/	Average Yr	80% Yr 1/	Average Yr
	30,357,000	34,030,000	35,678,000	42,511,000

Limiting Water Months

The linear programing model determined the limiting water months for the With Plan condition. This is shown on Table 105. Water is not limiting on the lower Carson and Truckee Subbasins due to existing storage facilities and a cropping shift.

Table 105-With Plan linear program projections for the limiting water months, Central Lahontan Basin

Subbasin	1990		2020	
	80% Yr 1/	Average Yr	80% Yr 1/	Average Yr
Calvada	June October	June -	June October	June -
Walker	July August September October	August September October -	July August September October	August September October -
Upper Carson	June July August September October	- September - - -	- June July - -	- None - - -
Lower Carson	None	None	None	None
Truckee	None	None	None	None

1/ The 80 percent chance flow is that flow which will be met or exceeded in 80 percent of the years when considered on a long time basis.

Analysis of Select USDA Programs

Using the expected future acreages available for agriculture, the impact of the USDA Plan for irrigated agriculture was determined by modeling different portions of the USDA Plan separately. This was done through use of the LP model. The model made possible an analysis of the effects on the economy of changes in the resources allocated to agriculture in the Basin for the years 1990 and 2020: Three specific forms of water resource change were considered.

1. Reservoir storage of early spring runoff for use at a later period in the growing season. A series of five upstream storage and facilities were considered:
    a. Bunnel site on the Susan River in the Calvada Subbasin.
    b. Hope Valley site on the west fork of the Carson River.
    c. Watasheamu site proposed by the Bureau of Reclamation, on the east fork of the Carson River.
    d. Willow-Leavitt two-dam complex proposed by USDA and California interests in conjunction with the Walker River Irrigation District on the West Walker River.
    e. Hudson-Strosnider two-dam complex proposed by the Walker River Irrigation District, on the East and West Walker Rivers.
2. Improvement of irrigation efficiency through the reduction of seepage from conveyance systems, reorganization of irrigation systems on farm, and the utilization of conservation measures on farms that will result in higher on-farm irrigation efficiencies.
3. Phreatophyte control is a measure proposed that could result in the augmentation of water available for agriculture by an estimated 0.8 acre-foot per year per acre of phreatophyte control.

Reservoir Storage

Only two out of the five upstream storage proposals were included in the USDA Plan. They are:

1. Willow-Leavitt Damsites, West Walker-Antelope Valley WIR, Walker River Subbasin.
2. Hope Valley Damsite, West Carson WIR, Carson River Subbasin.

The other three storage proposals are not considered eligible for treatment under USDA Programs, but because of local interest and significance, they are evaluated by the LP model in a following section.

Construction of the Willow Flat and Leavitt Meadows Dams on the Little Walker and West Walker River, respectively, would add the following increase in total net returns to agriculture in the total Basin as follows:

Year	Water Flow	Increase in Net Returns	Increase in Total Basin
1990	Average	0	0
1990	80%	$ 443,500	1.7 Percent
2020	Average	$ 373,000	.96 Percent
2020	80%	$ 1,638,900	5.5 Percent

The Hope Valley Damsite is situated on the west fork of the Carson River approximately 14 miles West of the Gardnerville-Minden area. Although the damsite itself is in California the major benefits from the storage of early spring runoff water would be in Nevada. It was felt that the effect on the agriculture of the upper Carson River Basin resulting from the late summer water available from this storage should be evaluated.

Net stored water available for agricultural water management by 1990 would be 12,920 acre-feet. Irrigation efficiency in Carson Valley should increase due to on-farm application of conservation practices and the upgrading of diversion works.

Construction of the Hope Valley Reservoir would add the following increase in total net returns to agriculture in total Basin for the years 1990 and 2020.

Year	Water Flow	Increase in Net Returns	Increase in Total Basin
1990	Average	$1,668,300	5.3 Percent
1990	80%	$1,544,900	5.8 Percent
2020	Average	$ 264,800	.7 Percent
2020	80%	$ 947,700	3.2 Percent

For the estimated 12,920 acre-feet of water expected to be impounded, this would result in an increase in returns per acre-foot ranging from a high of $129 in the average year by 1990 to a low of $20.50 average year by 2020.

Improvement of Irrigation Efficiency

With the initiation of USDA programs emphasizing irrigation water management, the following increases in irrigation efficiency may be expected and are shown in Table 106. The cost per irrigated acre was estimated to exist with or without the program and was included in the base model.

Table 106- Projections of field irrigation efficiencies With and Without programs by subbasin and time frame, Central Lahontan Basin.

Subbasin	Base without additional programs (percent)	Base with additional programs (percent)	Cost/Irrigated acre 1/ (dollars)
Calvada			
1970	40	40	
1990	50	60	16.11
2020	54	67	16.11
Walker			
1970	50	50	
1990	55	60	4.27
2020	58	67	9.30
Upper Carson			
1970	50	50	
1990	55	60	4.49
2020	58	67	17.09
Lower Carson			
1970	60	60	
1990	65	69	4.49
2020	68	75	17.09
Truckee			
1970	50	50	
1990	50	50	None
2020	50	50	None

1/ The cost-irrigated acre is to be charged to the increased efficiencies during future years for both without and with additional programs.

If the irrigation efficiency practices proposed for the Calvada, Carson, and Walker Subbasins were to be placed into effect, from the model projections, the following future changes in net returns to agriculture for the Central Lahontan Basin are shown in the following tabulation:

Year	Water Flow	Increased Net Returns
1990	Average	$ 421,800
1990	80%	1,272,500
2020	Average	1,045,600
2020	80%	2,222,400

Phreatophyte Control

It has previously been stated that there are more than 534,000 acres of phreatophytes in the Basin. It is estimated that salvageable water resulting from phreatophyte eradication may be possible on about 30,000 acres of presently irrigated land. Assuming that adverse environmental impacts would be mitigated, the treatable acreage by subbasin would be as follows:

Calvada	7,000 acres
Truckee	1,400
Carson	
Lower	6,330
Upper	5,270
Walker	10,000
Total	30,000 acres

Table 107 indicates the amount of water that could be available if the Basin's treatable acres were subjected to some method of phreatophyte control. In the table, the total acre-feet of water involved is released in amounts proportional to the water use by pasture per month.

Table 107 - Estimates of water available due to phreatophyte control on presently irrigated lands, Central Lahontan Basin, acre-feet

Subbasin	Water Released	Subbasin	Water Released
CALVADA		TRUCKEE	
April	500	April	107
May	406	May	86
June	616	June	129
July	910	July	178
August	791	August	154
September	491	September	98
October	187	October	48
Total	3,900	Total	800
WALKER		LOWER CARSON	
March	191	March	296
April	163	April	320
May	257	May	405
June	398	June	607
July	546	July	842
August	478	August	714
September	316	September	415
October	147	October	200
Total	2,496	Total	3,799
UPPER CARSON			
April	271		
May	193		
June	290		
July	391	Total water released by the program - 12,795 acre-feet.	
August	325		
September	224		
October	106		
Total	1,800		

If the total phreatophyte program were to be placed into effect, a savings of 12,975 acre-feet of water would result. The total net revenue added to agriculture, as estimated from the model is shown in the following tabulation:

Year	Water Flow	Value Added	Value/Acre-Feet
1990	Average	$105,200	$ 8.20
1990	80%	$464,300	$36.30
2020	Average	$291,900	$22.80
2020	80%	$797,200	$62.30

Evaluations not Part of USDA Plan

The following reservoirs which for various reasons were considered to be outside of consideration in the USDA Plan were also analyzed by the linear programming model.

Bunnel Damsite, Calvada Subbasin

This site is situated on the Susan River approximately seven miles west of Susanville, California. There is much local interest in this detention structure, even though when analyzed under Public Law 566 procedures, it does not show a favorable Benefit: Cost ratio.

Net stored water available from this reservoir for use in agriculture would be 4,800 acre-feet, 8 years out of 10. Its function would be to store early spring runoff in excess of irrigation requirements during that part of the season. This would extend the present irrigation season by release of the stored water during the water short portion of late summer. There are at the present time two other small reservoirs on the upper Susan River, McCoy and Hog Flat, operated by the Lassen Irrigation Company.

Construction of the Bunnel Reservoir would add the following increase in total net returns to agriculture in the total Basin for the years 1990 and 2020.

Year	Water Flow	Increase in Net Returns	% Increase in Total Basin
1990	Average	$768,900	2.4 Percent
1990	80%	887,100	3.4 Percent
2020	Average	620,500	1.6 Percent
2020	80%	861,600	2.9 Percent

For the 4,800 acre-feet impounded on an 80 percent water year, this would result in an added net return high of 185 dollars per acre-foot in 1990. There would be 5,520 acre-feet stored in an average year resulting in a low of 112 dollars added net return per acre-foot in 2020.

Watasheamu Damsite, Carson River Subbasin

The Watasheamu Reservoir on the East Carson River was conceived as a part of the U.S. Bureau of Reclamation's Washoe project in the 1950's. The reservoir is a large multi-purpose facility originally designed to serve Carson Valley, but because of many circumstances the project was never carried forward. Since 1970, interest in the project has increased to where the USBR has been requested to reevaluate it in light of the following considerations:

1. Increasing value of flood damages
2. Increased M&I needs
3. Use of Carson River for Tahoe Basin effluent transport
4. Anticapation of settlement of water rights litagation
5. Broadening of the repayment base
6. Change in electric power market
7. Increased recreation, fish and wildlife needs.

Because of the revived local interest, the project was submitted to analysis by the LP model. Construction of the Watasheamu Reservoir, according to the model, would yield the following increase in net returns to agriculture in the total Basin.

Year	Water Flow	Increase in Net Returns	% Increase in Total Basin
1990	Average	$2,650,200	8.4 Percent
1990	80%	2,204,600	8.35 Percent
2020	Average	1,076,700	2.8 Percent
2020	80%	1,395,300	4.7 Percent

On the assumption of 172,000 acre-feet of water impounded, this results in an increase per acre-foot of between $15.40 for average flow by 1990, to a low of $6.30 for an average flow by 2020.

Watasheamu damsite on the East Carson River, a major feature of the U. S. Bureau of Reclamation Washoe Project.

Flood protection from the East Carson River as well as water storage for other uses would be provided to Carson Valley by the proposed Watasheamu Reservoir.

Hudson-Strosnider Damsites, Walker Subbasin

Construction of Hudson and Strosnider Dams on the West and East Walker Rivers, respectively would add the following increase to the net returns to agriculture in the total Basin:

Year	Water Flow	Increase in Net Returns	% Increase in Total Basin
1990	Average	$ 287,800	0.9 Percent
1990	80%	846,600	3.2 Percent
2020	Average	355,800	0.9 Percent
2020	80%	1,117,600	3.8 Percent

On the assumption of 9,000 acre-feet of reservoir water in 1990 and 21,800 acre-feet of reservoir water in the year 2020, this leads to a high return per acre-foot of stored water of 124 dollars in 2020 during 80 percent flow year to a low of 32 dollars in 1990 during an average flow year.

The Hudson-Strosnider Reservoirs would improve irrigation in a large portion of Mason Valley.

Additional WIR Evaluations

Additional evaluations were carried out on the watershed investigation reports using several interest rates. This will assist in determining impacts of variations in interest rates on project justification. These are shown on Figure 10.

Figure 10 - Effects of interest rate change on Watershed Investigation Reports, Central Lahontan Basin

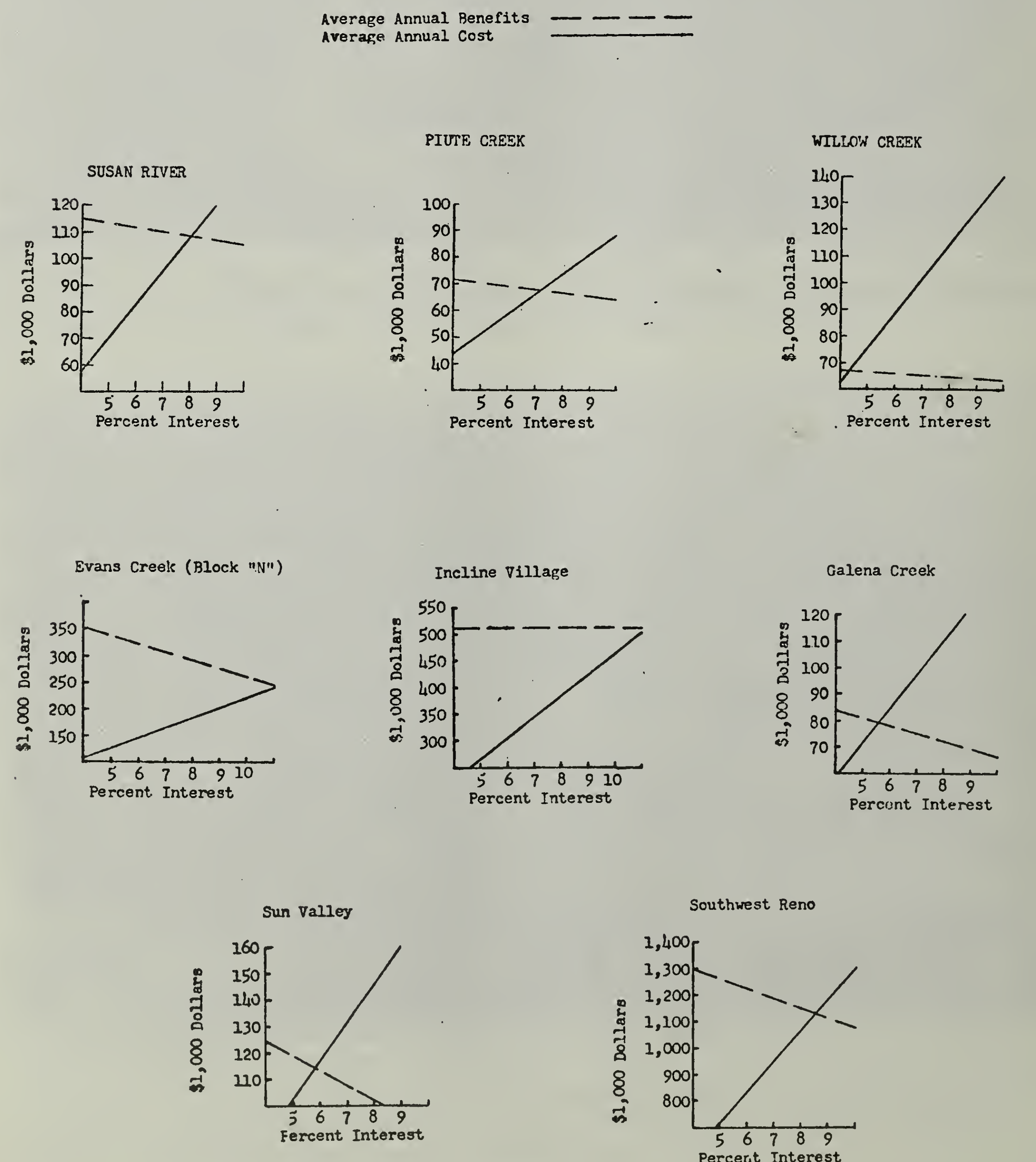
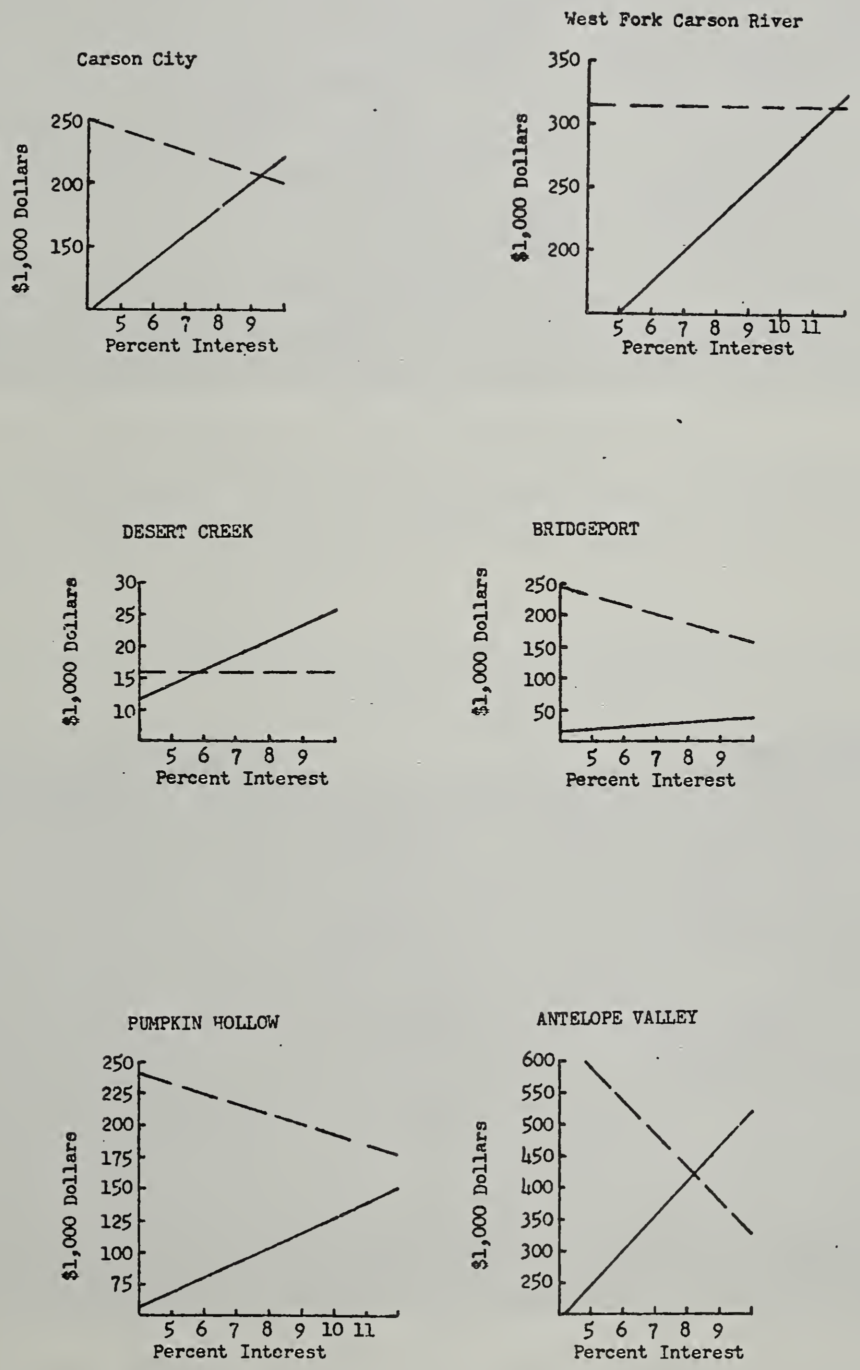


Figure 10 - Continued



The Sand Mountain Recreation Area, Carson Subbasin, developed by Bureau of Land Management will contribute toward meeting the Basin's increasing recreation demand.

This borrow pit, which resulted from freeway construction, has been smoothed and seeded by Nevada Highway Department to reduce erosion and sedimentation. Truckee Subbasin

CHAPTER XI

FUTURE COORDINATION AND PROGRAMS FOR FURTHER DEVELOPMENT

Highlight

This chapter reviews the unmet resource demands that cannot be provided by the USDA Plan. It also describes water and related land resource subjects and potentials that need to be considered in the evaluation of guidelines for future development.

CONTENTS

Unmet Needs

This report has presented major water and related land resource needs to meet future requirements for the Central Lahontan Basin. A portion of these needs can be met by implementation of the USDA Plan. However, deficiencies will continue to exist in certain resource uses which have projected demands in excess of the Basin's capacity to provide them. Significant unmet resource needs exist in commercial forest products, range livestock forage, recreation, terminal lakes, flood protection, fish and wildlife, and watershead treatment.

Commercial Forest Products

Much of the higher quality publicly owned commercial timber land will be removed from production because of environmental and urban commitments. It is also likely that much of the private timber lands will be converted to recreational uses. The demand in 2020 is projected to be about 314 million board feet annually, compared with the 1970 production of about 115 MmBF. Capacity of primary wood processing plants only increases from 128 MmBF in 1970 to 143 MmBF by 2020 which reflects the inability of the Basin's timber resource to meet projected demand.

Livestock Forage

Increased production of livestock forage resulting from the USDA Plan will fail to meet 2020 needs by about 143,000 AUMs. A protion of this deficiency could be met through more intensive utilization of the Basin's privately owned range lands than is called for in the USDA Plan. The major problem, though, is that the Basin's National Resource Lands are not projected for future forage production increases.

Recreation

Projected 2020 recreation demand for the Basin is 106 million visitor-days. This compares with a 1970 use of about 12 million visitor-days, of which about 6.8 million visitor-days was provided by the Federal land sector. The USDA Plan will provide for an additional 16 million visitor-days on the Federal lands by 2020. Much of the remaining demand has been allocated to the private sector, which indicates a large opportunity for private recreation development.

Terminal Lakes

This study indicates that during the 80 percent chance water year, Walker Lake would be deficient by about 30,000 acre-feet.

Flood Protection

The Basin's $2.8 million average annual flood damage would be reduced by about $1.8 million by implementation of the USDA Plan. The remaining $1 million need would have to be met through other than USDA programs.

Fish and Wildlife

Fish and wildlife needs on National Forest lands are mostly met through the USDA Plan. A large unmet need exists on the private lands, particularly those being shifted from grazing to urban uses. Many of these areas involve lands providing important winter forage for deer, and mitigation of this loss is a major unmet need. Management programs to meet fish and wildlife needs must be an integral part of resource planning by all State and Federal agencies.

Watershed Treatment

Treatment measures to reduce erosion and sedimentation and to improve the hydrologic condition of the higher water yielding watersheds are set forth in the USDA Plan for National Forest lands and those other lands covered by the WIRs. These measures will reduce sediment yield by about 480,000 tons annually at the designated location, plus result in a water yield increase of about 5,800 acre-feet. There will still remain a large portion of the Basin untreated, and existing erosion and sedimentation problems will continue.

Legal and Institutional

Water rights problems affecting future developments in the Basin must be resolved in order for present growth to continue. It is very important that a California-Nevada interstate Compact be finalized and the Pyramid Lake lawsuit be resolved. The Compact will allocate the waters of the Truckee-Carson-Walker systems between the two states. The lawsuit is expected to define the rights of the Pyramid Lake Paiute Tribe as they relate to the maintenance of Pyramid Lake. The impacts of the resolution of these two problems will need to be evaluated and determination made regarding augmentation of existing water supplies from outside sources.

Maintenance of Walker Lake, determination of instream maintenance flows, and the long pending suit on the upper Carson both present problems to be resolved. Stream adjudications in the Calvada Subbasin and the determination of existing undefined rights need to be completed so that growth potential can be ascertained.

Extensive devlopment of the Basin's many ground water reservoirs has been advanced as a way to meet the future water needs of Pyramid Lake and other places in the Basin. Nevada, however, has a water statute which prohibits mining of ground water. Further ground water development would necessitate sound analysis before any change is made in the existing legal structure.

Public Law 566

Existing provisions of PL-566 are not always compatible with the recognized needs of some of the Basin's watershed. Single plans cannot be prepared for watershed areas exceeding 250,000 acres.

The exclusion of detention structures having more than 12,500 acre-feet of floodwater detention capacity or more than 25,000 acre-feet of total capacity limits project opportunities under PL-566. The arid climate and low water yields from many of the Basin watersheds indicate that the present statutory size limitations are not well adapted to this area. The extremely high construction costs, compared to relatively low rural benefits, make project justification difficult. Only in the urban and urbanizing locations can project costs be justified, however, present congressional criteria restricts this approach.

Primary emphasis of the watershed Protection and Flood Prevention Act (Public Law 566) is on the following three items: (1) flood prevention (including structural and land treatment measures), (2) the conservation, development, utilization, and disposal of water, or (3) the conservation and proper utilization of land in watershed or sub-watershed areas not exceeding two hundred and fifty thousand acres. In the Basin, item (2) is the primary purpose at several location. This study indicates that revised emphasis on item (2) would enhance agricultural water management project potentials that offer the most needed benefits to the total Basin.

Nevada State Water Plan Implementation and Coordination Needs

The Nevada State Engineer will present recommendations to the 1975 Legislature concerning future water and related land resource development in the state. These recommendations will express the desires and needs of local interests. The legislature is expected to concur and give additional guidance in this effort, thus setting the stage for program implementation. The USDA Plan should be considered an "early action" program for the Basin. Since many other componenets of the Statewide Plan are outside USDA, there is need for close interagency coordination.

The Western U.S. Water Plan Study points out the primary opportunities for water conservation on the Newlands Project and elsewhere in the Basin. Unresolved factors include identifying beneficiaries of conservation practices and working out equitable financing and repayment plans for cost sharing. The acceleration of programs could result in a savings of as much as 200,000 acre-feet per year. This water is now lost to phreatophytes, evaporation, and deeppercolation, however, it also supports a mjor wildlife refuge. A closely coordinated effort between all water managing agencies could result in an overall irrigation efficiency increase from the present 66 percent up to 77 percent.

Other Agency Programs

Many agencies or entities other than those within the U.S. Department of Agriculture have developed programs or proposals that would impact on the water and related land resources in the Basin. Some of these have previously been discussed, but they are also summarized here. In most of these proposals, USDA agencies could lend active assistance in carrying out various conservation measures. These would be initiated by the existence of the project.

The Bureau of Reclamation's Walker River Project and the Watashemmu Reservoir project on the East Carson River are possible projects which would have a significant impact on the Basin. Project facilities are economically justified but implementation is not considered imminent because of various factors, including the acreage limitations imposed by the 1902 Reclamation Act.

For many years, the Walker River Irrigation District has been considering additional storage facilities on the East and West Walker Rivers. This would give them greater management capability over their water service activities.

On the Susan River, local interests and the Lassen irrigation Company have long advocated additional storage utilizing the Bunnel dam site. This would improve irrigation water management and provide recreation and flood control.

The City of Reno will live under a flood threat until additional flood protection is provided on the main stem of the Truckee River. The Corps of Engineers has advanced several proposals to accomplish this, but local reactions have not been favorable.

Geologic commodity explorations and development by several large industrial concerns could result in heavy impacts on the Basin. Extensive low grade iron ores in Mason Valley and geothermal power potentials at Brady and Steamboat Hot Springs are but two examples of what may develop into large scale operation by 2020.

The Comprehensive Framework Studies suggest that a nuclear power plant be projected for the Carson Sink area in the 2000 to 2020 time frame. The large water demand for this would be met from a combination of poor quality surface and ground water that is unsuited for most other uses.

The Bureau of Indian Affairs in cooperation with the Bureau of Reclamation are developing plans for use of the Indian agricultural water right from the Truckee River on Indian owned decreed lands on the Pyramid Lake Indian Reservation.

Surface Environment and Mining (SEAM)

SEAM is a USDA research, development, and applications program to help meet the Nation's energy crisis and produce needed minerals in harmony with a quality environment and other natural resource values. Although projected mining acivity largely involves public domain, it affects agriculture and related urban and industrial areas through preemption of water. Environmental protection controls at present demand the integration and coordination of all who use these natural resources. Means for solving or mitigating the problems imposed by geologic commodity development were discussed in CHAPTER IX. SEAM provides an excellent program to engage in the necessary research, development, and application involving the complex management of these natural resources.

Evaporation Suppression

Total annual evaporation from the major water bodies in the Basin is estimated to average some one million acre-feet annually. Intensive studies of evaporation suppression are being pursued by several agencies throughout the world, but the "state of the art" has not yet advanced to the point where assurances of recovery of a substantial portion of this loss can be determined. A special study of evaporation suppression at Pyramid Lake was carried out by a U.S. Department of interior committee several years ago but it disclosed no immediate prospects for reducing the loss at that lake.

Suppression of evaporation from the Sierra Nevada snowpacks has been studied for many years by the U.S. Forest Service Central Sierra Snow Lab near Donner Summit. They estimate that more than two and one-half million acre-feet of water a year may be lost from the entire Sierra Snowpack. Laboratory experiments have shown that this evaporative loss can be reduced substantially by spreading films of chemicals over the snow surface. Data on costs, practicability, and ecological impacts are still being evaluated.

Weather Modification

Substantial progress has been made in the last decade towards weather modification to increase runoff. The Bureau of Reclamation's "Project Skywater" is one of the major activities along this line. This resulted in a 1970 contract between USBR and the Desert Research Institute to study the development and assessment of physical and chemical methods on the effects of weather modification over the Truckee and Carson Subbasins. This effort was in line with the findings of the Pyramid Lake Task Force which was seeking means of increasing runoff to benefit Pyramid Lake. Silver iodide generators located west of the Sierra crest have been in operation for the past four years. Separate analysis of each individual year's data have so far shown that the project is increasing the snowfall of seeded storms by about 10-15 percent. DRI states that each percentage increase in the snowpack is estimated to result in an increase of 10,000 acre-feet of water to the terminal lake; however, they caution that many variables still need to be determined before firm conclusions can be reached.

Water Supply Augmentation

Potentials for augmenting the Basin water supply from sources outside the Basin have been given cursory study by several agencies. The Comprehensive Framework Studies indicated that schemes to import about 300,000 acre-feet of water from the Colorado River or from Oroville Dam had been examined with cost estimates ranging from $300-500 per-acre foot. The Bureau of Reclamation completed a reconnaissance study on importing 30,000-70,000 acre-feet from the American River into Lake Tahoe. The Pyramid Lake Task Force studied the possibility of diverting about 50,000 acre-feet from the Calvada Subbasin into Pyramid Lake. Of probably greater long range significance are the several proposals that have been advanced concerning importation of large volumes of water from the Pacific Northwest. The Task Force report states that this proposal is definitely worthy of further study, and they say that this may be the only real answer to the Pyramid Lake problem.

GLOSSARY

Abbreviations

AF	ac. ft. Acre-foot
AF/Y AFY	Acre-feet per year
AUM	Animal unit month
ASCS	Agricultural Stabilization and Conservation Service
AWC	Available water capacity
BIA	Bureau of Indian Affairs
BF	Board foot
BLM	Bureau of Land Management
BOD	Biochemical oxygen demand
BOR	Bureau of Outdoor Recreation
BSFW	Bureau of Sport Fisheries and Wildlife, Now U.S.F.N.S.
CD	Conservation District
CDFG	California Department of Fish and Game
CFS	Cubic feet per second
DMU	Deer month use
DRI	Desert Research Institute
EQ	Environmental Quality
ETP	Evapo-Transpiration
FmHA	Farmer's Home Administration
GPM	Gallons per minute
LRA	Land Resource Area
MBF	Thousand board feet
Mgd	Million gallons per day
Mgle	Milligrams per liter
MmBF	Million board feet
NDFG	Nevada Department of Fish and Game
NDWR	Nevada Division of Water Resource
NED	National Economic Development
OBERS	Office of Business Economics and Economic Research Service
OM&R	Operation, Maintenance and replacement cost
PH	A unit of measure for hydrogen ion concentration
PL	Public law
PPM	Parts per million
RD	Regional Development
RCD	Resource Conservation District
RC&D	Resource Conservation and Development Program
RECP	Rural Environmental and Conservation Program
RON	Rest of Nation
SCS	Soil Conservation Service
SEAM	Surface environment and mining
SWB	Social Well-Being
TDS	Total dissolved solids
TRPA	Tahoe Regional Planning Agency
USBR	U.S. Bureau of Reclamation
USDA	U.S. Department of Agriculture
USDI	U.S. Department of Interior
USFW	U.S. Fish and Wildlife Service

Terms

ACRE-FOOT - A unit of volume of water equal to the volume of prism one foot high with a base one acre in area.

ACTIVE STORAGE CAPACITY - The total amount of usable reservoir capacity available for seasonal or cyclic water storage. It is gross reservoir capacity minus inactive storage capacity.

ACTIVITY DAY - A statistical unit of recreation use by one person in pursuit of a single activity for all or a part of one 24-hour period (SEE RECREATION DAY).

ADEQUATELY STOCKED AREAS - Commercial forest land, 40 to 70 percent stocked with stock trees.

ADVERSE EFFECT - Monetary and nonmonetary values deleterious to a project evaluation.

AEOLIAN - Also spelled eolian. Of or borne by wind as dunes.

ALFISOL - A classification order in soil taxonomy.

ALLOWABLE CUT - Harvestable trees in forest management.

ALLUVIAL FAN - A land form resulting from water borne sediment deposition.

ALLUVIUM - Water borne sediment.

ALPINE - High elevation plant zone, hence cold.

ANIMAL UNIT MONTH (AUM) - The equivalent forage required to support a cow or a cow and a calf for one month.

ANNUAL - Occurring once during, or accumulated over, a consecutive 12 month period of time for which the beginning date is identified.

ANNUAL LOW-FLOW - The lowest flow occurring each year, usually the lowest average flow for periods of perhaps 3, 7, 15, 30, 60, 120, or 180 consecutive days.

AQUIFER - A permeable geologic formation which stores and transmits water.

ARGILLIC HORIZON - A diagnostic horizon used in soil taxonomy. Subsurface horizon into which clay has moved.

ARID - A term applied to a climate or region where precipitation is so deficient in quantity, or occurs so infrequently, that agriculture is impractical without irrigation.

ARIDISOL - A classification order in soil taxonomy.

AVAILABLE WATER HOLDING CAPACITY - Water retained by soil that can be used by plants.

AVERAGE ANNUAL BENEFIT - Average yearly value of benefits that will accrue over the length of the evaluation period.

AVERAGE ANNUAL COST - Yearly cost derived from amortization of a project evaluation period.

BADLAND - Steep, barren land broken by numerous drainage channels.

BASE FLOW - That portion of runoff not resulting from direct runoff of precipitation.

BASE PERIOD - A period of time specified for the selection of data for analysis.

BED LOAD - Sediment moved mainly by tractive or gravitational forces or both, but at a velocity less than that of the surrounding flow.

BENEFICIAL EFFECT - A favorable change generated by an alternative plan.

BENEFICIAL USE OF WATER - The use of water for any purpose from which benefits are derived, such as domestic, irrigation, or industrial supply, power development or recreation.

BENEFIT COST RATIO - A mathematical computation of benefit divided by cost.

BIOCHEMICAL OXYGEN DEMAND (BCD) - The quantity of oxygen utilized primarily in the biochemical oxidation of organic matter in a specified time and at a specified temperature.

BLEACHED ROCK LAND - An extremely acid and erodeable land form map unit delineated on the General Soil Map, Central Lahontan Basin.

BOARD FOOT - A unit of measure of the wood in lumber, logs, bolts, or trees; it is the amount of wood in a board 1 foot wide, 1 foot long and 1 inch thick before surfacing or other finishing.

BRUSH - A growth of shrubs or small trees.

BRUSH CONTROL - Suppressing of brush to reduce its competition with more desirable species.

CARRYING CAPACITY - 1. The maximum number of livestock that a range unit will support each season without injury to the soil or deterioration of the forage plants. (May be expressed in Animal Unit Months, AUM) 2. The optimum density of a given wildlife species which a given environment or range is capable of sustaining permanently.

CENOZOIC AGE - Division of geological history from the beginning of the Tertiary (first period in the Cenozoic Era) to the present.

CHANCE SUPPLY - A statistical term used referring to the probability some event or quantity will occur within a specified time.

CHANNEL - A natural or artificial water course with definite bed and banks to confine and conduct continuously or periodically flowing water.

CHANNEL LINING - Protection of the channel bottom and banks with concrete or riprap.

CHECKERBOARD OWNERSHIP PATTERN - The land ownership pattern similar in appearance to a checkerboard, generally the result of the government's land grants to railroads during the mid-1800s.

CHISELING AND SUBSOILING - Loosening the soil to break up layers of soil below the normal plow depth that inhibit water movement or root development. The soil is not turned over as in plowing and there is a minimum of surface soil mixing.

CLASSIFIED WATERSHED - See designated watershed.

CLOSED BASIN - A basin is considered closed with respect to surface flow if its topography prevents the occurrence of surface outflow. It is closed hydrologically if neither surface nor underground outflow can occur.

CLOUD SEEDING - The addition of materials into clouds in an attempt to induce rainfall.

COARSE FRAGMENT - Detached part of bedrock as boulder, stone, cobble, pebble, or gravel.

COMMERCIAL FOREST LAND - Forest land that is producing or is capable of producing crops of industrial wood (20 cu. ft. or more/ac./yr. capability) and is not withdrawn from timber use by statute or administration regulation.

COMPREHENSIVE PLAN - A plan for water and related land resources development, that does consider all economic and social factors and provides the greatest overall benefits to the region as a whole.

CONFINED AQUIFER - An aquifer which is bounded above and below by formations of impermeable or relatively impermeable material.

CONIFEROUS FOREST LAND - All conifer covered land except those urban-industrial areas having residual conifer cover.

CONJUNCTIVE USE - The joining together of two sources of irrigation water, such as ground water and surface water, to serve a particular piece of land.

CONSUMABLE WATER SUPPLY - That amount of river water available for consumption at a given point on the river after existing prior water rights have been met.

CONSUMPTIVE USE (WATER) - The quantity of water discharged to the atmosphere or incorporated in the products in the process of vegetative growth, food processing, industrial processes, or other use.

CONTAMINATION (WATER) - Impairment of the quality of water sources by sewage, industrial waste, or other matters to a degree which creates a hazard to public health.

CONTOUR TRENCHING - Development of water storage capacity along the contour by excavation and placement of soils as an embankment along the downstream side. Intervals vary with precipitation, slope, and soil.

CONTROL SECTION - A part of the soil profile including diagnostic horizons used in soil taxonomy.

CRITICAL AREA PLANTING - Establishing vegetative cover to stabilize severely eroded areas.

CROP AND PASTURE DAMAGE - Damages such as crop loss or reduced yield, quality or life span; increased production costs resulting from flooding, spreading of diseases, and weed infestation; the inability to grow crops best adapted to the area; and losses due to suspension of irrigation water delivery or other loss of water.

CROP RESIDUE MULCHING - Utilizing and managing crop residues for soil protection on a year round basis or when critical erosion periods usually occur.

CROPLAND - This is essentially composed of lands presently used for the production of both irrigated and non-irrigated crops and for pasture.

CRYIC - A term used in soil taxonomy which refers to cold soil temperatures within specified limits.

CUBIC FOOT PER SECOND - Rate of fluid flow at which 1 cubic foot of fluid passes a measuring point in one second. Abbr. cfs. Syn Second-foot: cusec.

DEBRIS BASINS - Storage for sediment and floating material provided by a dam with spillway above channel grade, by excavation below grade, or both. Water retention is not an intended function of the structure.

DECREED RIGHTS (WATER) - Water rights determined by court decree.

DEER MONTH USE (DMU) - The amount of forage required to sustain an adult deer and a fawn for one month.

DEEP PERCOLATION - In a geologic sense, water that percolates below the root zone and cannot be used by plants.

DEMAND - The quantity of a service, commodity, or resource that will be utilized when the price of providing it is considered.

DEPLETABLE WATER SUPPLY - See CONSUMABLE WATER SUPPLY

DEPLETION (GROUND WATER) - The withdrawal of water from a ground water source at a rate greater than its rate of recharge, usually over an extended period of several years.

DESALINIZATION - Removal of salt. Usually used with respect to salt in water.

DESIGNATED FISH AND WILDLIFE - Lands that have been set aside for intensive fish and wildlife purposes have this classification. They include fish hatcheries, game refuges and game management areas.

DESIGNATED GROUND WATER BASIN - Basin where permitted ground water rights approach or exceed the estimated average annual recharge.

DESIGNATED WATERSHEDS - Watershed areas that have been set aside as sources of municipal water or other similar purposes would be included in this category. Other uses are either modified or excluded.

DEVELOPED RECREATION - This use includes all lands classified or otherwise designated for outdoor recreation use. National recreation areas, national parks and monuments, scenic areas, and state parks are included as "developed". These areas would also include public and private campgrounds, picnic sites, winter sport sites, shore lands, resorts, etc., where other uses are restricted or excluded.

DEVELOPMENT FACTORS - Development factors are the projection of economic growth (such as residential, commercial, agriculture, public facilities, etc.) to the various time frames. These factors are based on population projections, employment, per capita income, recreation demand, etc.

DISCOUNT RATE - The interest rate the Federal Reserve Bank charge member banks for loans or advances.

DISSOLVED OXYGEN - The amount of free (not chemically combined) oxygen in water. Usually expressed in milligrams per liter. See MILLIGRAMS PER LITER.

DISSOLVED SOLIDS - Chemicals in solution.

DISTURBED AREA PROTECTION - This measure may include any of the treatment and structural measures. In addition it often includes stabilizing steep slopes, lining road ditches, construction of diversion structures, and temporary structural measures which permits regrowth of native or planted vegetal protective cover.

DIVERSIONS AND DIKES - Structures used to divert water away from eroding areas.

DIVERTIBLE WATER SUPPLY - Includes that amount of water consumptively used and that water which returns to the river system. Since return flow becomes available for subsequent diversion and reuse, the total divertible supply is greater than the depletable supply.

DOMESTIC USE - Water used normally for residential purposes, including household use, personal hygiene, and drinking, and outside uses such as car washing, swimming pools, and for lawns, gardens, and shrubs.

DRAINAGE - 1. The processes of the discharge of water from an area of soil by sheet or streamflow (surface drainage) and the removal of excess water from within soil by the downward flow of water through the soil (internal drainage).
2. The means for effecting the removal of water from the surface of soil and from within the soil.

DRAINAGE WATER - Water which has been collected by a drainage system. It may derive from surface water or from water passing through soil and may be of a variable quality suitable for reuse.

DRAWDOWN - The magnitude of lowering of the surface of a body of water or of its piezometric surface as a result of withdrawal or the release of water therefrom.

DRYLAND (FARMING) - Non-irrigated cropland.

DUNELAND - Hills or ridges of particles drifted and piled up by the wind so recently, that no soil horizons have developed.

DURIPAN - A cemented soil horizon (hardpan) where the cement is partly or completely composed of some form of silica.

ECOLOGICAL IMPACT - The total effect of a change, either natural or man-made, in an environment upon the ecology of the area.

ECOLOGY - The study of the interrelationships of organisms to one another and to the environment.

ECONOMIC BASE - The economic characteristics (e.g., quantities of resources, demand for products, supply of investment goods, quantity and quality of labor force, marginal capital-output ratio, production relationships, stage of development of the region) that contribute to the region's income and growth and economic trends and cycles of the region. The economic base considers: (1) basic activities which produce and distribute goods and services for exports and (2) service activities whose goods and services are consumed within the region.

ENDANGERED SPECIES - See THREATENED SPECIES.

ENHANCEMENT - A condition resulting from the development of a project, program or activity, such that the value of the existing resources is greater than that which existed before the project, program or activity.

ENTISOL - A classification order in soil taxonomy.

ENVIRONMENTAL QUALITY - An evaluation term for an account used in the Four-Account System of evaluation.

EOLIAN - Of or borne by wind, as dunes.

EPHEMERAL STREAM - A stream that flows only in direct response to precipitation, and thus discontinues its flow during dry seasons.

EPICENTER - The position of origin of an earth-shaking occurrence.

EROSION - The process by which earth or rock materials are dissolved or separated and removed from any part of the earth's surface. It includes weathering, solution, corrosion, and transportation.

EUTROPHICATION - A means of aging of lakes whereby aquatic plants are abundant and waters are deficient in oxygen. The process is usually accelerated by enrichment of waters with surface runoff containing nitrogen and phosphorus.

EVAPOTRANSPIRATION - The process by which water is transpired by plants and evaporated from the plant and surrounding surfaces.

EXISTING SUPPLY (RECREATION) - The total acreage of recreation areas that were operational in 1965. Data were derived from the Bureau of Outdoor Recreation's Nationwide Plan inventory and the National Association of Soil and Water Conservation District's inventory of private enterprises supplemented by information from management agencies.

EXOTIC VEGETATION - Introduced plants and therefore not native to an area.

EXTERNAL DISECONOMIES - Costs or adverse effects expected to be incurred as a result of project action by others than those expected to bear the incurred costs necessary to accrue direct or primary benefits.

EXTERNAL ECONOMICS - Benefits that accrue as a result of project action to others than direct primary beneficiaries.

FAULT (GEOLOGY) - A fracture in the earth's crust.

FIELD DIVERSION - An interception channel near the contour to carry runoff to a waterway. Intervals vary with the precipitation, slope, and cropping.

FIREBREAK - A lane or strip devoid of vegetation which passes through flammable forest, brush, or grass fuels. It may be (1) constructed specifically for fire control, (2) a highway, (3) natural barren areas, or (4) bodies of water.

FIRE PLAN - A plan for the operation and use of a fire protection system which is designed and sized to meet specific protection objectives. Part of the plan is usually an inventory of the existing system accompanied by an estimate of the size of system needed to meet the protection objectives. Such plans are usually for a period of about 5 years.

FIRE PROTECTION DISTRICT - A geographic area with delineated boundaries from which taxes are collected for the sole purpose of providing fire protection. The area is formed without consideration of political boundaries such as cities, counties and other special districts. When accepted by the appropriate state authority such Districts are legal governmental entities. They sometimes contract with the State to discharge State's fire protection responsibility on lands of state and national interest.

FIRE PROTECTION SYSTEM - The complete organization necessary to protect designated areas from damage by fire. Such a system includes statutory and administrative laws and authority, fire prevention and education efforts, all support functions and main elements of the fire control forces, and cooperative-mutual aid contracts and agreements between agencies.

FIRE RETARDANTS - These are slurries or viscous solutions usually dropped from airplanes on wildfires. They build a blanket of water on fuels and have a chemical blanketing effect when the water evaporates. Two major retardants in use in this region are diammonium phosphate with a sodium carboxymethylcellulose thickerner and ammonium sulphate with an attapulgite clay (Bentonite) thickerner. Both types are fertilizers.

FIRE SEASON - The season of the year when forest and brush fuels are cured out and highly flammable and when annual grasses have matured, died, and cured to a highly flammable state. In the Basin this period covers late spring, summer, and early fall

FIRM YIELD (WATER) - The maximum annual supply of a given water development that is expected to be available on demand, with the understanding that lower yields will occur in accordance with a predetermined schedule or probablility.

FISHERY - A fish habitat area.

FLOOD WATER DETENTION CAPACITY - That part of the gross reservoir capacity which, at the time under consideration, is reserved for the temporary storage of floodwaters. It can vary from zero to the entire capacity (exclusive of dead storage) according to a predetermined schedule based upon such parameters as antecedent precipitation, reservoir inflow, potential snowmelt, or downstream channel capacities.

FLOOD FORECASTING - Flood forecasts are primarily the responsibility of the National Weather Service of the National Oceanic and Atomospheric Administration and are used to predict flood stages and indicate areas subject to flooding.

FLOOD FREQUENCY - The average interval of time between floods or percent chance equal to or greater than a specified discharge or stage. It is generally expressed in years.

FLOOD PLAIN - The relatively flat area adjacent to rivers or streams subject to overflow.

FLOOD PLAIN INFORMATION REPORTS - The Corps of Engineers assists State agencies and local governments throughout the nation by preparing flood plain information reports outlining flood conditions, and providing technical assistance in use of the data.

FLYWAY - An air route used by migratory birds.

FORB - An herbaceous plant which is not a grass, sedge, or rush.

FOREST AND RANGE FACILITIES DAMAGE - Damages to recreation facilities, fences and corrals, fish and wildlife facilities, roads, trails, and bridges, and forestry administration facilities.

FOREST AND RANGE RESOURCES DAMAGE - Losses or reduced yields from timber, brush, range, and creek bottom meadow lands; reduced fish and wildlife habitat.

FOREST FIRE - A wildfire originating in forest, brush, or grass fuels or a wildfire originating from structures, vehicles, debris burning, or other non-vegetative source that burns more than 1/4 acre of vegetation.

FOREST LAND - Land at least 10 percent stocked by forest trees of any size or fomerly having had such tree cover and not now developed for non-forest use. Chaparral and mountain brush areas are included.

FOUR-ACCOUNT SYSTEM - An economic and environmental analysis that considers the Four Accounts: National Economic Development, Environmental Quality, Regional Development and Social Well-being.

FRAMEWORK PLAN - An assessment of the ability of a Region to meet the needs of assumed projected levels of population growth and economic development. Present uses are identified and available resources compared with estimated needs to the year 2020. It represents a conceptual way of meeting needs developed under the direction of the Water Resources Council.

FRESH WATER - Not containing or composed of salt water. Concentration less than 1,000 p.p.m.

FRIGID - A term used in soil taxonomy to indicate specified temperature.

FROST ACTION - A term used relative to heaving of soil resulting from freezing.

FUELBREAK - Strips, usually 50 to 350 feet wide, in which flammable fuels have been modified, reduced or thinned to provide the fire control forces with a safer place to work and to reduce wildfire intensity if it burns into the strip. A firebreak is included within the fuelbreak.

FULLY STOCKED AREAS - Commercial forest land, 70 percent or more stocked with growing-stock trees.

GABION - Wire cage, usually rectangular, filled with cobbles and used as a component for water control structures or for channel and bank protection.

GAGING STATION - A station to measure water level or water quality parameters in a stream, reservoir pool, lake, or tidal basin.

GALLONS PER CAPITA (GPC) - A term used relative to water requirement per person per specified time, usually a day.

GEOLOGIC COMMODITIES - All commercial items related to geology. Includes mining, sand and gravel, limestone for cement, ornamental or construction stones, saline playa products, petroleum, and geothermal products.

GEOMORPHOLOGY - The science dealing with the land relief features and the interpretations of them.

GEOTHERMAL - Terrestrial heat, usually associated with water as around hot springs.

GRAZABLE WOODLAND - Forest land on which the understory includes, as an intergral part of the forest plant community, plants that can be grazed without significantly impairing other forest values.

GRAZING LAND - All lands presently being grazed by livestock within grass, brush, and forest cover types, excluding irrigated pasture.

GROSS RESERVOIR CAPACITY - The total amount of storage capacity available in a reservoir for all purposes, from the streambed to the normal maximun operating level. It does not include surcharge, but does include dead storage.

GROSS WATER YIELD - The available water runoff, both surface and subsurface, prior to use by man's activities, use by phreatophytes, or evaporation from free water surfaces.

GROUND WATER - Underground water that is in a zone of saturation.

GROUND WATER BASIN - A ground water reservoir together with all the overlying land surface and the underlying aquifers that contribute water to the reservoir. In some cases, the boundaries of successively deeper aquifers may differ in a way that creates difficulty in defining the limits of the Basin.

GROUND WATER MINING - See DEPLETION (GROUND WATER).

GROUND WATER RECHARGE - Inflow to a ground water reservoir.

GROUND WATER RESERVOIR - An aquifer or aquifer system in which ground water is stored. The water may be placed in the aquifer by artificial or natural means.

GROUND WATER STORAGE CAPACITY - The reservoir space contained in a given volume of deposits. Under optimum conditions of use, the usable ground water storage capacity volume of water that can be alternately extracted and replaced in the deposit, within specified economic limitations.

GROWING SEASON - The average number of days exceeding 32° F.

GULLY EROSION - The erosion process whereby water flows in narrow channels, and over short periods, removes the soil from such channels to considerable depths.

HARDNESS (WATER) - Characteristic of water due primarily to calcium and magnesium salts. This characteristic is generally evidenced by inability to develop suds when using soap. The U.S.G.S. has suggested the following degrees of hardness:

Range of Hardness (mg/l)	Classification
0-55	soft
56-100	slightly hard
101-200	moderately hard
>200	hard

HYDROELECTRIC POWER - Electric power produced by water power.

HYDROGRAPHIC STUDY AREA - An area of hydrological and climatological similarity so subdivided for study purposes.

HYDROLOGIC BUDGET - An accounting of all inflow to, outflow from, and changes in storage within a hydrologic unit such as a drainage basin, soil zone, aquifer, lake, or project area.

HYDROLOGIC CYCLE - The circuit of water movement from the atmosphere to the earth and return to the atmosphere through various stages or processes as precipitation, interception, runoff, infiltration, percolation, storage, evaporation, and transpiration.

HYDROLOGIC UNIT - A classification of soils concerning water infiltration characteristics used in hydrologic analyses.

IGNEOUS ROCK - Rock formed by volcanic action or great heat.

IMPOUNDMENT - Generally an artificial collection and storage area for water.

INACCESIBLE RANGELAND - Land areas too steep, too rocky, or too dry for livestock use.

INCEPTISOL - A classification order in soil taxonomy.

INDIRECT BENEFIT - Increased net returns resulting from economic activity, stimulated by production, utilization, and disposition of intermediate goods and services.

INDUCED BENEFIT - Increase net returns which result from the economic activity stimulated by consumer spending of wages and income derived from direct and indirect activity.

INDUCED COSTS - Uncompensated or unmitigated adverse effects caused by installation, operation and maintenance of project improvements.

INDUSTRIAL AND UTILITY DAMAGE - Damage to manufacturing, processing, and fabricating plants and facilities; communication and utility lines and facilities; railroads, equipment, and facilities; and business losses due to increased cost of normal operation.

INDUSTRIAL ESTABLISHMENT - An establishment engaged in the mechanical or chemical transformation of inorganic or organic substances into new products, such as plants, factories, or mills which characteristically use power-driven machines and materials-handling equipment. Establishments engaged in assembling component parts of manufactured products are also considered manufacturing if the new product is either a structure or other fixed improvement.

INDUSTRIAL WATER - Water used for manufacturing or processing activities by an industrial establishment.

INFILTRATION - The process whereby water passes through an interface, such as from air to soil or between two soil horizons.

INITIAL ATTACK FORCE - The men and equipment in the Fire Protection System who are kept in a constant state of readiness to take control action on reported wildfires. Commonly, such forces are enroute to the fire scene within 3-5 minutes after the fire report is received.

IRRIGABLE LANDS - Lands capable of being irrigated by any method. The Bureau of Reclamation is required by law to define irrigable land as: "Arable land for which a water supply is available and which is provided with, or planned to be provided with, irrigation, drainage, flood protection, and other facilities as necessary for sustained irrigation utilization."

IRRIGATED CROPLAND - All lands being supplied water by artificial means, excluding waterfowl refuges, that are being used for the production of orchard, field, grain crops, and pasture.

IRRIGATION DEPLETION - See DEPLETION (WATER).

IRRIGATION EFFICIENCY - The ratio of consumptive use of applied irrigation water to the total amount of water applied expressed as a percentage of that applied water.

IRRIGATION REQUIREMENT - The quantity of water, exclusive of precipitation, that is required for production of a specific crop.

IRRIGATION RETURN FLOW - Applied water which is not consumptively used and returns to a surface or ground water supply. See also RETURN FLOW.

IRRIGATION WATER MANAGEMENT - The use and management of irrigation water where the quantity of water used for each irrigation is determined by the water-holding capacity of the soil and the need for the crop, and where the water is applied at a rate and in such a manner that the crop can use it efficiently and significant erosion does not occur.

IRRIGATION WATER REQUIREMENT - Quantity of water, exclusive of effective precipitation, that is required for crop production.

JOINT USE FACILITIES - The features of a project used in common for more than one project purpose, such as the dam in a multiple-purpose reservoir.

KEY ELEMENT - A term used in recreation evaluation that is determined by consultation with local people.

LAND CAPABILITY CLASSIFICATION - A grouping of kinds of soil into special units, subclasses, and classes according to their capability for intensive use and the treatments required for sustained use, prepared by the Soil Conservation Service, USDA.

LAND RESOURCE AREAS - Broad, geographic areas having similar soil, climatic, geologic, vegetative, and topographic features which are grouped into land resource regions.

LAND RESOURCE REGION - Geographically associated major land resources areas which divide the United States into 20 physiographic regions uniform enough to be significant for national planning.

LAND RIGHTS COST - Expenditures for acquiring land or casements, relocation of existing utilities and public property and associated legal costs.

LAND SUITABLE FOR TIMBER PRODUCTION - This includes all land capable of producing crops of industrial wood (20 cubic feet or more acre annual growth capability). Present land uses, such as transportation and utilities, wilderness, and recreation were not excluded from this total acreage.

LAND TREATMENT MEASURES - A tillage practice, a pattern of tillage or land use, or land or management facility improvements to alter runoff, reduce sediment production, improve use of drainage and irrigation facilities, or improve plant or animal production.

LEVEES - A continuous dike or ridge of earth for confining floodflow.

LINEAR PROGRAMMING - A mathematical technique which is concerned with problems involving the optimization of a linear objective funtion (e.g. net returns to resources) subject to a set of linear constraints (e.g. availability of resources, market shares, and environmental standards) imposed on the variables of the objective function.

MAN YEAR - One person employed for one year.

MANTLE - Coarse fragments on a soil surface.

MANAGEMENT MEASURES - Those measures applied in the form of decisions by the land user without the application or installation of practices.

MEAN ANNUAL PRECIPITATION- The average of all annual precipitation values known, or an estimated equivalent value derived by such methods as regional indexes or isohyetal maps.

MEAN ANNUAL RUNOFF - The average value of all annual runoff amounts usually estimated from the period of record or during a specified base period from a specified area. See BASE PERIOD AND RUNOFF.

MESOZOIC AGE - The geological era after the Paleozoic and before the Cenozoic eras.

METAMORPHIC ROCK - Rock formed by a change in structure due to pressure, heat, chemical action, etc.

MILITARY - Those areas administered by the Armed Forces or by the Atomic Energy Commission in the interest of nation defense. Lands administered by the Corps of Engineers (Army) are not included.

MINERAL PRODUCTION - See GEOLOGIC COMMODITIES.

MILLIGRAMS PER LITER - The weight in milligrams of any substance contained in one liter of liquid. Nearly the same as parts per million.

MILLION GALLONS PER DAY - A statistical term relating to water use.

MITIGATION - Providing of services or facilities to compensate for project detriments.

MULTIPLE USE - The management of all the various renewable surface resources so that they are utilized in the combination that will best meet the needs of society, without impairment to the productivity of the land, and with consideration being given to the relative values of the various resources, and not necessarily the combination of uses that will give the greatest dollar return or the greatest unit output.

MULTIPLE-FAMILY RESIDENTIAL USE - Residential use, for other than single-family dwellings and duplexes in commercial-type establishments including motels, apartments, condominiums, and hotels.

MOLLISOL - A classification order in soil taxonomy.

MULTI-PURPOSE PROJECT - A project designed to serve more than one purpose; for example, irrigation, flood control, recreation, and hydroelectric power.

MUNICIPAL WATER - Water whose use has a direct relationship to a municipality and its surrounding area. It may be for domestic, commercial, or public purposes, but excludes industrial use unless relatively small.

MUNICIPAL AND INDUSTRIAL WATER - Water supplied to a central municipal distribution system, for rural domestic use, stock water, steam electric powerplants, and water used in industry and commerce.

NATIONAL ECONOMIC DEVELOPMENT - One of the accounts used in the Four-Account System of economic and environmental evaluation procedure.

NATIONAL RECREATION AREA - Areas which have natural endowments that are well above the ordinary in quality and recreation appeal, of lesser significance than the unique scenic and historic elements of the National Park System, but affording a quality of recreation experience which transcends that normally associated with areas provided by State and local governments.

NATIONAL RESOURCE LAND - Public domain land administered by BLM.

NATURAL AREAS - Areas set aside by federal, state, county, and private organizations to preserve permanently, in unmodified condition, representative flora for the purposes of science, research, and/or education. Developed recreation sites do not exist within these areas.

NATURAL FLOW - The rate of water movement past a specified point on a natural stream from a drainage area for which there have been no effects caused by stream diversion, storage, import, export, return flow, or change in consumptive use caused by man-controlled modifications to land use. Natural flow rarely occurs in a developed country.

NET RESERVOIR EVAPORATION - The difference between the total evaporation from the reservoir water surface and the evapotranspiration from the reservoir area under prereservoir conditions, with identical precipitation considered for both conditions.

NET WATER YIELD - The available water runoff at a given location, both surface and subsurface, after the upstream uses by man's activities, use by phreatophytes, and evaporation from upstream free water surfaces.

NON-COMMERCIAL FOREST LAND - Unproductive forest land incapable of yielding crops of industrial wood because of adverse site conditions, and productive forest land withdrawn form commercial timber use through statute or administrative regulation.

NON-CONSUMPTIVE USE (WATER) - The use of stream diverted water for hydroelectric power generation.

NON-IRRIGATED CROPLAND - Those non-irrigated cultivated lands that are used for the production of grain crops (harvested and/or grazed), orchard, and field crops.

NONSTOCKED AREAS - Commercial forest land less than 10 percent stocked with growing-stock trees. Generally brush and/or currently non-commercial tree species are present.

NON-SKELETAL, STONY SOILS - Soils with mantle but without coarse fragments to some horizon within or below the subsoil.

NORMAL - A mean or average value established from a series of observations for purposes of comparison, for example, normal precipitation, normal temperature, normal flow.

NORMALIZED PRICES - The long term trend of prices, that are expected to be in effect after adjustment for seasonal and cyclical fluctuation.

OBERS PROJECTIONS - Economic projections for water resources planning areas, developed by the Office of Business Economics and Economic Research Service for the Water Resources Council.

OLD BEACHES - A miscellaneous land type mapped in the soil survey. In this report, Pleistocene Lake Lahontan bars, spits, shore lines and associated features, highly variable.

PERCHED GROUND WATER - Ground water supported by a zone of material of low permeability and located above an underlying main body of ground water with which it is not hydrostatically connected.

PERCOLATION - 1. The movement of water within a porous medium such as soil, 2. The entrance of a portion of the streamflow into the channel materials to contribute to ground water replenishment.

PERMANENT FULL TIME EMPLOYMENT - Job that provides full year's employment during project evaluation period.

PERMANENT SEASONAL EMPLOYMENT - Job that provides seasonal employment annually during project evaluation period such as winter recreation employment.

PERENNIAL YIELD (GROUND WATER) - The amount of usable water of a ground water reservoir that can be withdrawn and consumed economically each year for an indefinite period of time. It cannot exceed the natural recharge to that ground water reservoir and ultimately is limited to the maximum amount of discharge that can be utilized for beneficial use.

PERMANENT WILTING PERCENTAGE - See wilting point.

PERMEABILITY - Capacity for transmitting a fluid. It is measured by the rate at which a fluid of standard viscosity can move through material in a given interval of time under a given hydraulic gradient.

PERMEABILITY SOIL - The quality of a soil horizon that enables water or air to move through it. The permeability of a soil may be limited by the presence of one nearly impermeable horizon even though the others are permeable.

PH (HYDROGEN ION CONCENTRATION) - Measure of acidity or alkalinity of water. Distilled water, which is neutral, has a ph value of 7; values above 7 indicate the presence of alkalies, while those below 7 indicate acids.

PHREATOPHYTE - A plant that obtains its water supply from the zone of saturation, either directly or through the capillary fringe.

PITTING - The construction of pits or basins of suitable capacity and distribution to retain water and increase infiltration on rangeland.

PROJECT EVALUATION PERIOD - Expected useful life of project beginning at end of installation of project.

PROJECT INSTALLATION PERIOD - The time period required for construction and installation of project.

POLLUTION (WATER) - The alteration of the physical, chemical, or biological properties of water, or a discharge of any substance into water, which adversely affects any legitimate beneficial water use.

PRICE FLEXIBILITY - The percentage change in commodity price associated with a one percent change in the quantity available and demanded of the same commodity, given assumed production levels in the rest of the U.S., substitutes and compliments, and levels of real income.

PRIMARY TREATMENT - In sewage, the removal of larger solids by screening, and of more finely divided solids by sedimentation.

PUBLIC FACILITIES - All structures, parks, and public places, other than recreational areas, engaged either in serving the public or in providing a public use.

PUBLIC FACILITIES DAMAGE - Damage to highways and bridges, municipal facilities, public schools, levee systems, irrigation diversions and canals, improved stream channels, and navigation channels, all of which are owned or administered by public agencies or private concerns.

OPERATION, MAINTENANCE AND REPLACEMENT COSTS (OM&R) - The value of goods and services needed to operate a constructed project and make repairs and replacements necessary to maintain the project in sound operating condition during its economic life.

OTHER AGRICULTURAL DAMAGE - Losses of livestock and stored crops and damage to machinery, fences, farm buildings, farm bridges and roads, farm levees, irrigation and drainage systems, and other farm and ranch facilities.

OPTIMUM DEVELOPMENT - The optimum development of an area or a resource is that combination of scope and type of development which, when measured by economic, social, and other factors, best achieves the objectives of the development.

OROGRAPHIC PRECIPITATION - Precipitation which results from the lifting of moist air over a topographic barrier such as a mountain range.

OUTDOOR RECREATION - Leisure time activities which utilize outdoor recreation resources and facilities.

OUTDOOR RECREATION CARRYING CAPACITY - An expression of the optimum per acre annual visitation at recreation areas. Levels of development, physical conditions (soil, climate, vegetation, slope, etc.) and the quality and type of recreation experience are factors that were considered in evolving capacity estimates.

OUTDOOR RECREATION UNIT - A facility or group of complementary facilities normally in a camp, picnic site or parks, designed to accommodate a family or other small groups.

PARTS PER MILLION (PPM) - Parts in weight per million units of water.

PEAK FLOW - The maximum instantaneous discharge of a stream or river at given location.

PEAK LOAD (POWER) - The maximum load in a stated period of time. Usually it is the maximum integrated load over an interval of one hour which occurs during the year, month, week, or day. It is used interchangeably with peak demand.

RANGE - 1. All land producing native forage for animal consumption and land that is revegetated naturally or artifically to provide a forage cover that is managed like native vegetation. Generally considered as land that is not cultivated. 2. (wildlife) the geographic area occupied by an animal or bird.

RANGE CONDITION - The state and health of the range based on what it is naturally capable of producing.

RANGE CONDITION CLASS - One of a series of arbitrary categories used to classify range condition, usually expressed as either excellent, good, fair, or poor.

RANGE CONDITION TREND - The direction of change in range condition.

RANGE MANAGEMENT - The art and science of planning and directing range use to obtain sustained maximum animal production consistent with perpetuation of the natural resources.

RANGE SEEDING - Establishing adapted plant species on ranges by means other than natural revegetation.

RECLAIMED WATER - Waste water treated for reuse or brackish water demineralized for use.

RECONNAISSANCE INVESTIGATION - A preliminary study and evaluation of existing data supplemented by a minimum amount of specifically collective data when it is not available to determine the merits of further, more detailed investigations. It normallly includes all facets of more detailed investigations, but the studies are generalized.

RECORDING GAGE - A gage which provides a continuous recording of the parameter being monitored.

RECREATIONAL AREA - An area predominantly occupied or used on intermittent basis (e.g., weekends or during the summer) for leisure and recreational purposes.

RECREATION DAY - A statistical unit of recreation use consisting of a visit by one person for all or a portion of one 24-hour period. One recreation day may consist of one or several activity days by the same person (See Activity Day).

RECREATION DEMAND - The quantity of participation in outdoor recreation activities that will occur based on surveys indicating trends in increased participation rates through time. Demand as used in this study does not include latent demand that might be expressed if additional opportunities were available.

RECREATION FACILITIES - Structures or other improvements specifically constructed for use in outdoor recreation activities in a designated area.

RECREATION LAND - Land and water used or usable primarily as sites for outdoor recreation facilities and activities.

RECREATION NEEDS - The difference between demand and supply expressed in units of recreation days or land acreage requirements.

RECREATIONAL SUBDIVISION - Land developments being advanced on lands not adjacent to urban areas and their associated facilities. These developments are located on essentially virgin lands such as mountain areas, lake and sea shores, deserts, etc., primarily for second or vacation homes although some permanent residences may be included.

RESIDENTIAL AREA - Urban area occupied by single-family dwellings and duplexes.

RESIDENTIAL AND COMMERCIAL DAMAGE - Residential damage is damage to single and multiple residences, including structures, contents, and property improvements. Commercial damage is damage to commercial enterprises such as hotels, motels, stores, and service establishments, including structures, furnishings, inventories, and property improvements; and loss of business and wages resulting from this damage.

RESIDUAL AVERAGE ANNUAL FLOOD DAMAGES - Those flood damages which are not prevented by a flood control project or by other structural or non-structural flood damage prevention measures.

RESOURCE CONSERVATION DISTRICT - See CONSERVATION DISTRICT

REST OF NATION (RON) - One of the parts used in the Four-Account System of project evaluation.

RETURN FLOW - That part of a diverted flow which is not consumptively used and which returns to a surface supply.

REUSE WATER - Water used repeatedly.

RIPARIAN LAND - Land situated along the bank of a stream or other body of water.

RIPARIAN RIGHTS - The rights of an owner whose land abuts water. They differ from state to state and often depend on whether the water is a river, lake, or ocean. See Water Rights.

RIPARIAN VEGETATION - Vegetation growing on the banks of a stream or other body of surface water.

RIVER BASIN DEVELOPMENT - A program to develop the use of the water and land resources of a river basin, so coordinated as to obtain a greater efficiency of use than would be possible if the resources were developed by uncoordinated multiple-purpose projects.

ROCKLAND - Areas having enough rock outcrop and very shallow soil to submerge other soil characteristics.

ROTATION GRAZING - Grazing two or more pastures or parts of a range in regular order, with definite recovery periods between grazing periods. Where only two fields are involved. Sometimes called alternate grazing. Contrast with continuous grazing.

ROTATION-DEFERRED GRAZING - Grazing under a system where one or more grazing units are rested (not grazed) at planned intervals. Deferment is based upon the growing season of key forage plants. Generally, no unit is grazed at the same time in successive years.

RUBBLE - A miscellaneous land type as mapped in soil surveys consisting of 90 percent or more coarse fragments on the soil surface.

RURAL DOMESTIC WATER - Supplied by a municipal distribution system to rural residences.

RUNOFF (HYDRAULICS) - That portion of the precipitation on a drainage area that is discharged from the area in stream channels. Types include surface runoff, ground water runoff or seepage.

SALINE WATER - Water in which the concentration of dissolved solids exceeds 1,000 ppm.

SALT BALANCE - A condition in which specific or total dissolved solids removed from a specified field, stratigraphic zone, political area, or drainage basin equals the comparable dissolved solids added to that location from all outside sources during a specified period of time.

SALVAGED WATER - The part of a particular stream or other water supply that is saved from loss, in respect to quantity or quality, and is retained and made available for use.

SEASON - A period of time characterized by some distinguishable occurrence or feature, such as growing season, harvest season, winter season, dry season, etc. It is not to be used in reference to a 12 month period.

SECONDARY TREATMENT - In sewage, the further purification of the effluent from primary treatment by bio-filters, oxidation ponds, or other means.

SEDIMENT CONTROL - The control of movement of sediment on the land, in a stream or into a reservoir by means of manmade structures; such as debris dams, wing dams, or channelization; land management techniques, or natural processes.

SEDIMENT LOAD - The total sediment, including bedload, being moved by flowing water in a stream at a specified cross section.

SEDIMENT POOL - The reservoir space allotted to the accumulation of submerged sediment during the life of the structure.

SEDIMENT STORAGE - The accumulation, in a reservoir, of sediment that would normally be carried downstream without the project.

SEDIMENT YIELD - That amount of sediment transported by a stream system that may be measureable at a particular location. Usually expressed in acre-feet per square mile per year.

SEDIMENTATION - The accumulation or depositing of fragments of material that settle from water or air. The material normally results from the erosion process.

SEEPAGE - The gradual movement of a fluid into, through, or out of a porous medium.

SELF-SUPPLIED WATER - Water pumped or diverted by a company of industry of self-use.

SEMIARID - A term applied to regions or climates where moisture is normally greater than under arid conditions but still definitely limits the growth of most crops. Dryland farming methods or irrigation generally are required for crop production. The upper limit of average annual precipitation in the cool semiarid regions is as low as 15 inches. Whereas in tropical regions it is as high as 45 or 50 inches. Contrast with arid.

SERVICE AREA - The geographic area served by the function or functions under discussion.

SEWAGE PLANT EFFLUENT - The outflow from a sewage treatment plant.

SHARE OF THE MARKET, CURRENT SHARE - The average production level for the last five years expressed as a percentage of the total U.S. production.

SHARE OF THE MARKET, PROJECTED CONSTANT SHARE - The current percentage share of the market multiplied times the projected U.S. production levels.

SHRINK-SWELL - A characteristic of soils having a high amount of some kinds of clay or organic material.

SOCIAL WELL-BEING - One of the accounts used in the Four-Account System of economic and environmental evaluation procedure.

SOIL ASSOCIATION - A group of defined and named soils associated together in a characteristic geographic pattern but not necessarily similar pattern. Each soil association is named for the major soil classification it contains and differs from other soil associations by having contrasting soil properties or different potentialities.

SOIL RESOURCE GROUP - A broad grouping of soils that have similar cropping patterns, yield characteristics, responses to fertilizers, management, and land treatment measures.

STOCK RESOURCES VS. FLOW RESOURCES - Stock resources are resources that can be permanently expended and whose quantity is usually expressed in absolute amounts rather than in rates. Examples are coal and petroleum. Flow resources are not permanently expendable under usual circumstances. They are commonly expressed in annual rates at which they are regenerated. Examples are fresh-water runoff and timber.

STREAMFLOW - The rate of flow of water past a specified point in a stream channel. Streamflow can originate from either a natural or a modified environment.

STREAMFLOW DEPLETION - That amount of water lost from a stream between two given locations during a specified period of time.

STRUCTURAL MEASURE - Measures such as installation of dams, levees, channel improvements, etc.

SUB-ALPINE - A vegetation zone usually in mountains joining and below the alpine area or having a similar climate. It supports some trees in contrast to the alpine zone.

SUMMER CONVECTIVE STORMS - A summer rainstorm produced by the upward movement of moist air masses until they reach their condensation level.

SUSPENDED SEDIMENT - Sediment particles suspended in a liquid.

SUSPENDED SOLIDS - Solids which are not in true solution and which can be removed by filtration.

SUSTAINED YIELD - Achievement and maintenance, in perpetuity, of a high-level annual or regular periodic output or harvest of the various renewable land and water resources.

TAILINGS - Waste materials from ore milling or mining operations.

TERMINAL LAKE - A lake with no outlet.

TERTIARY TREATMENT - n ewage, the additional treatment of effluent beyond that of secondary treatment, in order to obtain a very high quality of effluent.

TOTAL DISSOLVED SOLIDS (TDS) - A measure of the mineral constituents in a liquid, usually expressed as mg/l.

TOXICITY - The state or degree of being poisonous.

TRANSPIRATION - The process whereby free water in a plant is released as a vapor into the air through the leaves or bark.

TRANSPORTATION AND UTILITIES - Roads, highways, railroads, trails, airports, power lines, pipelines (oil, gas, water), telephone lines, water conveyance facilities, and related items outside of urban-industrial areas are included in this category.

TRAVEL TIME ZONES (recreation) - Potential demand for recreation is directly related to available time. Time coupled with means of mobility governs the distances recreation seekers are willing and able to travel. In this study, four travel zones were established for each metropolitan area:

1. Zero to one hour zone.
2. One to two hour zone.
3. Two to four hour zone.
4. Over four hour zone.

TURBIDITY - Level of concentration of suspended particulate matter which can be removed through filtration.

UNDESIGNATED FISH AND WILDLIFE - All lands in the Region except the designated fish and wildlife areas and those areas classified as urban and industrial.

UNDEVELOPED RECREATION - This includes other lands used for less intensive recreational purposes and not included in developed recreational classified category.

UNSUITABLE RANGELAND - See inaccessible rangeland.

URBAN LAND - Areas so altered or obstructed by urban works or structures that identification of soils is not feasible. A miscellaneous land type.

URBAN-INDUSTRIAL - Those incorporated and/or unincorporated areas principally used for residential, commercial, and/or industrial development, including "fringe areas" which restrict or eliminate other uses. Usually refers to land.

URBAN POPULATION - The total number of people living in urban places and urbanized areas as defined in the 1960 census of population. In general this includes all persons living in urbanized areas and in places of 2,500 inhabitants or more, outside of urbanized areas.

URBAN WATER USE - The use of water for urban purposes, including residential, commercial, industrial, recreational, military, and institutional classes. The term is applied in the sense that it is a kind of use rather than a place of use.

URBAN WATER USE PER CAPITA - A unit value of water use which encompasses all urban uses of water in a service area.

VALLEY FILL - Alluvium or other material occupying areas below mountain slopes.

VEGETAL TYPE - A group of plants that occupy a landscape position in a repetitious manner.

VISITOR DAY - Twelve visitor hours of recreation use. (It may be composed of twelve persons visiting for one hour each, etc. A visitor hour is composed of one person visiting for 60 minutes, five persons for 12 minutes each, etc. One overnight 24-hour visit would consist of two visitor days.) (See Activity Day and Recreaton Day.)

WASTE WATER RECLAMATION - The process of treating salvaged water from municipal, industrial, or agricultural waste water sources for beneficial uses, whether by means of special facilities or through natural processes.

WATER BUDGET - See Hydrologic Budget

WATER DEMAND SCHEDULE - A time distribution of the demand for prescribed quantities of water for specified purposes. It is usually a monthly tabulation of the total quantity of water that a particular water user intends to use during a specified year.

WATER DESALINATION - The removal of salts, such as, from a saline water supply.

WATER QUALITY - A term used to describe the chemical, physical, and biological characteristics of water, usually in respect to its suitability for a particular purpose.

WATER MANAGEMENT - The analysis, protection, development, operation, or maintenance of the land, vegetation, and water resources of a drainage basin for the conservation of all its resources for the benefit of man. Watershed management for water production is concerned with the quality, quantity, and timing of the water which is produced.

WATER REQUIREMENT - The total quantity of water, regardless of its source, required for a specified use under a predetermined or prescribed situation.

WATER REQUIREMENT (AGRICULTURAL) - The total quantity of water, regardless of its source, required for production of crops at their normal growth under field conditions. It includes applied water, subsurface irrigation, and precipitation needed by the crops.

WATER RIGHT - A legally protected right to take possession of water occurring in a water supply and to divert that water and put it to beneficial use.

WATER SALVAGE - See SALVAGED WATER.

WATER SERVICE AGENCY - An agency organized, founded, or established to produce and distribute water directly or indirectly to customers. The two major types are privately owned companies which consist of commercial companies and mutual water groups; and public companies which include water districts and municipally-owned water departments.

WATER TABLE - The upper surface of a zone of saturation, except where that surface is confined by an impermeable body.

WATER YEAR - A continuous 12-month period of time for which water records are compiled and summarized. In the Pacific Southwest, it starts October 1.

WATER-BASED RECREATION - Those activities which require water for participation such as boating, swimming, sailing and canoeing. Boating was the key activity used to determine needs for this study because it requires the most space and can be undertaken only on relatively large bodies of water. Fishing needs are treated at length under Fish and Wildlife, APPENDIX II.

WATERSHED - All lands enclosed by a continuous hydrologic drainage divide and lying upslope from a specified point on a stream.

WATERSHED INVESTIGATION REPORT (WIR) - A report on a potential PL-566 Project.

WATERSHED MANAGEMENT - The analysis, protection, development, operation or maintenance of the land, vegetation and water resources of a drainage basin for the conservation of all its resources for the benefit of man. Watershed management for water production is concerned with the quality, quantity and timing of the water which is produced.

WATERSHED PLANNING - Formulation of a plan to use and treat water and land resources.

WATERSHED PROTECTION AND FLOOD PREVENTION PROJECTS - A system of land treatment or soil conservation practices combined with structural measures installed to improve infiltration and reduce erosion of land within a drainage basin and to protect lands from floods.

WATERSPREADING - The application of water to lands for the purpose of increasing the growth of natural vegetation or to store it in the ground for subsequent withdrawal by pumps for irrigation.

WILDERNESS - Those areas classified by Congress or other authority as a wilderness or primitive area.

WILDFIRE - Natural or man-caused fires burning on forest, brush, or grass covered lands, not confined to safe and predetermined control lines or set for a legal purpose, and on which fire control action is necessary to prevent resource and watershed damage.

WILDLIFE LAND - Land managed or used primarily for wildlife.

WILDLIFE MANAGEMENT - The art of producing sustained annual crops of wildlife.

WILDLIFE MANAGEMENT AREA - Delineated area of land for wildlife management.

WITH PLAN - An acceleration plan of an on-going program.

WITHOUT PLAN - An on-going program.

WILTING POINT (or permanent wilting point) - The water content of soil on an oven-dry basis at which plants, specifically sunflower plants, wilt and fail to recover their turbidity when placed in a dark humid atmosphere. Values are approximated by the moisture content at 15-bar tension.

WOODLAND - Any land used primarily for growing trees and shrubs. Woodland includes, in addition to what is ordinarily termed "forest" or "forest plantations," shelterbelts, windbreaks, wide hedgerows containing woodland species for wildlife food or cover, stream and other banks with woodland cover, etc. It also includes farmland and other lands on cover, etc. It also includes farmland and other lands on which woody vegetation is to be established and maintained.

XEROPHYTE - Drought-resistant plant.