UNITED STATES
DEPARTMENT OF THE INTERIOR
Fred A. Seaton, Secretary

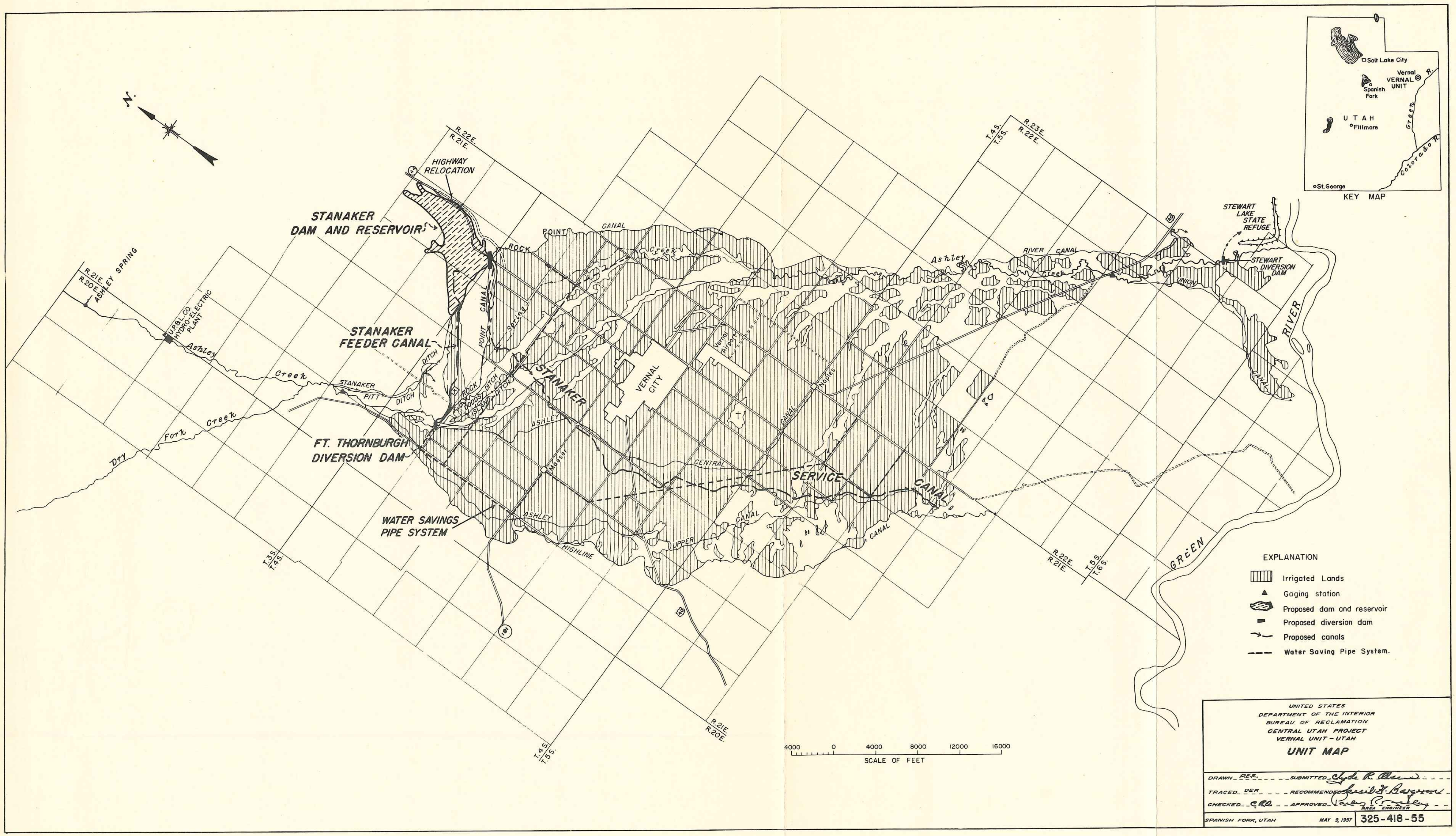
BUREAU OF RECLAMATION
W. A. Dexheimer, Commissioner
E. O. Larson, Regional Director

V E R N A L U N I T
C E N T R A L U T A H P R O J E C T

DEFINITE PLAN REPORT

May 1957

Region 4 Salt Lake City, Utah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UNITED STATES
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BUREAU OF RECLAMATION
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VERNAL UNIT – UTAH
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DRAWN D.E.R.
SUBMITTED Clyde R. Olsen
TRACED DER
RECOMMENDED Cecil F. Bargeron
CHECKED C.R.O.
APPROVED
AREA ENGINEER
SPANISH FORK, UTAH
MAY 9, 1957
325-418-55

SUMMARY SHEETS

Vernal Unit--Central Utah Project

LOCATION: Northeast Utah in Ashley Valley of the Uinta Basin, approximately centered by Vernal, Utah.

AUTHORIZED: Initial phase of the Central Utah project, including the Vernal unit, authorized as a participating project with the Colorado River Storage project by the Act of April 11, 1956 (70 Stat. 105).

PLAN

Through storage regulation and water exchanges, the Vernal unit will provide supplemental irrigation water for 14,781 acres of land and 1,500 acre-feet of water annually to supplement the municipal supplies of Vernal, Naples, and Maeser. The unit will also provide benefits to fish and wildlife and recreation. Excess flows of Ashley Creek will be diverted at the Ft. Thornburgh Diversion Dam into the Stanaker Feeder Canal and conveyed to the Stanaker Reservoir. Water stored in the reservoir will be released into the Stanaker Service Canal and delivered to existing irrigation canals and ditches. The water will in part replace Ashley Creek water, including releases from upstream reservoirs. Some of the replaced water will be used on lands above the Stanaker Service Canal and some will be diverted from Ashley Spring on Ashley Creek into the municipal pipeline. Land drains will be provided as needed and some sections of existing canals will be lined to prevent seepage. A pipe system will be constructed for stock-watering purposes during the nonirrigation season to save for unit storage and use water now lost through open canals. Recreational and fishing attractions will be provided at Stanaker Reservoir. Small tracts of land distributed through the unit area will be acquired and developed for upland game, and a pump and pipeline will be installed to deliver water from Green River to the Stewart Lake State Refuge. Repayment of reimbursable construction costs will be completed in 50 years, following a 3-year development period. Irrigation costs that are beyond the repayment ability of the irrigators will be paid from the Upper Colorado River Basin Fund.

CONSTRUCTION COSTS — 1/$6,874,000

Stanaker Dam and Reservoir	$3,870,000
Ft. Thornburgh Diversion Dam	200,000
Stanaker Service Canal	1,060,000
Stanaker Feeder Canal	570,000
Water Savings pipe system	340,000
Stanaker Canal laterals	40,000
Vernal area drainage system	675,000
Recreation	92,000
Fish and wildlife	27,000

1/ Estimated at January 1957 prices.

BENEFITS, ALLOCATIONS, AND REPAYMENT

		Allocations (tentative)	
Unit purpose	Benefits (annual)	Construction costs	Annual O.M.& R. costs
Irrigation	$253,500	1/$6,154,000	$12,700
Municipal water	23,800	2/619,000	1,800
Recreation	14,200	3/92,000	7,100
Fish and wildlife	13,600	3/27,000	1,200
Total	305,100	2/6,892,000	22,800

1/ $1,500,000 will be repaid by Vernal unit irrigators through the Upper Colorado River Basin Fund and the remaining $4,654,000 will be paid from other revenues in the basin fund apportioned to Utah.

2/ Includes $18,000 in interest during construction.

3/ Nonreimbursable

Average annual water costs per acre-foot

	Construction repayment	O.M.& R. costs
Irrigation water	$1.65	$0.70
Municipal water	1/	1.20

1/ Municipal water payment will increase from $12.00 per acre-foot during first 10 years to $22.13 during last 10 years of 50-year repayment period.

BENEFIT-COST RATIO — 1.44 to 1

REPAYMENT ORGANIZATION

The Uintah Water Conservancy District has been organized in accordance with Utah State law and will contract with the United States for the repayment of irrigation and municipal water costs.

IRRIGATION

Irrigable area furnished supplemental water	Acres
Class 1	3,286
Class 2	5,357
Class 3	5,801
Unclassified (town site)	337
Total	14,781

Elevation of farm lands (avg. feet msl)	5,300
Frost-free period (avg. days annually)	119
Effective precipitation (avg. inches annually)	3
Diversion requirement (avg. ac.-ft. annually)	51,700
Increase in water supply (avg. ac.-ft. annually)	18,000
Increased depletion of Colorado River from unit operation (avg. ac.-ft. annually)	11,800

UNIT WORKS

Stanaker Dam

Located on offstream Stanaker Draw, 3.5 miles north of Vernal.

Type	rolled earth-fill
Height above ground	140 ft.
Height above foundation	145 ft.
Volume of embankment	1,820,000 cu. yds.
Spillway capacity	(emergency only)
Outlet capacity (at res. elev. 5,472)	300 sec.-ft.

Stanaker Reservoir

Elevation at normal water surface (37,560 ac.-ft.)	5,516.2 ft.
Active storage capacity	33,200 ac.-ft.
Inactive storage capacity	4,360 ac.-ft.
Total storage capacity	37,560 ac.-ft.
Reservoir surcharge capacity above normal water surface elevation	2,170 ac.-ft.

Stanaker Feeder Canal

Length	3.1 miles
Capacity	400 sec.-ft.

Stanaker Service Canal

Length	11.8 miles
Capacity at head	300 sec.-ft.

Water Savings Pipe System

Length	17.3 miles
Capacity at head	289 gal. per min.

HYDROLOGY

Ashley Creek at "Sign of the Maine" gage

Drainage area	241 sq. mi.
Period of record	1940-56
Average runoff, 1940-56	92,800 ac.-ft.
Maximum annual runoff	142,300 ac.-ft.
Minimum annual runoff	52,400 ac.-ft.
Maximum daily discharge of record	2,650 sec.-ft.
Minimum daily discharge of record	14 sec.-ft.

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FOREWORD

This report presents the results of definite plan studies of the Vernal unit of the initial phase of the Central Utah project. Construction of the initial phase as a participating project in the broad plan for the Colorado River Storage project was authorized by the Act of April 11, 1956 (70 Stat. 105). By the same act four units of the Colorado River Storage project and ten other participating projects were authorized. These authorizations were an important step toward the further development of the water allocated to the five States of the Upper Colorado River Basin by the Colorado River Compact of 1922 and distributed among the States by the Upper Colorado River Basin Compact of 1948. A copy of the authorizing act is appended to this report.

The Vernal unit is a separable segment of the Central Utah project's initial phase. Its principal purpose is to store the erratic flows of Ashley Creek to provide supplemental irrigation water for lands in Ashley Valley and additional municipal water for the communities of Vernal, Maeser, and Naples. The unit is physically independent, so far as water supply is concerned, of any other part of the Central Utah project as presently authorized. Plans for the ultimate phase of the project, however, include water exchanges that will relate the Vernal unit physically to other units of the overall plan. Construction of the ultimate phase must await further investigations by the Bureau of Reclamation and associated interests and authorization by Congress.

The Uintah Water Conservancy District has been organized for the purpose of contracting with the Federal Government for construction of the Vernal unit and for payment through the Upper Colorado River Basin Fund of certain costs relating to construction, operation, maintenance, and replacement of unit works. Construction costs of the unit that are allocated to irrigation and that are beyond the repayment ability of the unit irrigators will be repaid from power revenues of the Colorado River Storage project that are apportioned to Utah through the Upper Colorado River Basin Fund.

The preparation of this separate definite plan report on the Vernal unit ahead of a report on the entire initial phase of the Central Utah project is justified by the degree to which the unit is physically and financially independent and because definite plan studies for the unit are now complete whereas studies for other segments of the initial phase will continue for some time. When a report is prepared on the initial phase as a whole, this report will by reference be made a part thereof and the Vernal unit will be included in all initial phase summations.

CHAPTER I

GENERAL DISCUSSIONS

Natural Setting

Location and physical features

The Vernal unit area is located in the northeastern corner of Utah. It comprises the northern and central portions of Ashley Valley in the Uinta Basin and is approximately centered by the town of Vernal. It is bordered by the Uinta Mountains on the north, a low mesa on the east, and by Asphalt Ridge on the west. The area has no natural southern boundary but extends as far south in Ashley Valley as the main body of irrigated land. The southern portion of Ashley Valley not considered a part of the unit area is composed primarily of waste land with only isolated tracts of arable land.

Ashley Valley is drained by Ashley Creek, a tributary of the Green River, which in turn is a tributary of the Colorado River. The main tributary of Ashley Creek is Dry Fork Creek. Both Ashley and Dry Fork Creeks rise in small glacial lakes at the base of Marsh Peak (elevation 12,219 feet) in the Uintas. They run through deep canyons which they have cut through the upturned geological formations of the Uinta Range and converge about 5 miles northwest of Vernal. From this point Ashley Creek flows 20 miles in a southeasterly direction to its confluence with the Green River.

Heavy stands of timber interspersed with flat grassy parks and glacial lakes are characteristic of the upper reaches of the Ashley Creek drainage basin. Sagebrush and juniper cover the lower hills. As part of the Ashley National Forest, the watershed area is administered by the Forest Service and is well preserved.

Lands in the unit area range in elevation from 4,700 feet in the southern portion of the area to 5,700 feet in the northern portion. The lands slope uniformly from the surrounding hills to Ashley Creek and are of gentle gradient. Several natural drainage channels drain into Ashley Creek, dissecting the land into long flat ridges.

Climate

The Vernal unit area is characterized by rather wide extremes in temperature and precipitation. Ordinarily summer days are warm with occasional short periods of hot weather. Summer nights are generally cool. Winters are cold and short. Maximum and minimum temperatures recorded at Vernal are 103° F. and -38° F., respectively. The mean annual temperature is 44° F. The humidity of the area is unusually low.

The frost-free period averages 119 days. Killing frosts, however, have occurred as late as the middle of June and as early as the last day of August.

Winds are common but seldom violent. During the spring months westerly winds often blow for several days at a time. Hail storms are rare and seldom damage crops.

Precipitation averages 8.52 inches annually but varies widely from year to year. Variations are 171 to 53 percent of normal. Summer rains frequently augment the streamflow during July, August, and September. At times these storms reach cloudburst proportions, causing some damage. Annual precipitation in the mountains to the north, chiefly winter snows, averages more than 19 inches.

A Weather Bureau station has been maintained at Vernal since 1894. Climatic data for this station are tabulated below.

Summary of climatic records at Vernal (1894-1955)

	Precipitation (inches)					
		Yearly maximum	Yearly minimum	Temperature (degrees F.)		
Month	Average	(1941)	(1934)	Average	Maximum	Minimum
January	0.55	0.69	0.58	15	54	-38
February	.49	.30	.22	22	62	-32
March	.69	.62	1/T	34	75	-12
April	.91	1.96	.76	46	84	5
May	.79	.70	.20	54	90	12
June	.68	1.22	.47	62	100	25
July	.53	.33	.35	69	103	33
August	.82	2.07	.51	67	99	32
September	.84	2.60	0	59	94	17
October	.97	3.07	0	48	84	8
November	.57	.55	1.13	33	72	-16
December	.68	.67	.40	21	61	-32
Annual	8.52	14.78	4.62	44	103	-38

1/ Trace

Settlement

History

Settlement of the Vernal unit area began in 1873 when Pardon Dodds, an Indian agent from the Uintah-Ouray Indian Agency, established a ranch north of the present site of Maeser. In the following year other ranchers made their homes in the area, constructed ditches, and began to irrigate large tracts of land. The first ranches were devoted to livestock. General farming subsequently became the standard agricultural pattern. By

1900 most of the irrigable lands in the valley had been placed under production. Since 1900 only small areas have been developed. The tendency has been to divide original holdings to provide a livelihood for more families.

Population

Vernal, situated near the center of the unit area, is the largest trading center within a radius of 80 miles and is the only major community within the area. The farm population is concentrated in the rural communities of Maeser, Naples, Glines, Ashley, and Davis.

Present estimates place the population of the unit area at 7,090. Approximately 300 farm families reside in the area. Population by communities as reported by the Bureau of Census for 1940 and 1950 is shown below.

Community	1940	1950
Vernal	2,119	2,845
Maeser	770	873
Naples	620	608
Glines	395	454
Ashley	725	499
Davis	466	429
Total	5,095	5,708

A marked increase in population has resulted since 1944 from expansion of the oil industry in the Rangely district of Colorado, 50 miles east of the unit, and from a new oil field in the southern portion of Ashley Valley. Because Vernal is the nearest trading center, it has absorbed most of the influx of workers and prospectors. Many new homes and business buildings have been constructed to meet housing and business needs.

Industrial Development

Local industry

General farming is the major industry of the Vernal unit area. Agricultural development centers around livestock production and the raising of forage crops and small grains for livestock feed. Sheep and cattle are grazed on Federal lands in the Uinta Mountains north of the unit area.1/ Although the mainstay of the area's economy, production of both crops and livestock is limited by insufficient water supplies. Crop

1/ Some of these lands are administered by the Forest Service and some by the Bureau of Land Management.

yields are low and outright crop failures occur. Also, despite actions taken pursuant to the Taylor Grazing Act of 1934 providing for orderly use of the Federal range, range lands are seriously depleted by overgrazing and drouth.

Several industries centered around agricultural production have been established in the unit area. These include creameries, a flour mill, and meat-processing plants.

Agriculture is followed in industrial importance by the production and processing of large deposits of mineral resources. Gilsonite, a hydrocarbon found only in the Uinta Basin, is mined at several points near the unit area for use in a variety of products such as battery cases, paints, varnishes, and roofing compounds. Its exploitation has attracted a large amount of outside capital. A recently completed pipeline conveys pulverized gilsonite suspended in water to a new refinery near Fruita, Colo., where the gilsonite is processed into gasoline and other fuels. Native rock asphalt is mined from extensive deposits in the area west of Vernal. Sub-bituminous coal also is mined near the unit area.

Oil is produced in the southern portion of Ashley Valley, as well as in the nearby Rangely district. Most of the oil is transported by pipeline for processing in Salt Lake City, but a small refinery at Jensen, 12 miles from Vernal, produces gasoline and other petroleum products for local consumption. A plant is also operated at Jensen for processing natural oil for fuel oil, asphalt paints, and road-surfacing material.

Lumber from nearby forests is processed for local consumption by a number of small mills. Mine timbers are cut and hauled to the Carbon coal area in Utah and the Sweetwater district in Wyoming.

Public facilities

U. S. Highway 40, one of the Nation's chief transcontinental routes, passes through Vernal and connects the town with Salt Lake City, 180 miles to the west, and Denver, 340 miles to the east. Adequate roads connect the outlying districts of the unit area with Vernal. Frontier Airlines provides service from Vernal to Salt Lake City and Grand Junction, Colo. The area has no railroad facilities, the nearest accessible rail terminals being at Craig, Colo., 120 miles east of Vernal, and Heber, Utah, 130 miles to the west. The lack of railroads is not a serious handicap, however, because of the airline service and the truck and bus service available on the highway.

Electric energy is supplied to Vernal by the Utah Power and Light Company and to the surrounding area by the Moon Lake Electric Association, a Rural Electrification Administration cooperative. The two systems are not interconnected. Energy for the Utah Power and Light Company's system

is produced by a 250-kilowatt hydroplant located on Ashley Creek 9 miles northwest of Vernal and a 3,470-kilowatt diesel-electric plant located in Vernal. The Moon Lake Electric Association produces energy at its 900-kilowatt Yellowstone hydroplant on the Yellowstone River; a 600-kilowatt diesel-electric plant at Altamont, Utah; and a 4,344-kilowatt combination steam- and diesel-electric plant at Rangely, Colo. The plants are connected by a 69,000-volt transmission line, and rural distribution is made at 13,200 volts.

The Flaming Gorge unit of the Colorado River Storage project, which includes a large hydroelectric development on the Green River about 35 miles north of Vernal, is under construction. Flaming Gorge power will very likely be available to Ashley Valley and surrounding areas with resulting stimulation of industrial development.

Domestic water is supplied to Vernal and adjoining communities from Ashley Spring on Ashley Creek just above the hydroelectric powerplant of the Utah Power and Light Company. A steel pipe, 12 inches in diameter and with a capacity of 7 second-feet, conveys water to the headworks of the distribution system. Many farmers haul their culinary water and a few obtain it from irrigation ditches.

Elementary schools at Vernal, Maeser, and Naples serve the entire unit area. Pupils are transported by bus from the outlying areas. A high school in Vernal serves most of Uintah County.

Recreational areas have been set aside within the nearby Ashley National Forest for the use of picnickers and tourists. Recreational use is not highly developed, but many excellent sites are available for development.

Irrigation development

Ashley Creek is characterized by high discharges from snowmelt in May and June followed by rapidly receding flows which are far below irrigation requirements. As early as 1888, efforts were made to develop storage for the erratic water supply. To date, however, only about 1,100 acre-feet of storage capacity is available on Ashley Creek. This is provided in a group of small glacial lakes (Long Park, Twin Lakes, Mirror Lake, and Goose Lake) on the headwaters of Ashley Creek. An additional 5,740 acre-feet of capacity is provided for the Vernal unit area in Oaks Park Reservoir on Brush Creek which lies north of Ashley Creek. Water is diverted by the Oaks Park Canal from the reservoir to Ashley Creek.

Presently irrigated lands in the unit area are served by six major canals and ditches diverting from Ashley Creek. These include the Ashley Upper, Ashley Central, Highline, and Rock Point Canals and the Island and Dodds ditches. The Colton ditch is combined in the Ashley Upper Canal and the Hardy ditch in the Ashley Central Canal. In addition to the

diversions by the main canals and ditches, there are some small diversions made by individuals or small groups of private interests. In the southern portion of Ashley Valley the Union and River Canals supply some small areas with high water from Ashley Creek and return flows from irrigated lands in the unit area.

Undeveloped resources

Although great strides have been made in recent years in developing natural resources in the vicinity of the Vernal unit area, there is a big potential for still more development. Some water, land, mineral, and timber resources still remain unused.

Presently irrigated lands in the unit area have an inadequate late-season water supply, and nearby areas of arable land are lying idle for lack of water. At the same time high spring flows run unused because storage facilities are not available to smooth out the flows to meet beneficial use requirements.

An estimated 5 percent of the world's known phosphate reserves lie undeveloped in or adjacent to Ashley Valley and large deposits of oil shale and sub-bituminous coal remain unused. Additional oil fields also may be found upon further exploration.

Extensive timber stands in the Uinta Mountains are undeveloped. The Forest Service estimates the annual marketable growth at more than 25 million board-feet, only a third of which is now being cut. Timber available from local mills is not finished. The local demand for lumber exceeds the supply, necessitating large imports from the Pacific Northwest. Expansion of the lumber business and establishment of finishing facilities for the lumber produced would supply most of the needs of the area.

Needs of the Area

Agriculturally Ashley Valley has been an area of limited opportunity, of depressed incomes, and relatively low standards of living. The unfavorable economic condition of the farm people is indicated by the type and condition of farm dwellings and other buildings, by the farm and home conveniences, and by the kind of rural roads and other public services, all of which are below the average for the State of Utah. Uintah County farms are considerably below State averages in the percentages having telephones and piped water service and slightly below in electric lighting service.

Most of the young people have been forced to migrate outside the area to find livelihoods. In recent years some economic stimulation has resulted from mineral resource developments, particularly in the fields of petroleum and gilsonite, but the fundamental farm situation is largely unimproved.

The greatest need of the farmers is for additional irrigation water after high springtime flows recede. The limited reservoir storage capacity now available is far from adequate in meeting the storage needs of the irrigators. Late-season water is urgently needed to bring crops to full maturity. Additional forage crops are required to supplement grazing and stabilize the livestock industry.

Local industry and employment will be stimulated for a few years by construction of the nearby Flaming Gorge unit of the Colorado River Storage project. The abundant power that will be produced at that development should provide a continuing stimulus, particularly in industrial and mineral resource development. The municipal water supply for Vernal, Maeser, and Naples, that are now served by a piped system, is barely adequate for existing needs. Additional municipal water will be needed if the population increases as is now anticipated.

Previous Reports

The Vernal unit was originally investigated by the Bureau of Reclamation as an independent project. A tentative project report dated January 1949 was reviewed by various interests at the field level and their comments were solicited for consideration in the preparation of a feasibility report. Before the feasibility report was prepared, however, the Vernal development was adopted as a unit of the Central Utah project and as such it was covered by the feasibility report of February 1951, entitled Central Utah Project, Utah. (A Supplement to the Colorado River Storage Project Report). This latter report was submitted to Congress and was the basis for authorization of the Central Utah project as a participating project with the Colorado River Storage project by the Act of April 11, 1956.

CHAPTER II

POTENTIAL DEVELOPMENT

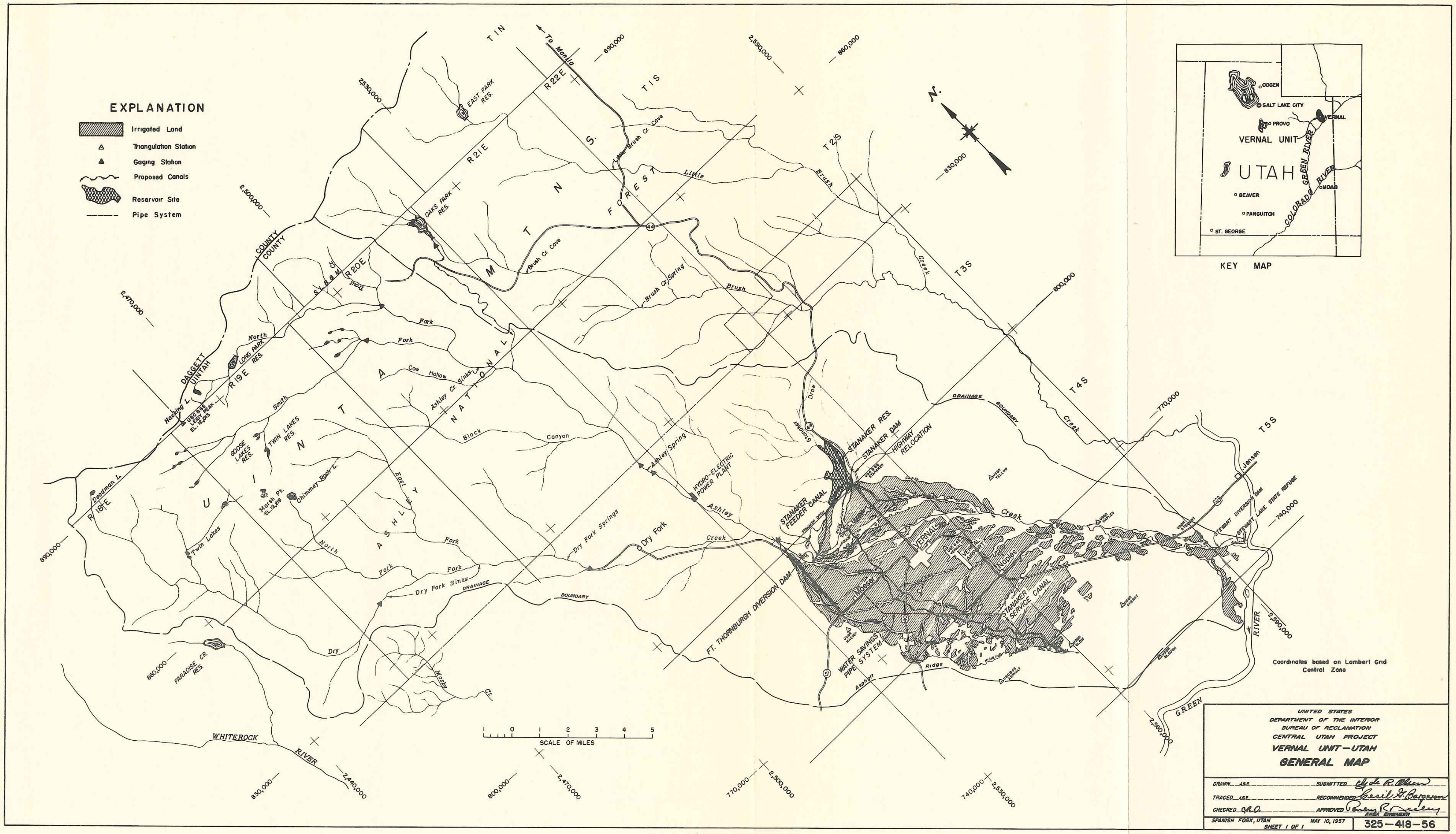
Unit Plan

Through storage regulation and water exchanges, the Vernal unit will provide water for irrigation and municipal use. It will provide an average of 18,000 acre-feet of supplemental irrigation water annually for 14,781 acres of irrigable land in the northern and central portions of Ashley Valley including farm lands and some residential lots in the Vernal town site. In addition it will increase the municipal water supply of Vernal, Maeser, and Naples by an average of 1,500 acre-feet annually. The unit will provide an increase in fish and wildlife values, development of new recreational areas, and incidental control of floods. It will not affect Indian lands nor involve problems of sediment and debris control nor navigation. No practical possibilities exist for hydroelectric power production in connection with the unit development. Power production at an existing small hydroelectric plant on Ashley Creek will be slightly reduced. Features of the unit plan are shown on the frontispiece map and on the map on the following page.

Excess flows of Ashley Creek will be regulated at the Stanaker Reservoir that will be constructed to a capacity of 37,560 acre-feet at an offstream site on Stanaker Draw about 3.5 miles north of Vernal. The water from Ashley Creek will be diverted by the Ft. Thornburgh Diversion Dam that will be constructed on the creek 4 miles northwest of Vernal. From the diversion dam the water will be conveyed eastward to the reservoir through the 3.1-mile long Stanaker Feeder Canal. Reservoir water will be released to the Stanaker Service Canal and conveyed south 11.8 miles to existing canals and ditches that will be intercepted by the service canal.

Part of the reservoir water conveyed by the Stanaker Service Canal will be provided directly for unit lands below the canal as a supplemental irrigation supply and part will be utilized as a replacement supply to these lands in exchange for natural streamflow and storage releases from existing reservoirs that will be diverted upstream. The exchange water made available upstream will be used for municipal purposes in Vernal, Maeser, and Naples and for supplemental irrigation of unit lands above the Stanaker Service Canal.

The municipal water will be diverted from Ashley Spring on Ashley Creek and will be distributed through existing facilities. Treatment of the municipal water will be the responsibility of the communities receiving the water.



INTERIOR -- RECLAMATION, SLC, UTAH

Irrigation water will be distributed primarily through major existing canals and ditches, including the Ashley Upper, Ashley Central, Rock Point, and Highline Canals and the Island and Dodds ditches. Some water also will be distributed by small canals and laterals in private ownership in an area along Ashley Creek, known as the River Bottom area. Diversion structures for the Rock Point and Ashley Central Canals and the Island and Dodds ditches will be included in the Ft. Thornburgh Diversion Dam as existing headworks for these structures are in the vicinity of the diversion dam and will not be useable with construction of the dam. Water for the Ashley Central Canal will be diverted by the dam for control and measurement and then will be returned to the creek channel for rediversion farther downstream by an existing structure. As at present the Ashley Upper and Highline Canals will divert from Ashley Creek above the diversion dam. The Stanaker Service Canal will intercept and provide water to some existing canals and ditches, including the Ashley Central and Rock Point Canals and the Island and Dodds ditches, as well as some laterals of these canals and ditches and of the Ashley Upper Canal. Some new laterals also will be constructed for distribution of the water from the Stanaker Service Canal. Rehabilitation work on the existing canal systems will be undertaken independently by the water users.

It is possible that a drainage system may be required with unit development. The design of the system cannot be made, however, until after the irrigation features are in operation. To prevent seepage losses, some portions of the existing canals may be earth lined in areas where drainage requirements may occur. Unit cost estimates include lump sum allowances for drains and canal lining.

A Water Savings pipe system, consisting of two branches and with a total length of 17.3 miles, will be constructed to serve stock water during the nonirrigation season to rural areas in the vicinity of Maeser, Glines, Davis, Naples, and Ashley. This system will divert from the existing municipal pipeline about 5 miles below the pipeline head at Ashley Spring. The system is planned to save a substantial amount of water for diversion to Stanaker Reservoir by eliminating the comparatively heavy losses in the unlined canals and ditches now serving stock water to the rural areas during the nonirrigation season. Chlorination of water in the Water Savings pipe system is not now planned as the water is intended only for livestock but it could be provided through negotiation if found desirable. Stock-water requirements during the irrigation season will be met from irrigation diversions.

The increase in pipeline diversions at Ashley Spring for municipal uses and for stock water will decrease the water supply and power production at the Utah Power and Light Company's 250-kilowatt hydropower plant on Ashley Creek. No allowance has been made in the unit analysis for curtailment in the power production, however, as long continued operation of the plant is believed to be uncertain. Operating costs of the plant are high and an abundance of new power is expected to be available soon

from the Flaming Gorge unit of the Colorado River Storage project. Also the Federal license for the powerplant will expire in 1966.

With a low-elevation natural drainage area of only 19 square miles above the Stanaker Dam, natural inflow will, with but very rare exceptions, be controlled in Stanaker Reservoir. A surcharge capacity of 2,170 acre-feet above the normal water surface elevation will be reserved for flood water. Construction of the Vernal unit will thus reduce and possibly eliminate the infrequent flood flows on Stanaker Draw, which in the past have not been seriously destructive. Flood control benefits that will result from diversions from Ashley Creek to Stanaker Reservoir are not significant.

Facilities for recreation and fish and wildlife will be provided as recommended by the National Park Service and Fish and Wildlife Service, respectively. The recreational development will be constructed on the northwest side of Stanaker Reservoir. It will include an access road and an orderly arrangement for picnicking and boating with necessary parking facilities. The program for fish and wildlife includes acquisition and development of areas for upland game and improvement of the Stewart Lake State Refuge at the confluence of Ashley Creek and Green River. The refuge improvement will include pumping facilities and a pipeline to convey water to the lake from Green River. The developments for recreation and fish and wildlife are discussed further in Chapter VIII and in reports of the National Park Service and Fish and Wildlife Service which are appended to this report.

Modifications in Unit Plan

Modifications to date

Detailed studies conducted since issuance of the Central Utah project report in February 1951 have revealed the desirability of modifying the plan of development for the Vernal unit considered at that time. The basic purposes of the development remain the same. All contemplated modifications appear to be within the scope of the development as authorized by Congress so that reauthorization is unnecessary. Changes have been made in the amount of irrigation water provided, the acreages of agricultural land to be served, and in some unit works. The estimated cost of facilities has been changed as a result of more detailed surveys and designs and of changes in construction prices.

Modifications in Water Supply

The municipal water supply for the Vernal unit remains at an average of 1,500 acre-feet annually as provided in the 1951 report. The average annual irrigation supply, however, has been decreased from 23,400 acre-feet to 18,000 acre-feet. This decrease results largely from the fact

that irrigation efficiencies have been found to be lower than was previously estimated so that more water is required to satisfy present rights, leaving less available for unit development.

Modifications in Unit Acreage

The irrigable land area in the Vernal unit has been reduced from 24,970 to 14,781 acres since the 1951 report was issued. The 3,400 acres of full service land that were included in the 1951 report have been eliminated from the plan and the acreage of supplemental service land has been reduced from 21,570 to 14,781 acres. Acreage changes have resulted primarily from the reduction in the estimated available water supply and from refinements in the land classification and economic studies. Some isolated lands originally included in the unit have been eliminated as their location would necessitate excessive construction costs. Other lands have been excluded as it was found that the drainage required for their efficient utilization could not be economically justified. Lands in the southern portion of the valley under the Union and River Canals are not now included in the irrigable area because of the poor quality of the return flow water that would be available to these lands.

Modification in Unit Works

The route of Stanaker Service Canal has been modified to take advantage of a more gentle gradient. The canal now will be entirely of new construction and will not incorporate any portion of the existing Ashley Central Canal as previously planned. The Ashley Central Canal will discharge into the Stanaker Service Canal, however, at their point of intersection northwest of Vernal. Below this point some sections of the Ashley Central Canal will be abandoned and other sections will be used as laterals to distribute part of the water conveyed by the Stanaker Service Canal. Some of the lateral rehabilitation originally planned as part of unit development will now be undertaken independently by the water users.

Stanaker Dam has been redesigned and the capacity of its reservoir increased slightly, from 37,000 to 37,560 acre-feet. The outlet of the reservoir has been raised about 8 feet to serve the modified Stanaker Service Canal. Thus the inactive storage capacity has been increased from 3,000 acre-feet to 4,360 acre-feet and the active storage capacity decreased from 34,000 to 33,200 acre-feet.

A new feature of the Vernal unit plan is the Water Savings pipe system for distribution of stock water to the rural areas of Ashley Valley during the nonirrigation season. This pipe system has been included in the plan to save canal losses during the nonirrigation season and thus increase the storable water supply for unit development.

Facilities for recreation and fish and wildlife propagation, although contemplated in the 1951 report, were not identified. The National Park Service has since recommended a development for boating and picnicking. The program for fish and wildlife includes acquisition and development of land for upland game and improvement of the Stewart Lake State Refuge.

Modifications in Unit Costs

The overall cost estimates for the Vernal unit have been increased by refinements in designs, by modifications in required facilities, and to a greater degree by price increases occurring since the original studies. Construction costs are now estimated at $6,874,000 on the basis of January 1957 prices. This amount compares with $6,124,850 estimated in the 1951 report on the basis of December 1949 prices and with the estimate of $7,048,000 based on January 1953 prices that was presented to congressional committees in hearings on the authorizing legislation in 1955. Operation, maintenance, and replacement costs are now estimated at $22,800 on the basis of prices existing between 1954 and 1956. This amount compares with $20,770 estimated in the 1951 report on the basis of 1939-44 prices and with $38,720 estimated in 1955 for congressional committees on the basis of the 180 price level (1939=100).

Modifications in Financial Analysis

The cost allocations presented in the authorizing report were determined by averaging results of the alternative justifiable expenditure method and the priority-of-use method. Suballocations were then made to the different municipal water areas. Allocations for each unit of the Central Utah project are presently being made by the separable costs-remaining benefits method.

Future modifications

Future studies and changing conditions may show the desirability of additional modifications in some of the unit works before final designs and estimates for these works are prepared.

The Water Savings pipe system for the distribution of stock water to rural areas is now planned only for operation during the nonirrigation season. Since few of the rural residents now have a satsifactory domestic water supply, it is possible that they may desire to build a domestic and stock-watering system for year-round service that will include the service planned for the Water Savings pipe system. If the rural people desire to undertake the larger water system, they could negotiate with the Federal Government as to the extent to which it would participate in lieu of construction of a pipe system for water only during the nonirrigation season.

When the Vernal unit is in operation, the quantity and quality of return flow water can be determined. If the water is suitable, it could be used to supplement supplies available to the Union and River Canals in serving lands that are not presently in the unit plan.

The location and designs of unit land drains will be based on a study of seepage conditions following the application of the unit water to the area.

CHAPTER III

DESIGNS AND ESTIMATES

Design and Construction Considerations

Accessibility

All construction sites for features of the Vernal unit are within 6 miles of Vernal and can be readily reached over the local road net. U. S. Highway 40 passing through Vernal connects the area with railroad terminals at Heber, Utah, 130 miles to the west, and Craig, Colo., 120 miles to the east. With minor extensions of existing lines, power and telephone service will be adequate for construction needs. Permanent construction camps will not be required as housing facilities for the workers can be obtained at communities near the work sites.

Construction program

A period of about 4 years will be required for construction of the dams and canals in the Vernal unit. An additional 3 years will be required for completion of the drains, which will not be finally designed until after the new water is applied to the land. Construction will be undertaken first on the Stanaker Dam with work started first on the highway relocation. Soon after the Stanaker Dam is underway, work will be commenced on the Ft. Thornburgh Diversion Dam, the pipe system, and on the feeder and service canals. Construction work will be continued throughout the year except during periods of heavy frost. In a few locations the work will have to be done during the nonirrigation season to avoid interference with present irrigation practices. The construction control schedule is shown on the following page.

Preliminary geologic investigations have been made by the Bureau of Reclamation at the sites of all of the major unit works. Topographic surveys have been made at dam and canal sites and at sites of major canal structures. The dam sites have been core drilled and auger holes have been driven along the sites of the feeder and service canals and the pipeline. Preliminary investigations also have been made of embankment materials for dam construction.

Unit Works

Stanaker Reservoir and Dam

Reservoir and Dam

Stanaker Reservoir, to be constructed at an offstream site about 3.5 miles north of Vernal, will have a capacity of 37,560 acre-feet, including 33,200 acre-feet of active capacity and the 4,360 acre-feet of inactive

LEGEND: Types of Activity

Preconstruction | Construction

LINE NO.	CLASS AND ACCOUNT	PROGRAM ITEM	QUANTITY	UNIT	ESTIMATED TOTAL (Jan. 1957 prices)	TOTAL TO JUNE 30,	FISCAL YEARS							BALANCE TO COMPLETE	ESTIMATED COMPLETION DATE	LINE NO.
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
1																1
2		Irrigation development, - supplemental	14,781	Ac.							14,781					2
3		Municipal water	1,500	A.F.							1,500					3
4																4
5	108	CONSTRUCTION PROGRAM														5
6	.01.01	Stanaker Dam and Reservoir	37,560	A.F.	1/ 3,870,000		190,000	1,350,000	1,350,000	980,000	Storage initiated					6
7	.02.01	Ft. Thornburgh Diversion Dam			200,000			6,000	130,000	64,000						7
8	.05.01	Stanaker Service Canal	11.8	Mi.	1,060,000			210,000	320,000	320,000	210,000					8
9	.05.02	Stanaker Feeder Canal	3.1	Mi.	570,000			150,000	295,000	125,000						9
10	.05.03	Water Savings pipe system	17.3	Mi.	340,000			10,000	200,000	130,000						10
11	.06.01	Stanaker Canal laterals	1.6	Mi.	40,000				25,000	15,000						11
12	.07.01	Vernal area drainage system			675,000				34,000	68,000	100,000	135,000	170,000	168,000	1964	12
13	.15.01	Recreational development at Stanaker Reservoir			92,000				45,000	47,000						13
14	.15.11	Fish and wildlife development			27,000					10,000	17,000					14
15																15
16		Total Construction costs			6,874,000		190,000	1,726,000	2,399,000	1,759,000	327,000	135,000	170,000	168,000		16
17																17
18																18
19																19
20																20
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31																31
32																32
33																33

Notes: 1/ Priced as of April 1, 1957.

Recommended: _____ (Operating Office Head) _____ (Date)

Recommended: _____ (Regional Director) _____ (Date)

Recommended: _____ (Chief, Div. of P C F) _____ (Date)

Approved: _____ (Commissioner) _____ (Date)

Revised: _____ (Date)

SHEET 1 OF 1 SHEETS

Form PF-2 August 1955

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

CONTROL SCHEDULE
FOR THE
CENTRAL UTAH PROJECT—VERNAL UNIT-UTAH
PROJECT OR UNIT

Spanish Fork Development (OFFICE) May 17, 1957 (DATE) 4 (REGION)

☐ GENERAL INVESTIGATIONS ☐ OPERATION & MAINTENANCE
■ CONSTRUCTION ☐ OTHER

INTERIOR - - RECLAMATION, SLC, UTAH

capacity. No allowance is made for silt deposition as only slight amounts of sediment are expected to accumulate in the reservoir. The normal water surface elevation of the reservoir will be 5,516.2 feet and the minimum elevation, at dead storage level, will be 5,446 feet. At normal elevation the reservoir will cover an area of 840 acres. Above the normal water surface elevation the reservoir will have a surcharge capacity of 2,170 acre-feet that will be used only for flood control.

Stanaker Dam, as shown on the drawing on the following page, will be a rolled earth-fill structure 140 feet high above streambed and 2,400 feet long at the crest. Cutoff trenches 20 feet wide will be constructed to a depth of 5 feet in the upstream foundation of the dam. The dam embankment will consist of rolled layers of zoned earth materials. The center impervious zone of the embankment will grade into pervious outer zones on both the upstream and downstream slopes. The upstream face of the dam will be blanketed with a 4-foot layer of rock riprap. The downstream face will be covered with rock fill. No parapet or roadway on the top of the dam is planned.

Appurtenant Works

An emergency spillway 50 feet wide and 210 feet long will be cut through the rock on the right abutment of the dam. The reservoir outlet, also on the right abutment, will include a concrete-lined circular conduit 6 feet in diameter extending from the intake structure to the gate chamber located near the dam axis. The outlet also will include a $6\frac{1}{2}$-foot diameter flat-bottomed tunnel from the gate chamber to the stilling basin which will be located at the head of the Stanaker Service Canal. The dome-shaped concrete gate chamber will enclose four high pressure gates, each 2 feet 3 inches square. The outlet capacity will be 300 second-feet with the reservoir water surface at elevation 5,472 feet.

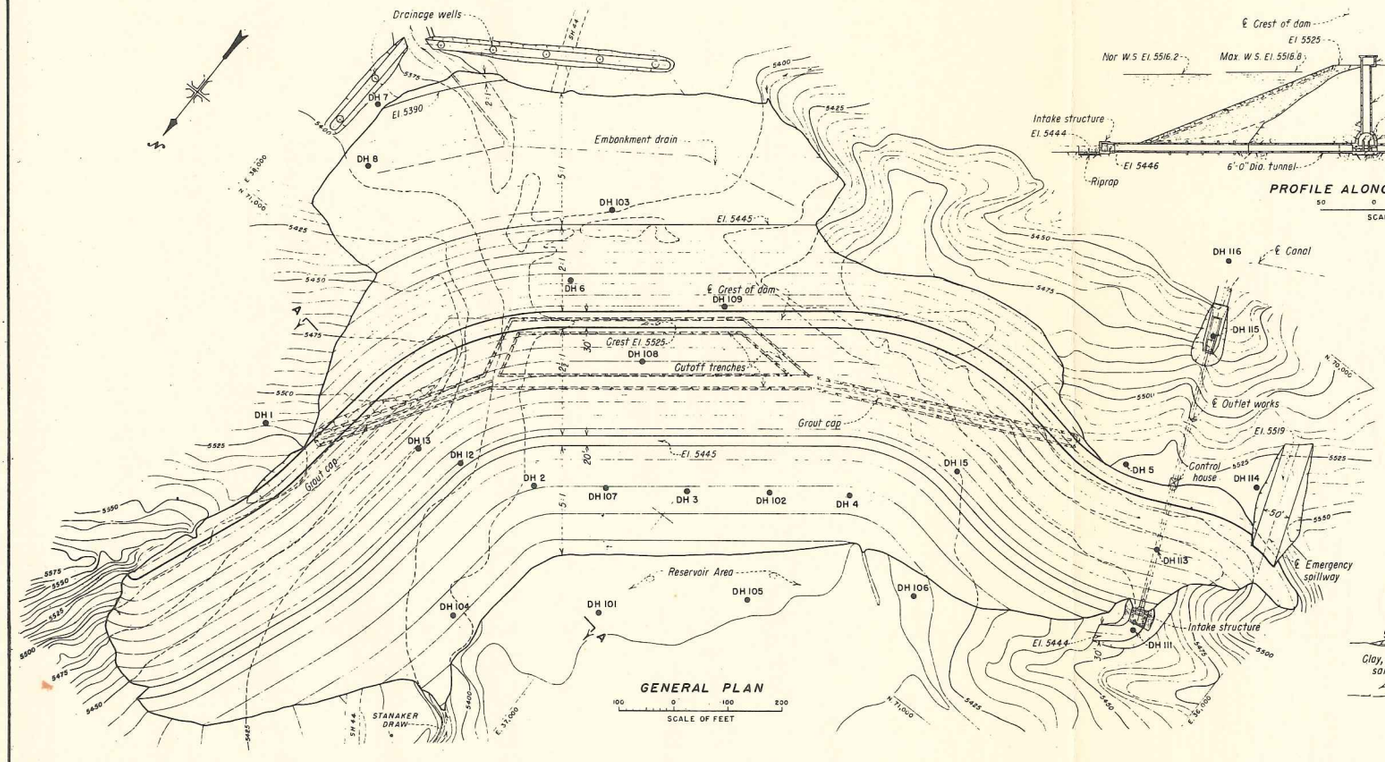
Design Flood

The maximum probable flood in a 100-year period from the 19 square miles of area naturally tributary to Stanaker Reservoir was estimated to have a peak discharge of 10,500 second-feet and an 18-hour volume of 2,170 acre-feet. In estimating this maximum flood, consideration was given to precipitation, snowmelt, and other related runoff data.

The Stanaker Reservoir was designed to absorb the design flood in its 2,170 acre-feet of surcharge capacity above the normal water surface elevation. With an outlet discharge of 240 second-feet, limited by the capacity of the Stanaker Service Canal above its Ashley Creek crossing, the full surcharge could be evacuated in a period of $4\frac{1}{2}$ days.

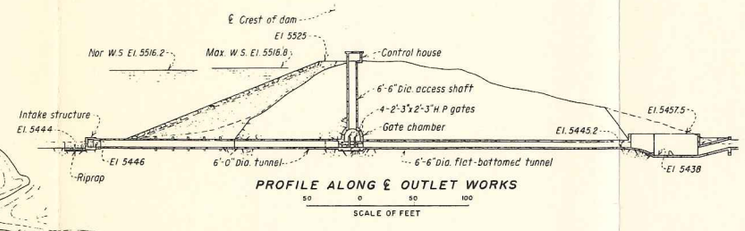
Relocation, Rights-of-way, and Reservoir Clearing

State Highway No. 44 which passes through the dam and reservoir area will have to be relocated above the high water level for a distance



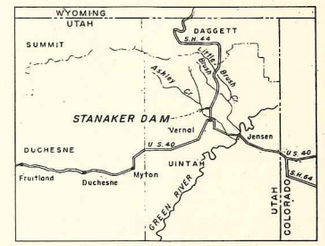
GENERAL PLAN

SCALE OF FEET

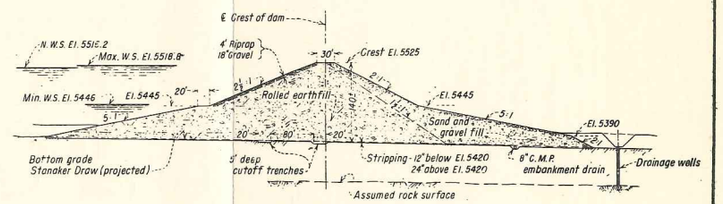


PROFILE ALONG ℄ OUTLET WORKS

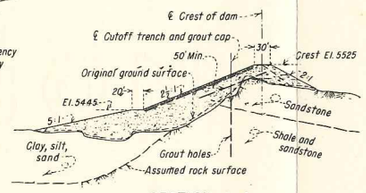
SCALE OF FEET



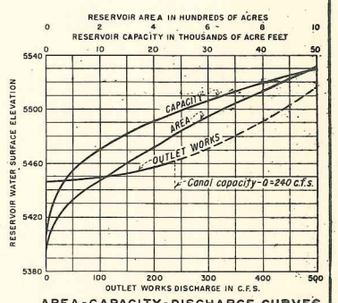
LOCATION MAP



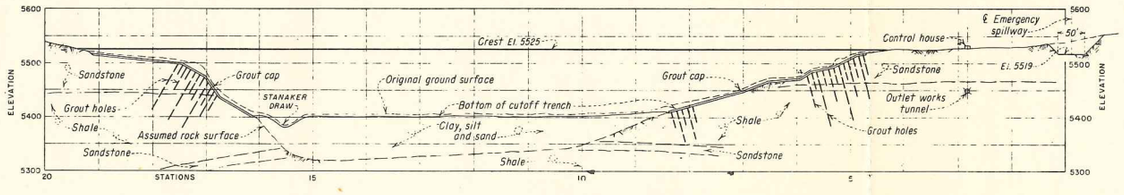
MAXIMUM SECTION



SECTION A-A



AREA-CAPACITY-DISCHARGE CURVES



PROFILE ALONG UPSTREAM CUTOFF TRENCH

RESERVOIR STORAGE ALLOCATION

PURPOSE	ELEVATION	STORAGE ACRE FEET
Irrigation	5451.4 to 5516.2	33,200
Inactive	5446.0 to 5451.4	1,094
Dead	Streambed to 5446	3,266
Total storage capacity		37,560

A surcharge of 2,170 a.f. (Max. W.S. El. 5518.8) is provided to protect against the inflow design flood having a peak of 10,500 c.f.s. and an 18 hour volume of 2,170 a.f. The canal outlet of 240 c.f.s. capacity can evacuate this surcharge in 4½ days.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL UTAH PROJECT
VERNAL UNIT - UTAH

STANAKER DAM

FEASIBILITY DESIGN DRAWING

DRAWN W.G.H. SUBMITTED
TRACED E.M.W. RECOMMENDED
CHECKED APPROVED
ASSOCIATE CHIEF ENGINEER

DENVER, COLORADO, APRIL 5, 1957 | 325-D-1

INTERIOR - RECLAMATION, SLC, UTAH

of 2.5 miles. Approximately 3 miles of power lines and 1.5 miles of telephone lines also will have to be relocated.

Acquisition of rights-of-way for the dam and reservoir will necessitate the purchase of about 890 acres of land now in private ownership, including four farmsteads. Most of the land in the reservoir area is cultivated or undeveloped range that will present only minor clearing problems.

Geologic Conditions and Construction Materials

Geologic conditions at the Stanaker site were found suitable for the dam as planned. Highly impervious shale and sandstone will form the abutments. The foundation bedrock is covered by a mantle of fine alluvial valley-fill material with a maximum depth of 90 feet. The abutments are covered by a layer less than 5 feet thick of talus, loose blocks, and decomposed shale. No faulting is in evidence in the dam site area.

Impervious materials in ample quantities for construction of Stanaker Dam are found within a mile of the site. A shallow deposit of pervious material is also located within a mile of the site and another deposit is 2.5 miles from the site. Rock riprap material can be quarried from Frontier sandstone formations at the site. Concrete aggregates can be crushed from cobbles along the bed of Ashley Creek or they can be obtained from deposits along the Green River near Jensen, about 18 miles from the dam site over well maintained roads.

Ft. Thornburgh Diversion Dam

The Ft. Thornburgh Diversion Dam on Ashley Creek at the head of the Stanaker Feeder Canal will replace an existing upstream diversion dam and a section of a canal that serves the Rock Point and Ashley Central Canals and the Island and Dodd ditches. The diversion dam will consist of a rock-fill overflow weir section with a timber sheet piling core and a compacted earth-fill dike on either side. The dikes will extend laterally from the weir section approximately 370 feet on the right side of the creek and 330 feet on the left side. The weir section is designed to pass a maximum probable flood over a 50-year period with a peak discharge of 3,400 second-feet. A reinforced concrete sluiceway and canal headworks will be constructed on the left side of the weir section. The canal headworks will have a diversion capacity of 680 second-feet, including 280 second-feet for the Rock Point and Ashley Central Canals and the Island and Dodds ditches and 400 second-feet for the Stanaker Feeder Canal. Water for the Ashley Central Canal will pass through the canal headworks for control and measurement and then will be returned to the creek channel for rediversion farther downstream.

The foundation at the Ft. Thornburgh Diversion Dam site consists of creek sands and gravels to a depth of about 28 feet over shale and soft

sandstones. The foundation is considered adequate for the type of structure contemplated.

Earth-fill material for the dikes can be obtained from the creek bed. Concrete aggregates in the immediate area have not been tested. If they are unsuitable, aggregates could be hauled from the Green River near Jensen, Utah, 20 miles away. Riprap can be obtained from the borrow areas near the Stanaker Dam site or from other nearby areas.

The dam site is on privately owned land. Thus, a small acreage will have to be purchased for right-of-way.

Stanaker Service Canal

Stanaker Service Canal extending generally south from the stilling basin of the Stanaker Dam will be about 11.8 miles in length. It will convey regulated reservoir releases to the existing Rock Point and Ashley Central Canals and to the Island and Dodds ditches as well as to some laterals of these canals and ditches and to laterals of the Ashley Upper Canal. As its capacity permits, the canal will also convey flood water releases from the Stanaker Reservoir to the channel of Ashley Creek.

For the first 199 feet of its length, above its turnout for the Rock Point Canal, the Stanaker Service Canal will have a capacity of 300 second-feet. At the Rock Point turnout its capacity will be reduced to 240 second-feet. Progressive reductions in capacity will be made at additional irrigation turnouts until a capacity of 20 second-feet is reached for the last canal section. At its Ashley Creek crossing and wasteway the canal will have a turnout capacity of 240 second-feet. The siphon across Ashley Creek will have a capacity of 210 second-feet.

The upper 2,889 feet of the Stanaker Service Canal will be concrete lined. The remaining portion will be either earth lined or unlined. Canal turnouts will be of reinforced concrete and will include water-measuring devices.

An operating road will be provided along the embankment for the entire length of the canal, and the canal right-of-way will be fenced. A two-lane timber bridge will be provided for the U. S. Highway 40 crossing. Timber county road and farm bridges will also be constructed.

The fine sandy loams and silts from canal excavation are suitable for compacted earth lining required for the canal where the excavation will be in gravel and cobble. Riprap can be obtained from the cobble canal excavation or from the Stanaker Dam site. Aggregates for concrete structures may be obtained from deposits at Jensen, Utah.

Right-of-way from 60 to 100 feet wide will be required for the canal. The total area required will amount to 120 acres, most of which is privately owned and cultivated.

Stanaker Feeder Canal

Stanaker Feeder Canal, extending eastward from Ft. Thornburgh Diversion Dam to Stanaker Reservoir, will be 3.1 miles long. It will include 8,497 feet of unlined section, 6,106 feet of earth-lined section, 500 feet of concrete-lined section, 324 feet of concrete structures, and 739 feet in concrete drop structures which will lower the water to an elevation just above the maximum water surface elevation of the reservoir. Two concrete baffled-apron sections will convey the water from the last drop to the reservoir when the reservoir water surface is below the maximum elevation.

The major canal structures will be of reinforced concrete and precast concrete. Irrigation crossing structures will be provided and timber bridges will be constructed for farm and county road crossings.

Aggregate for concrete lining and structures may be obtained from tested deposits at Jensen, Utah, an average distance of about 18 miles from the canal route.

A 100-foot right-of-way, with a total area of 30 acres, will be required. All of the land is now in private ownership and part is cultivated.

Water Savings pipe system

The Water Savings pipe system will branch from the existing 12-inch pipeline that conveys water from Ashley Spring to Vernal, Maeser, and Naples for domestic and municipal use. The connection will be made at a point about 4 miles northwest of Vernal where the municipal system's chlorination house is located and where the existing Maeser line branches from the system.

From the connection point a pipe and lateral system with a total length of 17.3 miles will extend south and east to serve farms in the Ashley, Glines, Davis, and Naples areas surrounding Vernal. The pipe will be welded steel, asphalt dipped, and wrapped with a protective coating. It will vary in outside diameter from 8 to 4 inches. A lateral 4 inches in diameter will branch off from the main pipeline about 0.7 mile below the connection point and will extend eastward about 6 miles through the Ashley area north of Vernal. The main line will continue south and east through the Maeser, Glines, Davis, and Naples areas in the order named. Pressure-reducing valves will be installed along the system. Sublaterals and individual service connections are not planned as a part of the Federally constructed system.

Most of the pipe will be laid parallel to Uintah County roads and on public property. About 5.5 miles of the line, however, will be on private property.

Service canal laterals

The Ashley Central Canal will discharge into the Stanaker Service Canal at their point of intersection. Below that point some short sections of the Ashley Central Canal will be abandoned and other sections will serve as laterals to distribute water from the service canal. Three new laterals will be constructed to convey water from the service canal to segments of the Ashley Central Canal and a fourth will directly serve a land area located near the junction of the two canals. The four laterals will have a total length of about 1.6 miles and their capacities will range from 10 to 40 second-feet.

Land drains

The drainage system for the Vernal unit cannot be designed until the irrigation water is applied and the need for drainage is more definitely known. Some sections of existing canals will be earth lined to eliminate excessive seepage and possibly diminish the need for drains.

Recreational and Fish and Wildlife Facilities

Facilities for recreation and fish and wildlife propagation will be provided as discussed in Chapter VIII and in the attached reports of the National Park Service and Fish and Wildlife Service.

Cost Estimates

Construction costs

Construction costs of Vernal unit features that will be constructed under contracts with the Federal Government are estimated at $6,874,000 on the basis of January 1957 prices. These costs include allowances for investigations, engineering, overhead, rights-of-way, and contingencies. The cost estimates for individual unit features are itemized on the official estimate form on the following pages.

In addition to costs of features to be constructed under Federal contracts, the local irrigation water users will incur costs for improvement of their existing distribution systems. Also the municipal users may incur additional costs for filtration and chlorination works.

Form PF-1
(3-57)
Bureau of Reclamation

OFFICIAL
ESTIMATE

Project: Central Utah Project, Vernal Unit

Date of Estimate: May 1, 1957

Prepared by: L. E. Perigo, Jr. Approved by: Parley R. Neeley

Cost Classification	DESCRIPTION	Quantity	Unit Cost	Total Estimate	Labor and materials by contractor	Materials and Supplies by Govt.	Labor by Government Forces	Service Facilities	Investigations, Engineering and Other Costs	Previous Official Estimate
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	VERNAL UNIT									
01.01	Stanaker Dam and Reservoir			3,870,000	2,977,000	--	--	89,000	804,000	5,046,000
02.01	Ft. Thornburgh Diversion Dam			200,000	155,000	--	--	4,000	41,000	234,000
05.01	Stanaker Service Canal			1,060,000	810,000	--	--	24,000	226,000	722,000
.02	Stanaker Feeder Canal			570,000	436,000	--	--	13,000	121,000	305,000
.03	Water Savings pipe system			340,000	261,000	--	--	8,000	71,000	--
06.01	Stanaker Canal laterals			40,000	29,000	--	--	1,000	10,000	247,000
07.01	Vernal area drainage system			675,000	520,000	--	--	15,000	140,000	384,000
15.01	Recreational development			92,000	78,000	--	--	5,000	9,000	110,000
.11	Fish and wildlife development			27,000	23,000	--	--	1,000	3,000	--
	Total construction costs			1/ 6,874,000	5,289,000	--	--	160,000	1,425,000	7,048,000

1/ Includes $350,000 expended for past investigations from reimbursable funds. Does not include $82,000 expended for past investigations from nonreimbursable Colorado River Development Fund.

Form PF-1
(3-57)
Bureau of Reclamation

OFFICIAL
ESTIMATE

Project: Central Utah project, Vernal unit

Date of Estimate: May 1, 1957

Prepared by: L. E. Perigo, Jr. Approved by: Parley R. Neeley

Cost Classification	DESCRIPTION	Quantity	Unit Cost	Total Estimate	Labor and materials by contractor	Materials and Supplies by Govt.	Labor by Government Forces	Service Facilities	Investigations, Engineering and Other Costs	Previous Official Estimate
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	VERNAL UNIT									
01.01.	STANAKER DAM AND RESERVOIR			3,870,000	2,977,000	-	-	89,000	804,000	5,046,000
.30	Land and rights	904 ac.		163,800	126,000	-	-	3,800	34,000	
.31	Relocation of existing property-highway, utilities, canal			430,300	331,000	-	-	9,900	89,400	
.32	Clearing lands--reservoir			13,000	10,000	-	-	300	2,700	
.35	Dams--earth, crest length 2,400', 140' above streambed	37,560 a.f.		3,262,900	2,510,000	-		75,000	677,900	
02.01	FT. THORNBURGH DIVERSION DAM			200,000	155,000	-	-	4,000	41,000	234,000
.30	Land and rights			1,300	1,000	-	-	-	300	
.35	Dams--compacted earth fill, crest length 700', height above streambed 12', uncontrolled spillway			185,800	144,000	-	-	3,700	38,100	
.50	Roads, railroads, and bridges--access road	0.5 mi.		12,900	10,000	-	-	300	2,600	
05.01	STANAKER SERVICE CANAL			1,060,000	810,000	-	-	24,000	226,000	722,000
.30	Land and rights	120 ac.		40,500	31,000	-	-	900	8,600	
.31	Relocation of existing property--farm bridges, irrigation crossings			213,300	163,000	-	-	4,800	45,500	
.33	Structures and improvements--cattle guards, fences			52,400	40,000	-	-	1,200	11,200	
.36	Waterways--concrete-lined and unlined canal	11.8 mi.		458,000	350,000	-	-	10,400	97,600	
.37	Canal structures--siphons, checks, turnouts			230,300	176,000	-	-	5,200	49,100	
.38	Canal protective works			65,500	50,000	-	-	1,500	14,000	
05.02	STANAKER FEEDER CANAL			570,000	436,000	-	-	13,000	121,000	305,000
.30	Land and rights	30 ac.		5,200	4,000	-	-	100	1,100	
.31	Relocation of existing property--bridges			56,200	43,000	-	-	1,300	11,900	
.36	Waterways--earth-lined canal, concrete-lined canal, unlined canal; bottom widths 24', 10' and 6'.	3.1 mi.		253,800	194,000	-	-	5,900	53,900	
.37	Canal structures			248,300	190,000	-	-	5,600	52,700	
.38	Canal protective works			6,500	5,000	-	-	100	1,400	
05.03	WATER SAVINGS PIPE SYSTEM			340,000	261,000	-	-	8,000	71,000	
.30	Land and rights	21 ac.		5,200	4,000	-	-	100	1,100	
.36	Waterways--welded steel pipe system, capacity 432 g.p.m. to 50 g.p.m.	17.3 mi.		334,800	257,000	-	-	7,900	69,900	
06.01	STANAKER CANAL LATERALS			40,000	29,000	-	-	1,000	10,000	247,000
.30	Land and rights	5 ac.		2,700	2,000	-	-	-	700	
.33	Structures and improvements, fences	1.7 mi.		4,100	3,000	-	-	100	1,000	
.36	Waterways--earth laterals	1.6 mi.		8,300	6,000	-	-	200	2,100	
.37	Lateral structures			24,900	18,000	-	-	700	6,200	
07.01	VERNAL AREA DRAINAGE SYSTEM			675,000	520,000	-	-	15,000	140,000	384,000
.36	Waterways			675,000	520,000	-	-	15,000	140,000	
15.01	RECREATIONAL DEVELOPMENT			92,000	78,000	-	-	5,000	9,000	110,000
.33	Structures and improvements--boat landings and picnic areas			92,000	78,000	-	-	5,000	9,000	
15.11	FISH AND WILDLIFE			27,000	23,000	-	-	1,000	3,000	
.33	Structures and improvements			27,000	23,000	-	-	1,000	3,000	
	Total construction cost			6,874,000	5,289,000	-	-	160,000	1,425,000	7,048,000

Operation, maintenance, and replacement costs

Costs of operating and maintaining the irrigation and municipal water features of the Vernal unit have been estimated on the basis of the staff and work required, including costs for equipment, supplies, replacements, and administrative expenses.

The estimates do not include costs of operating and maintaining existing facilities which will continue to be borne by the owners. Costs of major replacements were estimated on a straight line basis. The estimates are based on January 1957 prices.

The estimated annual costs are summarized in the following tabulation.

Item	Estimated annual cost
Personnel	$8,110
Equipment	5,030
Supplies	800
Administrative and general expense	1,100
Replacements	260
Total	1/15,300

1/ Equivalent to $14,500 when adjusted to a long-term projected price level. Assumed to be equivalent to average prices which prevailed during 1954, 1955, and 1956.

In addition to the foregoing annual costs pertaining to the irrigation and municipal water features of the unit, annual operation, maintenance, and replacement costs pertaining to recreational facilities have been estimated by the National Park Service at $7,100 annually and similar costs pertaining to fish and wildlife facilities have been estimated by the Fish and Wildlife Service at $1,200 annually.

The estimated annual unit costs for operation, maintenance, and replacements are summarized in the following tabulation.

Reclamation facilities (cost adjusted to long-term price basis)	$14,500
Recreational facilities	7,100
Fish and wildlife facilities	1,200
Total	22,800

On the basis of cost allocations made in Chapter X and on the basis of projected price levels, annual operation, maintenance, and replacement costs in the amount of $12,700 will be allocated to irrigation, which is equivalent to about $0.90 per irrigable acre. This is in addition to costs of operating and maintaining existing irrigation works, averaging about $1.60 per acre annually. This latter cost is included as a farm expense in the farm budgets developed in Chapter IX.

CHAPTER IV

WATER SUPPLY

Streamflows as they occurred from 1930 to 1956 were used as a basis for the water supply studies. Water supplies available during this period are considered representative of future supplies as the period includes 1934, the year of lowest runoff on record, as well as the 6-year period from 1931 to 1936, the driest recorded series of years. It also includes the wet years of 1944, 1947, and 1952.

The water supply studies were based on the productive acreage of 14,041 acres for the Vernal unit or the acreage on which water will actually be used. For convenience this acreage was divided into four areas: land under the Highline Canal (990 acres), land above Stanaker Service Canal exclusive of land under the Highline Canal (4,124 acres), land below the Stanaker Service Canal (8,571 acres), and land in the River Bottom area (356 acres). All of the lands except those in the River Bottom area are presently served by the major irrigation canals diverting from Ashley Creek. The River Bottom area is under small private ditches that obtain their present water supply from springs and return flow.

Water Resources

Available supply

The sources of irrigation water for the unit area are Ashley Creek and Brush Creek to the northeast of Ashley Valley from which water is obtained by a transmountain diversion through the Oaks Park Canal. Storage for the unit area is presently provided by the Oaks Park Reservoir on Brush Creek above the transmountain diversion and by four small reservoirs on the headwaters of Ashley Creek.

A determination was made of the runoff of Ashley Creek for the 1930-56 study period at the "Sign of the Maine" gage[1/] at the head of the unit area near the intake of the potential Stanaker Feeder Canal. The runoff at this gage, with deductions for existing downstream uses, is representative of the flow available for unit development. The gage is above major irrigation diversions in Ashley Valley. It is below Ashley Spring where existing municipal diversions are made and below the common diversion to the Stanaker and Pitt ditches which serve lands above the Vernal unit area.

1/ So named from a sign "Remember the Maine" painted on a high sandstone cliff near the gaging station.

Ashley Creek flows at the "Sign of the Maine" gage were determined from recorded and estimated data. Records are available at the gage from June 1939 to the present time. Flows for the portion of the study period for which records are not available (1930 to May 1939) were estimated by correlation with a gage designated as "Ashley Creek near Vernal" which is on Ashley Creek about 5 miles above the "Sign of the Maine" gage. Diversions from Brush Creek have been reflected in the runoff measurements at the "Sign of the Maine" gage since 1941 when the diversions were started. They have been deducted from the recorded runoff, however, in the determination of the Ashley Creek flow. From the data available, the Ashley Creek flow at the "Sign of the Maine" is estimated at 82,400 acre-feet annually over the study period, with flows ranging from a maximum of 136,400 acre-feet in 1944 to a minimum of 29,200 acre-feet in 1934. The flows are summarized on a monthly basis in the table on page 29.

Records are available of all of the diversions that have been made to Ashley Valley from Oaks Park Reservoir on Brush Creek. The diversions averaged 40,800 acre-feet annually from 1941 to 1956 as shown in the monthly summary on page 30.

Ground water

General observations and geological data indicate that ground-water development for irrigation or municipal use would be infeasible. Any interception of ground water in the Ashley Creek area above Ashley Valley would interfere with the flow of the creek at the lower diversion points. Wells in the valley would have to penetrate several thousand feet of impervious clay shale before reaching permeable sandstone formations, where, if suitable water were found, the cost of pumping would be prohibitive.

Quality of water

Water available to the Vernal unit has been analyzed and found suitable for irrigation use. Analyses were made of the flow of Ashley Creek at the "Sign of the Maine" gage which includes diversions from Oaks Park Reservoir on Brush Creek. The analyses were made according to standards of the United States Salinity Laboratory at Riverside, Calif., and showed the water to be of excellent quality, suitable for most plants under most conditions. The water has been used for irrigation without harmful effects for about 100 years.

Water below unit lands in lower Ashley Valley consists largely of return flow and was found to be inferior in quality to the water available for the unit. Samples taken below the unit and tested according to standards of the Salinity Laboratory had an objectionable salt content. Some

Runoff of Ashley Creek at "Sign of the Maine"1/
Excluding diversions from Oaks Park Reservoir
(Unit--1,000 acre-feet)

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Total
1930	5.5	4.3	3.3	3.0	2.3	2.4	6.4	30.5	24.0	6.7	8.2	6.1	102.7
31	5.4	3.6	3.0	2.7	2.1	2.3	2.6	9.4	4.0	2.0	1.9	1.8	40.8
32	2.1	2.1	2.1	2.0	2.0	2.0	2.0	33.5	30.1	10.7	6.0	4.4	99.0
33	3.4	2.8	2.0	1.8	1.6	1.6	1.5	9.4	24.4	4.2	3.3	2.0	58.0
34	2.0	1.8	1.7	1.6	1.4	1.5	3.5	7.2	2.0	1.6	2.6	2.3	29.2
1935	2.2	2.2	2.1	1.9	1.7	1.9	1.8	13.3	47.6	7.2	3.8	2.1	87.8
36	2.0	1.9	1.7	1.5	1.4	1.4	2.2	12.6	6.5	3.8	4.8	3.9	43.7
37	3.2	2.7	1.9	1.7	1.3	1.4	2.3	45.2	24.8	11.6	6.1	3.7	105.9
38	2.9	2.3	1.9	1.7	1.4	1.6	2.3	26.8	42.5	12.0	5.8	4.9	106.1
39	7.0	5.1	3.5	2.7	2.1	2.4	7.9	22.5	7.8	3.2	2.0	5.8	72.0
1940	5.4	3.4	2.4	1.8	1.4	1.5	4.3	21.2	6.1	3.7	1.7	2.4	55.3
41	4.5	3.3	2.4	2.0	1.6	1.6	1.7	45.2	40.3	10.5	5.8	6.3	125.2
42	11.3	6.9	4.4	2.9	2.1	2.2	6.1	29.9	41.0	9.4	3.9	2.3	122.4
43	2.7	2.4	2.1	1.8	1.5	1.6	9.3	24.7	16.7	6.1	3.6	2.1	74.6
44	2.4	2.0	1.8	1.5	1.2	1.4	1.8	33.7	65.4	17.3	5.1	2.8	136.4
1945	2.7	2.2	1.8	1.7	1.5	1.6	1.5	19.2	24.1	9.4	5.7	3.8	75.2
46	3.2	2.4	2.0	1.7	1.4	1.4	6.8	10.5	6.0	2.7	3.0	3.1	44.2
47	3.2	3.2	2.9	2.4	1.7	2.1	3.4	52.0	34.8	13.6	6.6	4.4	130.3
48	3.0	2.6	2.3	1.9	1.5	1.6	2.0	32.5	17.7	4.9	2.9	1.5	74.4
49	4.8	1.7	1.6	1.4	1.2	1.3	2.5	30.5	40.9	9.5	4.5	2.5	99.4
1950	3.3	2.8	2.2	2.0	1.7	2.0	4.5	36.0	37.7	13.1	5.2	3.1	113.6
51	2.4	2.2	2.0	1.8	1.4	1.5	1.3	21.7	22.4	5.3	5.4	3.7	71.1
52	3.0	2.3	1.9	1.8	1.5	1.6	4.1	46.6	38.2	9.6	12.5	5.4	128.5
53	3.1	2.9	2.3	2.2	1.8	2.0	2.1	8.8	22.6	5.9	2.6	1.8	58.1
54	1.8	2.0	2.0	1.8	1.4	1.4	3.2	23.3	7.7	4.6	3.0	2.2	54.4
1955	2.5	2.1	1.8	1.6	1.2	1.4	1.5	17.5	11.0	3.3	3.9	1.2	49.0
56	2.4	1.7	1.8	1.6	1.3	1.4	2.2	31.6	14.4	4.0	1.8	1.1	65.3
Total	94.4	74.9	60.9	52.5	42.7	46.1	90.8	695.3	660.7	195.9	121.7	86.7	2,222.6
Mean	3.5	2.8	2.3	1.9	1.6	1.7	3.4	25.8	24.5	7.2	4.5	3.2	82.4

1/ Records from the Geological Survey are available from June 1939 through 1956. Runoff for 1930 through May 1939 was estimated by correlation with flow of "Ashley Creek near Vernal" minus diversions to Ashley Creek from Oaks Park Reservoir on Brush Creek.

INTERIOR -- RECLAMATION, SLC, UTAH

Diversions to Ashley Creek
from Oaks Park Reservoir on Brush Creek
(Unit--1,000 acre-feet)

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Total
1941										1.4	0.9	0.8	3.1
42										1.1	2.0	2.3	5.4
43	0.6									2.6	2.0	1.1	6.3
44										1.3	3.2	1.4	5.9
1945	.1									1.5	1.5	1.5	4.6
46	.6	0.1						0.1	1.9	1.8	.2	.2	4.9
47								.1	.1	1.2	1.2	1.1	3.7
48	1.3								.2	2.0	2.4	.8	6.7
49	.2								.2	1.3	2.5	1.0	5.2
1950	.3									.6	2.6	1.2	4.7
51	.8									2.2	1.1	.6	4.7
52	.6									1.9	.5	.7	3.7
53	1.3	.4								2.5	2.7	.5	7.4
54									1.0	2.2	.7	.3	4.2
1955									.2	1.9	.2	.1	2.4
56										2.3	1.5	.6	4.4
Total	5.8	.5						.2	3.6	27.8	25.2	14.2	77.3
Mean	.4	0						0	.2	1.7	1.6	.9	4.8

of the water samples were rated as "good to injurious" for crop production and some as "injurious to unsuitable." Water now used below the unit is harmful to crops.

Results of the analyses made of Ashley Valley water both within and below the Vernal unit area are summarized in the table below.

Quality of water in Ashley Valley

	Ashley Creek at "Sign of the Maine"				Ashley Creek at River Canal				Ashley Creek near Jensen			
	Flow	Class			Flow	Class			Flow	Class		
Date	(sec.-ft.)	C	S	B	(sec.-ft.)	C	S	B	(sec.-ft.)	C	S	B
7/21/55	103	1	1	1						4+	2	3
9/26-27/55	--	1	1	1		4	2	1		4	2	1
3/13-14/56	27	2	1	1					29.3	3	1	1
5/24-25/56	797	1	1	1		2	1	1				
7/9-10/56	125	1	1	1	4	4	1	1	8.47	4	1	2
8/7/56	59	1	1	1					.98	4+	2	2
9/17/56	28	1	1	1					7	4	1	2
10/19/56	32	2	1	1		4	1	1	8	4	1	2

C = Total concentration of salts.
S = Relative proportion of sodium to other cations.
B = Boron concentration.
Class 1 = Excellent to good, suitable for most plants under most conditions.
Class 2 = Good to injurious, probably harmful to more sensitive crops.
Class 3 = Injurious to unsatisfactory, probably harmful to most crops.
Class 4 = Unsuitable, probably harmful to all but the most tolerant crops.

Water Rights

Existing rights

Direct Flow Rights

Decree of 1897.--Rights to the flow of Ashley Creek were adjudicated and a decree made in November 1897 in the Fourth Judicial Court of the State of Utah. The decree apportioned the entire flow of the creek among the water users. Several companies and numerous individuals were each awarded a certain portion of the total flow. Water under the various 1897 rights is now almost entirely distributed through six canals and ditches, the total diversion capacity of which has been accepted in operating practices over many years as 500 second-feet. The 1897 decree then, while ostensibly covering the entire flow of Ashley Creek, is in practice limited to 500 second-feet. The approximate percentages of the 1897

rights conveyed by each canal and ditch are tabulated below. Percentages shown for the Ashley Upper and Ashley Central Canals include water acquired from these canals by the municipal water systems and now diverted into a pipeline from Ashley Spring located above the canal intakes and above the "Sign of the Maine" gage.

Canal or ditch	1897 water rights (approximate percent)
Ashley Upper Canal (includes Colton ditch)	36
Ashley Central Canal (includes Hardy ditch)	34
Rock Point Canal	20
Island ditch	7
Stanaker ditch	2
Dodds ditch	1
Total	100

Miscellaneous decrees.--Rights for the use of Ashley Creek flows for irrigation have been decreed since the original decree of 1897, primarily for use of flood waters and return flows from irrigation.

The Highline Canal which diverts near the head of Ashley Valley has no right under the Decree of 1897 but uses water from Ashley Creek under a right acquired through an application made to the State Engineer in 1912. By this right the canal is entitled to 182 second-feet of the Ashley Creek runoff after the runoff reaches 500 second-feet.

Water users under the Union and River Canals in the lower part of Ashley Valley hold rights to return flows and flood waters of Ashley Creek. These rights were obtained by application in 1909 and 1911, respectively, and were adjudicated by court decree in 1915. The decree provides for primary rights of 10-6/7 second-feet to the Union Canal Company, 5-5/7 second-feet to the River Irrigation Company, and 6/7 second-foot to other minor users. It further provides for secondary rights totaling 35-1/10 second-feet.

Storage Rights

A number of applications have been filed with and approved by the State Engineer to store water on Ashley Creek and its tributaries and on other nearby streams for use as needed in the Vernal area. The State Engineer's approval of an application gives the applicant permission to proceed with the construction of works and use of water, but a final certificate of appropriation is issued only after proof of appropriation is made. The certificate of appropriation is issued only for the amount of water applied for or the amount of water beneficially used, whichever is less. No certificates of appropriation have yet been issued on storage rights for the Vernal area although four small reservoirs have been

constructed on tributaries of Ashley Creek and one on Brush Creek with rights under approved applications as shown below.

Reservoir	Drainage area	Right for which application has been made (acre-feet)
Long Park	Ashley Creek	500
Twin Lakes	Ashley Creek	360
Goose Lake	Ashley Creek	150
Mirror Lake	Ashley Creek	100
Oaks Park	Brush Creek	7,500

All of the storage reservoirs are operated for the benefit of the Ashley Valley Reservoir Company although some of the rights are held by Government agencies pending repayment of loans granted for construction. The capital stock of the Ashley Valley Reservoir Company and in turn its reservoir water were distributed in 1956 among Ashley Valley irrigators and municipalities as shown below.

Name of stockholder	Shares owned	
	Number	Percent of total
Stanaker ditch	108.00	0.5
Highline Canal	4,407.46	19.6
Ashley Upper Canal	9,991.50	44.4
Ashley Central Canal	5,235.52	23.3
Rock Point Canal	1,165.76	5.2
Island ditch	20.00	.1
Municipal system (Vernal, Maeser, and Naples)	1,564.55	6.9
Total	22,492.79	100.0

Other Water Rights

The Utah Power and Light Company has by application to the State Engineer acquired a right to use 55 second-feet of water from Ashley Creek for its hydroelectric powerplant on that stream. Water rights for the municipal water system have been acquired by the purchase of irrigation water. These rights are discussed in Chapter VII.

In addition to the water rights previously mentioned, some applications approved by the State Engineer cover additional high flows of Ashley Creek for storage or direct use. No works have been constructed to utilize the water, however, and proofs of appropriation have not been made. The applicants apparently do not intend to pursue their filings to completed appropriations and will very likely abandon them in favor of the Vernal unit which would result in greater water resource development and greater benefits to the water users. Steps are now being taken to clear the records of applications on Ashley Creek where the applicants do not intend to diligently prosecute the appropriations.

Vernal unit rights

Agreements by Canal Companies

In order to receive storage benefits from the Vernal unit, boards of directors of all of the canal and ditch companies that will be served by the unit have approved resolutions stating that they are willing to limit diversions to amounts that can be used beneficially under a pattern of need to be determined by the Bureau of Reclamation[1/]. The Stanaker Ditch Company has not agreed to such a limitation since it will not receive unit water. The company's share of the flow of Ashley Creek is insignificant, however, and should excessive diversions be made to the Stanaker ditch, highest in the valley, the resulting return flows will be useable on lands in the unit area. No diversion limitation agreements have yet been made with the Union and River Irrigation Companies as the participation of these companies in the Vernal unit will not be determined until after the unit is in operation.

Water Right Application

The Bureau of Reclamation on February 20, 1945, filed with the State Engineer Application No. 16387 to appropriate 50,000 acre-feet of water annually for the Vernal unit, at that time planned as an independent development. The application was approved by the State Engineer on September 30, 1946.

Compact Agreements

The water that will be utilized under the Vernal unit is a portion of the water of the Upper Colorado River Basin to which Utah is entitled by terms of the Upper Colorado River Basin Compact. This compact, approved by Congress April 6, 1949, apportions consumptive use of the water of the upper basin among the upper basin States. Previously water of the Colorado River Basin had been distributed between the upper and lower basins by the Colorado River Compact of 1922.

Water Requirements

Irrigation diversion requirements

Irrigation diversion requirements at the heads of major canals for beneficial use under the Vernal unit are estimated by the Bureau of

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1/ Additional information on agreements with water users is given in Chapter XII.

Reclamation at an average of 3.7 acre-feet per acre annually, properly distributed over the irrigation season. This estimate is based on the Blaney-Criddle method[1/] which relates the consumptive use of irrigation water to temperature, precipitation, and daytime hours for various types of crops. The computations used in determining the requirement and the monthly distribution of the requirement are given in the tables below.

Computation of annual diversion requirement

	Acre-feet per acre annually
Growing season consumptive use	1.92
Less effective precipitation	.25
Net consumptive use	1.67
Plus farm losses (45 percent of delivery)	1.36
Farm delivery requirement	3.03
Plus canal losses (18 percent of diversion)	.67
Diversion requirement	3.70

Estimated monthly distribution of diversion requirement

	April	May	June	July	Aug.	Sept.	Oct.	Total
Percent	4.8	17.0	20.2	23.0	18.0	12.0	5.0	100.0
Acre-feet per acre	.18	.63	.75	.85	.67	.44	.18	3.70

The overall diversion requirement from Ashley and Brush Creeks for the Vernal unit area is estimated at 51,700 acre-feet annually, including 51,400 acre-feet for lands under the main canals and 300 acre-feet for lands in the River Bottom area. The requirement for lands under the main canals is based on the per acre requirement of 3.7 acre-feet and includes 3,700 acre-feet for the productive area of 990 acres under the Highline Canal, 15,300 acre-feet for the 4,124 acres above the Stanaker Service Canal exclusive of land under the Highline Canal, and 32,400 acre-feet for the 8,571 acres below the Stanaker Service Canal. The 300 acre-feet for the River Bottom area is a supplementary requirement and is estimated as the amount needed for the area in addition to its present supply from return flow and springs. The requirement is equivalent to a little less than 1 acre-foot an acre for the productive area of 356 acres.

Return flow

Only a negligible amount of return flow from the Vernal unit would be re-useable on unit lands. Since the return flow would have no significant effect on the overall water supply, it is not included in the water supply studies.

1/ Blaney, Harry F., and Criddle, Wayne D., Determining Water Requirements in Irrigated Areas from Climatological and Irrigation Data, published by Soil Conservation Service, United States Department of Agriculture, August 1950.

The amount of return flow available to the Union and River Canals located below the unit lands and to several private ditches probably will be increased with development of the unit. The amount of the increase and the quality of the increased flows cannot practicably be determined, however, until after the unit is in operation.

Evaporation

Evaporation losses from Stanaker Reservoir are expected to average 2,100 acre-feet annually or about 3.31 feet a year from the reservoir water surface area. These losses were estimated from data of the Utah State Agricultural College publication, entitled Consumptive Water Use and Requirements in the Colorado River Area of Utah. Allowance was made for the effect of rainfall and present consumptive uses in the reservoir basin.

Sedimentation

Only negligible amounts of sediment are expected to accumulate in features of the Vernal unit. The sediment load of Ashley Creek is light as the streambed is lined with rock cobbles and erosion in the watershed area is controlled by natural vegetative cover. Much of the sediment that is carried in the stream will be dropped at Ft. Thornburgh Diversion Dam before diversions are made to Stanaker Feeder Canal and Stanaker Reservoir. Only slight amounts of sediment will be diverted by the existing canals that will distribute unit water above the Stanaker Service Canal. Occasional summer cloudbursts bring measurable quantities of silt into the Stanaker Reservoir site. These storms occur so infrequently, however, that the silt deposition could have only a slight effect on the storage capacity during the life of the reservoir. Reduction of the reservoir capacity by sedimentation will be negligible.

Water Utilization

Unit operation

Operation of the Vernal unit was simulated by months over the 1930-56 study period on the basis of water supplies and diversion requirements previously discussed. The operation was based on coordinated utilization of natural streamflow and storage releases from the existing Oaks Park Reservoir and the potential Stanaker Reservoir to provide the maximum beneficial use of the available water supply. In actual operation, use is expected to be made of the existing Long Park Reservoir, Twin Lakes, Mirror Lake, and Goose Lake. Because of the small capacities of these reservoirs, however, their effect on unit operation will be insignificant and has not been considered in the operation studies. The monthly studies made are summarized on an annual basis in the table on the following page.

Under the plan of operation storage releases to the unit lands under the major canals will be made during the late irrigation season in accordance with the estimated diversion requirement of 3.7 acre-feet per acre

Stanaker Reservoir active capacity: 33,200 acre-feet
Stanaker Feeder Canal capacity: 400 cubic feet per second

Annual water supply summary--Vernal unit lands
(Unit--1,000 acre-feet)

	Streamflow						Stanaker Reservoir operation					Land above Stanaker Service Canal exclusive of land under Highline Canal 5/					Land under Highline Canal 8/				
										Active reservoir content		Water supply		Shortage			Water supply		Shortage		
Year	Ashley Creek flow at "Sign of the Maine" 1/	Future increase in municipal diversions	Required for prior rights 2/	Surplus flow at Ft. Thornburgh Diversion Dam 3/	Bypass 4/	Diverted to Stanaker Reservoir	Evaporation	Total release	Spill	Maximum	End of year	Present supply within ideal demand (3.7 ac.-ft. per acre)	Additional water from Vernal unit 6/	1,000 acre-feet	Percent of annual demand	Additional water at rate of 4 ac.-ft. per acre 7/	Present supply within ideal demand (3.7 ac.-ft. per acre)	Additional water from Vernal unit 6/	1,000 acre-feet	Percent of annual demand	Additional water at rate of 4 ac.-ft. per acre 7/
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1929											25.6										
1930	102.7	1.5	55.0	46.2	8.4	37.8	2.8	12.4	2.5	33.2	21.2	12.5	2.8			0.3	1.2	2.5			
31	40.8	1.5	23.2	16.1		16.1	1.8	31.3		33.2	1.7	5.8	8.4	1.1	7		.4	2.0	1.3	35	
32	99.0	1.5	51.6	45.9	11.3	34.6	1.9	14.9		31.2	19.5	11.6	3.7			.3	1.2	2.5			
33	58.0	1.5	29.7	26.8	6.5	20.3	2.1	29.2		28.3	8.5	6.9	8.4				.7	2.7	.3	8	
34	27.2	1.3	17.8	8.1		8.1	1.2	15.5		14.5	-.1	4.3	1.5	9.5	62		.2	1.0	2.5	68	
1935	87.8	1.5	41.2	45.1	16.5	28.6	1.6	20.3		23.6	6.6	9.6	5.4	3.3	2	.2	1.2	2.3	.2	5	
36	43.7	1.5	32.3	9.9		9.9	1.1	15.3		12.5	.1	7.5	2.8	5.0	33		.3	1.7	1.7	46	
37	105.9	1.5	54.2	50.2	16.3	33.9	1.3	12.5		31.5	20.2	12.2	3.0	1.1	1	.3	1.1	2.4	.2	5	
38	106.1	1.5	55.8	48.8	15.7	33.1	2.5	12.2	16.3	33.2	22.3	12.3	3.0			.3	1.2	2.5			
39	72.0	1.5	37.7	32.8	2.8	30.0	2.3	23.5	16.8	33.2	9.7	8.8	6.5			.2	.6	2.7	.4	11	
1940	55.3	1.5	32.5	21.3	1.0	20.3	1.8	26.5		28.0	1.7	7.8	7.2	.3	2	.1	.6	2.8	.3	8	
41	125.2	1.5	55.9	67.8	22.2	45.6	2.0	12.1	10.9	33.2	22.3	12.2	3.1			.3	1.6	2.1			
42	122.4	1.5	49.7	71.2	23.9	47.3	2.7	15.9	33.3	33.2	17.7	11.2	4.1			.3	1.1	2.6			
43	74.6	1.5	45.1	28.0	1.5	26.5	2.5	19.1	7.4	33.2	15.2	10.2	5.1			.4	.9	2.8			
44	136.4	1.5	50.2	84.7	40.3	44.4	2.4	16.9	17.1	33.2	23.2	10.6	4.7			.8	1.6	2.1			.1
1945	75.2	1.5	49.1	24.6	.4	24.2	2.4	16.4	8.7	33.2	19.9	11.3	4.0			.3	.6	3.1			
46	44.2	1.5	30.6	12.1		12.1	1.8	28.8		30.3	1.4	7.2	8.1			.1	.4	3.1	.2	5	
47	130.3	1.5	60.5	68.3	18.9	49.4	2.2	10.0	15.4	33.2	23.2	12.6	2.7			1.1	1.7	2.0			
48	74.4	1.5	36.6	36.3	9.5	26.8	2.6	24.3	9.8	33.2	13.3	8.5	6.8				1.0	2.7			
49	99.4	1.5	49.9	48.0	12.1	35.9	2.5	16.5	11.8	33.2	18.4	11.1	4.2			.6	1.3	2.4			
1950	113.6	1.5	56.7	55.4	18.7	36.7	2.4	12.2	19.4	33.2	21.1	12.0	3.3			.8	1.2	2.5			
51	71.1	1.5	40.5	29.1	6.0	23.1	2.3	22.2	3.2	33.2	16.5	9.3	6.0			.1	.8	2.9			
52	128.5	1.5	65.3	61.7	19.5	42.2	2.6	9.0	22.4	33.2	24.7	13.6	1.7			1.1	1.3	2.4			
53	58.1	1.5	36.1	20.5	.9	19.6	2.4	24.4	3.4	33.2	14.1	8.8	6.5				.6	3.1			
54	54.4	1.5	34.1	18.8	.8	18.0	1.9	26.5		28.7	3.7	8.2	7.1			.1	.6	3.1			
1955	49.0	1.5	33.9	13.6		13.6	.9	16.5		13.9	-.1	8.2	4.3	2.8	18		.5	2.2	1.0	27	
56	65.3	1.5	37.5	26.3	2.1	24.2	1.3	22.8		18.9	0	7.9	5.9	1.5	10	.8	1.0	2.0	.7	19	
Total	2,220.6	40.5	1,162.7	1,017.6	255.3	762.3	55.3	507.2	198.4	--	--	262.2	130.3	20.6	--	8.5	24.9	66.2	8.8	--	.1
Mean	82.2	1.5	43.1	37.7	9.5	28.2	2.1	18.8	7.3	--	--	9.7	4.8	.8	5%	.3	.9	2.5	.3	8%	0

	Land below Stanaker Service Canal 9/					Total for land under major canals 11/					River Bottom area		Total unit shortages					
	Water supply		Shortage			Water supply		Shortage						Irrigation 14/		Municipal water		
Year	Present supply within ideal demand (3.7 ac.-ft. per acre)	Additional water from Vernal unit 6/ 10/	1,000 acre-feet	Percent of annual demand	Additional water at rate of 4 ac.-ft. per acre 7/	Present supply within ideal demand (3.7 ac.-ft. per acre)	Additional water from Vernal unit 6/ 12/	1,000 acre-feet	Percent of annual demand	Additional water at rate of 4 ac.-ft. per acre 7/	Water supplied from Vernal unit 12/ 13/	Shortage	1,000 acre-feet	Percent of demand	1,000 acre-feet	Percent of demand	Year
	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	
1929																	1929
1930	25.6	6.8			0.3	39.3	12.1			0.6	.3						1930
31	11.8	20.6				18.0	31.0	2.4	5		.3						31
32	24.0	8.4			.6	36.8	14.6			.9	.3		2.4	5			32
33	14.6	17.8				22.2	28.9	.3	1		.3						33
34						13.3	15.5	22.6	44			0.3	23.1	45	.2	13%	34
1935	19.4	12.3	.7	2	.4	30.2	20.0	1.2	2	.6	.3		1.2	2			1935
36	15.7	10.8	5.9	18		23.5	15.3	12.6	25			.3	12.9	25			36
37	25.4	6.8	.2	1	.5	38.7	12.2	.5	1	.8	.3		.5	1			37
38	26.0	6.4			.6	39.5	11.9			.9	.3						38
39	18.4	14.0			.4	27.8	23.2	.4	1	.6	.3						39
1940	16.1	16.3			.2	24.5	26.3	.6	1	.3	.3		.4	1			1940
41	25.8	6.6			.6	39.6	11.8			.9	.3		.6	1			41
42	23.4	9.0			.4	35.7	15.7			.7	.3						42
43	21.5	10.9			.7	32.6	18.8			1.1	.3						43
44	22.6	9.8			.6	34.8	16.6			1.5	.3						44
1945	23.4	9.0			.5	35.3	16.1			.8	.3						1945
46	15.1	17.3				22.7	28.5	.2	0	.1	.3		.2	0			46
47	27.4	4.8	.2	1	1.0	41.7	9.5	.2	0	2.1	.3		.2	0			47
48	17.9	14.5				27.4	24.0				.3						48
49	22.8	9.6			.9	35.2	16.2			1.5	.3						49
1950	26.3	6.1			.6	39.5	11.9			1.4	.3						1950
51	19.4	13.0			.2	29.5	21.9			.3	.3						51
52	27.8	4.6			2.1	42.7	8.7			5.2	.3						52
53	17.9	14.5				27.3	24.1				.3						53
54	16.4	16.0			.2	25.2	26.2			.3	.3						54
55	16.9	10.0	5.5	17		25.6	16.5	9.3	18			.3	9.6	19			1955
56	17.0	14.7	.7	4	1.6	35.9	22.6	2.9	6	2.4	.2	.1	3.0	6			56
Total	547.4	303.6	23.8	--	12.4	854.5	500.1	53.2	--	21.0	7.1	1.0	54.4	--	.2	Total	
Mean	20.3	11.2	.9	3%	.5	30.9	18.5	2.0	4%	.8	.3	0	2.0	4%	0	0%	Mean

1/ Exclusive of upstream diversions to Stanaker Ditch and the municipal pipeline.

2/ Required for all presently irrigated land, with diversions limited to a rate of 4 acre-feet per acre annually by agreements made for Vernal unit operation.

3/ Flow of Ashley Creek at "Sign of the Maine" in excess of downstream rights supplied at rate of 4 acre-feet per acre annually less 1,500 acre-feet annually that will be diverted above gage to supply municipal requirements.

4/ Bypass is available flow in excess of capacity of Stanaker Feeder Canal. In actual practice bypass may be increased to reduce reservoir spill, Column 9.

5/ Demand is 15,300 acre-feet annually.

6/ Supplied under annual demand of 3.7 acre-feet per acre.

7/ Water in excess of ideal requirements (3.7 acre-feet per acre) divertible by prior rights from natural streamflow during high water periods under agreements limiting prior rights to 4 acre-feet per acre.

8/ Demand is 3,700 acre-feet annually.

9/ Demand is 58,400 acre-feet annually.

10/ Includes an average of 800 acre-feet of water released in exchange for future municipal diversion from Ashley Springs during the irrigation season. The remaining 700 acre-feet of municipal diversions would be made during the nonirrigation season when exchange would not be necessary.

11/ Demand is 51,400 acre-feet annually.

12/ Total water supplied would be:

Reservoir release (Col. 28 & 32)	18,800 acre-feet
Less municipal exchange	800 " "
Irrigation supply	18,000 " "
Vernal unit municipal supply	1,500 " "
Total	19,500 " "

13/ River Bottom area comprises 356 acres, which require 300 acre-feet of Vernal unit water for a full supply.

14/ Total irrigation demand is 51,700 acre-feet including 51,400 for land under major canals and 300 acre-feet for land in River Bottom area.

annually. At the request of the local water users, however, natural flow diversions will be permitted at the rate of 4 acre-feet per acre annually during the high runoff months when sufficient water is available for such releases. Releases to the River Bottom area will be made during the late irrigation season at the rate of 300 acre-feet annually.

Water supply exchanges will be made among the areas under the major canals. Part of the natural flow and upstream storage water presently used on land below the Stanaker Service Canal will be used on land above the canal including land under the Highline Canal, and replacement to lands below the service canal will be accomplished with storage water from Stanaker Reservoir. Natural flow of Ashley Creek will be used first to supply the needs of the upper area. Natural flow not required by the upper area will be used in the lower area, and natural flow not useable in either the upper or lower area will be stored in Stanaker Reservoir. When requirements in the upper area exceed the natural flow, storage water will be supplied from Oaks Park Reservoir. Requirements in the lower area in excess of available natural flow will be supplied by storage water from Stanaker Reservoir.

Vernal unit water for municipal use in Vernal, Maeser, and Naples will be diverted from Ashley Spring above irrigation diversions. Whenever such diversions interfere with downstream irrigation rights, a corresponding quantity of water will be released from Stanaker Reservoir for irrigation on an exchange basis. Priority will be given to municipal use in Stanaker Reservoir each year.

Rural residents in the Ashley Valley area obtain water for livestock during the nonirrigation season from canals that are kept open for that purpose. Approximately 10,000 acre-feet annually is diverted by these canals during the nonirrigation season. The practice is inefficient since most of the water is lost in operational waste or in seepage and evaporation. The rural residents, under unit operation, will receive water during the nonirrigation season from the new Water Savings pipe system which will divert only about 126 acre-feet, thereby increasing the storable supply for the unit by nearly 10,000 acre-feet. The rural residents will continue to utilize present sources of water for livestock during the irrigation season.

Improvements in water supply with unit development

As a result of the Vernal unit development, the irrigation water supply available within estimated requirements will be increased by about 18,000 acre-feet annually over a period similar to the 1930-56 study period. Shortages in the late summer months will average about 4 percent of the annual requirement as compared with a shortage of about 40 percent under existing conditions.

The municipal supply for the communities of Vernal, Maeser, and Naples will be increased by an average of 1,500 acre-feet annually.

No serious shortages are anticipated in the municipal supply because of the priority to municipal use that will be given in Stanaker Reservoir.

The rural residents in the Vernal area will receive as much water as they now utilize beneficially. The supply delivered by pipeline during the nonirrigation season will be more convenient and more sanitary than the supply presently furnished by the canals. Winter icing of the water will be avoided and water-logging of unit lands reduced.

Stream depletions

The flow of the Colorado River is expected to be depleted by an average of 11,800 acre-feet annually as a result of the Vernal unit development. Most of the depletion (10,000 acre-feet annually) will result from increased consumptive use from irrigation. Approximately 2,100 acre-feet will be lost in evaporation from Stanaker Reservoir, and a depletion of about 700 acre-feet will result from increased municipal use in Vernal, Maeser, and Naples. It is estimated that the Water Savings pipe system will save about 1,000 acre-feet of stream depletion now occurring from the canals during the nonirrigation season.

CHAPTER V

UNIT LANDS

A detailed classification survey has been made of all lands that could practicably be considered in formulating the irrigation plan for the Vernal unit. The soil and topographic conditions of the land and the land surveys made are discussed in subsequent sections of this chapter. Drainage conditions are discussed in the following chapter.

Soils

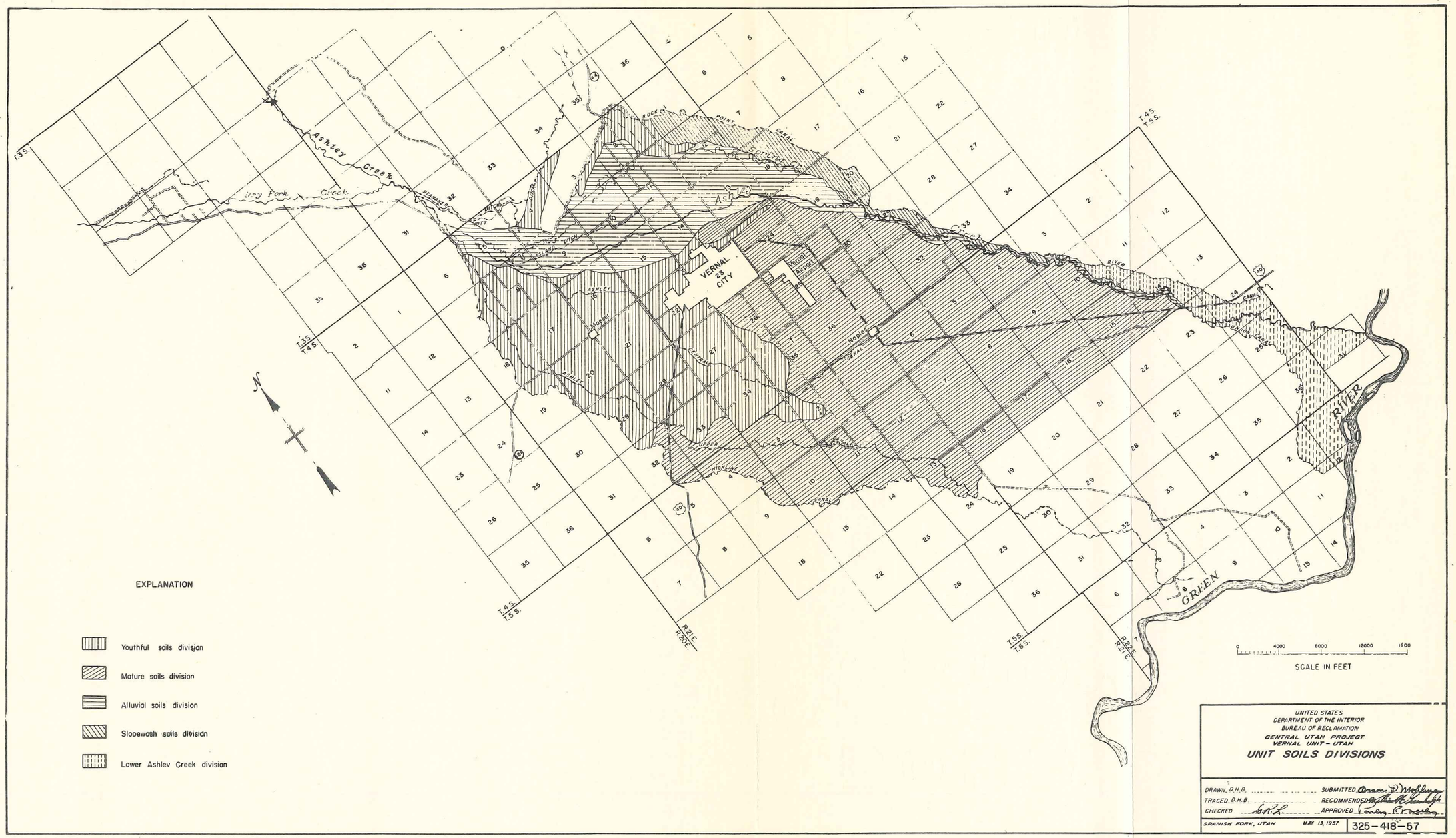
Soils of the area classified consist mainly of alluvial material deposited by stream action from the various sedimentary strata of the Uinta Mountains. The alluvial material varies in depth from a few inches to about 60 feet. The finer alluvium is underlain by a layer of water-worn cobble and gravel which in turn is underlain by shale of the Mancos formation. The maturity of soils differs greatly in various portions of the area classified. Thus for convenience in this report the soils have been grouped into five geographical divisions according to the time of their origin and their location. These include the divisions of youthful, mature, alluvial, slopewash, and Lower Ashley Creek soils. Soils in the various divisions are described in the following sections and their locations are shown on the map on the following page.

Division of youthful soils

Youthful soils are found in about 23 percent of the area classified. They are from 10 to 25 feet in thickness over cobble or rock. The soils are of medium texture and have an open structure. They are generally calcareous with only slight development of a partially cemented lime zone in the subsoil. The permeability and available moisture capacity are good. The content of organic matter varies from good to medium. The soils do not contain excessive amounts of salinity nor alkalinity. They are highly suitable for irrigation and are now utilized for production of all climatically adapted crops.

Division of mature soils

The division of mature soils includes about 51 percent of the soils in the area classified. The mantle of these soils over cobble and gravel is generally only 3 to 5 feet thick. The soils have a medium texture with an open porous structure. They are calcareous and have a well developed, partially cemented lime zone in the subsoil. They have good



UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL UTAH PROJECT
VERNAL UNIT - UTAH

UNIT SOILS DIVISIONS

DRAWN O.H.B. SUBMITTED
TRACED O.H.B. RECOMMENDED
CHECKED APPROVED

SPANISH FORK, UTAH MAY 13, 1957 325-418-57

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permeability and water-holding capacity. The organic matter content is medium to low. Alkalinity and salinity are generally low but considerable amounts of salinity occur in some soils with poor drainage. The soils are generally fertile but are not as productive as the youthful soils. They are moderately suitable for irrigation and are now used mainly for pasture, alfalfa, and small grains.

Division of alluvial soils

Alluvial soils comprise about 15 percent of the area classified. These soils are in a shallow mantle varying from a few inches to 4 or 5 feet in depth over a thick layer of coarse gravel and cobble. They have a medium to sandy texture. Rock and cobble present a serious problem and are a limiting factor in development. The soils are calcareous but there is no development of a lime zone layer in the subsoil. They have an open structure and good to excessive permeability. The organic matter content is medium to low. The soils contain little salinity or alkalinity. They have a low fertility and are now used largely for pasture.

Division of slopewash soils

Slopewash soils are found in only about 3 percent of the area classified. These soils are generally 10 to 25 feet thick over cobble or shale. They are of a clay nature, varying from clay loam to heavy clay. Practically no rock appears in the soil profile. The soils are calcareous but have no lime zone development. Their water-holding capacity is good and their permeability is fair to poor. They have a low content of organic matter and contain little salinity or alkalinity. The lands are now used primarily for the production of alfalfa, small grains, and pasture. Their suitability for irrigation is good to fair.

Division of Lower Ashley Creek soils

The Ashley Creek division comprises about 8 percent of the area classified. Its soils vary in thickness from 5 to 15 feet and lie over a layer of water-rounded rock and cobble. Soils in the division that lie east of Ashley Creek are of heavy clay nature while those west of the creek vary in texture from sandy loam to silty clay. Some of the soils adjacent to the creek are poorly drained and are high in salinity. All the soils are calcareous with no lime zone development. Their water-holding capacity is good and their permeability is fair to slow. The soils have a low to medium content of organic matter. The lands are utilized mainly for production of pasture, alfalfa, and small grains.

Topography

The surface relief of unit lands is smooth to gently sloping with average slopes of 1 to 3 percent. The relief is generally conducive

to efficient irrigation without costly preparation of the lands. Smoothing in some areas would facilitate irrigation but deep cuts would not be necessary. Erosion is not a problem except along Ashley Creek when flood flows occur.

Land Classification

Classification survey

The detailed land classification survey was made in 1955 and 1956 as a part of the definite plan studies. It included all irrigated lands that will receive supplemental water from the Vernal unit and some adjacent irrigated lands that will not be served by the unit. Some nonirrigated lands in the same general vicinity were also classified. Because of their rural character, lands in the towns of Maeser and Naples were surveyed and classified in the same manner as other farm lands. Lands in the Vernal town site and airport, which are more urban in nature, were not designated by land class, however, but were merely segregated into either "town site" or "rights-of-way." A large part of the town site area is in yards and gardens which presently are irrigated from the Ashley Central Canal. Land classes were not determined for rights-of-way, whether in farm or urban areas.

The farm lands were grouped into five classes according to their soil, topographic, and drainage characteristics. The nature of each class is briefly indicated below and is shown in greater detail in the table on the following page.

Class 1.--Lands highly suitable for irrigation farming.

Class 2.--Lands that are moderately suitable for irrigation farming, being measurably lower in productive capacity than class 1 lands because of deficiencies in soils, topography, or drainage.

Class 3.--Lands suitable for irrigation farming but more restricted in use or productivity than the class 2 lands because of more extreme deficiencies.

Class 6W.--Lands which have a water right but which fail to meet the minimum requirements for an arable class. These lands are restricted mainly to pasture because of excessive deficiencies.

Class 6.--Lands permanently nonarable because of noncorrectable deficiencies.

Land classes 1, 2, and 3 include some lands that presently do not meet the standards for these classes because of inadequate drainage but

Specifications for detailed land classification

Land characteristics	Class 1--Arable	Class 2--Arable	Class 3--Arable	Class 6W--Nonarable
Soils				
Texture				
0-3 feet	Medium sandy loam to friable clay loam.	Loamy fine sand to very permeable clay.	Loamy sand to permeable clay.	Loamy sand to slowly permeable clay.
3-5	Sandy loam to clay loam.	Loamy sand to permeable clay.	Loamy sand to permeable clay.	Loamy sand to slowly permeable clay.
Internal characteristics				
Exchangeable sodium	Less than 10%.	Less than 15%.	Less than 15%.	Less than 20%.
Salinity	Less than 0.2%.	Less than 0.5%.	Less than 0.5%.	Less than 0.75%.
Alkalinity	pH less than 8.6.	pH less than 9.0.	pH less than 9.0.	pH less than 9.0.
Permeability	No layer less than 0.5 inch per hour.	No layer less than 0.2 inch per hour with most layers greater than 0.3 inch per hour.	No layer less than 0.1 inch per hour with most layers greater than 0.2 inch per hour.	No layer less than 0.07 inch per hour with most layers greater than 0.1 inch per hour.
Infiltration	0.5 to 1 inch per hour.	0.25 to 1.5 inches per hour.	0.15 to 2.5 inches per hour.	0.1 to 3 inches per hour.
Available H_2O	Greater than 4.5 inches in 4 feet.	Greater than 3.75 inches in 4 feet.	Greater than 3.5 inches in 4 feet.	Greater than 3 inches in 4 feet.
Depth				
To sand or gravel	42 inches for sandy loams, 36 inches for loam and clay loams.	42 inches for loamy fine sands, 36 inches for sandy loams, 30 inches for loams, clay loams, and clays.	36 inches for loamy sands, 30 inches for sandy loams, 24 inches for loams, clay loams, and clays.	30 inches for loamy sands, 24 inches for sandy loams, 18 inches for loams and clay loams, 12 inches for clays.
To broken nonsaline rock	60 inches.	48 inches.	36 inches.	24 inches on slopes, 30 inches on flat areas.
To solid nonsaline rock	Same but with 6-inch highly permeable layer above rock.	Same but with 6-inch highly permeable layer above rock.	36 inches with 6-inch highly permeable layer above rock.	Same but with 6-inch highly permeable layer above rock.
To saline shale	60 inches with 12-inch highly permeable layer above broken shale.	48 inches with 12-inch highly permeable layer above broken shale.	36 inches with 12-inch highly permeable layer above broken shale.	24 inches on slopes, 30 inches on flat areas with 12-inch permeable layer above shale.
To penetrable lime zone	24 inches with 60 inches penetrable.	18 inches with 48 inches penetrable.	14 inches with 36 inches penetrable.	12 inches with 24 inches penetrable.
Topography				
Smooth slopes in one plane	0.5 to 3% in general gradient.	Up to 7% in general gradient.	Up to 11% in general gradient.	Up to 20% in general gradient.
Surface	Areas greater than 500 feet in direction of irrigation runs; leveled by moving less than 175 cu. yds. per acre. Minimum depths required after leveling.	Areas greater than 300 feet in direction of irrigation runs; leveled by moving less than 300 cu. yds. per acre. Minimum depths required after leveling.	Areas greater than 200 feet in direction of irrigation runs; leveled by moving less than 700 cu. yds. per acre. Minimum depths required after leveling.	Areas greater than 150 feet in direction of irrigation runs; leveled by moving less than 175 cu. yds. per acre. Minimum depths required after leveling.
Cover (brush or rocks)	Clearing costs less than $35 per acre.	Clearing costs less than $55 per acre.	Clearing costs less than $115 per acre.	Clearing costs less than $35 per acre.
Drainage				
Farm drainage	Corrected at costs less than $25 per acre.	Corrected at costs less than $45 per acre.	Corrected at costs less than $105 per acre.	Corrected at costs less than $25 per acre.
Project drainage class 5	Must meet all requirements for class 1 with completion of project works.	Must meet all requirements for class 2 with completion of project works.	Must meet all requirements for class 3 with completion of project works.	Project drainage not applicable to pasture class land.

NOTE: Class 6--Nonarable lands which do not meet the minimum requirements for a higher class. Also small or isolated areas of arable land. Also arable land above any contemplated plan of development.

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that will be improved through unit development so that they will qualify for the class in which they have been placed.

Results of survey

Area Classified

A total of 41,697 acres was classified in the detailed survey. Results of the survey are tabulated below with the acreage of farm land shown by land class.

Land classification summary

Type of land and land class	Acres
Farm land[1]	
Class 1	3,554
Class 2	5,843
Class 3	6,226
Class 6W	8,658
Class 6	15,653
Subtotal	39,934
Rights-of-way	918
Town site	845
Total	41,697

1/ All farm lands except the class 6 lands are presently irrigated but experience late-season water shortages.

Unit Acreages

Of the total area classified, 14,781 acres were found irrigable or suitable to receive supplemental water from the Vernal unit. This acreage includes 14,444 acres of class 1, 2, and 3 land or all land in such classes except 238 acres under the Stanaker and Pitt ditches which are above the Stanaker Feeder Canal, 241 acres required for right-of-way for unit features, and 700 acres in the Lower Ashley Creek division which are irrigated by return flow water of inferior quality. Also in the irrigable area are lands in the Vernal town site which are utilized for yards and gardens, estimated at 337 acres.

The 14,444 acres of irrigable land in classes 1, 2, and 3 include about 2,950 acres which may require unit drainage. Drainage-deficient lands that will not be improved by the Vernal unit were placed in class 6W as their drainage could not be economically justified. These lands although largely irrigated under present water rights were not allowed supplemental water from the Vernal unit as they fail to meet minimum specifications for arable classes. Class 6 lands, permanently nonarable, were likewise excluded from the unit development.

The productive area in the Vernal unit or the land on which the unit water supply will actually be used is estimated at 14,041 acres. This area represents 95 percent of the irrigable acreage, an allowance of 5 percent having been made to account for farmsteads, farm roads, ditches, and other nonproductive areas.

The acreages of irrigable and productive land in the unit area are tabulated below, with the acreage of farm land shown by land class. The irrigable lands are shown on the maps on pages 47 and 49.

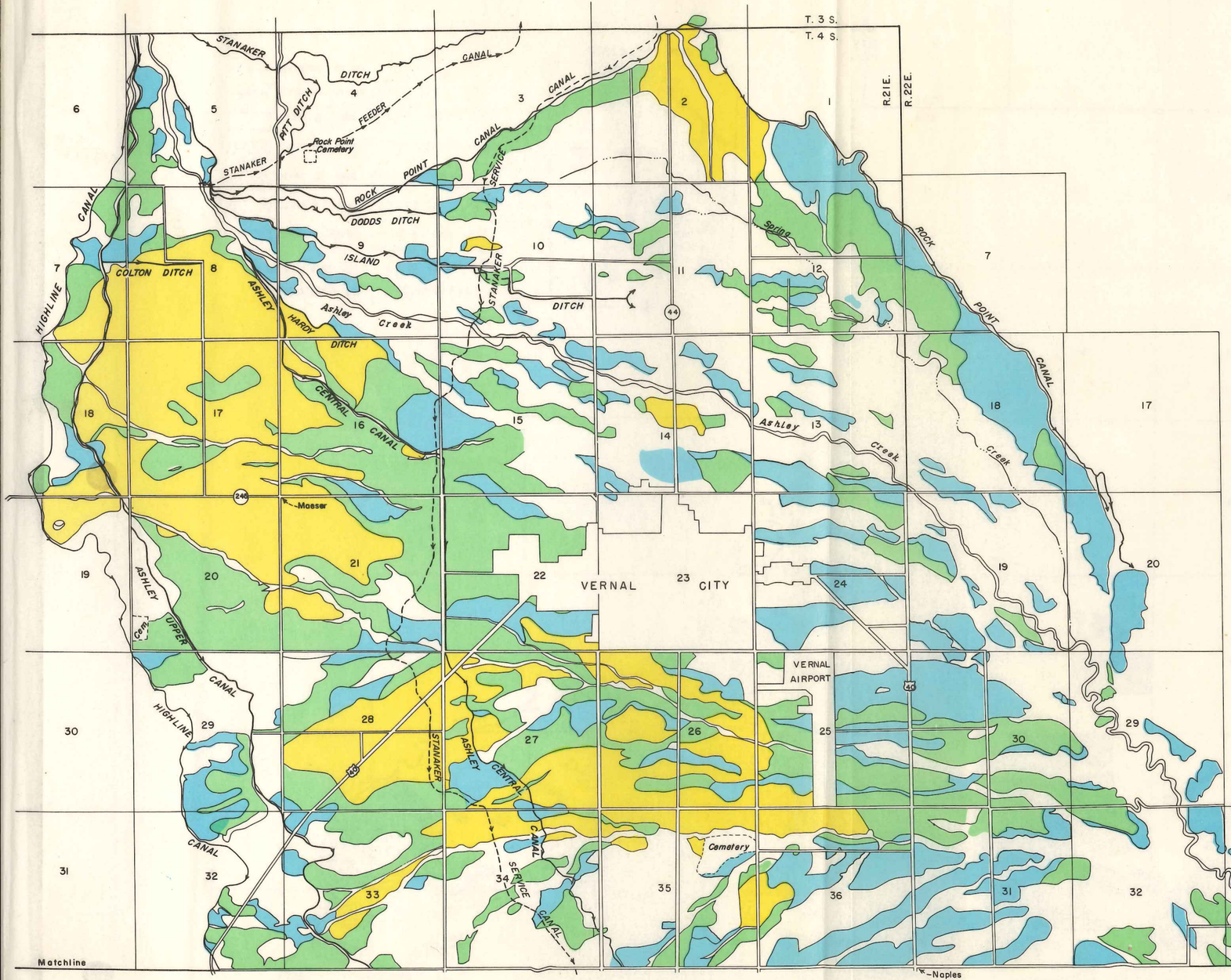
Irrigable and productive acreages in Vernal unit[1]/
(Unit--acres)

Type of land and land class	Irrigable land	Productive land
Farm land		
Class 1	3,286	3,122
Class 2	5,357	5,089
Class 3	5,801	5,510
Subtotal	14,444	13,721
Town site	337	320
Total	14,781	14,041

1/ All supplemental service land.

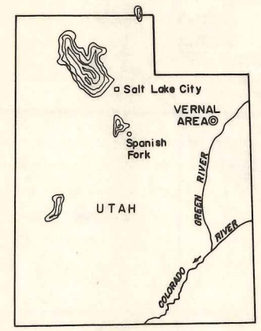
Certification of land classification

The Secretary of the Interior will certify to Congress, as required by the Act of July 9, 1952 (66 Stat. 445), that an adequate soil survey and land classification have been made and that the lands to be irrigated are susceptible to the production of agricultural crops by means of irrigation.



EXPLANATION
IRRIGABLE LAND

- Class 1 land
- Class 2 land
- Class 3 land
- Existing canals
- Proposed canals



LOCATION MAP

N.

SHEET INDEX

2000 0 2000 4000 6000

SCALE OF FEET

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL UTAH PROJECT
VERNAL UNIT-UTAH

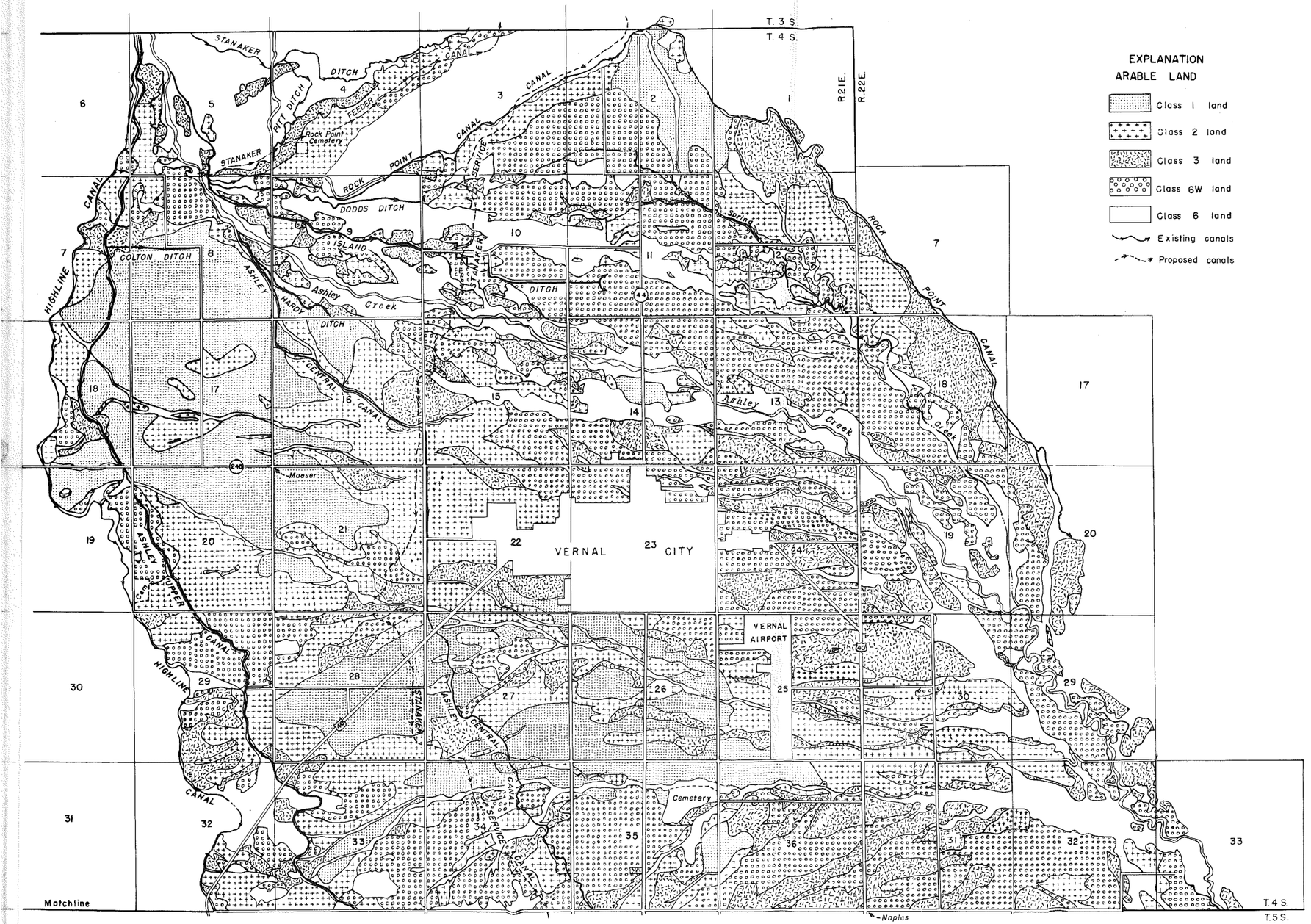
VERNAL AREA

DETAILED LAND CLASSIFICATION
IRRIGABLE AREA

DRAWN RHN — SUBMITTED Orson D. Wolfgang
TRACED DER — RECOMMENDED [illegible]
CHECKED RLB — APPROVED [illegible]

SPANISH FORK, UTAH FEBRUARY, 1957
SHEET 1 OF 2 SHEETS

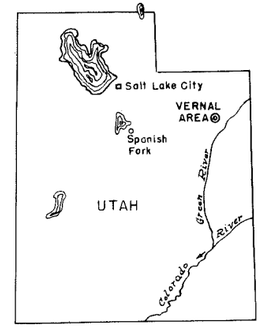
325-418-21



EXPLANATION

ARABLE LAND

- Class 1 land
- Class 2 land
- Class 3 land
- Class 6W land
- Class 6 land
- Existing canals
- Proposed canals



LOCATION MAP

N.

1
2

SHEET INDEX

2000 0 2000 4000 6000

SCALE OF FEET

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL UTAH PROJECT
VERNAL UNIT - UTAH

VERNAL AREA

DETAILED LAND CLASSIFICATION

ARABLE AREA

DRAWN R.H.N. SUBMITTED Orson D. Israelsen

TRACED R.H.N. RECOMMENDED Richard A. Henderson

CHECKED E.C.B. AND APPROVED Fenton R. Bailey

SPANISH FORK, UTAH SEPTEMBER, 1956
SHEET 1 OF 2

325-418-15

Matchline

T. 5 S.

R. 22 E.
R. 23 E.

ASHLEY
CENTRAL CANAL
ASHLEY UPPER CANAL
STANAKER
HIGHLINE CANAL
SERVICE
13 CANAL
HIGHLINE CANAL
50
RIVER
IRRIGATION CO. CANAL
Ashley Creek
UNION CANAL
40
GREEN RIVER
GREEN RIVER

N.

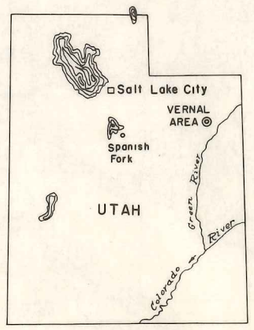
SHEET INDEX

2000 0 2000 4000 6000
SCALE OF FEET

EXPLANATION

IRRIGABLE LAND

- Class 1 land
- Class 2 land
- Class 3 land
- Existing canals
- Proposed canals



LOCATION MAP

T. 5 S.
T. 6 S.
R. 21 E.
R. 22 E.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL UTAH PROJECT
VERNAL UNIT – UTAH

VERNAL AREA

DETAILED LAND CLASSIFICATION

IRRIGABLE AREA

DRAWN R.H.N. SUBMITTED Orson D. Mohlman
TRACED R.H.N. RECOMMENDED
CHECKED [illegible] APPROVED

SPANISH FORK, UTAH SEPTEMBER, 1956
SHEET 2 OF 2

325-418-22

Matchline

T. 5 S.

R. 22 E.

R. 23 E.

ASHLEY CENTRAL CANAL

ASHLEY UPPER CANAL

HIGHLINE CANAL

HIGHLINE CANAL

RIVER IRRIGATION CO. CANAL

ASHLEY CREEK

UNION CANAL

GREEN RIVER

GREEN RIVER

N.

SHEET INDEX

1

2

2000 0 2000 4000 6000

SCALE OF FEET

T. 5 S.

T. 6 S.

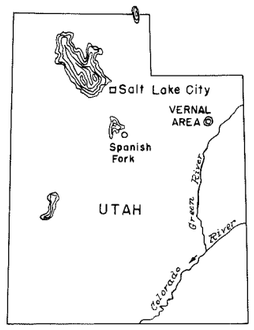
R. 21 E.

R. 22 E.

EXPLANATION

ARABLE LAND

- Class 1 land
- Class 2 land
- Class 3 land
- Class 6W land
- Class 6 land
- Existing canals
- Proposed canals



LOCATION MAP

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL UTAH PROJECT
VERNAL UNIT - UTAH

VERNAL AREA

DETAILED LAND CLASSIFICATION

ARABLE AREA

DRAWN R.H.H. SUBMITTED Assoc. Director

TRACED R.H.H. RECOMMENDED Chief Engineer

CHECKED E.G.R. APPROVED Commissioner

SPANISH FORK, UTAH SEPTEMBER, 1936

SHEET 2 OF 2

325-418-16

CHAPTER VI

DRAINAGE

Existing Conditions

The floor of Ashley Valley within the unit area is covered by alluvial material, including a soil mantle and an underlying layer of cobble. The soil mantle, varying from a few inches to 20 feet in depth, is composed of clays, silts, sands, and loams. The cobble layer, which varies in thickness from a few inches to 45 feet, consists of water-worn cobble and gravel in a matrix of sand, all of which has been transported principally from the upper Ashley Creek drainage. Below the soil and cobble formations is a stratum of shale from the Mancos formation which is highly impermeable and limits the downward percolation of ground water.

Permeability tests and drainage well bail-out recovery rates indicate good permeability in the alluvial soil and cobble materials. Permeability rates from disturbed samples range from an average of 0.5 inch per hour for the clay loams to 5.98 inches per hour for the sand matrix in the cobble. Rapid fluctuations of the ground-water surface give further evidence of good drainability in these materials.

Several natural drainage channels traverse the unit area. These channels have cut into the soil mantle and in some areas have penetrated through the cobble layer and into the shale formation. Ashley Creek, below a point due east of Vernal, has become deeply entrenched into the shales of the valley floor. East of the Vernal airport the river flood plain is entrenched from 80 to 100 feet below the ground surface.

Lands in Ashley Valley vary in slope from 5 percent below Asphalt Ridge on the western edge of the area to about 1 percent on river bottom lands along the lower reaches of Ashley Creek.

Approximately 20 percent of the unit lands are subject to peak water tables varying from 0 to 5 feet in depth. The water tables are highest for about 3 weeks in April, May, or June when the spring runoff occurs and excessive diversions are made for irrigation. The ground-water levels recede rapidly as irrigation water supplies diminish in the late spring.

Other areas interspersed with unit lands, including approximately 8,320 acres, have high water tables but were not found to be irrigable and therefore were not included as unit lands. Approximately 80 percent

of these nonirrigable lands are in the permanent pasture class. From economic and physical considerations, drainage of the remaining 20 percent was found to be infeasible.

Several factors contribute to the existing high water table conditions. Excessive application of irrigation water in the spring is foremost, followed by canal seepage resulting from the conveyance of irrigation water. Diversions for stock-watering purposes during the nonirrigation season also add to the ground-water supplies. In addition, at least two geologic conditions account in part for the high water tables. The first condition is a funneling effect produced by the underlying cobble aquifer. At the western or upper edge of the unit lands this aquifer is comparatively thin. For a distance of several miles downslope the aquifer becomes progressively thicker and then it begins to decrease in thickness, reaching its minimum thickness at the lower elevations. The decrease in thickness generally begins at about the point where the surface slopes begin to decrease. Below this point the capacity of the aquifer to carry water is reduced by the combined effect of decreasing thickness and slope. Thus the aquifer becomes overloaded and does not provide adequate subsurface drainage for the lower lands. The second geologic condition influencing the high water tables is a cemented barrier which occurs along the margins of the escarpment at the lower edge of the area adjacent to the entrenched river bottoms and presumably in the banks of the deeper natural drainages. The barrier has been formed by the precipitation of calcium carbonate in the interstices of the gravel and boulders resulting from heavy evaporation of water at these points. The cemented barrier has the effect of a dike around the perimeter of the escarpment, thus restricting the natural outlet for removing surplus ground water from the area.

Natural drainage channels are effective as surface drains but are limited in their effectiveness as subsurface drains. The general slope of the land, which varies from 60 to about 100 feet per mile, lends well to the use of these channels as drainage outlets. Improvement of these channels will be necessary, however, to effectively provide outlets for the unit drains.

Unit lands are relatively free of salinity and alkalinity in quantities which are detrimental to the growth of most irrigated crops.

Drainage Requirement

The unit land presently subject to peak water tables may require drainage in varying degrees in order to sustain the productivity contemplated in the land classification as shown. Under unit operation some

improvement of the present water table conditions may result from the more efficient seasonal distribution of irrigation water and lining of portions of the distribution canals and ditches. Since a firm appraisal of the improvement cannot be made until the irrigation features of the Vernal unit are in operation, the final design and construction of the drainage system will be deferred until that time.

Deep drains, surface inlet structures, and improvement of natural channels are planned as part of the Vernal unit with the costs estimated at about $45 per acre of irrigable land. No surface drains other than the inlet structures are contemplated. The steep surface slopes and the well developed natural surface drainage coupled with the additional effect of the deep drains will provide adequate surface drainage.

Drainage Investigations

Present investigations

Seventy-one ground-water observation wells with an average depth of about 9 feet were established on a 1-mile grid through most of the area as a basis for determining the depth to, and the fluctuation of, the ground-water surface under pre-project and post-project conditions. The depth to ground water as determined by these wells varied from 0.6 to 19.8 feet with an annual fluctuation of 0.6 to 10.9 feet.

In addition to the observation wells, 52 deep exploration holes were drilled for the study of the subsurface conditions. Data from the deep exploration holes were supplemented by data from 56 seismic exploration holes obtained from private companies.

Future investigations

Observation of ground-water tables will be continued. In addition it is planned to construct a pilot drain, install piezometers, provide additional recorders, obtain samples for testing quality of water, and make canal seepage observations of existing canal systems. The additional investigations will be made to determine the effect unit operation will have on ground-water tables and to provide data for the design and construction of a drainage system.

CHAPTER VII

MUNICIPAL WATER

Introduction

The Vernal unit will provide additional water to the existing municipal pipeline system that serves the towns of Vernal, Maeser, and Naples. Although municipal water service is not planned for the remaining rural areas of Ashley Valley, a Water Savings pipe system will be extended to these areas for operation during the nonirrigation season as explained in Chapter II. There is a possibility that the rural residents may decide to build a domestic and stock-watering system for year-round operation and seek cooperation from the Vernal unit in lieu of separate construction of the Water Savings pipe system. In view of this possibility, the municipal water situation in the rural areas is discussed in this chapter, following a discussion of the area served by the existing municipal system.

Vernal, Maeser, and Naples

Present municipal water system

Municipal water for Vernal, Maeser, and Naples is presently obtained from Ashley Spring on Ashley Creek. The water is conveyed by a 12-inch steel pipeline from the spring to a chlorination plant near the head of Ashley Valley. The capacity of the pipeline is about 7 second-feet. Under present conditions, the flow through the pipeline varies from about 3 second-feet in the winter to 5 second-feet in the summer.

After leaving the chlorination plant, the water is measured by a weir and then flows into a division structure. About one-eighth of the flow is diverted to the distribution system serving the Maeser area, and the remainder goes to the Vernal water system which includes two concrete reservoirs with capacities of 500,000 and 75,000 gallons. Excess water overflows from the Vernal distributing reservoirs into the Ashley Central Canal. An extension of the Vernal system serves the Naples area.

Municipal water rights

The water rights of the Vernal, Maeser, and Naples municipal systems are based on the Decree of 1897 which is discussed in Chapter IV. The municipalities have purchased stock in the Ashley Upper Irrigation Company and in the Ashley Central Irrigation Company and have acquired the

rights originally decreed to A. J. Johnson so that their total rights now represent approximately 4.34 percent of the natural flow of Ashley Creek at the "Sign of the Maine" gaging station as shown in the following table.

Municipal water rights to Ashley Creek flow

Right acquired from:	Percent of creek flow acquired by: Vernal	Maeser	Naples	Total
Ashley Upper Irrigation Co.	0.39	0.18	--	0.57
Ashley Central Irrigation Co.	2.60	.38	0.46	3.44
A. J. Johnson	.33	--	--	.33
Total direct flow	3.32	.56	.46	4.34

In addition to natural flow rights in Ashley Creek, the municipal water system owns about 7 percent of the stock of the Ashley Valley Reservoir Company which operates storage reservoirs as discussed in Chapter IV. This stock provided the municipal system with the equivalent of about 480 acre-feet of storage capacity during 1956.

Rather than divert water for municipal use from Ashley Creek, the municipalities have changed their point of diversion upstream to Ashley Spring where more potable water is available. The new diversion is made above the intake for the existing powerplant of the Utah Power and Light Company and at times infringes on the company's right to use 55 second-feet for power generation. The municipalities have an agreement with the Power Company providing for compensation whenever infringement on the power right is made.

Present municipal water supply

The amount of water that is available to the municipalities under their natural flow rights in Ashley Creek varies widely from year to year and from month to month depending on the total flow in the creek. As a basis for analysis, 4 particular years were selected for study and the natural flow available to the municipalities by months in each of these years was determined. The years selected are listed below.

1929--highest recorded annual runoff
1934--Lowest recorded annual runoff
1935--average annual runoff (1920-56 period)
1955--57 percent of average annual runoff

The annual flows available to the municipalities varied from 1,275 acre-feet in 1934 to 6,250 acre-feet in 1929. Not all of this water was useable, however, even in the driest year, because surplus flows were wasted during the spring runoff period and water shortages occurred later in the year. The extent of the surpluses and shortages is affected by the changing requirements for municipal water as discussed later in this chapter.

The water available to the municipalities under their storage rights was not included in the municipal water supply studies. This is because the storage water represents only a minor part of the total supply and because Oaks Park Reservoir, the main source of storage water, was not constructed in 1934 and the amount of water it would have yielded in that critically dry year is uncertain.

The water of Ashley Spring is reported by the Utah State Health Department to be of excellent quality for municipal purposes and is used without filtration. The findings of the Public Health Service with respect to water quality are presented in the attached report of the Service.

Water requirements

Present Requirements

Partial meter readings of water used from the municipal system were made in 1953 and 1954, but 1955 was the first full year of complete readings in all three of the areas served. The 1955 population of the area was estimated at 5,820, made up of 4,300 in Vernal, 912 in Maeser, and 608 in Naples. The total meter readings when increased one-third to allow for system losses[1] averaged 224 gallons per capita daily. The average daily per capita use was higher in Vernal (248 gallons) than in Maeser (162 gallons) and Naples (147 gallons).

From metered records the average per capita daily use during each month of 1955 was calculated as shown below.

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
134	134	128	222	306	370	354	283	285	214	128	120	224

Future Requirements

Future requirements for municipal water will be determined primarily by population changes and trends in the per capita use of water. As a basis for projecting future population changes, present and past populations are tabulated below.

	Population					
	1910	1920	1930	1940	1950	1956 1/
Vernal	836	1,309	1,744	2,119	2,845	4,300
Maeser	2/	2/	2/	770	873	912
Naples	2/	605	518	620	608	608
Total				3,509	4,326	5,820

1/ Same as previously estimated for December 1955.
2/ Data not available.

1/ Approximates measured system losses at Provo, Utah

From past trends and consideration of local prospects, future populations in the combined areas served by the municipal water system are estimated as shown below.

Year	Population
1956	5,820
1960	6,800
1970	9,800
1980	12,000

The estimated rates of population growth are somewhat greater than the estimates for the State of Utah made in a 1955 report by the Stanford University Research Institute. The higher anticipated rate of growth for the Ashley Valley area is justified by prospective mineral resource and recreational developments and by the impending abundance of hydroelectric energy from the nearby Flaming Gorge unit of the Colorado River Storage project.

It is expected that the trend toward increased water use per capita will continue to the point where the present daily average of 224 gallons will increase to 240 gallons by 1980. On the basis of this per capita use and the foregoing estimates of population growth, determinations were made on a monthly basis of the anticipated needs for additional municipal water under streamflow conditions that prevailed in 1929, 1934, 1935, and 1955. The annual results are summarized in the table below.

Municipal water requirement in addition to present Ashley Creek supply for Vernal, Maeser, and Naples areas

		Requirement					
		Average per capita requirement	Total annual requirement	Annual requirement in addition to supply available from Ashley Creek in selected years[1] (acre-feet)			
Year	Population	(gallons daily)	(acre-feet)	1929	1934	1935	1955
1956	5,820	224	1,460	20	380	140	180
1960	6,800	225	1,710	40	560	240	360
1970	9,800	230	2,520	180	1,270	760	970
1980	12,000	240	3,230	430	1,953	1,290	1,500

1/ Exclusive of storage rights in Ashley Valley Reservoir Company.

The table shows that by 1980 an additional 1,500 acre-feet of municipal water will be needed in a year such as 1955 and that, even with that much additional water, shortages will be experienced in a critically dry year such as 1934. Resolutions were passed in February 1957 by the Vernal City Council, the Maeser Town Board, and the Naples Water Company to the effect that an additional municipal water supply in the amount of

1,500 acre-feet is required to supply the increasing needs of the area over the next 25 years and that the respective communities are willing to contract for the additional water provided such procurement is economically feasible.

Plans for increasing water supply

Plans for the Vernal unit include additional municipal water in the amount of 1,500 acre-feet annually for the Vernal, Maeser, and Naples areas. The increased supply will be diverted from Ashley Spring and distributed through the existing pipeline system which has sufficient capacity for that purpose. In order to replace the spring water to irrigators who now use it, the municipalities will acquire Vernal unit water in the Stanaker Reservoir for release to the irrigators through the Stanaker Service Canal. The municipal subscription will be on the basis of a firm water supply in order to avoid the shortages that will occur in dry years. This arrangement will be made because shortages of municipal water are more damaging than irrigation shortages. The preference to the municipalities will be taken into account in the allocation of unit costs between irrigation and municipal use.

Ample water flows from Ashley Spring to provide the additional municipal supply. Measurements made through 1944, 1945, and 1955 show that the spring flow in excess of diversions to the municipal system varied from 15 to 45 second-feet. Increased diversions under the unit plan will not exceed 2 second-feet.

Any additional water diverted into the municipal system will bypass the powerplant of the Utah Power and Light Company and will reduce the water supply for the plant. Since continued operation of the plant for any length of time is believed to be uncertain, however, no allowance was made in the unit analysis for any curtailment of power generation.

Ashley Valley Rural Areas

Rural residents living outside the Vernal, Maeser, and Naples areas now served by the municipal water system either haul culinary water to their homes or take it from irrigation ditches. Neither method provides an adequate, convenient, nor sanitary water supply for domestic use.

The Water Savings pipe system planned as a part of the Vernal unit could be adapted to supply both the domestic and stock-watering needs of the rural areas. This would probably require the construction of regulatory tanks or reservoirs on the system as well as the extension of service lines to each farm or residence. The Water Savings pipe system, now designed primarily for stock watering, would run within a mile of all rural residences but would not include service branches.

By a count made in 1956, approximately 300 families live in the rural area. Assuming 4.22 persons per family, which is the average for Uintah County according to Census Bureau data for 1945, the total population is 1,270. The rural population is not expected to change materially and was assumed to remain constant in determining future domestic water requirements.

Domestic water requirements per capita as previously determined for Maeser should be representative of the rural areas in Ashley Valley. Thus the present average daily requirement of 162 gallons per person may be increased to 175 gallons in keeping with the trend toward slightly greater use per capita. On the basis of a population of 1,270 and an average daily requirement of 175 gallons per capita, the annual requirement would be 250 acre-feet.

The per capita water requirements in Maeser, upon which the foregoing estimate is based, include some water for domestic animals. A greater number of animals in proportion to the number of people is found in the other rural areas, however, so that additional water will be required for stock watering. The additional stock-watering requirement from a piped system will be felt only in the nonirrigation season. During the irrigation season many of the livestock will be away from the farms on summer range and those remaining on the farm could largely be supplied from irrigation ditches. The nonirrigation season stock-watering requirement from a piped system, determined on the basis of the number and kind of livestock to be served, is estimated at 126 acre-feet for the season.

The monthly distribution of the domestic and stock-watering requirements of the rural areas is shown below.

	Water requirement (acre-feet)		
Month	Domestic	Stock watering	Total
January	13	20	33
February	11	21	32
March	12	22	34
April	21	22	43
May	29	--	29
June	34	--	34
July	34	--	34
August	27	--	27
September	26	--	26
October	20	--	20
November	12	21	33
December	11	20	31
Total	250	126	376

CHAPTER VIII

COOPERATIVE PLANNING

The Vernal unit of the Central Utah project is planned primarily as an irrigation development. It will also provide some municipal water and will affect recreation, fish and wildlife, mineral resources, flood control, and public health.

Responsibility for planning the irrigation development has rested largely with the Bureau of Reclamation. The direct agricultural benefits have been independently appraised, however, by the Department of Agriculture. A number of other Federal agencies have cooperated in appraising effects of the unit in their fields of interest and in some instances have recommended the construction of additional facilities or operating practices that will enhance the associated unit benefits. The following Federal agencies have prepared reports on the Vernal unit which are appended to this report and which provide the basis for the discussions of this chapter.

National Park Service
Fish and Wildlife Service
Bureau of Mines
Corps of Engineers
Public Health Service
Department of Agriculture

Acknowledgments

The Bureau of Reclamation wishes to acknowledge the valuable information and assistance received in the unit investigations from agencies which have prepared reports and from numerous other local, State, and Federal entities who have cooperated.

Recreation

Recreational aspects of the Vernal unit were appraised in a report by the National Park Service dated October 1956. The Service found that recreational development at Stanaker Reservoir will be limited by the rough terrain. On the northwest side of the reservoir, however, a small area could be developed for recreation. It should include individual picnic areas and boating facilities, with necessary parking areas. An access road to the recreational area also should be constructed. The road would be a continuation of an existing unimproved public road and would approach the area from the southwest. Eventually the access road could be extended beyond the planned development to a junction with relocated State Highway 44 north of the reservoir. This could make a pleasant 16-mile loop road from the Vernal-Maeser area.

The Park Service estimates that at least 15,000 people will use the reservoir during a season if adequate facilities are provided. If good fishing materializes, a greater visitation may be expected. The use will generally be by nearby residents so that the reservoir will be of less than National significance.

The National Park Service estimates the cost of the recreational facilities at $92,000 which, when amortized over a 25-year period at 2.5 percent interest, is equivalent to about $5,000 annually. The annual cost of operation and maintenance is estimated at $2,100, making the total annual cost $7,100.

In order to arrive at a "judgment value" of the anticipated recreational benefits, the Park Service capitalized the annual cost of $7,100 for 100 years at 2.5 percent, thus developing a value of $260,000 as the benefit arising specifically from the recreational facilities. It assumed that a like benefit would arise from the recreational use of the reservoir, making a total recreational benefit over a 100-year period of $520,000 or a benefit of $14,200 annually.

The Park Service recommends that a State, county, or municipal agency be encouraged to assume the administration and operation of the recreational area. Uintah County and the towns of Vernal and Maeser were mentioned as prospective administrators. The recreational area will approximate the geographic center of the developed portion of the county.

The Bureau of Reclamation endorses the recommendations of the National Park Service and has included the recommended recreational facilities in the unit plan and the estimated costs and benefits in the overall financial analysis. Costs incurred in providing recreational facilities shall be nonreimbursable as provided in the project authorizing act.

Fish and Wildlife

The Fish and Wildlife Service evaluated effects of the Vernal unit on fish and wildlife in a report dated May 1957. The Service concluded that without special features for fish and wildlife propagation the unit would provide additional sport fishing values and would decrease present values for game and fur animals. It recommended certain measures, however, that would mitigate unit-caused damages to upland game and waterfowl and further improve conditions for these wildlife resources.

Stanaker Reservoir is expected to provide a favorable habitat for trout if it is stocked and maintained for that purpose. The present value of the Stanaker Reservoir site as winter range for big game and as an upland game habitat will be lost when the site is inundated. The provision of supplemental irrigation water to farm lands in the unit area will also slightly lower the quality of these lands as a habitat for upland game but will improve the area for waterfowl. Waterfowl will be adversely affected,

however, by the reduction of flood flows of Ashley Creek since this will reduce marsh areas along the creek channel and will diminish the water supply for the Stewart Lake Refuge located near the junction of Ashley Creek with the Green River. The fur animal habitat at the Stewart Lake Refuge will be damaged to a degree that will more than offset the improved fur animal conditions along unit drains and canals and the new habitat along the shores of Stanaker Reservoir.

As a means of mitigating losses and improving conditions for upland game, the Fish and Wildlife Service recommends the acquisition, development, and management for wildlife of small plots of land interspersed throughout the irrigated farm land. The plots would range from 5 to 10 acres in size and would amount to a total of 125 acres. They would be confined to pasture lands, margins of drainage ditches, and odd corners throughout the irrigated area. The tracts must have soils suitable for growing cover plants. By fencing the tracts and establishing winter food and cover plantings where necessary, it would be possible to provide critical winter cover for pheasants and other game birds. The cost of acquiring the lands is estimated at $9,400 and of fencing and development at $12,700. Annual operation and maintenance costs, estimated at $760, will be borne by the Utah State Department of Fish and Game.

The Fish and Wildlife Service recommends that water be pumped from the Green River to the Stewart Lake Refuge in order to offset unit-caused damage and further improve the refuge for migrating and nesting waterfowl. The pump would deliver 5 second-feet of water to the refuge during the months of March, April, May, September, and October. The installation cost is estimated at $4,500 and the annual operation and maintenance cost at $400.

The estimated monetary effect of the Vernal unit on fish and wildlife values is summarized in the following table.

Estimated monetary effects of Vernal unit on fish and wildlife

Resource	Average annual benefit or loss (-) from Vernal unit		Cost of recommended facilities		
	Without specific fish and wildlife facilities	With recommended fish and wildlife facilities	Capital costs: Total	Capital costs: Annual equivalent cost 1/	Annual operation and maintenance costs
Fishery	$11,000	$11,000	--	--	2/
Big game	-1,100	-1,100	--	--	--
Upland game	-300	2,950	$22,100	$610	$760
Fur animals	-50	-50	--	--	--
Waterfowl	-850	750	4,500	125	400
Total	9,700	13,550	26,600	735	1,160
Rounded	9,700	13,600	27,000	700	1,200

1/ Amortized capital costs for 100 years at 2.5 percent interest.
2/ Costs of stocking and operating Stanaker Reservoir were not reported by the Fish and Wildlife Service.

The Bureau of Reclamation is in general accord with the recommendations of the Fish and Wildlife Service. The costs of the recommended facilities are included in the unit cost estimates made for this report and the estimated costs and benefits pertaining to fish and wildlife are taken into account in the financial analysis. The project authorizing act of April 11, 1956, provides that costs incurred in providing fish and wildlife facilities shall be nonreimbursable.

In determining the irrigable area for the unit, the Bureau of Reclamation did not set aside any specific lands for the 125-acre game habitat recommended by the Fish and Wildlife Service. It was assumed that lands used for this purpose need not necessarily be irrigable within the Bureau of Reclamation standards and therefore they will not be deducted from the acreage that will be provided unit irrigation water.

The Fish and Wildlife Service recommends that the sum of $31,250 be provided for the installation, operation, and maintenance of a pump at the Stewart Lake Refuge. This sum apparently includes the capitalized cost of operating and maintaining the pump over a long-term period. Since funds for operation and maintenance of the pump will probably be obtained by annual appropriations rather than an initial lump sum, the Bureau of Reclamation used the estimated annual cost rather than the capitalized cost in its overall unit analysis.

Mineral Resources

In a report dated December 1956, the Bureau of Mines concluded that no significant mineral resources will be affected by construction of the Stanaker Reservoir. A small quantity of coal is within the area needed for construction and maintenance of the reservoir, but this is not considered important. The uranium potential in the reservoir site was considered negligible. No oil or gas drillings have been made in the reservoir area.

Flood Control

In a letter dated August 7, 1956, the Corps of Engineers concluded that floods on Ashley Creek damage irrigation structures, roads, and bridges, and erode some farm lands, mostly those that are located outside the irrigable area of the Vernal unit. Peak floods up to 3,350 second-feet have been recorded whereas the safe carrying capacity of the creek channel is only 700 second-feet.

The letter from the Corps of Engineers did not mention flood control benefits from the reclamation features of the Vernal unit. Apparently such benefits were considered to be insignificant, particularly since only off-stream storage will be provided and the reservoir feeder canal will have

a capacity of only 400 second-feet. The Corps of Engineers concluded that the construction of special flood control features as a part of the Vernal unit would be infeasible.

Public Health

The Public Health Service, in collaboration with the Utah State Department of Health, has concluded in its report of December 1956 that the Vernal unit could either benefit or impair mosquito control, depending on factors of construction and operation. The application of additional irrigation water, considered alone, will tend to increase mosquito production. Of benefit in mosquito control, however, will be the storage of high spring flows in place of the past practice of lavishly spreading water on the land, the lining of canals to prevent seepage, the construction of drains, and the more efficient control and use of irrigation water that may be expected with operation of the unit. The Public Health Service made several recommendations concerning unit construction, operation and maintenance, and farm practices aimed at minimizing mosquito-breeding areas. The measures suggested are in harmony with the reclamation objectives of efficient control, conveyance, and utilization of irrigation water. The Bureau confidently expects that the Vernal unit will bring a substantial benefit in mosquito control.

The Public Health Service recommended that an effort be made to construct or extend pipelines that will bring to the rural residents of Ashley Valley a satisfactory supply of domestic water. The extension of domestic pipelines to the rural areas is largely a matter of local concern. The Bureau, however, will be glad to negotiate with the local people concerning a means of accomplishing the purposes of its planned Water Savings pipe system in combination with a locally sponsored domestic water system that would operate all year.

Certain recommendations were made by the Public Health Service with regard to the disposal of municipal and private sewage. Such disposal is not directly related to the Vernal unit, however, and is a matter over which the Bureau of Reclamation has no jurisdiction.

Agriculture

In response to a directive by the President in his letter of March 19, 1954, to the Secretary of Agriculture, the Department of Agriculture has prepared a report on the direct agricultural benefits anticipated from the Vernal unit. It has also reported on the impact of the unit on National forests and the relation of watershed conditions to the unit.

The Department of Agriculture concluded that the Vernal unit lands which will receive additional water are suitable for long-continued cultivation under irrigation. From studies of representative farms in the area

with and without the supplemental water provided by the Vernal unit, the Department of Agriculture estimated that the direct agricultural benefits from the unit will be substantially the same as the benefits estimated independently by the Bureau of Reclamation.

The Forest Service concluded that the Vernal unit will not impair existing services nor anticipated future services and facilities in the Ashley National Forest. It also concluded that use of the forest resources will not be materially influenced by unit construction and operation. The Forest Service presumed that recreational uses and facilities at Stanaker Reservoir will be administered and operated by State or local agencies and will have very limited effect upon the use and management of the National forest lands.

The Forest Service reported that vegetative cover and erosion conditions in the watershed area above the proposed development are poor. It did not recommend any remedial measures other than those which are normally a part of regular programs of land-administering agencies. It proposed, however, that land-administering agencies, such as the Forest Service, Bureau of Land Management, and State of Utah, and private land owners should orient their regular and special programs to restore and maintain a good cover of vegetation so that the runoff will be retarded and erosion reduced.

CHAPTER IX

AGRICULTURAL ECONOMY

The farmers' ability to repay unit costs was estimated from studies of anticipated conditions without and with development of the Vernal unit. The studies were based on information collected by the Bureau of Reclamation over a period of several years including a farm management survey made in the unit area in 1956 by the Bureau of Reclamation and the United States Department of Agriculture.

Without Unit Development

Crops and livestock

Agricultural development in the unit area consists primarily of the production of livestock, livestock products, and livestock feed. Such production is necessitated by the climate, topography, and long distances to markets.

The main types of livestock in the area are dairy cattle, beef cattle, and sheep with most of the farms maintaining two of the livestock types. Approximately 55 percent of the farmers maintain dairy cows, approximately 65 percent have farm flocks of sheep, and about 45 percent have beef cattle. The dairy farms primarily produce Grade A or market milk and Grade C or manufacturing milk. Most of the dairy products are marketed in the Salt Lake City area. Sheep enterprises consist primarily of farm flocks. The practice is to combine wool-type ewes with mutton-type rams, thus obtaining high yields of both wool and meat. Most of the beef cattle and sheep are maintained only for a short time in the unit area and then are shipped for fattening to the Corn Belt or the Pacific Coast. Limited numbers of sheep and beef cattle are grazed in the spring and summer months on the public range lands adjacent to the unit area. Farm feeding is required in the winter months for the range stock and throughout the year for cattle not permitted on the range.

Crop production is limited almost entirely to alfalfa, pasture, wheat, barley, oats, and corn silage which are used locally for livestock feed. Per acre yields are low as the late-season water supply prevents full maturing of crops and discourages the use of proper rotation practices. Practically no cash crops such as potatoes and canning crops are produced although the area does have the potential for production of such crops.

Size of farms

There are approximately 450 farm ownerships in the unit area, ranging in size from less than 10 acres to more than 900 acres. The average full-time holding contains about 160 acres, including about 105 acres of irrigated land and 55 acres of poor quality grazing land. The smaller holdings, generally of 50 acres or less, are run on a part-time basis by operators with off-the-farm employment. Acreages in various farm holdings in the unit area are shown below.

Range in size[1/]	Number of property ownerships
5 to 50 acres	264
51 to 100 acres	105
101 to 160 acres	54
161 to 320 acres	24
Over 320 acres	8
Total	455

1/ Including both irrigated land and dry grazing land.

Although a number of ownerships contain more than 160 acres of land, as shown in the tabulation above, the irrigated land does not exceed 160 acres in any single ownership nor 320 acres in any joint ownership. Thus all the farms are within the acreage limitation established by reclamation law.

Fiscal aspects

Assessed Values

The actual value of farm land in the unit area varies considerably, depending on the suitability of the land for future residential use and its present state of agricultural development. Assessed values of irrigated crop land range from $11 to $50 an acre while values of irrigated pasture land range from $10 to $24 an acre. Values of nonirrigated land vary from $1.20 to $4.80 an acre. The county tax rate levy on assessed land values in 1956 was $43.90 per $1,000 valuation. Additional special taxes amounting to about 30 mills were levied on the assessed value of sheep and 8 mills for cattle to cover the cost of special services to livestock. Another 1 mill charge was made for the Uintah Water Conservancy District.

Farm Mortgage Indebtedness

The extent of farm mortgage debt in the Vernal area is constantly changing. Debts generally decreased from 1930 to 1945 and since that time have been increasing steadily. It is estimated that the total farm mortgage indebtedness in the Vernal unit area is approximately $800,000

at the present time. Practically all loans are in good standing. The supply of farm credit appears ample for the needs, with commercial banks, insurance companies, the National Farm Loan Association, the Farmers Home Administration, and private individuals all making loans within the area.

With Unit Development

Crops and livestock

Significant but not major changes in the area's basic economy will result with development of the Vernal unit. Better utilization can be made of the existing farm lands, however, as the increase in late-season water supply will permit longer maturing of crops and proper rotation practices. Higher per acre yields of the feed crops will be realized. Also some land now devoted to alfalfa can be utilized for rotation pasture and corn for silage. The increase in feed crops will permit a general expansion and stabilization of the livestock industry. The most significant expansion is expected in the dairy and farm flock sheep enterprises as such intensive enterprises are particularly suited to the Vernal area with its small farms and limited range facilities. Some increase also will be realized in beef production with more local fattening of the cattle.

Since no new lands will be brought under cultivation, development of the unit will be in compliance with provisions of the project authorizing legislation pertaining to production of surplus farm crops. Wheat will be the only crop produced on the supplemental service land that could be termed surplus. Vernal, however, is now a deficit area for small grain and the small increase in wheat production will only tend to reduce the amount of small grain presently being shipped to the area.

Land development

With unit development it will be necessary for the farmers to make a few land development improvements at their own expense. These will include provision of turnouts, some leveling or planing, and ditches. The cost of such improvements has been included as a farm expense in the farm budget analyses.

Development period

Irrigators should be allowed a development period of about 3 years after the first delivery of unit water in order that they might attain full crop production before they are assessed irrigation construction costs. A 3-year development period is considered adequate since the increased water supply will be utilized on presently irrigated lands and benefits can be realized quickly with little change in farming practices and with only small land development costs.

Local support

The Vernal unit has the support of the local population. Evidence of such support is the approval of the local people for organization of the Uintah Water Conservancy District which will be the contracting entity between the United States and the water users.

Irrigation Repayment

Bases for analysis

Estimates of possible payments by the irrigators were made from detailed studies of agricultural conditions. The studies were based on the total irrigable area of 14,781 acres with the land in the Vernal town site considered as farm land since it is a relatively small acreage and does not justify a separate analysis.

Payment capacity

Payment capacity was estimated by the farm budget method which involves analyses of annual income and expenditures anticipated on representative farms without and with the Vernal unit. The farms selected as representative for the analyses were Grade A dairy, beef, and Grade C dairy-sheep farms. In the study of these farms different land classes and sizes of farms were considered. Budgets for conditions both without and with the unit were based on 100 acres of class 2 land for the Grade A dairy farms and 120 acres of class 2 land for the beef farms. For the Grade C dairy-sheep farm one "without" budget was made for 120 acres of class 2 land and three "with" budgets were made, including budgets for 100 acres in class 1, 120 acres in class 2, and 160 acres in class 3.

Prices used in the farm budget analyses reflect the average prices which farmers could expect to receive and pay over the irrigation repayment period. Price projections are based on a level of 235 for prices received and 250 for prices paid for items of agricultural production (1910-14=100). This level is essentially the same as the 250/265 level recently adopted by the Bureau of Reclamation.

Summarized data from the farm budget studies including the estimated payment capacities for the representative farms are summarized in the table on the following page.

Amortization capacities and recommended annual installment

Increased payment capacities with unit development for representative farms as determined by the farm budget analyses were used as a basis for estimating average amortization capacities by land class for the entire

Summarized data from representative farm budgets

	Grade A dairy farm		Beef farm		Grade C dairy-sheep farm			
	Without unit	With unit	Without unit	With unit	Without unit	With unit		
Land class	Class 2	Class 2	Class 2	Class 2	Class 2	Class 1	Class 2	Class 3
Size of farm (acres)	100	100	120	120	120	100	120	160
Receipts								
Crops	$357	$588	$834	$1,017	$655	$1,151	$1,534	$1,695
Livestock	9,649	12,322	6,931	8,342	6,284	7,955	7,955	7,955
Farm perquisites	723	723	685	685	693	693	693	693
Total	10,729	13,633	8,450	10,044	7,632	9,799	10,182	10,343
Expenses[1]								
Taxes	404	429	474	506	418	453	445	454
Depreciation	1,168	1,180	1,105	1,112	1,106	1,123	1,128	1,188
Other	3,093	4,267	2,430	2,774	2,180	2,699	3,065	3,785
Total	4,665	5,876	4,009	4,392	3,704	4,275	4,638	5,427
Net farm income	6,064	7,757	4,441	5,652	3,928	5,524	5,544	4,916
Investment allowance at 5 percent	1,625	1,746	2,041	2,243	1,549	1,635	1,674	1,795
Family living allowance	3,200	3,800	2,208	2,800	2,187	3,200	3,200	2,650
Payment capacity per farm	1,239	2,211	192	609	192	689	670	471
Payment capacity per acre	12.39	22.11	1.60	5.07	1.60	6.89	5.58	2.94
Increased payment capacity per acre[2]	--	7.30	--	2.60	--	--	3.00	[3]1.20

1/ Expenses exclude irrigation operation and maintenance costs.
2/ Allowance has been made for contingency.
3/ Weighted to include Grade A dairy and beef farms.

unit area. For combinations of land classes and types of farms for which no specific farm budgets were made, projections were made from budget estimates on the basis of known relationships. In determining the amortization capacities, allowance was made for increased payments that would be required with unit development for irrigation operation, maintenance, and replacement costs. The average amortization capacities by land class were weighted to account for variations in the different types of farms. The amortization capacities thus determined amount to $3 per acre-foot of unit water supply for class 1 land and land in the town site, $2.50 for class 2 land, and $0.25 for class 3 land. The estimates made and explanations of projections used in arriving at the estimates are summarized in the table on the following page.

Although the farmers' amortization capacities vary according to land class, a uniform annual installment is recommended to simplify administration of the repayment. The installment recommended amounts to $1.65 per acre-foot of unit water supply and is based on an average of the estimated amortization capacities weighted in proportion to the amount of the unit area in each land class. Although the installment exceeds the estimated payment capacity for class 3 land, it is not expected to exceed the capacity of individual farmers as nearly all of the class 3 land is interspersed and farmed in conjunction with the more productive class 1 and 2 lands.

On the basis of the recommended installment of $1.65 per acre-foot of unit water, the irrigators could pay an average of approximately $30,000 each year towards construction costs. The actual repayment ability for a specific year may vary from the average because of changes in farm prices and other factors. For this reason, a variable repayment plan would be desirable in the unit repayment contracts.

Amortization capacity and recommended annual installment

Type of farm	Irrigable area (acres)	Unit water supply (acre-feet)	Increased payment capacity per acre	Increased operation, maintenance, and replacement costs per acre	Amortization capacity: By type of farm: Per acre	Amortization capacity: By type of farm: Per acre-foot	Amortization capacity: Weighted by land class: Per acre-foot	Amortization capacity: Weighted by land class: Total (Rounded)
Class 1	3,286	3,600	--	$0.90	--	--	1/ $3.00	$10,800
Class 2								
Grade A dairy	(1,340)	(1,600)	$7.30	.90	$6.40	$5.30		
Grade C dairy-sheep	(2,680)	(3,220)	3.00	.90	2.10	1.70		
Beef	(1,337)	(1,600)	2.60	.90	1.70	1.40		
Subtotal or average	5,357	6,420					2.50	16,200
Class 3	5,801	7,600	1.20	.90	.30	.25	.25	1,900
Vernal townsite	337	380					2/ 3.00	1,100
Total	14,781	18,000					3/ 1.65	30,000

1/ Estimated as 120 percent of repayment capacity for class 2 land.
2/ Assumed to be the same repayment capacity as that for class 1 land.
3/ Recommended annual repayment rate.

CHAPTER X

FINANCIAL ANALYSIS

Benefit-Cost Analysis

The economic desirability of developing the Vernal unit was determined by a comparison of the unit's benefits from a National standpoint and the Federal costs of development. Both benefits and costs were computed as average annual equivalent values at 2.5 percent interest over a 100-year period beginning with the first year of full unit operation. The comparisons were made for a 100-year period as the unit is expected to have a minimum useful life of at least 100 years in view of the allowances made for replacements.

Benefits

The benefit-cost analysis was based on consideration of all benefits from the unit that could be evaluated in monetary terms, including those from irrigation, provision of municipal water, recreation, and fish and wildlife conservation. No evaluations were made of the minor benefits that would incidentally result from mosquito abatement and reduction of flood flows along Ashley Creek.

Irrigation Benefits

Irrigation benefits from the Vernal unit are expected to average $253,500 annually over the 100-year period of analysis which includes the 3-year development period recommended for the unit farmers. About $167,400 of the total benefit represents direct benefits, measured by the increase in net farm income that would be realized with unit development. Approximately $66,100 represents indirect benefits, measured by the increased profits of businesses handling, processing, and marketing products from the unit area and of enterprises supplying goods and services to the farms within the area. The remaining $20,000 of the irrigation benefit would be of a public nature realized from the increase or improvement in community facilities and services and stabilization of the local and regional economy. Benefits from irrigation were based on a level of 235 for prices received by farmers and 250 for prices paid for items of agricultural production (1910-14=100). The price basis is comparable to the 250/265 level recently adopted by the Bureau of Reclamation.

Municipal Water Benefits

Benefits from municipal water are estimated at an average of $23,800 annually. This estimate is based on the average annual equivalent cost of

obtaining a comparable water supply by the cheapest alternative means which is considered to be the purchase of approximately 80 percent of the irrigation supply from Oaks Park Reservoir. The cost of the alternative was based on the present value of the Oaks Park Reservoir water rights and physical facilities that would have to be obtained. An allowance also was made for costs of operation, maintenance, and replacements of the facilities obtained.

No allowance was made in the analysis for the reduction in power production at the Utah Power and Light Company plant on Ashley Creek that would result from the municipal diversions. As previously discussed, continued operation of the plant for any length of time is believed to be uncertain and therefore loss of production is not attributed directly to the unit.

Recreational Benefits

Annual recreational benefits are expected to amount to $14,200. This estimate was made by the National Park Service and, as discussed in the attached report of that Service, amounts to twice the specific cost of developing, operating, and maintaining recreational facilities.

Fish and Wildlife Benefits

Net benefits to fish and wildlife as estimated in the attached report of the Fish and Wildlife Service will amount to approximately $13,600 annually.

Summary of Benefits

Annual benefits of the unit that have been evaluated in monetary terms are summarized below.

Irrigation	
Direct	$167,400
Indirect	66,100
Public	20,000
Subtotal	253,500
Municipal water	23,800
Recreation	14,200
Fish and wildlife	13,600
Total	305,100

Average annual equivalent costs

For comparison with the average annual benefits, the average annual equivalent value of all Federal costs of development was determined for the 100-year period of analysis. This value includes the unit investment amortized over the 100-year period of analysis at 2.5 percent interest; annual operation, maintenance, and replacement costs; and the unit's prorated share of costs of regulatory facilities of the Colorado River Storage project.

The unit investment as determined for the analysis includes the construction costs estimated on the basis of January 1957 prices as well as interest during construction computed at the rate of 2.5 percent during the construction period. The cost of past investigations was excluded since costs already incurred have no bearing on the relationship of future costs and the benefits that would result therefrom. No allowance was made for salvage value after the useful life of the unit as salvage would be limited to land in the reservoir basin and this would not be significant. Operation, maintenance, and replacement costs were based on average prices existing between 1954 and 1956. The Vernal unit's prorated share of the cost of regulatory features of the Colorado River Storage project was based on $0.40 for each acre-foot of average annual increase in unit stream depletion estimated at 11,800 acre-feet.

The average annual equivalent costs are summarized in the following tabulation.

Item	Total value	Average annual equivalent value
Construction cost	$6,874,000	
Interest during construction	221,000	
Less cost of past investigations	-350,000	
Unit investment	6,745,000	$184,100
Annual operation, maintenance, and replacement costs		22,800
Prorated share of cost of regulatory features of the Colorado River Storage project		4,700
Total		211,600

Benefit-cost relationships

Average annual benefits of the unit ($305,100) would compare the average annual equivalent costs ($211,600) in a ratio of 1.44 to 1. The benefits would exceed the costs by an average of $93,500 annually.

Cost Allocations

Estimated costs of the Vernal unit, including construction costs and annual operation, maintenance, and replacement costs, were allocated to irrigation, municipal water, recreation, and fish and wildlife conservation. Only the costs of facilities provided specifically for recreation and fish and wildlife conservation were allocated to those purposes. The remaining costs were allocated to irrigation and municipal water by the

separable costs-remaining benefits method. The allocation to any purpose is not less than the separable cost of including that purpose in the multiple-purpose development and not more than the benefits or the alternative single-purpose cost. The allocations made are shown in the tabulation below.

Allocation of unit costs

Unit purpose	Construction cost	Annual operation, maintenance, and replacement costs
Recreation	$92,000	$7,100
Fish and wildlife conservation	27,000	1,200
Irrigation	6,154,000	12,700
Municipal water	1/ 619,000	1,800
Total	6,892,000	22,800

1/ Includes $18,000 for interest during construction.

Repayment

In accordance with the project authorizing act of April 11, 1956, the allocations to recreation and fish and wildlife conservation will be nonreimbursable. The municipal water and irrigation costs will be repaid by the water users as discussed in the following sections. The repayment analyses are based on repayment in 50 years, as specified in the authorizing legislation.

Irrigation repayment

As explained in Chapter IX, irrigators could pay their annual operation, maintenance, and replacement costs and could pay an average of $30,000 each year toward their allocation of construction costs. Thus in 50 years they could pay $1,500,000 or 24 percent of the total construction cost allocated to irrigation. The remaining portion of the irrigation allocation, amounting to $4,654,000, will be paid from revenues in the Upper Colorado River Basin Fund that are apportioned to Utah. The irrigation costs will be interest free in accordance with existing reclamation law.

Municipal water repayment

Costs allocated to municipal water, including interest during construction, will be repaid with interest. An interest rate of 2 7/8 percent was used in this analysis, but the actual rate will be determined later by the Secretary of the Treasury as provided in the project authorizing legislation.

Since the municipal water made available by the unit is to some extent a reserve to meet the growing needs of the future, the repayment

ability of the municipalities will increase over the repayment period as the water use increases. For this reason repayment schedules have been prepared on the basis of increasing rates in five steps of 10 years each over the repayment period. The annual payments would start at $18,000 and would increase through steps of $21,700, $25,400, $29,100, and $33,200. These payments would fully repay the construction costs allocated to municipal water with interest over a 50-year period. The total interest paid would, of course, be greater than it would be under a constant repayment rate and would amount to $663,225 over the 50-year period. The five-step repayment rates indicated would be equivalent to per acre-foot rates of $12, $14.47, $16.93, $19.40, and $22.13. In addition to repaying capital costs, the municipalities would pay Vernal unit costs for operation, maintenance, and replacements allocated to municipal water, estimated at $1,800 annually or $1.20 an acre-foot.

Payout schedule

The payout schedule for irrigation and municipal water is shown on the following page.

Payout schedule

Year of study	Fiscal year	Preliminary estimates of Utah's cumulative Upper Colorado River Basin Fund credits: Total	Previous commitments	Vernal unit commitment	Balance	Irrigation: Operation, maintenance, and replacement costs 1/	Repayment accomplished from: Irrigation water users	Upper Colorado River Basin Fund credits	Total	Irrigation plant in service	Interest-free balance to be paid	Total revenue	Municipal water: Revenue applied to: Operation, maintenance, and replacement costs	Interest on investment at 2 7/8%	Principal	Municipal plant in service	Balance to be paid	Recapitulation: Total operation, maintenance, and replacement costs	Total revenue applied to repayment	Total plant in service	Total balance to be paid	Year of Study
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)
0	1961	0	0	0	0			0		$5,579,000	$5,579,000					$619,000	$619,000	$14,500		$6,198,000	$6,198,000	0
1	62					$12,700	0				5,579,000	$19,800	$1,800	$17,796	$204		618,796	$14,500	$204	6,198,000	6,197,796	1
2	63									5,579,000	5,579,000			17,790	210		618,586		210	6,198,000	6,197,586	2
3	64						0				5,579,000			17,784	216		618,370		216	6,198,000	6,197,370	3
4	1965						$30,000		$30,000	5,579,000	5,749,000			17,778	222		618,148		30,222	6,398,000	6,367,048	4
5	66									6,154,000	6,094,000			17,772	228		617,920		30,228	6,773,000	6,711,920	5
6	67										6,064,000			17,765	235		617,685		30,235		6,681,685	6
7	68										6,034,000			17,758	242		617,443		30,242		6,651,443	7
8	69										6,004,000			17,751	249		617,194		30,249		6,621,194	8
9	1970										5,974,000			17,744	256		616,938		30,256		6,590,938	9
10	71										5,944,000	19,800		17,737	263		616,675		30,263		6,560,675	10
11	72										5,914,000	23,500		17,729	3,971		612,704		33,971		6,526,704	11
12	73										5,884,000			17,615	4,085		608,619		34,085		6,492,619	12
13	74										5,854,000			17,498	4,202		604,417		34,202		6,458,417	13
14	1975										5,824,000			17,377	4,323		600,094		34,323		6,424,094	14
15	76										5,794,000			17,253	4,447		595,647		34,447		6,389,647	15
16	77										5,764,000			17,125	4,575		591,072		34,575		6,355,072	16
17	78										5,734,000			16,993	4,707		586,365		34,707		6,320,365	17
18	79										5,704,000			16,858	4,842		581,523		34,842		6,285,523	18
19	1980										5,674,000			16,719	4,981		576,542		34,981		6,250,542	19
20	81										5,644,000	23,500		16,576	5,124		571,418		35,124		6,215,418	20
21	82										5,614,000	27,200		16,428	8,972		562,446		38,972		6,176,446	21
22	83										5,584,000			16,170	9,230		553,216		39,230		6,137,216	22
23	84										5,554,000			15,905	9,495		543,721		39,495		6,097,721	23
24	1985										5,524,000			15,632	9,768		533,953		39,768		6,057,953	24
25	86										5,494,000			15,351	10,049		523,904		40,049		6,017,904	25
26	87										5,464,000			15,062	10,338		513,566		40,338		5,977,566	26
27	88										5,434,000			14,765	10,635		502,931		40,635		5,936,931	27
28	89										5,404,000			14,459	10,941		491,990		40,941		5,895,990	28
29	1990										5,374,000			14,145	11,255		480,735		41,255		5,854,735	29
30	91										5,341,000	27,200		13,821	11,579		469,156		41,579		5,813,156	30
31	92										5,311,000	30,900		13,488	15,612		453,544		45,612		5,767,544	31
32	93										5,281,000			13,039	16,061		437,483		46,061		5,721,483	32
33	94										5,251,000			12,578	16,522		420,961		46,522		5,674,961	33
34	1995										5,221,000			12,103	16,997		403,964		46,997		5,627,964	34
35	96										5,191,000			11,614	17,486		386,478		47,486		5,580,478	35
36	97										5,161,000			11,111	17,989		368,489		47,989		5,532,489	36
37	98										5,131,000			10,594	18,506		349,983		48,506		5,483,983	37
38	99										5,101,000			10,062	19,038		330,945		49,038		5,434,945	38
39	2000										5,071,000			9,515	19,585		311,360		49,585		5,385,360	39
40	01										5,041,000	30,900		8,952	20,148		291,212		50,148		5,335,212	40
41	02										5,011,000	35,000		8,372	24,828		266,384		54,828		5,280,384	41
42	03										4,981,000			7,659	25,541		240,843		55,541		5,224,843	42
43	04										4,951,000			6,924	26,276		214,567		56,276		5,168,567	43
44	2005										4,921,000			6,169	27,031		187,536		57,031		5,111,536	44
45	06										4,891,000			5,392	27,808		159,728		57,808		5,053,728	45
46	07										4,861,000			4,592	28,608		131,120		58,608		4,995,120	46
47	08										4,831,000			3,770	29,430		101,690		59,430		4,935,690	47
48	09										4,801,000			2,924	30,276		71,414		60,276		4,875,414	48
49	2010	0				0					4,771,000	35,000		2,053	31,147		40,267		61,147		4,814,267	49
50	11	$2,048,000				$2,048,000					4,741,000	43,225		1,158	40,267		0		70,267		4,744,000	50
51	12	7,224,000				7,224,000					4,711,000	0		0	0		0		30,000		4,714,000	51
52	13	12,382,000	0	$4,654,000		12,382,000			30,000		4,681,000	0		0	0		0		30,000		4,684,000	52
53	2014	17,525,000	0	4,654,000		12,871,000	673,100	1,500,000	4,654,000	6,154,000	6,154,000	0	0	0	1,800	619,000	619,000	0	768,500	6,773,000	6,773,000	0	53
	Total	17,525,000				12,871,000	12,700	30,000	4,684,000			1,377,525	95,400	663,225	619,000			14,500	4,684,000			

Summary of cost allocations and repayment

Item	Irrigation	Municipal water	Recreation	Fish and wildlife	Total
Cost allocation					
Construction cost	$6,154,000	$601,000	$92,000	$27,000	$6,874,000
Interest during construction		18,000	--	--	18,000
Total	6,154,000	619,000	92,000	27,000	6,892,000
Repayment					
Investment repayment	1,500,000	619,000	1/	1/	2,119,000
Upper Colorado River Basin Fund credits	4,654,000	--	--	--	4,654,000
Total	6,154,000	619,000	--	--	6,773,000
Payment of interest during repayment period (rounded)	--	663,000	--	--	663,000

1/ Allocations to recreation and fish and wildlife are nonreimbursable.

1/ Excludes conservancy district administrative costs which are paid from revenues obtained from the ad valorem tax.

CHAPTER XI

FORMULATION OF DEVELOPMENT PLAN

The plan of the Vernal unit was formulated toward providing optimum development of the water resources of Ashley Creek. Under present conditions the natural streamflow and available storage are insufficient to meet the late season irrigation requirements, while in other seasons natural flows are in excess of needs. Thus further development of the water resources is dependent on additional storage regulation. The Stanaker and Maeser Reservoir sites were the only sites found worthy of consideration for such storage. The adopted plan utilizing the Stanaker Reservoir site is evaluated in the previous chapters of this report, and formulation of the plan is briefly discussed in the following section. The possibility for utilizing the Maeser Reservoir site is briefly discussed later in this chapter for the purpose of comparison and verification of the superiority of the adopted plan.

Formulation of Adopted Plan

The scale of development of the Vernal unit is limited by the economy of providing long-term storage holdover to increase the amount of useable water and the inaccessibility of arable lands that are not presently irrigated. As pointed out in Chapter IV, significant irrigation shortages for most of the unit area would occur in only 3 years of the 27-year period of study. Additional reservoir capacity would only slightly increase the average reservoir yields. Thus the scale of development under the adopted plan is about the maximum that can be economically justified under present conditions.

The Vernal unit is physically and economically independent of other units of the initial phase of the Central Utah project. The unit will be an integral part of the ultimate phase of the project, but its early construction will in no way interfere with development of the ultimate phase.

No possibilities for hydropower development in the Ashley Creek Basin were found that would be nearly as economical as alternative sources of power for the area such as the nearby authorized Flaming Gorge unit of the Colorado River Storage project or possible fuel-electric power development.

A new distribution system for the irrigation supply was not required as a part of unit development inasmuch as the area worthy of irrigation is presently well served with canals and laterals of organized irrigation companies. In order to provide service to the maximum amount of land, the outlet from Stanaker Reservoir to the Stanaker Service Canal is planned at as high an elevation as is economically possible. Also a portion of the

Stanaker Service Canal is substituted for part of the existing Ashley Central Canal to bring as much of the unit area under the reservoir as possible so that exchanges of reservoir water and natural streamflow can be made to the best advantage for the Vernal unit. The capacity of the Stanaker Service Canal was determined from studies of the relationships of the existing normal streamflows, land classification surveys, and water requirements for full agricultural development.

Stanaker Feeder Canal from Ashley Creek to the top of the divide above the reservoir area was routed to bypass a cemetery which is near the point of diversion from Ashley Creek. The canal location from the divide to the reservoir was selected as the most advantageous economically. Consideration was given to locating the Stanaker Feeder Canal over the route of the existing Stanaker ditch. This route, however, is through rugged and broken terrain, would require a long and high drop, and has no advantage over the route selected.

Maeser Reservoir Plan

Features of the Maeser Reservoir plan would include the Maeser Reservoir on Ashley Creek at the head of Ashley Valley and the same Water Savings pipe system and drainage features as included in the Stanaker Reservoir plan previously described. The Maeser plan differs from the Stanaker plan in that the Maeser Dam and Reservoir would be substituted for the Stanaker Dam and Reservoir, the Ft. Thornburgh Diversion Dam, Stanaker Feeder Canal, and Stanaker Service Canal. The water that would be developed for irrigation and municipal use and the recreation and fish and wildlife values would be essentially the same under both plans.

Maeser Dam on Ashley Creek would be an earth-fill structure 192 feet high above streambed with a crest length of 1,920 feet and a total embankment of 6,158,000 cubic yards. The spillway capacity would be about 10,000 second-feet. The reservoir formed by the dam would have a total capacity of 40,000 acre-feet,of which 34,000 acre-feet would be active capacity.

Cost estimates for features of the Maeser Reservoir plan are tabulated on the following page.

	Estimated costs	
	Construction costs	Annual operation, maintenance, and replacement costs
Maeser Dam and Reservoir[1/]	$11,190,000	$6,000
Basic recreation facilities	92,000	7,100
Drainage system	675,000	2,000
Water Savings pipe system	340,000	2,000
Fish and wildlife	27,000	1,200
Total	12,324,000	18,300

1/ Reconnaissance estimate.

Average annual equivalent costs for a 100-year period with interest at 2.5 percent were estimated as shown below.

	Capital cost	Average annual equivalent cost
Construction cost	$12,324,000	
Interest during construction	442,000	
Net investment	12,766,000	
Amortization of net investment (100 years at 2.5 percent)		$348,700
Annual operation, maintenance, and replacement costs		18,300
Assignment of Colorado River Storage project cost		4,700
Total		371,700

The average annual equivalent cost of $371,700 for the Maeser Reservoir plan compares with a similar cost of $211,600 for the Stanaker Reservoir plan as derived in Chapter X for essentially the same benefits. In view of its materially higher cost, the Maeser Reservoir plan was discarded in favor of the Stanaker Reservoir plan.

CHAPTER XII

ADMINISTRATION AND CONTRACTS

Project Organizations

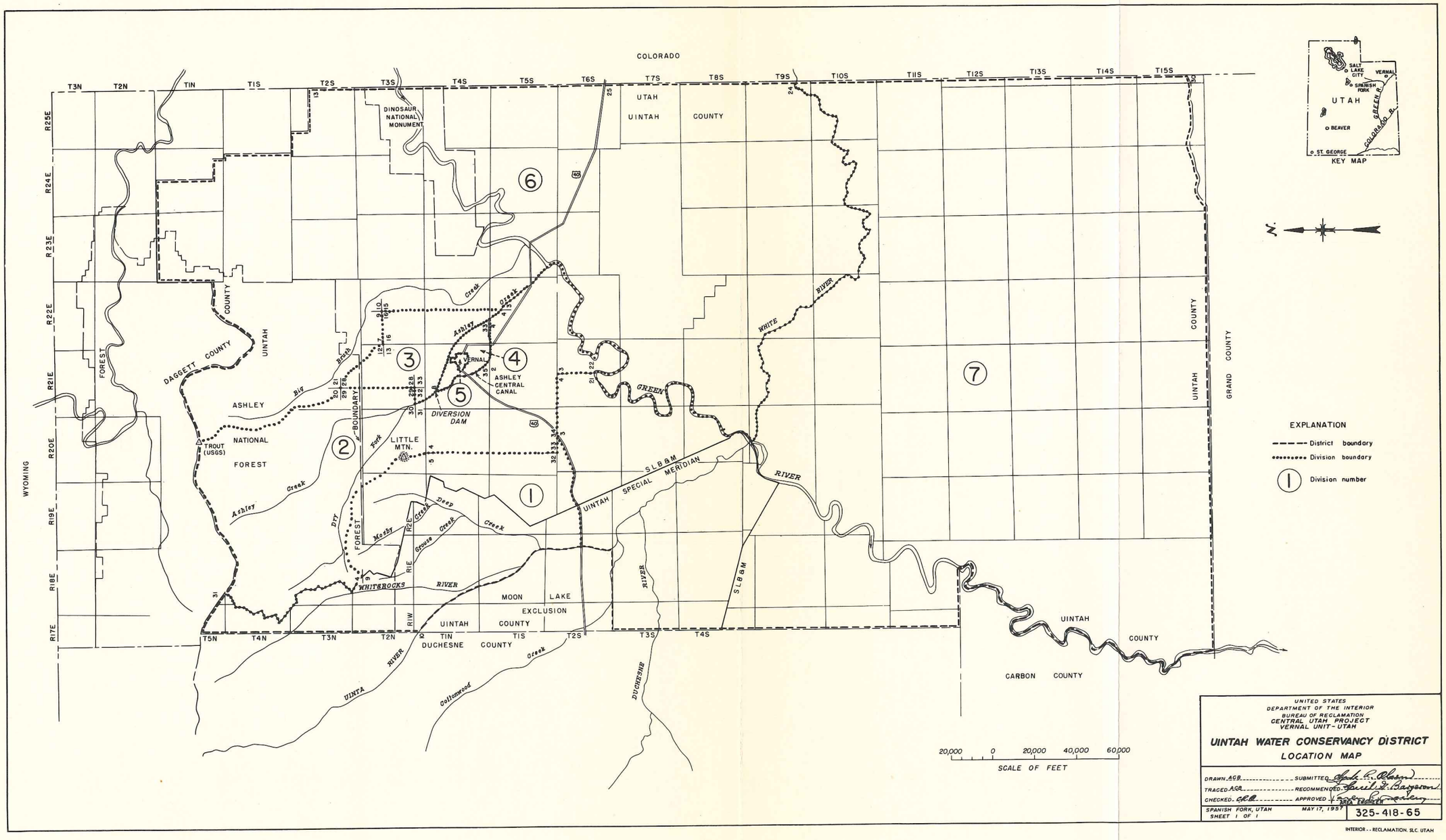
The Uintah Water Conservancy District was formed November 27, 1956, by order of the District Court of the Fourth Judicial District of the State of Utah. It will serve as a general administrative and contracting agency for the Vernal unit of the Central Utah project and for the Jensen unit which has also been authorized as a part of the project's initial phase. The conservancy district may sponsor other water resource developments within its boundaries, particularly yet unauthorized units of the ultimate phase of the Central Utah project. The conservancy district boundaries coincide with those of Uintah County except that a small western portion of the county is excluded from the district because it may more appropriately be included in a future district that will sponsor other units of the Central Utah project. The conservancy district boundaries are shown on the map on the following page.

The conservancy district has power to levy taxes against all property within its boundaries as provided by the Utah law and will be responsible for the collection of additional assessments from the water users to meet costs of the Vernal unit. Funds collected by the district will be used to cover unit operation, maintenance, and administrative costs and to meet repayment obligations to the United States. Part of the district's funds collected by taxation may also be used to assist in financing other water resource developments within the district.

The several irrigation companies that now operate in the Vernal unit area will purchase from the conservancy district the supplemental irrigation water that will be used under their systems. These include the Ashley Upper, Ashley Central, Rock Point, and Highline Canal Companies and the Island and Dodds Ditch Companies. Water purchases also will be made by the municipal interests, including the towns of Vernal and Maeser, and the Naples Water Company representing the unincorporated town of Naples. The Ashley Valley Reservoir Company, which operates all existing reservoirs that serve the area, is owned by the irrigation companies and municipalities previously mentioned. Operation of the existing reservoirs will be modified for the Vernal unit. The Utah Power and Light Company will be affected by the unit in that the additional water diverted into the municipal water system will at times diminish the supply available for power generation at the company's plant on Ashley Creek.

Contracts and Agreements

The Uintah Water Conservancy District will contract with the United States for the construction and operation of the Vernal unit and for



UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL UTAH PROJECT
VERNAL UNIT - UTAH

UINTAH WATER CONSERVANCY DISTRICT
LOCATION MAP

DRAWN AGB — SUBMITTED
TRACED AGB — RECOMMENDED
CHECKED GHB — APPROVED
SPANISH FORK, UTAH — MAY 17, 1957
SHEET 1 OF 1

325-418-65

INTERIOR - - RECLAMATION, SLC, UTAH

repayment of reimbursable construction costs. A favorable vote of the taxpayers within the district will be required before the conservancy district can enter into the repayment contract. The repayment will be completed in 50 years following a development period as permitted by the project authorizing act. Construction costs allocated to irrigation that are beyond the repayment ability of the irrigators will be repaid from monies apportioned to Utah in the Upper Colorado River Basin Fund. The conservancy district, in turn, will contract with the irrigation companies and municipalities concerning the amount of unit water to be purchased by each and the terms of repayment. Matters relating to the operation of existing works and new unit works will also be covered in these contracts. The conservancy district will also contract with individual irrigators in the River Bottom area for the purchase of a small amount of unit irrigation water that will be used in that area. The contract with the Ashley Central Canal Company will provide for the extensive modifications of the Ashley Central Canal that are planned as a part of the development. Where water exchanges are required for unit operation, these will also be provided for in the contracts between the conservancy district and the irrigation companies and municipalities. The construction, operation, maintenance, and replacement of facilities planned for recreation and for fish and wildlife will be the subject of contracts or agreements between the conservancy district, appropriate Federal agencies, and State or local interests.

Since the plan for the Vernal unit is dependent on certain modifications in irrigation and stock-watering practices, these modifications will be covered by contracts between the irrigation companies and the United States, represented by the Bureau of Reclamation. In order to make water available for storage as planned, the irrigation companies will be required to agree to limit their early season diversions of irrigation water and during the nonirrigation season to accept delivery of water for livestock through the Water Savings pipe system instead of through open canals. A contract will be negotiated with the Utah Power and Light Company regarding provisions for bypassing the powerplant with the additional water that will be diverted from Ashley Spring into the municipal pipeline.

The usual right-of-way negotiations will be required to obtain land for unit works. Utah State Highway No. 44 will require relocation around the Stanaker Reservoir and several county roads and public utility structures will require modification or relocation.

Although no contracts for the Vernal unit have yet been executed, preliminary discussions have been had with respect to most of them. The irrigation companies are desirous of obtaining the amount of unit water apportioned to them and are willing to modify their present practices as necessary for unit purposes. Each of the three communities has passed a resolution expressing its interest in acquiring the water planned for its use.

Repayment of the Vernal unit costs will be accomplished under a separate account within the Upper Colorado River Basin Fund. Thus there will be no financial interdependence between the Vernal unit and other units of the project. Data pertaining to the Vernal unit, however, will be combined with data pertaining to other units in accounts that apply to the Central Utah project as a whole.

Public Law 485 - 84th Congress, 2d Session
(70 Stat. 105)
Approved April 11, 1956

AN ACT to authorize the Secretary of the Interior to construct, operate, and maintain the Colorado River storage project and participating projects, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That, in order to initiate the comprehensive development of the water resources of the Upper Colorado River Basin, for the purposes, among others, of regulating the flow of the Colorado River, storing water for beneficial consumptive use, making it possible for the States of the Upper Basin to utilize, consistently with the provisions of the Colorado River Compact, the apportionments made to and among them in the Colorado River Compact and the Upper Colorado River Basin Compact, respectively, providing for the reclamation of arid and semiarid land, for the control of floods, and for the generation of hydroelectric power, as an incident of the foregoing purposes, the Secretary of the Interior is hereby authorized (1) to construct, operate, and maintain the following initial units of the Colorado River storage project, consisting of dams, reservoirs, powerplants, transmission facilities and appurtenant works: Curecanti, Flaming Gorge, Navajo (dam and reservoir only), and Glen Canyon: Provided, That the Curecanti Dam shall be constructed to a height which will impound not less than nine hundred and forty thousand acre-feet of water or will create a reservoir of such greater capacity as can be obtained by a high waterline located at seven thousand five hundred and twenty feet above mean sea level, and that construction thereof shall not be undertaken until the Secretary has, on the basis of further engineering and economic investigations, reexamined the economic justification of such unit and, accompanied by appropriate documentation in the form of a supplemental report, has certified to the Congress and to the President that, in his judgment, the benefits of such unit will exceed its costs; and (2) to construct, operate, and maintain the following additional reclamation projects (including power-generating and transmission facilities related thereto), hereinafter referred to as participating projects: Central Utah (initial phase): Emery County, Florida, Hammond, La Barge, Lyman, Paonia (including the Minnesota unit, a dam and reservoir on Muddy Creek

Colorado River storage project.

63 Stat. 31.

Initial units.

Curecanti Dam. Report to Congress and President.

Participating projects.

just above its confluence with the North Fork of the Gunnison River, and other necessary works), Pine River Extension, Seedskadee, Silt and Smith Fork: Provided further, That as part of the Glen Canyon Unit the Secretary of the Interior shall take adequate protective measures to preclude impairment of the Rainbow Bridge National Monument.

Rainbow Bridge National Monument.

Sec. 2. In carrying out further investigations of projects under the Federal reclamation laws in the Upper Colorado River Basin, the Secretary shall give priority to completion of planning reports on the Gooseberry, San Juan-Chama, Navajo, Parshall, Troublesome, Rabbit Ear, Eagle Divide, San Miguel, West Divide, Bluestone, Battlement Mesa, Tomichi Creek, East River, Ohio Creek, Fruitland Mesa, Bostwick Park, Grand Mesa, Dallas Creek, Savery-Pot Hook, Dolores, Fruit Growers Extension, Animas-La Plata, Yellow Jacket, and Sublette participating projects. Said reports shall be completed as expeditiously as funds are made available therefor and shall be submitted promptly to the affected States, which in the case of the San Juan-Chama project shall include the State of Texas, and thereafter to the President and the Congress: Provided, That with reference to the plans and specifications for the San Juan-Chama project, the storage control and regulation of water imported from the San Juan River shall (1) be limited to a single offstream dam and reservoir on a tributary of the Chama River, (2) be used solely for control and regulation and no power facilities shall be established, installed or operated thereat, and (3) be operated at all times by the Bureau of Reclamation of the Department of the Interior in strict compliance with the Rio Grande Compact as administered by the Rio Grande Compact Commission. The preparation of detailed designs and specifications for the works proposed to be constructed in connection with projects shall be carried as far forward as the investigations thereof indicate is reasonable in the circumstances.

Planning reports.

Reports to States, President and Congress

53 Stat. 785.

The Secretary, concurrently with the investigations directed by the preceding paragraph, shall also give priority to completion of a planning report on the Juniper project.

Juniper project.

Sec. 3. It is not the intention of Congress, in authorizing only those projects designated in section 1 of this Act, and in authorizing priority in planning only those additional projects designated in section 2 of this Act, to limit, restrict, or otherwise interfere with such comprehensive development as will provide for the consumptive use by States of the Upper Colorado River Basin

Congressional intent.

of waters, the use of which is apportioned to the Upper Colorado River Basin by the Colorado River Compact and to each State thereof by the Upper Colorado River Basin Compact, nor to preclude consideration and authorization by the Congress of additional projects under the allocations in the compacts as additional needs are indicated. It is the intention of Congress that no dam or reservoir constructed under the authorization of this Act shall be within any national park or monument.

63 Stat. 31.

Sec. 4. Except as otherwise provided in this Act, in constructing, operating, and maintaining the units of the Colorado River storage project and the participating projects listed in section 1 of this Act, the Secretary shall be governed by the Federal reclamation laws (Act of June 17, 1902. 32 Stat. 388, and Acts amendatory thereof or supplementary thereto): Provided, That (a) irrigation repayment contracts shall be entered into which, except as otherwise provided for the Paonia and Eden projects, provide for repayment of the obligation assumed thereunder with respect to any project contract unit over a period of not more than fifty years exclusive of any development period authorized by law; (b) prior to construction of irrigation distribution facilities, repayment contracts shall be made with an "organization" as defined in paragraph 2 (g) of the Reclamation Project Act of 1939 (53 Stat. 1187) which has the capacity to levy assessments upon all taxable real property located within its boundaries to assist in making repayments, except where a substantial proportion of the lands to be served are owned by the United States; (c) contracts relating to municipal water supply may be made without regard to the limitations of the last sentence of section 9 (c) of the Reclamation Project Act of 1939; and (d), as to Indian lands within, under or served by any participating project, payment of construction costs within the capability of the land to repay shall be subject to the Act of July 1, 1932 (47 Stat. 564): Provided further, That for a period of ten years from the date of enactment of this Act, no water from any participating project authorized by this Act shall be delivered to any water user for the production on newly irrigated lands of any basic agricultural commodity, as defined in the Agricultural Act of 1949, or any amendment thereof, if the total supply of such commodity for the marketing year in which the bulk of the crop would normally be marketed is in excess of the normal supply as defined in section 301 (b) (10) of the Agricultural Adjustment Act of 1938, as amended, unless the Secretary of Agriculture calls for an increase in production of such commodity in the interest of national

Laws governing.

43 USC 371 note.

Repayment contracts

43 USC 485a.

53 Stat. 1194, 1195.

25 USC 386a.

Restriction.

63 Stat. 1051.
7 USC 1441 note.

52 Stat. 41.
7 USC 1281.

security. All units and participating projects shall be subject to the apportionments of the use of water between the Upper and Lower Basins of the Colorado River and among the States of the Upper Basin fixed in the Colorado River Compact and the Upper Colorado River Basin Compact, respectively, and to the terms of the treaty with the United Mexican States (Treaty Series 994). 46 Stat. 3000; 45 Stat. 1057. 63 Stat. 31. 59 Stat. 1219.

Sec. 5. (a) There is hereby authorized a separate fund in the Treasury of the United States to be known as the Upper Colorado River Basin Fund (hereinafter referred to as the Basin Fund), which shall remain available until expended, as hereafter provided, for carrying out provisions of this Act other than section 8. Basin Fund.

(b) All appropriations made for the purpose of carrying out the provisions of this Act, other than section 8, shall be credited to the Basin Fund as advances from the general fund of the Treasury.

(c) All revenues collected in connection with the operation of the Colorado River storage project and participating projects shall be credited to the Basin Fund, and shall be available, without further appropriation, for (1) defraying the costs of operation, maintenance, and replacements of, and emergency expenditures for, all facilities of the Colorado River storage project and participating projects, within such separate limitations as may be included in annual appropriation acts: Provided, That with respect to each participating project, such costs shall be paid from revenues received from each such project; (2) payment as required by subsection (d) of this section; and (3) payment as required by subsection (e) of this section. Revenues credited to the Basin Fund shall not be available for appropriation for construction of the units and participating projects authorized by or pursuant to this Act. Availability of revenues.

(d) Revenues in the Basin Fund in excess of operating needs shall be paid annually to the general fund of the Treasury to return-

(1) the costs of each unit, participating project, or any separable feature thereof which are allocated to power pursuant to section 6 of this Act, within a period not exceeding fifty years from the date of completion of such unit, participating project, or separable feature thereof;

(2) the costs of each unit, participating project, or any separable feature thereof which are allocated to municipal water supply pursuant to section 6 of this Act, within a period not exceeding fifty years from the date of completion of such unit, participating project, or separable feature thereof;

(3) interest on the unamortized balance of the investment (including interest during construction) in the power and municipal water supply features of each unit, participating project, or any separable feature thereof, at a rate determined by the Secretary of the Treasury as provided in subsection (f), and interest due shall be a first charge; and

(4) the costs of each storage unit which are allocated to irrigation pursuant to section 6 of this Act within a period not exceeding fifty years.

Apportionment of revenues.

(e) Revenues in the Basin Fund in excess of the amounts needed to meet the requirements of clause (1) of the subsection (c) of this section, and to return to the general fund of the Treasury the costs set out in subsection (d) of this section, shall be apportioned among the States of the Upper Division in the following percentages: Colorado, 46 per centum; Utah, 21.5 per centum; Wyoming, 15.5 per centum; and New Mexico, 17 per centum: Provided, That prior to the application of such percentages, all revenues remaining in the Basin Fund from each participating project (or part thereof), herein or hereinafter authorized, after payments, where applicable, with respect to such projects, to the general fund of the Treasury under subparagraphs (1), (2), and (3) of subsection (d) of this section shall be apportioned to the State in which such participating project, or part thereof, is located.

Revenues so apportioned to each State shall be used only for the repayment of construction costs of participating projects or parts of such projects in the State to which such revenues are apportioned and shall not be used for such purpose in any other State without the consent, as expressed through its legally constituted authority, of the State to which such revenues are apportioned. Subject to such requirement, there shall be paid annually into the general fund of the Treasury from the revenues apportioned to each State (1) the costs of each participating project herein authorized (except Paonia) or any separable feature thereof, which are allocated to irrigation pursuant to section 6 of this Act, within a period

not exceeding fifty years, in addition to any development period authorized by law, from the date of completion of such participating project or separable feature thereof, or, in the case of Indian lands, payment in accordance with section 4 of this Act; (2) costs of the Paonia project, which are beyond the ability of the water users to repay, within a period prescribed in the Act of June 25, 1947 (61 Stat. 181); and (3) costs in connection with the irrigation features of the Eden project as specified in the Act of June 28, 1949 (63 Stat. 277).

Interest rate.

(f) The interest rate applicable to each unit of the storage project and each participating project shall be determined by the Secretary of the Treasury as of the time the first advance is made for initiating construction of said unit or project. Such interest rate shall be determined by calculating the average yield to maturity on the basis of daily closing market bid quotations during the month of June next preceding the fiscal year in which said advance is made, on all interest-bearing marketable public debt obligations of the United States having a maturity date of fifteen or more years from the first day of said month, and by adjusting such average annual yield to the nearest one-eighth of 1 per centum.

Budget to Congress.

(g) Business-type budgets shall be submitted to the Congress annually for all operations financed by the Basin Fund.

Cost allocations.

Sec. 6. Upon completion of each unit, participating project or separable feature thereof, the Secretary shall allocate the total costs (excluding any expenditures authorized by section 8 of this Act) of constructing said unit, project or feature to power, irrigation, municipal water supply, flood control, navigation, or any other purposes authorized under reclamation law. Allocations of construction, operation and maintenance costs to authorized nonreimbursable purposes shall be nonreturnable under the provisions of this Act. In the event that the Navajo participating project is authorized, the costs allocated to irrigation of Indian-owned tribal or restricted lands within, under, or served by such project, and beyond the capability of such lands to repay, shall be determined, and, in recognition of the fact that assistance to the Navajo Indians is the responsiblity of the entire nation, such costs shall be nonreimbursable. On January 1 of each year the Secretary shall report to the Congress for the previous fiscal year, beginning with

Navajos.

Report to Congress.

the fiscal year 1957, upon the status of the revenues from, and the cost of, constructing, operating, and maintaining the Colorado River storage project and the participating projects. The Secretary's report shall be prepared to reflect accurately the Federal investment allocated at that time to power, to irrigation, and other purposes, the progress of return and repayment thereon, and the estimated rate of progress, year by year, in accomplishing full repayment.

Power plant operations.

Sec. 7. The hydroelectric powerplants and transmission lines authorized by this Act to be constructed, operated, and maintained by the Secretary shall be operated in conjunction with other Federal powerplants, present and potential, so as to produce the greatest practicable amount of power and energy that can be sold at firm power and energy rates, but in the exercise of the authority hereby granted he shall not affect or interfere with the operation of the provisions of the Colorado River Compact, the Upper Colorado River Basin Compact, the Boulder Canyon Project Act, the Boulder Canyon Project Adjustment Act and any contract lawfully entered unto under said Compacts and Acts. Subject to the provisions of the Colorado River Compact, neither the impounding nor the use of water for the generation of power and energy at the plants of the Colorado River storage project shall preclude or impair the appropriation of water for domestic or agricultural purposes pursuant to applicable State law.

45 Stat. 1057.
43 USC 617 note.
54 Stat. 774.
43 USC 618o.

Recreational and fish and wildlife facilities.

Section 8. In connection with the development of the Colorado River storage project and of the participating projects, the Secretary is authorized and directed to investigate, plan, construct, operate, and maintain (1) public recreational facilities on lands withdrawn or acquired for the development of said project or of said participating projects, to conserve the scenery, the natural, historic, and archeologic objects, and the wildlife on said lands, and to provide for public use and enjoyment of the same and of the water areas created by these projects by such means as are consistent with the primary purposes of said projects; and (2) facilities to mitigate losses of, and improve conditions for, the propagation of fish and wildlife. The Secretary is authorized to acquire lands and to withdraw public lands from entry or other disposition under the public land laws necessary for the construction, operation, and maintenance of the facilities herein provided, and to dispose of

them to Federal, State, and local governmental agencies by lease, transfer, exchange, or conveyance upon such terms and conditions as will best promote their development and operation in the public interest. All costs incurred pursuant to this section shall be nonreimbursable and nonreturnable.

Saving provision.

Sec. 9. Nothing contained in this Act shall be construed to alter, amend, repeal, construe, interpret, modify, or be in conflict with the provisions of the Boulder Canyon Project Act (45 Stat. 1057), the Boulder Canyon Project Adjustment Act (54 Stat. 774), the Colorado River Compact, the Upper Colorado River Basin Compact, the Rio Grande Compact of 1938, or the Treaty with the United Mexican States (Treaty Series 994).

43 USC 617 note.
43 USC 618o.
53 Stat. 785.
59 Stat. 1219.

Expenditures.

Sec. 10. Expenditures for the Flaming Gorge, Glen Canyon, Curecanti, and Navajo initial units of the Colorado River storage project may be made without regard to the soil survey and land classification requirements of the Interior Department Appropriation Act, 1954.

68 Stat. 361.

Effectivity and approval of court decree, etc.

Sec. 11. The Final Judgment, Final Decree and Stipulations incorporated therein in the consolidated cases of United States of America v. Northern Colorado Water Conservancy District, et al., Civil Nos. 2782, 5016 and 5017, in the United States District Court for the District of Colorado, are approved, shall become effective immediately, and the proper agencies of the United States shall act in accordance therewith.

Appropriation.

Sec. 12. There are hereby authorized to be appropriated, out of any moneys in the Treasury not otherwise appropriated, such sums as may be required to carry out the purposes of this Act, but not to exceed $760,000,000.

Net power revenues.

Sec. 13. In planning the use of, and in using credits from, net power revenues available for the purpose of assisting in the pay-out of costs of participating projects herein and hereafter authorized in the States of Colorado, New Mexico, Utah, and Wyoming, the Secretary shall have regard for the achievement within each of said States of the fullest practicable use of the waters of the Upper Colorado River system, consistent with the apportionment thereof among such States.

Operation and maintenance, compliance.

Sec. 14. In the operation and maintenance of all facilities, authorized by Federal law and under the jurisdiction and supervision of the Secretary of the

Interior, in the basin of the Colorado River, the Secretary of the Interior is directed to comply with the applicable provisions of the Colorado River Compact, the Upper Colorado River Basin Compact, the Boulder Canyon Project Act, the Boulder Canyon Project Adjustment Act, and the Treaty with the United Mexican States, in the storage and release of water from reservoirs in the Colorado River Basin. In the event of the failure of the Secretary of the Interior to so comply, any State of the Colorado River Basin may maintain an action in the Supreme Court of the United States to enforce the provisions of this section, and consent is given to the joinder of the United States as a party in such suit or suits, as a defendant or otherwise.

63 Stat. 31.
45 Stat. 1057; 54 Stat. 774. 43 USC 617 note, 618o.
59 Stat. 1219.

Sec. 15. The Secretary of the Interior is directed to continue studies and to make a report to the Congress and to the States of the Colorado River Basin on the quality of water of the Colorado River.

Report to Congress.

Sec. 16. As used in this Act-

Definitions.

The terms "Colorado River Basin", "Colorado River Compact", "Colorado River System", "Lee Ferry", "States of the Upper Division", "Upper Basin", and "domestic use" shall have the meaning ascribed to them in article II of the Upper Colorado River Basin Compact;

The term "States of the Upper Colorado River Basin" shall mean the States of Arizona, Colorado, New Mexico, Utah, and Wyoming;

The term "Upper Colorado River Basin" shall have the same meaning as the term "Upper Basin";

The term "Upper Colorado River Basin Compact" shall mean that certain compact executed on October 11, 1948, by commissioners representing the States of Arizona, Colorado, New Mexico, Utah, and Wyoming, and consented to by the Congress of the United States of America by Act of April 6, 1949 (63 Stat. 31);

The term "Rio Grande Compact" shall mean that certain compact executed on March 18, 1938, by commissioners representing the States of Colorado, New Mexico, and Texas and consented to by the Congress of the United States of America by Act of May 31, 1939 (53 Stat. 785);

The term "Treaty with the United Mexican States" shall mean that certain treaty between the United States of America and the United Mexican States, signed at Washington, District of Columbia, February 3, 1944, relating to the utilization of the waters of the Colorado River and other rivers, as amended and supplemented by the protocol dated November 14, 1944, and the understandings recited in the Senate resolution of April 18, 1945, advising and consenting to ratification thereof. 59 Stat. 1219.

REPORTS OF COOPERATING AGENCIES

Planning Report

RECREATIONAL USE AND DEVELOPMENT

STANAKER RESERVOIR
VERNAL UNIT, CENTRAL UTAH PROJECT

Prepared by
Region Three Office, National Park Service
Department of the Interior

for
Region 4, Bureau of Reclamation
Department of the Interior

October 1956

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Recreation Planner

River Basin Code XL/102

NATIONAL PARK SERVICE REPORT

INTRODUCTION

Authority

The Park, Parkway and Recreational Area Study Act of June 1936 authorizes the National Park Service to cooperate with other Federal or State agencies in planning the development of recreational resources. On April 24, 1956 and, in accordance with the provisions of this Act, the National Park Service was requested by a memorandum from the Regional Director, Region 4 of the Bureau of Reclamation, to provide a planning report for the Vernal Unit of the Central Utah Project.

Purpose

This report offers a preliminary plan for a general recreational development at Stanaker Reservoir.[1] The plan is based on a more comprehensive study of the area than was attempted in the previous Reconnaissance Report of February 1951. Under an agreement between the Bureau of Reclamation and the National Park Service, this proposed recreational development, which lacks national significance, will have to be administered by some state, county, or local agency. Therefore, this plan does not necessarily solve all the operating or maintenance problems of the future administrator.

SUMMARY

Studies have indicated that Stanaker Reservoir will be generally used by local and nearby residents for day-time outings; therefore, the recreational development should be limited to the providing of day-use recreational facilities. Any development on Stanaker Reservoir should not affect existing National or State park or recreation areas. An archeological survey of any necessary salvage operation is to be planned by the time dam construction begins.

GENERAL DESCRIPTION OF AREA

Location

This off-stream reservoir will be in Stanaker Draw which is about four miles north of Vernal, Utah via State Highway No. 44. Water will enter the reservoir through a canal at the southwest end. This canal will be fed by Ashley Creek which is about two miles to the west

[1] Stanaker Reservoir is used in general reference to the Vernal Unit of the Central Utah Project.

NATIONAL PARK SERVICE REPORT

Purpose of Reservoir

This reservoir is being planned for irrigation purposes. The normal and minimum water surfaces are 5,518 and 5,445 feet which indicates a maximum drawdown of 73 feet. The area of the lake will fluctuate between 820 and 180 acres.

Physical Characteristics

Stanaker Reservoir will inundate a flat half-mile wide valley for nearly three miles. The northern half of the reservoir basin is generally sagebrush grazing land. The southern half is cultivated land in the flatter areas while the lower slopes are sagebrush. On the upper northwestern slopes of the reservoir, sagebrush gives way to juniper.

The outline of the reservoir will roughly resemble a crescent The blunter end of the crescent will point nearly north while the opposite end will swing around to a southwestern direction. About midway along the concave side of the reservoir there will be a sizable cove which is the major irregularity of the shoreline. (See Photo I.) The convex side of the reservoir will be paralleled by a very abrupt escarpment covered with sparse vegetation. This escarpment is so abrupt in places that one could literally dive into the water from the escarpment. A break in this escarpment, which is about two-thirds of the way from the north end of the reservoir, is the location of the dam site. (See Photo II.) When the reservoir is filled to capacity there will be two or three small islands about a quarter of a mile north of the dam and close to the east shore; but as the water recedes three islands will appear just off shore and about one quarter mile southwest of the cove.

The reservoir will be unique in the fact that it is sandwiched between two distinctive types of scenery. From a boat, one will view a stark, rugged, practically barren, stratified wall on the east and southeast side, and a more pleasing, gentle, evergreen garnished slope on the northwest.

The north end of the rugged wall that parallels the reservoir on the east and southeast is horizontally stripped in hues of orange, grey and off whites, and, except for the break at the dam site, the crest of this wall will be the horizon.

Actually, the more gentle scenery to the northwest is quite rugged in places because of small knife edge ridges and corresponding gullies. When the reservoir is full, the moderate growth of juniper on this slope will come to the water's edge in many places. (See Photo III.)

The adequacy of the impoundment and its scenic surroundings are factors favorable to the recreational uses of this proposed reservoir.

NATIONAL PARK SERVICE REPORT

Climate

This semi-arid region has an average precipitation of less than four inches from May through September of which nearly a third is accountable to September.

Average temperatures for May through September are 55.2, 64.8, 70 3, 68.1, and 58.5. For the same months, the maximum average temperatures are 71.7, 83.4, 88.2, 85.3, and 75.5. The climatic factor is not significant in appraising the recreational use of Stanaker Reservoir.

Historical and Archeological Investigations

This section of Utah is rich in both history and archeology. Such aboriginal antiquities as petroglyphs and pictographs have been found in the vicinity of Vernal. The National Park Service in cooperation with the University of Utah plan an archeological survey of the reservoir area.

Present Recreational Evaluation

Any recreational development on Stanaker Reservoir is seriously handicapped by the rough terrain. On the northwest side of the reservoir a limited area could be developed for recreational purposes. An unimproved public road exists approximately a mile to the southwest of this area.

At present, State Highway No. 44 is in the bed of the reservoir and will undoubtedly be relocated east of the escarpment that parallels the reservoir. (See Photo IV.) Eventually, if topographically feasible, an overlook could be built on the east side of the reservoir which should offer an excellent vantage point for viewing the reservoir and the scenery that lies to the northwest.

Type of Recreation

Any recreational development on Stanaker Reservoir should be limited to a day-use plan. The plan should include individual picnic areas and a boat ramp. Studies by the Fish and Wildlife Service have indicated that this reservoir should have favorable conditions for the propagation of trout.

FACTORS INFLUENCING RECREATIONAL DEVELOPMENT

The normal drawdown of Stanaker Reservoir during the recreation use season should be between 7 and 27 feet, which will be compatible with the recreational uses made of the reservoir.

NATIONAL PARK SERVICE REPORT

The towns of Maeser and Vernal had a combined population of 3,488 in 1950. These two neighboring towns are within five miles of the Stanaker Reservoir site. Within twenty-five miles of the proposed reservoir there is an urban population of more than 5,500 people and over 11,000 urban dwellers live within fifty miles of the reservoir. Uintah County has a rural population of 4,600. It is quite probable that the population figures in Uintah County are much larger today

Vernal is a main stop on U. S. 40, a major transcontinental highway between Denver, Colorado and Salt Lake City, Utah. According to the Highway Planning Department of the Utah State Road Commission, a daily average of 4,190 passenger vehicles pass through Vernal on this highway Of this total 950 are out-of-state cars. Furthermore, State Highway No 44, which will pass just east of the reservoir, is in the process of being completely paved to the Wyoming State Line. The continuation of this highway into Wyoming, which is already paved, will become an important artery connecting two transcontinental highways: U. S. 40 in Utah and U. S. 30 in Wyoming. Another name for State Highway No. 44 is "The Drive Through the Ages." Along this highway signs have been erected for identifying the numerous geological formations which are exposed in this area.

There are no railroads in this part of Utah, but Vernal is serviced by the Frontier Airlines.

Vernal is the major business and distribution center of the Uintah Basin and northeastern Utah. Much of the Uintah Basin has fertile soil and good range land which has encouraged agriculture, livestock raising and dairying. With increased development of the Uintah Basin gas and oil field, Vernal has become the center for these activities. Vernal is also the shopping center for the employees of the world famous gilsonite mines located farther south in Uintah County.

Besides the gilsonite mines there are large deposits of phosphate, valuable hydrocarbons and asphaltic substances in the Uintah Basin. When construction commences at the Flaming Gorge Dam on the Green River, Vernal may become the south gateway for this project. The abundance of power generated by the dam should eventually develop the phosphate industry of the Uintah Basin.

The civic organizations of Vernal are very cognizant of the potentials and values of recreational resources and opportunities. They have already developed a nine-hole golf course, Merkley Park, and a public swimming pool in the town park. Merkley Park, about nine miles northwest of town, contains about five acres. Within these five acres there are picnic tables, fireplaces, playground equipment and a softball diamond. In addition to the swimming pool in the town park there are tennic courts, picnic tables and playground equipment. The widely known Utah Fieldhouse of Natural History is located in the town park.

NATIONAL PARK SERVICE REPORT

In the Ashley National Forest, the U. S. Forest Service offers numerous facilities for camping, picnicking, fishing, hunting, boating, lodging, hiking and horseback pack trips into the wilderness areas of the Uinta Mountains.

The scenic Red Cloud Loop Road begins and terminates in Vernal. This scenic drive has become very popular with tourists. About a third of this loop road is State Highway No. 44.

ESTIMATE OF RECREATIONAL NEED AND USE

It is estimated that at least 15,000 people will use this reservoir for recreational purposes during a season if adequate facilities are provided. If good fishing materializes, a greater visitation can be expected due to the proximity of Maeser and Vernal. Previous reports have suggested homesites overlooking the reservoir. The more recent study of the area has revealed limiting factors of the terrain, and if there is a demand for homesites they can best be provided on adjacent private land instead of on lands acquired for the reservoir project.

RECOMMENDED RECREATIONAL DEVELOPMENT

Rough terrain limits the recreational development to the northwest side of the reservoir except for the possibility of an overlook on the east side.

An access road, which is a continuation of an existing unimproved public road, could approach the area of development from the southwest. The recommended preliminary plan of the recreational development provides an orderly arrangement for picnicking and boating facilities with necessary parking areas.

A moderate concession building should be provided and is included in this plan for dispensing fishing supplies and refreshments. Eventually, the access road could be extended beyond the planned development to a junction with relocated State Highway 44. This could make a pleasant 16-mile loop road from the Vernal-Maeser area.

LAND ACQUISITION

It appears that additional land over and above that needed for reclamation purposes will not be required with the possible exception of the recreational development area and along the access road. The $E\frac{1}{2}$ and $E\frac{1}{2}SW\frac{1}{4}$ of Section 36, T. 3 S., R. 21 E. of the Salt Lake Base Line and Meridian should assure sufficient protection for the recreational facilities, and a two-hundred-foot scenic easment should be adequate for the access road.

NATIONAL PARK SERVICE REPORT

ESTIMATED COST OF DEVELOPMENT

Roads and Parking Areas		$45,000.00
Trails		100.00
Water System		6,000.00
Pit Toilets		3,000.00
Boating Facilities		10,000.00
Picnic Facilities		2,000.00
Landscape Improvement		750.00
Signs and Markers		250.00
Subtotal		$67,100.00
Contingencies (10%)		6,710.00
Subtotal		$73,810.00
Detail Plans, Surveys, and Supervision (technical and other) of Construction (25%)		18,452.25
TOTAL NON-REPAYMENT COSTS		$92,262.25 - - - - rounded $92,000.00
Annual development cost - 25 yrs. @ 2½% interest (0.0543)		5,009.84
Operation and Maintenance		
Caretaker	$750.00	
Maintenance	750.00	
Supplies and Material	600.00	
		2,100.00
TOTAL ANNUAL COSTS		$7,109.84 - - - - rounded $7,100.00

ESTIMATED RECREATION BENEFITS

Although many economical benefits arise from the availability of adequate recreation facilities at reservoir areas, a long study of the subject has convinced the National Park Service that such benefits cannot be measured scientifically in monetary terms. The Service believes, however, that its experience warrants a "judgment value" approach to the problem of assigning monetary values to potential recreational benefits of proposed projects.

An estimate in monetary terms for the purpose of comparison of recreational values of a reservoir and its developed facilities may be computed from the specific costs of developing, operating and maintaining these facilities. A reasonable estimate of the benefits arising from use of the reservoir may be normally considered as an amount equal to the specific cost of such development, operation and maintenance.

These benefits are computed as follows:

Annual Costs - Development, Operation and Maintenance, $7100.00, capitalized for 100 yrs. @ 2½% (factor 36.614) - - - - - - - - - - - - - - -	$ 259,959.40
Existing Recreation Values Destroyed - - -	None
Net benefits arising specifically from development of facilities - - - - - - - - - - - - -	$ 259,959.40
Benefits arising from joint use of Reservoir	259,959.40
Total Recreation Benefits - - - - - - - - - -	519,918.80
Rounded -	$ 520,000.00

The foregoing figures represent the judgment of the National Park Service as to a reasonable and conservative valuation of the recreational benefits accruing to the public as a result of this project, including the recreational development recommended herein. They are necessarily conjectural as they deal with intangibles that are difficult to evaluate and involve an attempt to foresee conditions that may or may not materialize.

RECOMMENDED PLAN OF ADMINISTRATION

Since it has been determined that the Stanaker Reservoir area is of less than national recreational significance, some state, county or municipal agency should be encouraged to assume the administration and operation of this area. This reservoir should provide an ideal recreation area for citizens of Maeser and Vernal to enjoy and could be administered by those towns. Uintah County may be interested since this recreation area will approximate the geographic center of the developed portion of the county.

RECOMMENDED FUTURE STUDY AND PLANNING

When suitable arrangements are made with an agency to administer, maintain and operate this development, additional detailed studies will be required to evolve a more comprehensive plan or recreational development and management.

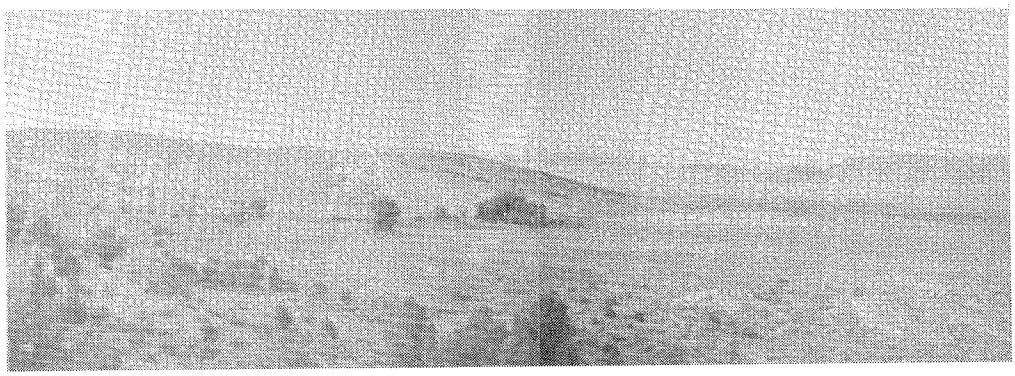


Photo I
Looking up the reservoir basin from near the recreational development, the upper reaches of the reservoir are in the right background. Buildings in this picture (left center) are about fifty feet below the maximum elevation of the reservoir. The cove for boating facilities is located behind these buildings.

Photo II
Looking across the reservoir area to dam site near the cottonwood trees in the center of photo.

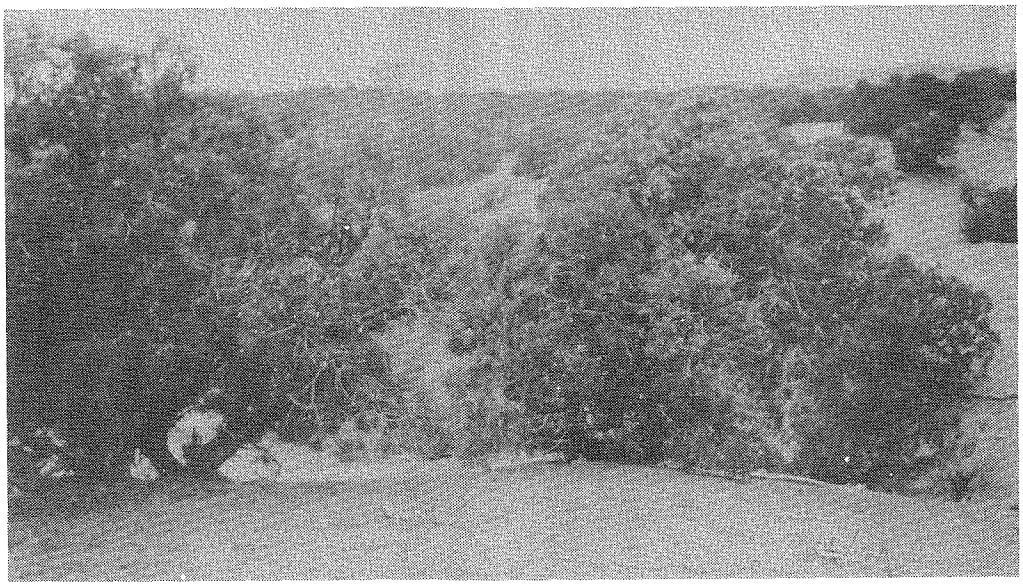


Photo III
Looking northwest from the reservoir basin in September, the dark green juniper trees are decorated with light bluish green berries. Some trees are ten feet tall.

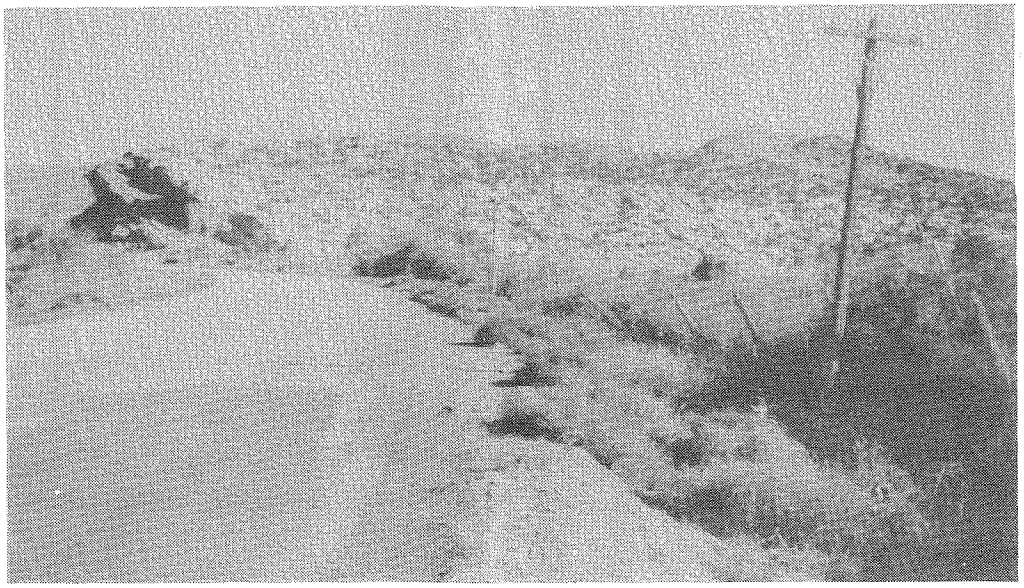
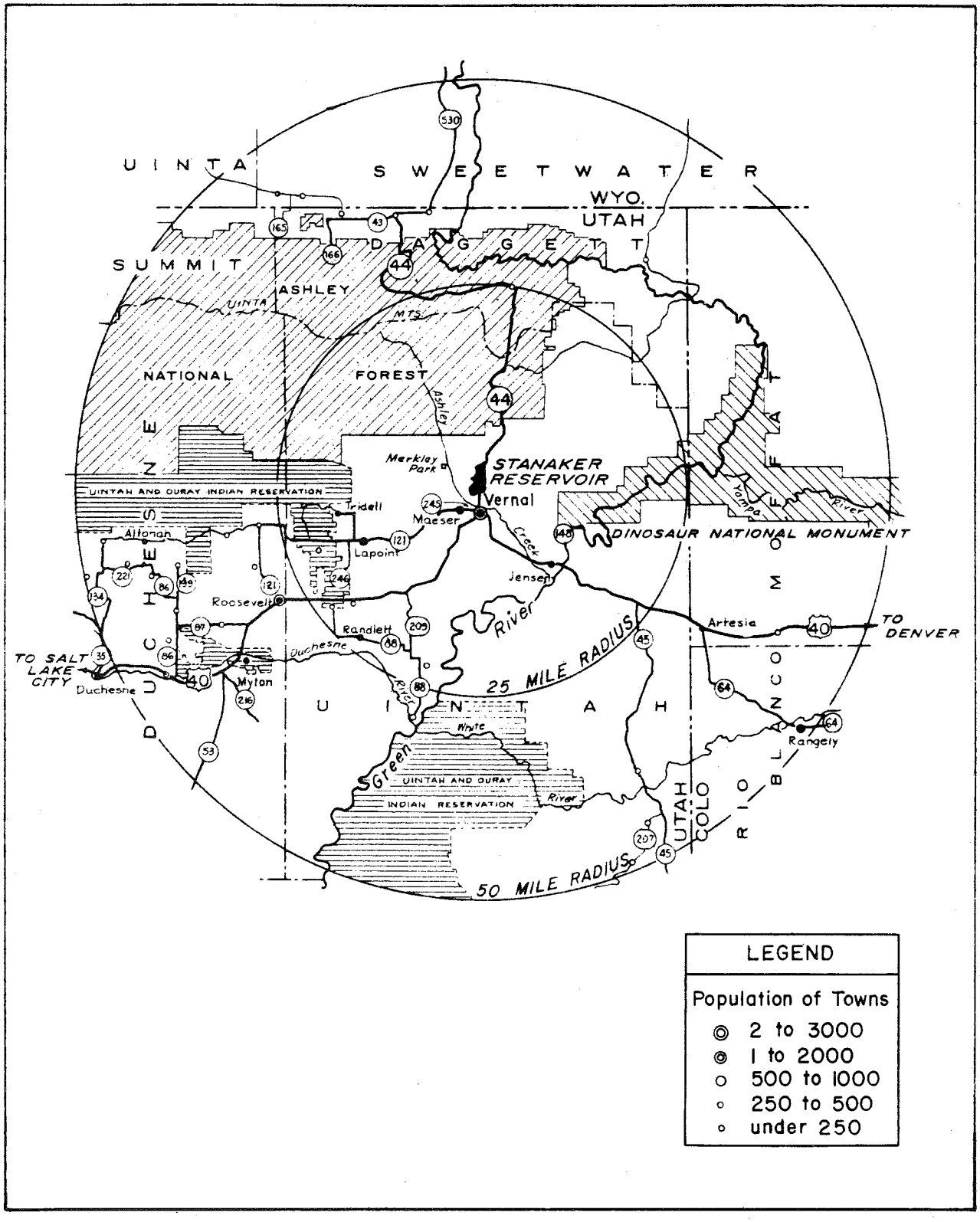


Photo IV
The northeast abutment of the dam will join the break in the escarpment at the left side of the photo. State Highway 44 will be relocated along the escarpment to the right.



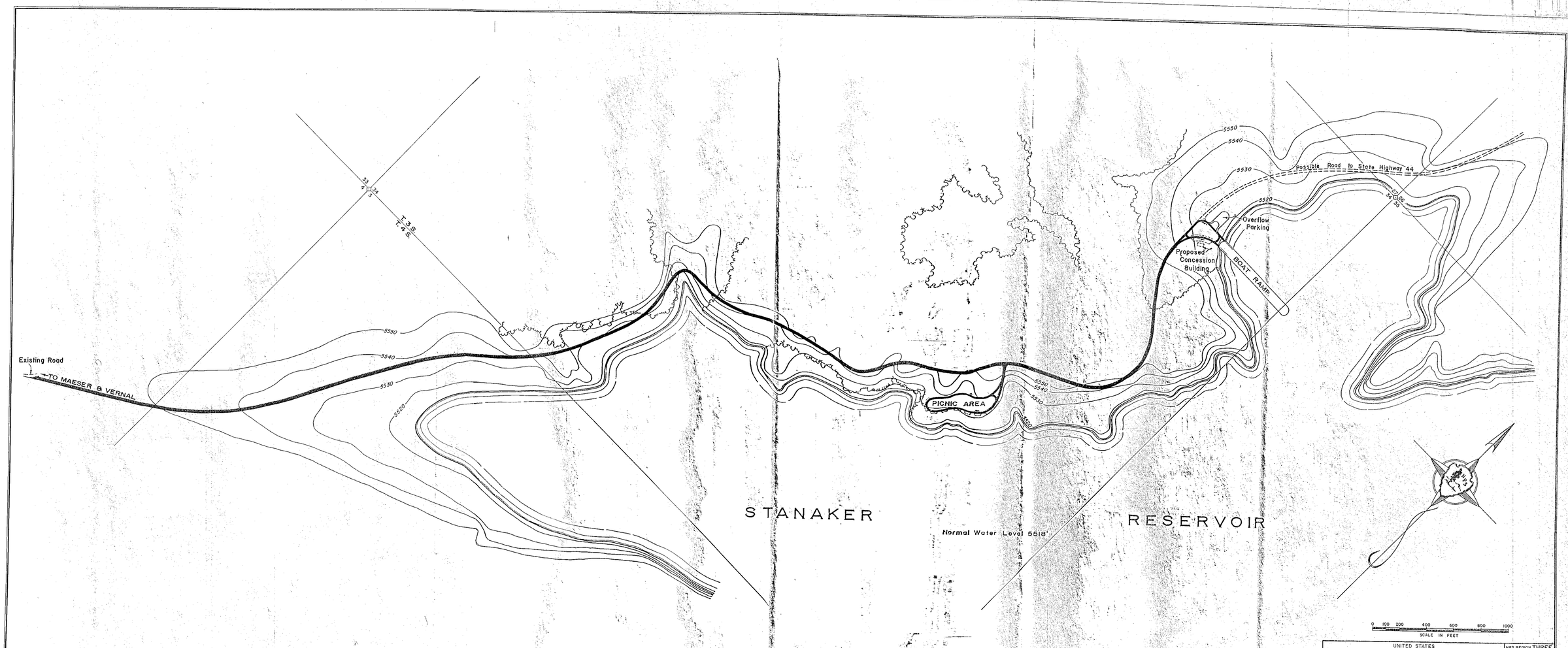
POPULATION CENTERS

STANAKER RESERVOIR–VERNAL UNIT–UTAH

CENTRAL UTAH PROJECT

OCTOBER, 1956

CODE NO. XL/102



UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
UPPER COLORADO SURVEY
SANTA FE, NEW MEXICO

NPS REGION THREE
FOR B.R.
DATE 10-56
DRAWN BY M.B.Hoey
CHECKED BY E.A.Bullard
SHEET 1 OF 1
CODE NO XL-102
DRAWING NO. RS STAN-7100

GENERAL DEVELOPMENT
STANAKER RESERVOIR-VERNAL UNIT-UTAH
CENTRAL UTAH PROJECT

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Region 2
Albuquerque, New Mexico

A REPORT ON FISH AND WILDLIFE RESOURCES IN RELATION TO THE PLAN FOR VERNAL UNIT, CENTRAL UTAH PROJECT COLORADO RIVER BASIN, UTAH

Prepared in cooperation with the
Utah State Department of Fish and Game

May 1957

FISH AND WILDLIFE SERVICE REPORT

PREFACE

The Vernal unit--a part of the initial phase of the Central Utah project, authorized for construction by Public Law 485, 84th Congress, 2d Session--provides for regulation of flows of Ashley Creek in the vicinity of Vernal, Utah, to make additional water available for irrigation and municipal uses. Presented herein is an analysis of the plan of development for the Vernal unit as it concerns fish and wildlife resources. Two previous reports have been issued: "A preliminary Report on Fish and Wildlife Problems in relation to the Water Development Plan for the Stanaker Draw Reservoir, Ashley Creek, Utah" dated November 1945, and "A Preliminary Evaluation Report on Fish and Wildlife Resources in Relation to the Proposed Vernal Project, Green River Subbasin, Colorado River Basin, Utah" dated February 1948.

This report is based on the Bureau of Reclamation's project-planning report "The Vernal Project, Utah" dated February 1951 and on information obtained through subsequent communications with the Area Engineer Bureau of Reclamation, Spanish Fork, Utah. Acknowledgment also is made of assistance by the Utah Department of Fish and Game in providing information concerning the fish and wildlife resources of the Vernal area and by the Forest Service in furnishing data indicative of the recreational use of such resources. The Utah Department of Fish and Game's concurrence in this report is signified in Director Egan's letter dated April 19, 1957.

DESCRIPTION OF THE PROJECT

Purpose

1. The primary purposes of the Vernal unit are to improve the seasonal distribution of the water supply available for irrigation of lands in the vicinity of Vernal, Utah, and to provide additional water for municipal use in Vernal and smaller nearby communities.

Location

2. It will be situated in Ashley Creek Valley, Uintah County, Utah. Stanaker Reservoir, the key storage facility, will be developed at an offstream site in Stanaker Draw, approximately 3 miles north of the lands to receive supplemental water surrounding the town of Vernal.

Project Features

Engineering data

3. Project features will consist of Stanaker Dam and Reservoir; Ashley Diversion Dam and Stanaker Feeder Canal, whereby flows of Ashley Creek will be diverted into Stanaker Reservoir; Stanaker Service Canal, which will distribute water from Stanaker Reservoir to existing irrigation systems; a system of open drains to prevent accumulation of excess surface water when irrigation applications are increased; and a water-saving pipeline that will deliver water to rural areas and permit storage of winter water now lost in the canals.

4. Ashley Diversion Dam will span the channel of Ashley Creek about 3 miles downstream from the mouth of Dry Fork and immediately above the headworks of the existing Ashley Central Canal. It will be constructed to a height of 9 feet above stream bed and will have an overflow crest 100 feet in length. The Stanaker Feeder Canal will extend from Ashley Diversion Dam to Stanaker Reservoir, a distance of $3\frac{1}{2}$ miles; en route, it will provide water to three existing ditches, and its design capacity will decrease from 495 to 405 second-feet. The canal will be unlined throughout its length.

5. Stanaker Dam will be an earthfill and rockfill structure 138 feet high, with a crest length of 1,800 feet. An open-channel spillway located on the right abutment will have a capacity of 400 second-feet. Both the spillway and the outlet works--a gated conduit $6\frac{1}{2}$ feet in diameter--will discharge into a concrete-lined stilling basin at the head of the Stanaker Service Canal.

6. From its origin at Stanaker Dam, the Stanaker Service Canal will extend southward for a distance of about 12 miles. The initial 3,300 feet will consist of a concrete-bench flume, and a wasteway-equipped siphon will be used to cross Ashley Creek; elsewhere, the canal will be unlined. Between Stanaker Dam and Ashley Creek the canal's capacity will be 400 second-feet; below Ashley Creek, in conjunction with successive turnouts to irrigation laterals, the canal will gradually diminish to its terminal capacity of 43 second-feet. For part of its length after crossing Ashley Creek, the Stanaker Service Canal will utilize the channel of the existing Ashley Central Canal.

Operation

Water Utilization

7. The Vernal unit will be operated to supply the water requirements of 14,780 acres of land now inadequately irrigated and to make an additional 1,500 acre-feet of water available annually for municipal use.

8. Understanding of the plan of operation is facilitated if the lands to be irrigated are envisioned as being in two distinct blocks--one lying above Stanaker Reservoir, the other below. (See Plate III.) Natural flow of Ashley Creek will be used first, insofar as possible, to supply the needs of the upper block; shortages resulting from insufficient natural flow will be met with water diverted into Ashley Creek from Oaks Park Reservoir--an existing impoundment in the adjacent Brush Creek watershed--or released from storage in the existing Long Park Reservoir and other small reservoirs on the North Fork of Ashley Creek. Water used in the upper block will be delivered through existing facilities and, in part, through the Stanaker Feeder Canal.

9. Any flow not required in the upper block will be available for direct-flow diversion to the lower block. Flows exceeding the combined needs of the upper and lower blocks will be diverted to Stanaker Reservoir for storage. Shortages in the lower block resulting from insufficient direct flow will be met with water released from storage in Stanaker Reservoir and delivered through the Stanaker Service Canal and existing canals.

10. Water for municipal use will be diverted from Ashley Creek at a point upstream from existing or project irrigation diversions, and, in exchange, a corresponding quantity of water will be released from Stanaker Reservoir for irrigation. In the reservoir, 1,500 acre-feet of storage will be accorded priority for implementing this exchange.

Reservoir Operation

11. Although operation of Oaks Park and Long Park Reservoirs will be integrated with that of Stanaker Reservoir, it is not anticipated that the current regimen of the existing impoundments will be significantly modified. Operational data for Stanaker Reservoir are summarized in Table 1, below:

Table 1 - Stanaker Reservoir Operating Data 1/

	Elevation 1/	Reservoir Capacity Acre-feet	Surface Area Acres	Shoreline Miles
Maximum pool	5,521	41,000	880	8.6
Normal high pool	5,518	38,500	850	8.4
Average annual maximum pool	5,514	35,000	800	8.2
Average annual minimum pool	5,482	15,000	480	5.9
Dead storage	5,456	5,300	260	3.5
Minimum pool	5,453	4,500	240	3.2
Stream bed	5,389	...	...	...

1/ All elevations are in feet and refer to mean sea level datum

Effect on Streamflow

12. Operation of the Vernal unit will not result in significant modification of the flow of Ashley Creek above the site of Stanaker Diversion Dam, or the flow of Brush Creek below Oaks Park Reservoir.

13. Existing irrigation systems diverting from Ashley Creek in the vicinity of the Stanaker Diversion Dam site currently take the entire flow of the stream throughout much of each year. During the late spring, when natural flows exceed the capacity of these canals, substantial volumes of water necessarily are bypassed at the canal headings. Except for these spring flows, the only water found in Ashley Creek below the Stanaker Diversion Dam site consists of return flow from adjoining irrigated lands. During the irrigation season the accumulated return flow is rediverted by a series of smaller ditches, so that the lower reach of Ashley Creek consists of alternating, intermittent, and permanently flowing segments. Operation of the Vernal unit will modify these conditions only insofar as spring flows are concerned; then, as the result of diversions for storage in Stanaker Reservoir, the flow of Ashley Creek downstream from the Ashley Diversion Dam will be drastically reduced, and in some years, essentially eliminated.

DESCRIPTION OF THE WATERSHED

Physical Features

14. Ashley Creek rises on the south slope of the Uinta Range in northeastern Utah, and flows southeastward to join the Green River approximately 11 miles southeast of the town of Vernal. Project lands lie in the lower Ashley Valley in the vicinity of Vernal, at an average elevation of about 5,300 feet.

15. The soils of project lands have developed from alluvial deposits of Ashley Creek and are generally productive even though they lack organic matter. The region is characterized by considerable faulting and folding of the earth's surface. The Stanaker Dam site is located in one of the folds where erosion has cut a gap through an uptilted layer of sandstone and shale.

16. The climate is temperate and semiarid in the valley, with a growing season of about 119 days between killing frosts. The annual rainfall averages about 9 inches in the valley and over 20 inches in the surrounding mountains, most of which falls during the nonirrigation season. The average January temperature is 17.1° F., while the average temperature in July is 70.4° F.

17. Vegetative cover in the upper watershed is characterized by moderately dense stands of coniferous trees interspersed with grassy parks.

This vegetative type merges into a pinyon pine - juniper type on the lower slopes and foothills. At still lower elevations the characteristic native vegetation is composed mostly of sagebrush, greasewood, rabbitbrush, and saltbush, with a sparse understory of grasses and forbs; however, extensive areas of this brushland type have been replaced by farmland.

Commercial Features

18. Agricultural development in the Ashley Valley is directed largely toward production of meat and dairy livestock. A substantial portion of the farmland consists of pasture. Forage crops--principally alfalfa--and small grains are produced in quantity to provide supplemental feed. Both summer and winter grazing lands are available for sheep and cattle, as the project area is bordered on the north by the Ashley National Forest and on the south, east, and west by public domain.

19. Industrial developments generally related to the agricultural economy include a milk-processing plant, a flour mill, and a meat-packing plant. The nearby forests support several sawmills.

20. The mining industry, producing coal and gilsonite in particular, is important in Uintah County. Since 1950, oil and gas fields have been developed nearby and oil and gas production has become an important source of income. More recently, prospecting for uranium has created additional business.

21. The 1950 census records a total population of 10,300 for Uintah County. Vernal, the largest town, reported a population of 2,845 during the 1950 census; however, in 1956, because of the industrial and mining boom, it is estimated that Vernal has increased to a population of 5,800.

22. Commercial transportation is limited to bus, truck, and air service. The nearest accessible rail junction is at Craig, Colorado, 130 miles east of Vernal. U. S. Highway 40, one of the Nation's chief transcontinental routes, passes through Vernal; and the project area is served by county roads, a few of which are of all-weather construction.

23. Vernal enjoys a growing tourist trade because of its proximity to Dinosaur National Monument and to recreational areas in the Ashley National Forest.

FISHERY SECTION

Without the Project

Stream fisheries

24. Above the Stanaker Diversion Dam site, Ashley Creek and its larger tributaries are cold, usually clear streams, productive of aquatic insects and characterized by pools, boulders, and overhanging banks which provide concealment for fish. Rainbow, brown, and Eastern brook trouts are present in moderate numbers. Comparable habitat and trout populations are found in Brush Creek both above and below Oaks Park Reservoir. All told, the upper watersheds of Ashley and Brush Creeks contain some 66 miles of trout stream. Segments which are easily reached by automobile sustain moderately heavy fishing use; other, less accessible segments are less frequently utilized by fishermen.

25. Of the 18 miles of Ashley Creek below the Stanaker Diversion Dam site only 6 miles provide yearlong habitat for fish; the remaining 12 miles are periodically dewatered by irrigation diversions and are habitable by fish only during the late spring and early summer of some years, when available flows exceed the irrigation demand. Rough fish--principally carp and suckers--predominate, but channel catfish are not uncommon near the Green River confluence and a few trout occasionally are present. Although the entire 18-mile reach is easily accessible, nowhere is it frequently utilized by fishermen. In the entire reach considered, average annual fishing use amounts to only 150 man-days.

26. The upper section of the Ashley Central Canal contains water yearlong and is periodically stocked with trout by the Utah Department of Fish and Game to provide fishing opportunity for children. Utilization of the canal for fishing approximates 600 man-days annually.

Reservoir fisheries

27. Long Park Reservoir, with an average annual maximum of 40 surface acres; Twin Lakes Reservoir, with an average annual maximum of 50 surface acres; and Oaks Park Reservoir, with an average annual maximum of 780 surface acres, are fishing lakes within easy day-use distance of any part of the project area. Long Park and Oaks Park Reservoirs are severely drawn down in the course of each irrigation season and frequently are incapable of sustaining fish-life throughout the winter. However, Oaks Park Reservoir is heavily stocked with hatchery-reared trout at the outset of each fishing season and attracts moderate numbers of fishermen. Long Park Reservoir is less intensively stocked and attracts only a limited amount of fishing use. The dam at Twin Lakes Reservoir has deteriorated to the extent that the reservoir cannot be used effectively for storage of irrigation water, and for several years the lake level has been nearly stable. Under these conditions Twin Lakes Reservoir provides yearlong fish habitat, and the tributary stream contributes naturally spawned trout in sufficient numbers to create an attractive and moderately utilized fishery.

With the Project

Stream fisheries

28. Project operation will have negligible effect on stream fisheries. Although operation of Oaks Park and Long Park Reservoirs will be coordinated with that of Stanaker Reservoir, flows of Ashley and Brush Creeks will not be modified in such degree that the productivity of these streams will be appreciably improved or impaired. Since more water will be available for late-season irrigation in Ashley Valley, the return flow to lower Ashley Creek will be somewhat more stable; however, the length of stream having permanent flow will not be increased, nor will these reaches which now have permanent flow be improved to the extent that they will be capable of supporting a more attractive fishery. Average annual fisherman utilization and harvests will remain unchanged. The segment of the Ashley Central Canal now managed for children's fishing will not be altered structurally, nor will its flow be altered significantly. Average annual fisherman utilization and harvests will remain unchanged in this section of the canal.

Reservoir fisheries

Existing Reservoirs

29. Coordinated operation of Oaks Park, Long Park, and Stanaker Reservoirs will not alter the general pattern of fluctuation of either of the existing impoundments and thus will have no appreciable effect upon their fishery status. The project will have no effect whatsoever upon Twin Lakes Reservoir.

Stanaker Reservoir

30. Hypothetical operating data indicate that the water level of Stanaker Reservoir will fluctuate within a vertical range of 62 feet and that the average annual fluctuation will amount to 32 feet. In association with these vertical fluctuations, the water-surface area will vary between 260 and 850 acres. Annual maximum levels usually will be reached in May or June, and annual minimum levels in September or October.

31. Water temperatures in Stanaker Reservoir will be more suitable for trout than for warm-water fish. The reservoir will afford no opportunity however for trout reproduction, and maintenance of a trout fishery will be dependent upon stocking. An estimated 11,000 legal-size trout will be stocked annually by the Utah Department of Fish and Game. Rough fish will enter through the Stanaker Feeder Canal and, in contrast to trout, will be able to reproduce in the reservoir. Over a period of years, a rough-fish population will develop which will severely compete with trout for the available food supply and will further limit the quality of the reservoir fishery.

32. Assuming that Stanaker Reservoir will be managed as a trout fishery, it is estimated that the average annual fishing use will amount to 2,200 man-days and that an average harvest of 5,300 trout (approximately 50 percent of those stocked) will be realized. Except for the first few years of operation, when the growth rate of stocked trout will be such that fishermen will be attracted from more remote areas, utilization of the reservoir fishery will be confined largely to residents of Vernal and other nearby communities. In view of the wide expanse of reservoir bed which will be exposed throughout much of the summer, and the generally poor quality of the fishery, few vacationing fishermen will be atracted to the reservoir.

Summary of Fishery Resources Without and With the Project

33. Construction and operation of the Vernal unit will have no sigficant effect upon existing stream or reservoir fisheries. The net effect of the project with respect to fisheries will be the creation of a lake that can be managed as a put-and-take trout fishery and, if so managed, will sustain about 2,200 man-days of fishing use annually and produce approximately 5,300 trout to the creel.

Related Monetary Values

34. Any economic expression of the effect of the project upon fishery resources can be limited to the expenditures that will be incurred in connection with use of the Stanaker Reservoir fishery, since existing fisheries will not be significantly affected. It is anticipated that nearly all of the fishing on Stanaker Reservoir will be done by persons residing in the general vicinity, and with short travel and no overnight lodging involved, their average monetary expenditure per fishing-day will be low. The average annual expenditure attributable to the Stanaker Reservoir fishery will amount to approximately $11,000.

WILDLIFE SECTION

Wildlife Resources Without the Project

Introduction

Species Present

35. The more important wildlife species present on the Vernal Unit are pheasant, valley quail, mourning dove, cottontail, beaver, muskrat, Canada goose, and various species of ducks. Other animals found on the

area include mule deer, sage hen, jackrabbit, red fox, mink, skunk, badger, bobcat, and many kinds of shore birds.

Vegetative Cover Types

36. Native vegetation on the uncultivated land of the valley benches and lower mountain slopes is composed of dryland plant species such as sagebrush, greasewood, rabbitbrush, saltbush, and various cacti. Progressing up the slopes, these species give way to scrub growth of pinyon pine and juniper. At higher elevations, where the project streams arise, a montane forest occurs which is composed of lodgepole pine, Douglas fir, Englemann spruce, aspen, and alder. Heavy stands of woody growth, mainly willow and alder, border the mountain streams. Species common to the lower flood plain are cottonwood, willow, alder, wild gooseberry, silver buffaloberry, and many kinds of forbs and grasses.

37. Much of the native vegetation in the valley has been replaced with cultivated crops, and under irrigation these lands produce alfalfa, hay, small grains, and vegetables. Marshlands occur in low spots and old oxbows along Ashley Creek and in the drainage ditches and seeps of the irrigated section. Hardstem bulrush, cattail, widgeongrass, pondweed, watercress, spikerush, and many sedges comprise the vegetative cover in these areas.

Refuge

38. The Stewart Lake State Refuge is located one mile south of Jensen, Utah, at the confluence of Ashley Creek and the Green River. A short distance above the mouth of Ashley Creek a concrete, two-way diversion structure is utilized to transfer a portion of the high spring runoff and irrigation return flow from the creek into the refuge. The diverted water is impounded within a low, V-shaped earthen dike, the wings of which parallel Ashley Creek and the Green River. The riverside dike contains a control gate permitting manipulation of the water level within the impoundment. During most years this 600-acre refuge affords good resting and feeding habitat for waterfowl migrating along the Green River. A significant amount of duck and goose nesting and moderate-quality waterfowl hunting is also provided. The refuge is open to the hunting of upland-game animals during the regular seasons.

Big game

39. The brushy cover along Ashley Creek and the drainages and breaks leading to Stanaker Draw provide some habitat for mule deer. In the upper portion of the proposed Stanaker Reservoir site, a tract of about 300 acres provides a limited source of emergency winter deer browse.

40. Resident mule deer are limited to a few animals along Ashley Creek and a small number in the vicinity of the Stanaker Draw. During years of severe winter weather and heavy snowfall, range in the Stanaker Reservoir area is utilized by an additional mule-deer population that moves down from higher elevations. Little deer-hunting pressure is exerted on project lands. Although local deer numbers are low, the large herd which inhabits the nearby mountainous country provides attractive hunting.

Upland game

41. High-quality upland-game bird habitat exists along the margins of the stream and upon the irrigated farmland of the Vernal Unit. Moderate-quality habitat is also found on a portion of the lands within the proposed Stanaker Reservoir site. The interspersion of croplands and natural woody coverts on the cultivated bottom land and lower benches of Ashley Creek Valley presents excellent pheasant habitat. Where clearing has not been intensive on the agricultural lands, high-quality habitat exists for valley quail and mourning doves. Although cottontails are found in the greatest numbers on the uncultivated sagebrush lands, the agricultural areas also provide good habitat for this species.

42. Upland game is subject to intensive hunting pressure on the lands of the Vernal unit. Although pheasants receive the heaviest pressure during the short annual game-bird season, valley quail and mourning doves also provide attractive hunting. Good cottontail hunting is scarce in Utah, and this area, with a very high cottontail population, proves attractive to the rabbit hunter. An average annual harvest of 2,600 upland-game animals furnishing approximately 2,050 man-days of hunting will take place on Vernal-unit lands.

Waterfowl

43. Waterfowl habitat associated with the Vernal unit is found along the drains and seeps of the irrigated farmlands, in the oxbows and sloughs bordering Ashley Creek, and within the Stewart Lake Refuge near the mouth of Ashley Creek. The refuge provides the largest single block of waterfowl marsh in northeasern Utah, but the value of the area is somewhat limited by the erratic flow of Ashley Creek, from which it derives its water supply. Total runoff from this stream fluctuates widely from year to year and is heavily drawn upon for irrigation purposes. Mallards are the principal users of wetlands along the creek and those formed by the drains. These latter areas furnish good quality resting and feeding habitat and moderate value nesting habitat. No waterfowl habitat exists in the Stanaker Reservoir site.

44. Substantial numbers of ducks utilize the Stewart Lake Refuge during the spring migration, and redheads, teal, scaup, mallards, and several

pair of Canada geese remain to nest on the marsh. A moderate number of mallards nest along Ashley Creek in the project area, and during the fall and early winter they feed in the open drains and seeps throughout the irrigated section. An average annual waterfowl utilization in the amount of 250,000 duck-days and 20,000 goose-days is estimated for the area concerned.

45. In those years when Stewart Lake Refuge has an adequate water supply during the late summer and autumn, it provides good waterfowl hunting. Good mallard shooting is found along the drains of the irrigated section and along the lower reaches of Ashley Creek. Collectively, these areas provide most of the waterfowl-hunting opportunities available locally An average annual harvest of 160 waterfowl furnishing 130 man-days of hunting is estimated for the area associated with the project.

Fur animals

46. Muskrats and beavers are the fur animals of importance on the project area. In addition, small numbers of minks, skunks, bobcats, and badgers are present. Muskrats are common along the drainage ditches and canals of the irrigated section and along Ashley Creek below Vernal, Utah. Muskrats are numerous also on the nearby Stewart Lake Refuge. Beavers occur in moderate numbers along the lower ten miles of Ashley Creek. There is an average annual harvest of about 340 muskrats and 10 beavers.

Wildlife Resources With the Project

Introduction

47. Construction of Stanaker Reservoir will impound an 880-acre lake flooding moderate-value habitat now utilized by upland-game animals and a few mule deer. Supplemental water on presently irrigated lands will encourage landowners to crop marginal lands such as field borders and odd corners that are currently providing most of the upland-game cover in these areas. Diversion of the high spring flows of Ashley Creek into the Reservoir will reduce the quality and quantity of waterfowl habitat in the Stewart Lake State Refuge.

Effects in Relation to Needs

48. With the exception of big game, the loss of habitat and subsequent reduction of hunting opportunities resulting from project operation will further aggravate the already overtaxed resources in this region. The deterioration of the aquatic habitat of the Stewart Lake Refuge will represent an important loss to waterfowl migrating along the Green River. An impoundment at the Stanaker site for irrigation purposes will add little to wildlife values of the area.

Big game

49. Approximately 880 acres of mule-deer habitat will be inundated by Stanaker Reservoir. About 300 acres of this area is winter range for a few animals during some years. Mule deer will be reduced in number with the project in operation. The small population in the vicinity of Stanaker Draw will be forced out due to the loss of most of their food supply. There will be no hunting or harvest of big-game animals associated with the Vernal unit.

Upland game

50. Eight hundred and eighty acres of upland-game habitat will be flooded by the Stanaker Reservoir. Of the total, about 300 acres are sagebrush grazing land which provides excellent habitat for cottontails; the remaining acreage is utilized by all upland-game species common to the project area. The quality of the upland-game habitat will be slightly reduced on the 14,780 acres of irrigated land that will receive a supplemental water supply.

51. Inundation of the habitat within the Stanaker Reservoir area will eliminate the upland-game populations, and existing populations will be slightly reduced on the 14,780 acres of irrigated land.

52. With the Vernal unit in operation, upland-game hunting and harvests on project lands will be slightly lowered. An average annual harvest of 2,500 upland-game species furnishing 2,000 man-days of hunting will be provided on the unit lands.

Waterfowl

53. The 880-acre lake created in Stanaker Draw will provide little waterfowl habitat. Severe fluctuation of the water level will preclude establishment of aquatic plants which would provide food and cover for ducks. The location of the reservoir off the regular flight path will reduce its value for waterfowl migration purposes. Waterfowl habitat associated with the irrigated lands will be benefited with the project; the benefits, however, will be largely negated by a reduction in the quality of the marshes along Ashley Creek which are dependent upon overbank flooding. Reduction of spring flows of Ashley Creek will have an adverse effect on Stewart Lake Refuge. It is expected that, over a period of years, food and cover conditions will deteriorate to the point that the refuge area will retain little value as waterfowl habitat.

54. Waterfowl utilization associated with the Vernal project will be reduced as a result of project operation. The annual waterfowl use of the refuge will be significantly reduced, because it will no longer receive enough water from Ashley Creek to create a marsh. Waterfowl use of the

habitat with the project will be reduced to an estimated 90,000 duck-days and 5,000 goose-days annually.

55. Waterfowl hunting opportunities and harvests will be reduced with the project, primarily at Stewart Lake Refuge. The limited increase in hunting expected on the Stanaker Reservoir will not go far toward mitigating losses incurred at the refuge. With the project, the average annual hunter usage will total 85 man-days with an associated harvest of 110 waterfowl.

Fur animals

56. Low-quality fur-animal habitat will develop along the shores of the Stanaker Reservoir. Habitat will be improved along the drains and canals of the irrigated area, and along limited reaches of the creek below Ashley Diversion Dam as a result of a more stabilized streamflow. The amount and quality of fur-animal habitat, however, will be reduced on Stewart Lake Refuge, which will result in an overall decrease in fur-animal populations and harvest on the area influenced by the project. With the project, the average annual harvest will amount to $300 fur animals.

Summary of Conditions Without and With the Project

57. Utah sportsmen sorely need more upland-game hunting opportunities Waterfowl hunting opportunities are also scarce in many sections of the State. Conversely, Utah's mule-deer population is and, barring incidence of some major decimating factor, will continue to be adequate to accommodate the foreseeable need for deer hunting opportunities within the State. With this in mind it is apparent that, in relation to the needs of Utah hunters, the Vernal unit's primary importance rests in its effect upon upland-game and waterfowl resources.

58. Although construction and operation of the project will destroy 300 acres of mule-deer wintering range and reduce populations on the remainder of the project area, this loss will be of little importance because numbers of deer affected are insignificant in view of the abundant big-game hunting opportunities nearby. On the other hand, the loss of upland game, although relatively small, represents a significant loss because these animals provide hunting opportunities which are heavily utilized by hunters from all over the State of Utah and which are inadequate to meet the need. Waterfowl resources which are of importance to local sportsmen and also, to a lesser degree, to out-of-county sportsmen will be significantly reduced with the project. Fur-animal populations, of minor importance, will be slightly decreased with the project.

59. The summary of habitat, populations, utilization, and harvest is presented in table 2, page 15.

Table 2 - Summary of Wildlife Resources, Utilization, and Harvest

	Without the Project				With the Project				Difference			
	Habitat (Acres)	Population (Total)	Utilization (man-days)	Harvest (Number)	Habitat (Acres)	Population (Total)	Utilization (man-days)	Harvest (Number)	Habitat (Acres)	Population (Total)	Utilization (Man-days)	Harvest (Number)
Big game	880 A	28	12	8	.....	.....	.....	.....	-880 A	-28	-12	-8
Upland game	16,260 A	10,800	2,050	2,600	15,380 A	10,400	2,000	2,500	-880 A	-400	-50	-100
Waterfowl	15,400 A**	270,000*	130	160	15,680 A**	95,000*	85	110	+280 A	-175,000*	-45	-50
Fur animals	740 A***	720	...	350	140 A***	630	. .	300	-600 A	-90	..	-50

* Waterfowl populations are presented as waterfowl-days utilization.

** Includes 18 miles of stream habitat converted to acres.

*** Includes stream habitat converted to acres.

Related Monetary Values

Hunter expenditures

60. Associated with hunting in the Vernal area are substantial monetary expenditures. Expenditures for ammunition, food, lodging, gasoline, and other items, increase the income of many local and nonlocal business establishments. Motels, hotels, cafes, hardware stores, and a sporting goods store in Vernal, Utah, benefit substantially from the influx of sportsmen during the hunting season. These monetary expenditures in no way represent the enjoyment derived from hunting, the needs of sportsmen, or the value of wildlife; they merely indicate the minimum amount the hunter is willing to spend to harvest game animals.

61. Average annual expenditures associated with the harvest of game animals which will be affected by the Vernal unit total approximately $16,900 under without-the-project conditions. With the project, average annual expenditures amount to about $14,650. This is a reduction of approximately $2,250 in gross annual sales.

Fur-animal values

62. Fur animals valued at $550 will be harvested annually without the project, while with the project the value of this harvest will amount to $500.

63. Related monetary values are summarized in table 3 below.

Table 3 - Summary Comparison of Monetary Values Related to Game and Fur Resources

	Without Project	With Project	Difference
Big game	$ 1,100	.....	-$1,100
Upland game	14,500	$14,200	-300
Waterfowl	1,300	450	-850
Subtotal	$16,900	$14,650	-$2,250
Fur animals	550	500	-50
Totals	$17,450	$15,150	-$2,300

DISCUSSION

Wildlife

Upland-game preservation and enhancement

64. The acquisition, development, and management for wildlife of small plots of land totaling 125 acres that are strategically located throughout the irrigated farmland would mitigate upland-game losses accruing from the project and would help meet the needs of the sportsmen for additional upland-game hunting opportunities. These plots should be approximately 5 to 10 acres in size and be confined to pasturelands, margins of drainage ditches, and odd corners throughout the farming area. By fencing them and establishing winter food and cover plantings where necessary, critical winter cover for pheasants and other game birds would be provided, which would enhance the entire irrigated section for wildlife.

65. Thoughtful selection of the lands to be developed for wildlife is essential to the success of this proposal. The plots must be of suitable size and shape; they must contain soils suitable for growing cover plants; and they must be properly dispersed throughout the area to be developed. The Fish and Wildlife Service will cooperate with the Utah Department of Fish and Game in the preparation of wildlife-habitat development plans for this area.

66. The initial cost of the 125 acres of land would be approximately $9,400, and the initial cost of fencing and development is estimated to be $12,700. Operation and maintenance costs will average about $760 annually. On an annual basis, acquisition costs would amount to $260 (amortized for 100 years at 2½ percent) and habitat development costs, including fencing and establishment of wildlife habitat plantings, would amount to $350 annually. Operation and maintenance of the developments would be borne by the Utah State Department of Fish and Game and would average $760 annually.

67. As a result of the acquisition and habitat development of 125 acres interspersed throughout the Vernal irrigated area, losses of upland game would be entirely mitigated and substantial benefits would be realized. Loss of harvest of 100 upland-game animals furnishing 50 man-days of hunting would be recouped; and an increased take of 550 upland-game animals providing 450 man-days of hunting would be realized. Annual hunter expenditures would be increased by the proposed development from an estimated $14,200 with the project to $17,450. Thus the $300 loss in hunter expenditures accruing from the project will be recouped and an additional $2,950 will be expended annually.

Stewart Lake Refuge preservation and enhancement

68. Habitat should be maintained on the refuge to provide for migrating and nesting waterfowl. Provision of hunting, though of primary benefit to local residents, is an important function of this refuge and should be safeguarded. To preserve this area it will be necessary to obtain a water supply from Green River by pumping. The Green River in this area is open to filings of 5 second-feet or less and consequently the Utah Department of Fish and Game has filed for 5 second-feet to be pumped into the refuge. The delivery distance would be short, since the refuge dike lies within 100 yards of the river at certain points. A diesel pump of 5-second-feet capacity will deliver enough water to meet water requirements for the refuge.

69. It is estimated that the initial cost of the diesel pump installed on Green River would be $3,000. Pipe to transport the water from the river into the refuge would cost approximately $1,500. The annual cost of these facilities would be $125 (amortized for 100 years at 2½ percent). Based on an average daily operation of 10 hours for a period of three months in the spring and two months in the fall, the annual operation and maintenance costs would total about $400. The total cost of this proposed development would be $31,250.

70. With the pump in operation during the months of March, April, May, September, and October, substantial benefits to waterfowl and waterfowl hunting would accrue in addition to mitigating the losses. Loss of 45 man-days of hunting and 175,000 waterfowl-days utilization would be prevented by pumping during March, April, and May. Benefits would accrue from pumping during September and October, since the area would provide an additional 100 man-days of hunting and waterfowl utilization would be increased during this period by 125,000 duck-days. Annual hunter expenditures would be increased by the proposed development from an estimated $450 with the project to $1,600. Thus the $850 loss in hunter expenditures accruing from the project will be recouped and an additional $750 will be expended annually.

RECOMMENDATIONS

71. It is recommended--

(1) That Federal lands and project waters in the project area be open to free use for hunting and fishing so long as title to the lands and structures remains in the Federal Government, except for sections reserved for safety, efficient operation, or protection of public property.

(2) That leases of Federal land in the project area reserve the right of free public access for hunting and fishing.

(3) That the Utah State Department of Fish and Game and the U. S. Fish and Wildlife Service be consulted when clearing specifications are developed for Stanaker Reservoir.

(4) That 125 acres of lands be acquired by the Bureau of Reclamation and made available to the Utah State Department of Fish and Game for administration and management under a General Plan, as provided for in Section 3 of the Coordination Act of August 14, 1946 (60 Stat. 1080; U.S.C. 661).

(5) That the sum of $12,700 be provided for the initial development of wildlife habitat on the 125 acres of lands requested in recommendation (4), the work to be done by the Utah State Department of Fish and Game under a Memorandum of Understanding with the construction agency.

(6) That the sum of $31,250 be provided for the purchase installation, operation, and maintenance of a 5-second-foot capacity diesel pump and approximately 300 feet of pipe needed to provide water to the Stewart Lake Refuge.

CONCLUSIONS

72. One out of every four people in the State of Utah hunts, or fishes, or does both. In so doing they spend $44,000,000 annually. Of the total number of sportsmen in Utah, over 44 percent hunt pheasants and 21 percent hunt waterfowl--this, despite the fact that neither pheasant nor waterfowl hunting is available in many parts of the State. Undoubtedly a higher percentage of the State's sportsmen would hunt these species if the opportunity were available. It is important, therefore, not only to prevent the loss of pheasant and waterfowl hunting opportunities, but to develop them to their maximum potential where compatible with other land-use interests. Construction and operation of the Vernal unit presents the opportunity to do both at a cost far less than the value of the resources saved and enhanced by so doing.

73. This report is based on data available from the planning agency as of September 1, 1956, and any modification of plans should be brought to the attention of the U. S. Fish and Wildlife Service.

John C. Gatlin
Regional Director

May 1957

INVESTIGATION OF MINERAL RESOURCES AT STANAKER RESERVOIR SITE, CENTRAL UTAH PROJECT, UINTAH COUNTY, UTAH

By F. D. Everett
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U. S. Bureau of Mines
Denver, Colorado

December 1956

BUREAU OF MINES REPORT

SUMMARY

A preliminary investigation of the Stanaker Reservoir site, Uintah County, Utah, indicated that coal-bearing and uranium-bearing formations crop out in its general vicinity. A field investigation disclosed that coal has been mined from a seam in the Frontier member of the Mancos formation near the Stanaker damsite, and that uranium claims had been staked over much of the Morrison formation north of the reservoir site.

The coal seam will not be inundated. A small quantity of coal is within the area needed for construction and maintenance of the Stanaker project, but not enough to be important. The dip of the coal seam is 17 degrees away from the reservoir site. Large reserves of coal occur in the Vernal region, but the market for coal is relatively small.

Portions of the reservoir site are privately owned; the rest has been withdrawn from mineral location. Mining claims have been located on public domain north of the reservoir site, along rim exposures of the Dakota sandstone and the upper part of the Morrison formation. All mining locations were made subsequent to the time of withdrawal, and any claims located within the withdrawn area are invalid.

The Morrison outcrops in the reservoir area were checked with a Geiger counter at quarter-mile intervals, and only normal background radioactivity was indicated. The only radioactivity found in Stanaker Draw was on a claim located along the rim about 1-1/2 miles north of the reservoir site, where bulldozer work had been done. About three times normal radioactivity was found in a spot 5 feet in diameter. This is not considered commercial ore, and the claim apparently had been abandoned. The Morrison formation crops out in other areas of Unitah County, but uranium production has consisted of only a few tons of carnotite ore. The uranium potential in the reservoir site is considered negligible.

Oil and gas leases have been granted in the reservoir site, but no drilling has been done.

INTRODUCTION

The Bureau of Mines investigated the Stanaker Reservoir site at the request of the Bureau of Reclamation. A preliminary investigation of geologic reports indicated that coal-bearing and uranium-bearing formations occurred in the Vernal region. The field examination was made between October 29 and November 2, 1956.

BUREAU OF MINES REPORT

The proposed Stanaker Reservoir is a part of the Bureau of Reclamation's Central Utah Project. It will store spring run-off and flood waters from Ashley Creek and Stanaker Draw. The reservoir will provide supplemental water to lands in Ashley Valley.

LOCATION AND PHYSICAL FEATURES

Stanaker damsite is 3.6 miles north of Main Street, Vernal, Utah. The reservoir would occupy most of secs. 26, 34 and 35, T. 3 S., R. 21 E., Salt Lake meridian, Uintah County, Utah.

The reservoir site is in Stanaker Draw, through which water flows intermittently into Ashley Creek. The reservoir will cover a basin about 1 mile wide and 2 miles long, bounded on the south and east by a steep-sided hogback of sandstone and shale interrupted by the breakthrough at Stanaker Draw. Low hills of shale and sandstone bound the basin to the west and north. The damsite is at the break in the hogback at the south end of the basin. The steep rim of the hogback, which slopes away from Stanaker Draw, is a conspicuous feature in the basin.

Most of the reservoir site is farmed. Natural vegetation consists of range grass and sagebrush.

Utah Highway No. 44 passes through the reservoir site.

LAND OWNERSHIP

Most of the land and mineral rights in the reservoir site are privately owned. The State of Utah retained mineral rights on a block of land in sections 34 and 35 that was sold for delinquent taxes. According to the Bureau of Reclamation's Central Utah Project Report, Appendix A, Design and Estimates, dated February 1951, the public domain in the Stanaker Reservoir site was withdrawn from mineral location.

The privately owned land is used for raising alfalfa and grain and for pasture. Several farm residences are within the project site. Oil and gas leases have been granted on much of the privately owned land.

PROJECT PLAN

Stanaker Dam will be at the break in the hogback in the SW $\frac{1}{4}$, sec. 35, T. 3 S., R. 21 E. The dam will be 138 feet high and have a crest length of 1,740 feet. The altitude of the crest will be 5,527 feet, and that of the active maximum water surface will be 5,517 feet. A 2-mile feeder canal from the proposed Thornburgh diversion reservoir, on Ashley Creek in sec. 5, T. 4 S., R. 21 E., will supply water to Stanaker Reservoir. Thornburgh Reservoir will cover about 2 acres. Stanaker Reservoir will have an active capacity of about 34,000 acre-feet.

BUREAU OF MINES REPORT

GEOLOGY

Regional Geology

The Stanaker Reservoir site is in a small anticlinal arch on the south limb of the broad Uinta Mountains anticline. The south flank of the Uinta Mountains anticline is composed of sedimentary rocks that range from Precambrian to Recent age. The regional dip of the rock formation is to the south.

Ashley Valley, south of Stanaker Draw, is in the upper Mancos shale member of Cretaceous age, flanked by the Frontier sandstone member of the Mancos formation. The Frontier member and the Dakota sandstone form prominent cuestas and hogbacks.

Stanaker Reservoir Site

Stanaker Reservoir will occupy a basin made by the erosion of soft shale beds that are surrounded by harder beds of more resistant sandstone. The damsite will be at the narrow break-through in the Frontier sandstone.

Rock formations in the reservoir site comprise alluvium, Cretaceous Mancos formation and Dakota sandstone, and Jurassic Morrison formation and Nugget sandstone. A generalized stratigraphic section of the formations in the reservoir site follows:

Age	Formation	Member	Description	Thickness (feet)
Recent	Alluvium		Fine sand and silt	0 - 90
Cretaceous	Mancos	Upper shale	Gray-black shale	5000-6000
		Frontier	Tan sandstone, some coal	60-215
		Aspen or Mowry shale	Carbonaceous, dark to tan, platy siliceous shale	141-284
	Dakota		Sandstone and conglomerate	10-300
Jurassic	Morrison		Multi-colored shale	780
	Nugget		Reddish sandstone	600

Apparently there are no geological reports on the area other than on a regional basis. A sketch of the geology of the reservoir site was made and is presented as figure 1.

Alluvium

Alluvium covers the floor of Stanaker Draw. It is composed of fluviatile sand and silt with few coarse boulders. At the damsite, the

alluvium found in a Bureau of Reclamation drill hole was 89 feet deep. In the central and northern part of Stanaker Draw the alluvium covers the Jurassic Morrison formation.

Mancos Formation

The Mancos formation of Cretaceous age conformably overlies the Dakota sandstone. In the Uinta Basin it has been divided 1/ into Upper shale, Frontier sandstone, Middle shale, Aspen shale, and Lower shale members. The rock formations, as were observed in this investigation of Stanaker Draw, include Upper shale, Frontier sandstone, and Aspen shale.

Upper Shale

The Upper shale does not crop out in the reservoir site, but is exposed immediately to the south of the damsite. The broad Ashley Valley was formed in this shale member.

Frontier Sandstone

This member crops out as a prominent hogback along the north edge of Ashley Valley, and will form the upper part of the dam abutments.

The Frontier member is composed mostly of light tan sandstone with some shale and contains at least one coal bed. It is hard and resistant to weathering and is about 100 feet thick at the damsite. Only the lower part will be inundated along the south side of the reservoir.

Aspen Shale

This member, sometimes referred to as the Mowry shale, lies between the Frontier and Dakota sandstones. It consists of more than 200 feet of blackish, thinly laminated, sheets of shale and a thin bed of sandstone.

The base of the dam will be constructed on this member, and in the southern or dam end of the reservoir, this member will be inundated.

Dakota Sandstone

The Dakota sandstone is the basal formation of the Cretaceous system and is a 10- to 20-foot bed between the Aspen shale and the Jurassic Morrison formation. It is resistant to weathering, usually forming prominent ridges, and in this area forms the crest of the east rim bounding Stanaker Draw.

1/ Walton, Paul T., Geology of the Cretaceous of Uinta Basin, Utah: Geol. Soc. of America, Vol. 55, Jan. 1, 1944, pp. 91-129.

This formation will be inundated near the damsite, where it has been eroded and is buried below the flow of the Draw.

Morrison Formation

The Jurassic Morrison formation crops out below the Dakota sandstone along the east rim of Stanaker Draw. It is about 780 feet thick and is comprised of red, white, purple, and green shale and sandstone beds. This formation underlies most of the alluvium in the reservoir site.

The Morrison is one of the uranium-bearing formations in Utah and Colorado, especially on the Colorado Plateau, which is south and east of Vernal.

Nugget Sandstone

The Jurassic Nugget sandstone crops out along the higher ridges on the west side of Stanaker Draw. It is comprised of red sandstone and some shale. This formation is more than 600 feet thick. Small strips of Nugget sandstone may be inundated along the west side of the reservoir.

MINERAL RESOURCES

The area was carefully examined for evidence of mineral resources and county courthouse records were searched for recorded mineral claims. Coal occurs in the Frontier sandstone member of the Mancos formation just south of the location of the right abutment of the proposed dam, and the Morrison outcrops have been prospected for uranium. According to residents living at the site, land within the area has been leased for oil and gas exploration, but no drilling has been done; however, there has been drilling activity for oil and gas in other parts of the Vernal region.

Coal

A coal outcrop in the Frontier sandstone was examined on the south side of the hogback outside of the reservoir site. The seam can be traced for several miles east and west of the proposed reservoir; it will not be inundated at any place. Near the damsite, a part of the coal seam probably is within the right-of-way required for constructing the dam and maintaining the reservoir.

The coal seam crops out near the damsite approximately along the 5,440-foot contour, which is about 55 feet above the floor of the reservoir. Above this elevation the coal seam, generally, has been eroded. At one place, a few hundred feet from the damsite, it has been mined, probably before 1907, when it was examined by Hoyt S. Gale of the U. S. Geological Survey 2/. This operation was known as the Gibson mine

2/ Gale, Hoyt S., Coal Fields of Northwestern Colorado and Northeastern Utah: U. S. Geol. Survey Bull. 415, 1910, pp. 207, 214 and 250.

and is on land patented for its coal reserve. According to U. S. Bureau of Mines Bull. 22 (p. 813) 3/ and Technical Paper 345 (pp.306 and 315) 4/, the mine was developed by an entry that extended 120 feet from the surface in 1907, and the coal bed was 86-1/2 inches thick measured as follows:

Coal	1 foot 10 inches
Coal	3 feet 6-1/2 inches
Clay	0 feet 1 inch
Coal	1 foot 9 inches

Analyses of the coal included the following:

	Volatile matter, percent	Fixed carbon, percent	Ash, percent	B.T.U.
Lower 14 inches of top 22 inches	32.8	44.9	12.9	10,370
Middle 42-1/2 inches	34.4	44.5	10.7	10,580
Lower 21 inches	32.7	44.8	12.3	10,690

This would be classed as a high ash, high volatile, bituminous coal.

The coal above the Ashley Valley floor would have 5 to 25 feet of cover; the beds dip 17 degrees to the south or away from the reservoir site. Two underground entries, about 75 feet apart and in line with each other, were open in October 1956. The coal outcrop was measured and found to be 5 feet thick and extremely weathered. The amount of coal mined probably has been less than 500 tons, and only a small amount remains above the floor of the valley in the vicinity of the damsite.

Markets for coal in this region would be restricted to domestic and business use in the settlements near Vernal, Utah. There are no railroads in the region. Other sources of good coal with railroad outlets are within 125 miles of Vernal. Vernal and vicinity has been supplied with natural gas since 1955. The present local source of coal is a mine in the Deep Creek district, about 8 miles northwest of Vernal.

The coal near the Stanaker damsite has no foreseeable economic importance, and its value is considered insignificant.

Uranium

The Morrison formation contains uranium in parts of Utah and Colorado. It has been prospected in Stanaker Draw, and about thirty claims

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3/ Iard, N. W. et al., Analyses of Coals in the United States, Bureau of Mines Bull. 22, 1913, 1200 p.

4/ Analyses of Utah Coals: Bureau of Mines Technical Paper 345, 1925, 90 p.

have been located north of the reservoir site. A few claim stakes were observed in the reservoir site. According to the Bureau of Reclamation's Central Utah Project report (see section on Stanaker Reservoir), the public land around the reservoir site was withdrawn from mineral location.

Outcrops of the Morrison formation in sections 26 and 35 were examined for radioactivity every one-quarter mile. Several mining claims located north of the reservoir site also were investigated, and the only abnormal radioactivity that was observed was 1-1/2 miles north of the upper end of the site where a claim had been trenched with a bulldozer. This work was done by Brownie Monroe Hatch of Vernal. At one place on the property, over an area 5 feet in diameter, three times the normal background radioactivity was noted. It appeared that about 150 hours of bulldozer work had been done on this claim before it was abandoned. Two adjoining claims also had been explored by bulldozer work.

Only a few tons of uranium ore have been produced from Uintah County, and none from Stanaker Draw. It is unlikely that uranium in commercial quantities will be found at the site of the proposed Stanaker Reservoir.

CONCLUSIONS

There are no significant mineral resources that will be affected by the proposed Stanaker Reservoir.

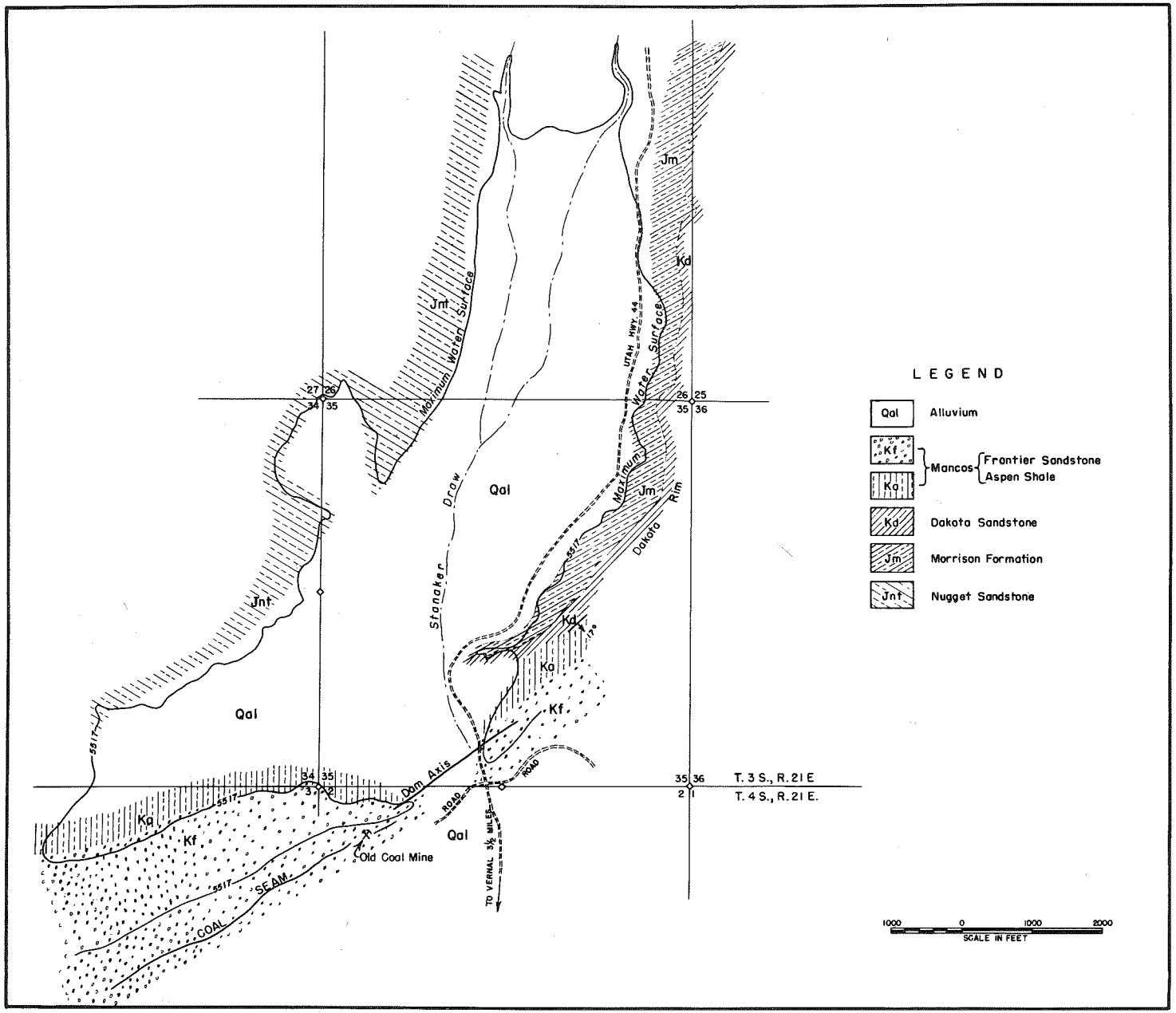

Figure 1 - Sketch of geology at Stanaker Reservoir site, Uintah County, Utah

CORPS OF ENGINEERS, U. S. ARMY
Office of the District Engineer
Los Angeles District
751 South Figueroa Street
Los Angeles 17, California

SPLGP-F 800.92 (Colo. R. above Lee Ferry) 7 August 1956

Mr. E. O. Larson
Regional Director, Region 4
Bureau of Reclamation
P. O. Box 360
Salt Lake City, Utah

Dear Mr. Larson:

Reference is made to your letter of 27 April 1956 that relates to flood-control investigations and planning for the Colorado River Storage Project and Participating Projects. In your letter, the Vernal Unit, Central Utah Project, is listed for first consideration.

A field reconnaissance of the Vernal Unit, in the vicinity of Vernal, Utah, was made by Los Angeles District representatives, accompanied by a Bureau of Reclamation representative, on 28 June 1956. Your report (U.S.B.R. Project Planning Report No. 4-8a. 51-0, dated January 1949), was used in the reconnaissance and in preparation of the report that follows.

The project plan, which includes provision for diversion of surplus flows from Ashley Creek to an off-channel reservoir on Stanaker Draw, would provide a full supply of water to 4,580 acres of land nonirrigated and a supplemental supply of water to 20,920 acres of presently irrigated land. The plan would also, through water exchange, provide for diversion of additional water from Ashley Creek Springs for municipal uses in Vernal and adjacent communities. This spring water, now used for irrigation, would be replaced with storage water from Stanaker Reservoir.

The Vernal Unit lies in Ashley Valley. Upstream from the project, Ashley Creek drains a 238-square-mile area with elevations ranging from 5,700 to 12,000 feet. The creek, with a gradient of about 50 feet per mile, runs through the project area for about 21 miles, discharging into the Green River at the lower end of the project area. The maximum flood of record on Ashley Creek occurred in 1921 when a peak of 3,350 cubic feet per second was reached. The safe carrying capacity of the creek channel has been estimated at 700 cubic feet per second.

Floods on Ashley Creek damage irrigation structures, roads, and bridges, and erode farmlands for about 8 miles in the central part of the valley. About 2,700 acres of farmland are affected. However, most

of the project lands are free from any flood menace. Present flood damage has been estimated by the Bureau of Reclamation at $9,500 annually. Future flood damage probably would not exceed $20,000 annually. Results of investigations indicate that the benefits from preventing this damage would not justify either the construction of local protection works in the project area or the provision of flood-control storage space in a reservoir on Ashley Creek above the valley. The conclusion is reached, therefore, that the construction of flood-control features as part of the Vernal Unit is infeasible.

Conservation storage on Ashley Creek is not planned in connection with the Vernal Unit of the Central Utah Project. However, if a reservoir is built for water conservation on Ashley Creek above Ashley Valley in connection with the Ultimate Development of the Central Utah Project, consideration should be given to the operation of this storage not only for water conservation but also for flood control. The ultimate development of lands along Ashley Creek may justify a small expenditure for providing operational features for flood control. The Corps of Engineers will be interested in further consideration of the operation of any such main-stream reservoir on Ashley Creek.

Very truly yours,

/s/ Leo E. Dunham Jr.

LEO E. DUNHAM, JR.
Lt. Col., Corps of Engineers
Acting District Engineer

REPORT
on
THE PUBLIC HEALTH ASPECTS
of the
PROPOSED VERNAL UNIT, CENTRAL UTAH PROJECT
COLORADO RIVER STORAGE PROJECT
for
THE BUREAU OF RECLAMATION--REGION 4
by
THE PUBLIC HEALTH SERVICE

Department of Health, Education, and Welfare
Region IX, San Francisco, California

December 1956

PUBLIC HEALTH SERVICE REPORT

Introduction

In accordance with the inter-agency Memorandum of Understanding between Bureau of Reclamation, Region 4, and Public Health Service, Region IX, consideration has been given to the public health aspects of the Bureau of Reclamation's Vernal Unit of the Central Utah Project.

In making this evaluation the Public Health Service wishes to acknowledge the assistance of the Utah State Department of Health in connection with their review and comments on this report.

Description of Project

The proposed Vernal unit, which will be located in Ashley Valley of the Uinta Basin in northeastern Utah, will meet the area's urgent needs for irrigation water. Locations of the principal features of the unit are shown on the general map in the preceding Bureau of Reclamation report.

The unit will control the fluctuating flow of Ashley Creek, a tributary of the Green River, by diverting water at Fort Thornburgh Diversion Dam to Stanaker Reservoir. The reservoir, with a maximum capacity of 38,500 acre-feet, will be formed by an earthfill dam at an offstream site located about $3\frac{1}{2}$ miles north of Vernal. It will be utilized primarily for irrigation purposes and will make possible a supplemental water supply for 14,780 acres of farm land inadequately irrigated. A total of 1,500 acre-feet of water annually will be provided for irrigation on an exchange basis so that an equivalent amount from Ashley Creek Springs, now used for irrigation, can be diverted above the reservoir for domestic purposes.

Ashley Creek and its tributaries originate in Ashley National Forest where heavy stands of timber interspersed with flat grassy parks and glacial lakes are characteristic of the upper reaches of the Ashley Creek drainage basin.

Construction features of the Vernal unit include the Stanaker Dam and Reservoir to regulate Ashley Creek flows, the Fort Thornburgh Diversion Dam on Ashley Creek and the Stanaker Feeder Canal to divert water to the reservoir, the Stanaker Service Canal to deliver water to project lands, the water saving pipe system, and drainage facilities. The Stanaker Service and Feeder Canals will be 12 and 3 miles in length respectively.

Population

According to the Bureau of the Census, the population in the unit area was 6,840 in 1950. Vernal and Maeser, with 1950 populations of 2,845 and 645 respectively, are the only incorporated communities in this area.

The population of Uintah County, which encompasses the entire unit area, was 10,300 in 1950, 9,898 in 1940, and 9,035 in 1930. The overall increase of 1,265 between 1930 and 1950 is an illustration of the previous growth trend. An accelerated growth will undoubtedly be encountered following completion of the Vernal unit.

Public Health Considerations

Public Water Supplies

In the Ashley Valley area of the Uinta Basin, public water supplies are limited to the communities of Vernal and Maeser. Water from the municipal systems is also supplied to some of the populated areas beyond the city limits, including the rural community of Naples which is supplied from the Vernal system. The Ashley Ward area, which adjoins Vernal on the northern boundary, also has been negotiating with the city to obtain water from the Vernal system. Estimates indicate that approximately 80 percent of the residents in the unit area are served by existing water supply systems.

Ashley Springs, located adjacent to Ashley Creek about 9 miles north of Vernal, is the common source of water supply for Vernal, Maeser, and Naples. The water is conveyed by a 12 inch steel pipeline from the springs to the head of Ashley Valley where the water is chlorinated continuously in accordance with the requirements of the State Department of Health. After leaving the chlorination plant the water flows into a structure where it is diverted to the Vernal and Maeser distribution systems through two separate pipelines. Estimates indicate that water consumption in the areas served by the Vernal, Maeser, and Naples systems in 1955, amounted to 1,460 acre-feet. This amounts to an average of 224 gallons per capita per day, based on the 1955 population of 5,820 served by these systems.

Since the water rights established by Vernal, Maeser, and Naples are inadequate to supply the demand for municipal purposes during years of low flow in Ashley Creek, additional water is needed to meet existing and future requirements. It has been estimated that a future population of 12,000 by 1980 in the combined areas served by the municipal water systems would require about 1,500 acre-feet of additional water annually for domestic purposes. The Vernal unit has been planned to make this amount of water available from a portion of the Ashley Creek Spring supply, currently used for irrigation purposes, in exchange for storage water from Stanaker Reservoir.

Private Water Supplies

Approximately 20 percent of the residents in the unit area, beyond reach of existing public water supply systems, rely on private water supplies or water transported from adjoining communities for domestic

purposes. According to the State Department of Health, about 50 percent of the homes in the area are supplied with water which is transported from the municipal systems and stored in cisterns for subsequent use. Most of the remaining supplies are obtained from shallow or deep wells which are generally undesirable as to quality and undependable as to quantity. Experience indicates that many of the deep wells are highly mineralized, and therefore, unsuitable for domestic purposes. The practice of hauling water from adjoining communities for domestic purposes is unsatisfactory from both an economic and sanitary standpoint, due to the cost involved and the fact that the water is frequently contaminated during handling.

Available information indicates that it is generally impractical to develop individual water supplies for domestic purposes in the project area. This problem can be solved and existing health hazards eliminated, by installing facilities that will provide the area with a safe and adequate water supply for domestic purposes. The most practical method of solving the problem involves: (1) extending the Vernal and Maeser water supply systems, or (2) by connecting the rural homes to the proposed Vernal unit water savings pipe system. A combination of both plans may be the most practical solution of the problem.

The water savings pipe system referred to in item 2, will be constructed and extended down both sides of the valley to serve stock water to the rural portions of the unit area during the nonirrigation season. This pipeline will divert water from the Vernal and Maeser supply line about 5 miles below its source at Ashley Springs. The pipeline is planned to save a substantial amount of water for diversion to Stanaker Reservoir by eliminating the comparatively heavy losses in the unlined canals and ditches serving the rural areas with stockwater during the nonirrigation season. Stockwater requirements during the irrigation season will be met from irrigation diversions.

If the rural residents become interested in obtaining water for domestic purposes from the proposed water savings pipe system, the local Conservancy District should carry on negotiations for the installation of service connections that will provide water from this system. Implementation of this plan will require provision of sufficient funds by the District to finance the installation of the service connections. If this plan is adopted, disinfection of the water near the source will be essential to meet the drinking water standards.

Public and Industrial Waste Disposal

Vernal is the only community in the unit area with a public sewerage system. Sewage is discharged from the system at three outlets, and following inadequate treatment at one point by means of a septic tank, the sewage and septic tank effluent flows in open drains to Ashley Creek which serves as a source of supply for irrigation purposes further downstream. Pollution of Ashley Creek from this source will be eliminated when the Vernal

treatment plant, currently under construction and scheduled for completion in 1957, is placed in operation. Complete treatment followed by chlorination of the final effluent was required by the State Department of Health in order to meet irrigation water requirements recently established by the State Water Pollution Control Board. Industrial wastes were not encountered in sufficient volume in 1957 to create a problem in the unit area.

The anticipated population increase in some of the unsewered communities in the unit area will undoubtedly necessitate the installation of sewerage systems and adequate sewage treatment to eliminate the health hazards associated with the use of private sewage disposal systems in urban areas.

Private Sewage Disposal

A major factor influencing the health of individuals where public sewers are not available is the proper disposal of human wastes. This problem will become more acute in the unsewered communities as the population increases.

Available information indicates that most of the homes in the rural areas are provided with modern plumbing that discharges to septic tank systems or cesspools. Good subsoil drainage is encountered in the unit lands bordering the hills surrounding the valley where relatively deep soils overlie gravel deposits. Where the slopes are flatter and the soils are heavier in texture, a high ground water table is usually encountered during the irrigation season, thus making the disposal of septic tank effluent more difficult. The proposed installation of underdrains as planned to reclaim some of the project land for irrigation purposes will lower the ground water table in the bottom lands, thus improving conditions for the disposal of septic tank effluent by means of sub-surface disposal. Although the majority of individual sewage disposal systems are provided with sub-surface disposal fields, some of the septic tanks discharge direct to the ground surface or adjoining irrigation ditches. The pollution of irrigation water from this source creates a health hazard to both cattle and humans when the water is used for stock watering and gardening. Appropriate action should be taken by the local health authorities to eliminate this source of pollution.

Recreational Developments.--Attractive recreational areas have been set aside for public use in Ashley National Forest which is located within 30 to 40 miles of population centers in the valley. These facilities include campgrounds, picnic areas, organization camps, hotels and resorts, summer home sites, wilderness areas, and other forest areas. During 1955, a total of 158,120 visitors used the facilities in Ashley National Forest. The development, construction, operation, and maintenance of these facilities are under the overall administration of the Forest Service.

Stanaker Reservoir, which will fluctuate between a surface area of 850 and 260 acres, will provide limited opportunities for recreational development. According to the National Park Service, recreational development on Stanaker Reservoir should be limited to daytime use and the plan should include individual picnic areas and facilities for boating and fishing.

Development of recreational facilities in the vicinity of a proposed impoundment may create public health problems if sanitary requirements are not enforced. In addition to the possible effects of these installations on the use of impounded water for irrigation purposes, the problem of providing adequate and safe sanitary facilities for the public at recreational areas is important from a public health standpoint. Proper design, construction, operation, and maintenance of recreational facilities are essential, both for the protection of visitors and for maximum benefit of subsequent water users. Sanitary requirements of the State and local health departments should be enforced to solve the public health problems involved.

Construction Phase of Project

Limited public health services are available in the project area from the Vernal District Office of the Utah State Department of Health.

The construction features required to complete the Vernal Unit will involve the influx of a large number of construction workers. Since the major features of the Vernal Unit are located within 4 miles of Vernal, quarters will undoubtedly be available in the community for some of the construction workers and their families. If a separate construction camp is considered essential, it should be located in or adjacent to the community where public services and utilities are available. This arrangement would solve many of the public health problems associated with the operation of a construction camp where public utilities are not accessible. If the construction camp is located beyond reach of local facilities, the problems which may be encountered will include adequate housing, development of a safe and adequate water supply, proper sewage and refuse disposal, insect and rodent control, and proper operation and maintenance of facilities. A sanitary survey of the proposed camp by the State or local health authorities would be of considerable value in revealing public health problems that may be encountered during the construction phase of the project.

Mosquito Field Investigations

During the field reconnaissance of the Vernal area in July 1956, adult and larval mosquitoes were collected in the vicinity of the proposed Stanaker Reservoir and at several locations near Vernal, Naples, and Jensen. Observations were also made on the type and extent of mosquito producing habitats within the area of the proposed Vernal unit.

Mosquito species in the area.--A total of 101 larval and 81 adult mosquitoes were collected during the field reconnaissance. Larvae of Culex tarsalis, the primary vector of encephalitis, were collected from a number of seeps and roadside ditches in the Vernal area and were found in large numbers in seepage pools near the proposed Stanaker Dam site. Larvae of Aedes dorsalis were also numerous in these seepage pools. Larvae of Anopheles freeborni, the Western malaria mosquito, and Culiseta incidens were present in small numbers in several of the roadside ditches and seepage pools.

Females of A. dorsalis and Aedes vexans were taken in a number of biting collections in the vicinity of the proposed Stanaker Dam site. A. dorsalis and Aedes campestris were especially annoying in the lower valley areas near Vernal and Jensen. In light trap collections at Naples and Jensen on the night of July 11, C. tarsalis comprised 29 of the 55 adult mosquitoes taken.

Mosquito-borne disease and pest problems.--Encephalitis is the vector-borne disease of most concern in the area. Records show that there were outbreaks of equine encephalitis in Uintah County during 1941 and 1952 when the incidence of encephalitis was in excess of 5 cases per 1,000 horses. Since encephalitis virus is active in the area and C. tarsalis, the primary encephalitis vector is prevalent, future outbreaks of the disease may occur among humans and horses.

Anopheles freeborni.--The western malaria mosquito is also prevalent in the area, but malaria has not been a problem.

Several species of Aedes mosquitoes are serious pests in Ashley Valley. These pest mosquitoes seriously interfere with farming and harvesting operations, greatly inhibit healthful outdoor activities, and may create public health problems not involving the transmission of specific diseases. For most people, mosquito bites cause irritation and itching. The allergic reactions and secondary infections from bites may require medical attention and sometimes hospitalization.

Factors influencing mosquito production.--During the field reconnaissance the following mosquito sources were noted: seepage areas, residual water in depressions on native pasture land, ponded water at the lower end of irrigated fields, and waste irrigation water in borrow pits and roadside ditches. The major mosquito producing areas are largely the result of seepage caused by leakage from canals and laterals, combined with deep percolation and poor irrigation practices, such as excessive application of irrigation water during the spring and early summer months, improper land preparation, and inadequate drainage systems for disposal of natural surface runoff and waste irrigation water. In addition, depressions along Ashley Creek are flooded during the spring runoff and provide favorable mosquito breeding habitats.

Anticipated effects of the Vernal unit on vector problems.--Storage of Ashley Creek water in the Stanaker Reservoir should be of benefit to mosquito control since it will reduce flooding of cultivated lands and bottom land areas during the spring season. With a more constant supply of irrigation water there should be increased irrigation efficiency and improved drainage conditions in the area which also should be of benefit to mosquito control.

No significant mosquito production would be expected where the reservoir has a steep shore line or where the water level recedes from the vegetated shore line during the summer. Production of mosquitoes may occur if shallow vegetated areas develop along the margin of the reservoir.

Mosquito production would not be expected to result from the canal and lateral systems unless seepage develops, in which case extensive mosquito production may occur. The increase in irrigation supply and development of additional irrigated lands may result in increased mosquito production unless adequate preventive measures are provided in the construction, operation, and maintenance of the project.

SUMMARY AND CONCLUSIONS

1. The water rights acquired by the communities in the unit area are inadequate to provide sufficient water for existing and future municipal needs.

2. Proper development, treatment, and utilization of water to be made available from the Vernal unit will benefit many communities and residents of Ashley Valley.

3. The provision of adequate and safe water supplies, especially in the rural areas where they are urgently needed to replace inadequate private supplies, will eliminate the health hazards associated with the use of unsafe water for domestic purposes.

4. The discharge of untreated sewage to Ashley Creek from the Vernal sewerage system creates a health hazard which will be eliminated when the sewage treatment plant currently under construction is completed and operating.

5. An undetermined number of individual sewage disposal systems discharge directly to the ground surface or adjoining irrigation ditches, thus contributing to the pollution of irrigation water.

6. The installation of underdrains in the low lying areas of the Vernal unit will improve operating conditions for private sewage disposal systems.

7. Stanaker Reservoir will provide limited opportunities for recreational development for possible picnicking, boating, and fishing.

8. Significant numbers of pest and disease vector mosquitoes, including the species that transmits encephalitis, are present in the unit area. The production of these mosquitoes will undoubtedly increase unless appropriate prevention and control measures are provided.

9. The major existing mosquito sources are largely the result of seepage from irrigation conveyance systems and other ponded water areas created by poor irrigation and drainage practices employed by irrigation farmers.

10. Storage of Ashley Creek water in Stanaker Reservoir should be of benefit to mosquito control since it will supply a constant supply of irrigation water that will reduce flooding of cultivated and bottom land areas during the spring season.

11. Mosquito control should benefit by the drainage that will be provided in the low-lying areas.

Recommendations

I. General

1. An effort should be made to provide rural residents with a satisfactory source of domestic water (a) by extending the Vernal and Maeser water supply sytems or (b) by providing service connections from the water savings pipe system.

2. The Vernal Sewage Treatment plant should be placed in operation as soon as possible in order to improve the quality of irrigation water in Ashley Creek.

3. Appropriate action should be taken by the local health authorities to eliminate all sources of pollution from private sewage disposal systems in the unit area.

4. A sanitary survey of the proposed construction camp should be made to eliminate possible health hazards.

5. The Utah State Department of Health should be kept currently informed regarding any changes in plans and any proposed construction schedules so that guidance and consultation may be provided on public health problems associated with the Vernal unit.

II. Mosquito Control

In order to prevent or minimize mosquito problems, it is recommended that the following basic principles and practices be adhered to in the design, construction, operation, and maintenance of the unit. The following principles apply to mosquito problem areas within 1½ miles of urban population centers, rural population groups, or recreational areas.

Stanaker Reservoir

Prior to impoundage, the reservoir basin should be properly prepared in order to prevent or minimize the development of mosquito breeding habitats during post-impoundment period and in order to realize maximum mosquito control from water level management.

1. All trees, brush, logs, or other materials below the minimum normal summer pool elevation which might float or collect flotage and drift should be removed.

2. The normal summer fluctuation zone should be cleared completely, except for isolated trees or small vegetation on abrupt shore lines exposed to wave action.

3. After the reservoir has been impounded, vegetative growth should be removed periodically from flat protected areas in the normal summer fluctuation zone.

4. Borrow areas should be located where they will be permanently inundated, if possible. Drainage should be provided for all borrow areas located in the fluctuation zone or outside the reservoir basin.

5. Adequate drainage should be provided for seepage areas below dam or back of dikes.

6. Drainage should be provided for all depressions, sloughs, and marshes in the fluctuation zone so that they will drain or fluctuate with the main reservoir.

Irrigation Canals and Laterals

1. Lining or other satisfactory seepage control measures should be provided for all sections of canals and laterals located in porous material to prevent excessive leakage which would result in water logged and seeped lands.

2. Maintain grade and provide facilities for the removal of residual water when the canals and laterals and their appurtenances are not in use.

3. Install underdrains, culverts, etc., on grade to assure complete drainage.

4. Install drains on the high side of canals to prevent ponding of surface runoff.

5. Provide for the removal of vegetation, debris, and flotage, and for other necessary maintenance to assure free flows.

Irrigated Lands

The production of encephalitis and other pestiferous mosquitoes is frequently a by-product of poor irrigation and drainage practices employed by irrigation famers. These same practices also cause serious damage to agricultural lands, excessive loss of water, and a great reduction in crop yields. Irrigation farmers should be encouraged to employ the following basic principles and practices that will be of mutual benefit to agriculture and mosquito control.

1. Avoid application of water to lands having unsuitable soil, topographic or drainage characteristics.

2. Employ field layouts and irrigation methods that fit land, crops, and water supply.

3. Prepare fields so that water can be applied with maximum efficiency.

4. Avoid application of water in excess of crop demands.

5. Avoid the practice of allowing livestock to run on pastures and waterways when the soil is too wet.

6. Install drains to insure adequate removal and disposal of waste water and natural runoff from all lands on the farm.

7. Provide adequate maintenance to assure free flows in all drains.

Main Surface Drainage System

1. Provide an overall drainage system for removal of waste water and natural runoff from all irrigated farms and to remove seepage water.

2. Make provision to prevent ponding of water in floodways and natural channels that are utilized for the disposal of excess irrigation water and natural surface runoff.

3. Make provision for additional construction of drains to meet actual needs as they develop.

4. Provide for the removal of vegetation, debris, silt, and flotage and for other necessary maintenance to insure free flows.

In any situation where preventive measures cannot be utilized, full provision should be made for chemical measures to control mosquito production or other supplemental measures to protect people from adult mosquitoes.

UNITED STATES DEPARTMENT OF AGRICULTURE

SUMMARY REPORT OF

REAPPRAISAL OF DIRECT AGRICULTURAL

BENEFITS & PROJECT IMPACTS

VERNAL UNIT

CENTRAL UTAH PROJECT

COLORADO RIVER STORAGE PROJECT

COOPERATING AGENCIES

Soil Conservation Service
Agricultural Research Service
Forest Service
Farmers Home Administration
Agricultural Stabilization & Conservation
Utah Agricultural Experiment Station
Utah Cooperative Extension Service
State of Utah

In Coordination With
Bureau of Reclamation
United States Department of the Interior

REPORT PREPARED BY

USDA FIELD ADVISORY COMMITTEE & USDA FIELD PARTY

Salt Lake City, Utah - April 1957

DEPARTMENT OF AGRICULTURE REPORT

General Description

The Vernal unit of the Central Utah Project is located on Ashley Creek--a tributary of the Green River--in Uintah County, northeastern Utah. Lands in the unit area range in elevation from 4,700 feet to 5,700 feet. The climate is arid with an average annual precipitation of 8.5 inches and an average frost-free season of 119 days. Irrigation is essential to successful crop production and has been practiced since 1873. General farming is the major industry of the unit area.

Evaluation of Expected Direct Agricultural Benefits

Procedures and Sources of Information

This report is based on available field data, published reports, and the combined judgment of agricultural technicians familiar with the unit area, its agricultural problems, and conditions.

Preliminary reports, land classification mpas and field sheets, farm schedules, and other data collected by the Bureau of Reclamation were made available and have been used to acquaint technicians with present conditions and proposed developments.

As limited time would permit, soil surveys, field investigations, engineering surveys, crop yield determinations, and irrigation water investigations were made by members of the Department of Agriculture Field Party and by local representatives of the Forest Service, Soil Conservation Service, Agricultural Research Service, and Bureau of Reclamation. These studies were made in portions of the unit area where available information did not give an adequate sample. In addition, assistance from representatives of the Utah Cooperative Extension Service, Utah Agricultural Experiment Station, Utah State Forester, Utah Water and Power Board, Farmers Home Administration, Agricultural Stabilization and Conservation Committees, Bureau of Land Management, Bureau of Indian Affairs, and others have been valuable in preparing the report.

Soils

The Soil Conservation Service, cooperating with the Uintah Basin Soil Conservation District, has supplied detailed soil survey information for the Vernal unit area. Useful references used in this survey include Bureau of Reclamation Land Classification Field Sheets and the Soil Survey Report of Ashley Valley. Detailed farm surveys on 9,624 acres were available but an additional 1,200 acres were surveyed to insure adequate consideration of all soil types and land conditions throughout the unit area. The total of 10,824 acres surveyed represents a 28 percent sample of the 38,439 acres, which is the total acreage of the Vernal unit area.

From this detailed soil survey sample, soils were grouped according to the USDA Land Capability classes. The acreages of these land capability classes were then compared with acreages in the Bureau of Reclamation land classes.

Based on this comparison, it is concluded that:

The 14,114 acres for which the Bureau of Reclamation plans to supply additional irrigation water are suitable for long-continued cultivation under irrigation.

Classes II and III include an additional 13,310 acres which have correctable limitations. The majority of this acreage is affected by water table alone or in combination with salinity and uneven topography. In addition, a small acreage is affected by limitations of stoniness and alkalinity. With these limitations removed and irrigation water available, these lands would be suitable for continuous cultivation under average management. Additional investigations would determine treatment and management required for development.

There are approximately 1,744 acres of land suitable for irrigated pasture and occasional cultivation with proper land treatment if additional irrigation water were made available.

Land Improvement

Present ditch systems and land preparation for irrigation are much below the standard which will enable farmers to use water most efficiently, obtain high crop yields, and obtain maximum benefits from the improved water supply which the unit will make available. The economic analysis of anticipated returns for this unit has been based largely on increased crop yields expected with the improved water supply. No allowance has been made for increased crop yields which might be obtained, except for minor improvements in present irrigation practices.

The financial advantages of improvements in land and more efficient water management on the farm have been so well demonstrated in other similar locations that this report would be incomplete without mentioning them.

The cost of irrigation improvements, which would raise the unit area land to a high practical level of productivity, will average from about $75 per acre for Class 1 land to about $100 per acre for Class 3 land.

Irrigation Requirement

Sufficient basic data regarding irrigation requirements in the Vernal unit are available from past detailed studies by the Utah State Agricultural College, Utah State Engineer, and the United States Department of Agriculture. No additional field work on this subject was necessary.

During spring snowmelt Ashley Creek usually carries more water than is needed at that time for the irrigated lands in the valley. Later in the summer

stream flow is usually much below the irrigation demand. This condition has led to excessive irrigation in the spring in an ineffective effort to store water in the soil for use late in the season. Irrigation water from canals, which do not have a full season water supply, is customarily over applied to all crops in the early months and in later months, primarily to the corn crop. This practice has caused alfalfa and irrigated pastures to suffer from the lack of water.

Some of the irrigation companies have old water rights and enjoy virtually a full year-long water supply while most irrigation companies have varying degrees of water shortage nearly every year. This makes the use of past diversion records valueless in studying the amount of water actually needed to produce high crop yields.

In making the survey all cooperating agencies agreed that the determination of irrigation water requirements by the Blaney-Criddle method, modified by field investigation, was satisfactory for this unit. This produced estimated consumptive use of irrigation water as shown in the following table.

Consumptive irrigation water requirements for Vernal unit area

Crop	Percent of area	Consumptive use: Frost-free period	Consumptive use: Pre & post frost-free period	Consumptive use: Total seasonal	1/ Effective Precipitation	Net seasonal consumptive use requirements
			Inches			
Alfalfa	37	21	4	25	3	22
Pasture	26	19	4	23	3	20
Corn 2/	9	19	-	19	2	17
Small grain	28	17	1	18	1	17
Average	100	-	-	-	-	20 3/

1/ Based on Bureau of Reclamation's formula of 90 percent of average seasonal precipitation for the 10 lowest growing seasons.
2/ Values permit maturity of corn. Predominant production in valley is for silage which would require lesser amounts of water.
3/ Weighted average for valley.

Management of water on the farm is now rather inefficient. With an adequate supply of late-season water in most years available as a result of the proposed development and with increased educational and technical assistance available to water users, it is reasonable to assume that an average irrigation efficiency of 55 percent can be obtained. Based on the probable crop distribution shown in the above table and an average irrigation efficiency of 55 percent, average annual water requirements at the farm headgate will approximate 36.5 inches per acre. Actually, unit lands

probably will receive no more water in total during the year than they do under present conditions but regulation of the stream flow by seasonal storage in Stanaker Reservoir will reduce the diversion from Ashley Creek in the spring and furnish this salvaged water when most needed late in the season.

Based on historical records of Ashley Creek, the proposed development is designed to deliver a full water supply in years of average water yield with shortages averaging about 15 percent in years of below-normal runoff. Infrequently there may be periods of one to three years when stream flow is so low that the water supply will be 40 percent of irrigation requirements averaged for the entire Vernal unit.

Projected Agricultural Economy

Information concerning present agriculture in the Vernal unit was obtained by the Field Party on 30 farms and by the Bureau of Reclamation on 57 farms. These records gave a picture of present agriculture in the Vernal unit area. Additional information was supplied by other local, state, and federal agencies.

Although the size of farms in the Vernal unit averages about 120 acres, most farms are smaller and much of the irrigated land is wet pastures and native hay meadows. The majority of the 300 farmers market their crops through dairy products, beef cattle, or sheep. There are about 100 dairy enterprises. Eighty-four cattle and sheep operators graze their stock during the spring, summer, and fall months on the Ashley National Forest and on other federal range administered by the Bureau of Land Management. They use the irrigated land in the valley chiefly as a winter feed base.

The average length of the frost-free season--119 days--restricts irrigated crops to comparatively short-season crops. An estimated projection of land in crops would be alfalfa, 37 percent; native hay meadows and irrigated pastures, 26 percent; small grains, 28 percent; and corn silage, 9 percent.

During the summer, when stream flow is low, available irrigation water is used first to mature corn silage, then small grains. Alfalfa and irrigated pastures suffer most with the present short water supply and probably will show the greatest increase in production when late-season water is provided. Water supply is the chief single factor controlling productivity of irrigated lands. A few farmers use commercial fertilizer effectively but the practice is not common. Increased use of fertilizer, improved water management on the farm, and generally better management of the land and crops can be expected when an adequate late-summer water supply is provided.

The projected agricultural incomes are based on projected prices released by the United States Department of Agriculture in 1956. Three types of farms have been selected as the basis of income analysis. These types are Grade-A dairy, Grade-C dairy, and beef cattle.

The irrigable land in the projected budgets ranges from 80 to 160 acres. The weighted average acreages for the three land classes are 90, 112, and 151 acres with size increasing as soil production capacity decreases. On the basis of 14,114 acres of irrigable land in the project area, the average projected size is 116 acres, including farmstead and other noncropland in farms.

Net farm incomes for three yield levels are estimated at $4,069, $4,175, and $3,125 per farm. The average for all farms is $3,850. These amounts would be available for family living expenses, savings, and payment of water charges, including operation and maintenance.

Projected Additional Returns

With the additional water that the development would provide, the average net farm income from all land should be well over $5,000 per farm. After allocating interest on the farm investment and land improvements, an average of $3,850 remains to compensate for operator and family labor and for investment in irrigation water, imcluding annual operation and maintenance costs.

Estimates of increased incomes have been made for three types and sizes of farms. The three budgets are Grade-A dairy, Grade-C dairy, and beef cattle. They are viewed as representing several kinds and variations in soils, farm types, and sizes of farms.

The estimated increases in net income with additional water are $14.91 per acre of productive land for the Grade-A dairy, $9.50 per acre for the Grade-C dairy, and $10.42 per acre for the beef cattle budget. An estimated weighted average for the three budgets is $11.85 per acre of cropland. Increased O & M costs are included in these averages.

At the present time, it is estimated that additional water would be supplied by the Vernal unit to about 13,500 acres of productive cropland. This acreage is net above farmsteads, ditches, and other noncropland estimated at about 5 percent of the total irrigable acreage. Application of $11.85 per acre to the total productive land shows an annual increase in agricultural income of about $160,000 for the Vernal unit.

Impacts of the Vernal Unit Area Upon the Administration Management, and Use of the Ashley National Forest

A survey has been made by the Forest Service to determine the effects of proposed construction and operation upon the services and facilities now provided to public users of the Ashley National Forest. Effect upon present and anticipated future uses of timber, forage, recreational, and wildlife resources of the forest were also studied. So far as can now be foreseen, the Vernal unit will not impair existing services or anticipated future services and facilities on the Ashley National Forest. Future uses of the resources provided by the forest will not be materially influenced by unit construction and operation.

Development of the Stanaker Reservoir and appurtenant structures is expected to create a demand for recreational use and may provide fishing opportunities. Any facilities provided for such uses as a part of the unit construction presumably will be administered and operated by state or local agencies. Their construction and operation will have very limited effect upon use and management of the national forest land.

Relationship of Watershed Conditions to the Vernal Unit Area

An appraisal was made of the extent to which conditions in the watershed above the proposed development, including the Stanaker Reservoir, might influence the success of the unit. Generally, vegetative cover and erosion conditions in the watershed are poor. Summer storms and spring snowmelt runoff cause some floodwater and sediment damage to agricultural lands and facilities. Heavy storms have occurred infrequently so that damages originating in the upper watershed area have not been as serious as watershed conditions might permit.

Land administering agencies, such as the Forest Service, Bureau of Land Management, State of Utah, and private land-owners, should orient their regular and special programs to restore and maintain a good cover of vegetation so that runoff will be retarded and erosion and the movement of sediment from watershed lands will be reduced. In time improved watershed management of all lands can reduce the present volume of damages. The floodwater and sediment damages, which now plague the irrigated lands, will continue to trouble the Vernal unit area to some extent.

It does not appear necessary to install any remedial measures in the upper portion of the watershed other than those which are normally a part of the regular programs of land-administering agencies. However, as administrators of federal lands and owners of private watershed lands improve present conditions and reduce the occurrence of damaging floods and erosion, unit maintenance costs will be reduced and operations will become less difficult.