UNITED STATES
DEPARTMENT OF THE INTERIOR
Douglas McKay, Secretary

BUREAU OF RECLAMATION
Wilbur A. Dexheimer, Commissioner
Clyde H. Spencer, Regional Director
Region 2

SAN LUIS UNIT
WEST SAN JOAQUIN DIVISION
CENTRAL VALLEY PROJECT (ULTIMATE PLAN)

APPENDIX
IMPORT WATER SUPPLY

Sacramento, California
May 1954

CONTENTS

Contents

Contents

CHAPTER I

INTRODUCTION

The purpose of the first four chapters of this appendix[1/] is to present the results obtained from the coordinated San Luis reservoir operation study SL30-A together with the data, assumptions, and criteria used in its preparation. This study, a copy of which is included in the envelope inside the back cover, indicates that an adequate water supply for the development of the San Luis Unit will exist in the Sacramento-San Joaquin Delta under the conditions considered in the study. This supply, which is derived principally from surplus flows, would be imported to the San Luis Unit to supplement the available local supply. The study also shows the adequacy of the existing Delta-Mendota Canal to convey the San Luis import supply in addition to previously assigned commitments. Operation study SL30-A may be compared with Operation study SVD40-G[2/] as an aid in evaluating the effect of adding the San Luis Unit to the Central Valley Project.

The San Luis Unit is located on the west side of the southern San Joaquin Valley in Merced, Fresno, and Kings Counties, California. The general plan for the proposed development of the San Luis Unit involves importing a water supply from surplus Sacramento-San Joaquin Delta water to supplement the supply of ground water available to the area. Its geographic relation to the Central Valley Basin and the Trinity

1/ See Foreword.
2/ See: Appendix, Reservoir Operation Study, Trinity River Division, prepared by Sacramento Valley District in December 1952.

Introduction

River Basin is illustrated on the frontispiece. The San Luis plan of development provides, initially, for an offstream storage reservoir, two canals, three wasteways, two pumping plants and relift pumping plants, and partial use of the existing Delta-Mendota Canal, Tracy Pumping Plant, and Delta Cross Channel Canal. The San Luis Dam will be located on San Luis Creek approximately ten miles west of Los Banos, Merced County. An intake canal from the Delta-Mendota Canal to the San Luis pumping plant will supply water to be pumped either directly into the San Luis Canal or into the reservoir for storage. The San Luis Canal will extend from the reservoir southeasterly some 104 miles, terminating near Kettleman City, Kings County. A pumping plant which will be located southwest of Five Points, on the San Luis Canal at approximately Mile 70, will lift water into the Pleasant Valley Canal which will follow the 462 foot elevation contour for some 19 miles.

All criteria and computations in this report are based on the assumption that the San Luis Unit will be fully integrated with the authorized and existing features of the Central Valley Project.

Following is a summary of the assumptions and demands used in the study, which covers the 20-year period October 1921 through September 1941.

Major assumptions:

1. 1945 level of diversions in the Sacramento-San Joaquin Valley.
2. 4500 c.f.s. delta outflow for salinity control.

3. 5,000 c.f.s. Sacramento River navigation requirement at control point with maximum allowable monthly deficiencies of 1000 c.f.s.
4. 50 per cent deficiencies during critical dry years in project water furnished for irrigation.

Annual project demands:

1. 665,000 AF Sacramento River Canals (canal headworks).
2. 126,000 AF Folsom North Canal (canal headworks).
3. 258,000 AF Folsom South Canal (canal headworks).
4. 59,000 AF Folsom Suburban Area (canal headworks).
5. 414,000 AF Irrigation along Delta-Mendota Canal (canal headworks).
6. 123,000 AF Contra Costa Canal (canal headworks).
7. 950,000 AF Exchange Contract - (20-year average Schedules 1 and 2 with 10 per cent losses).
8. 1,250,000 AF San Luis service area (canal headworks).

CHAPTER II

BASIC DATA, CRITERIA, AND ASSUMPTIONS

The basic data used in SL30-A are the same, with exceptions, as that used in Trinity River operation study No. SVD40-G. Since the data for SVD40-G has already been presented* the following material will concern itself primarily with the data, criteria, and assumptions, which have changed or are pertinent only to a San Luis study. This presentation will not in all cases be complete and detailed since even though a demand or criteria may differ the need for the demand or criteria is the same for both studies and therefore the discussions presented in the Trinity Appendix will also apply to SL30-A.

1. Summary of Basic Data Common to SL30-A and SVD40-G.

The following is a list of data which were used in both SL30-A and SVD40-G. Tables and Plates showing this data are included in Chapter IV of this report. For further information concerning them refer to Chapter II of the Trinity Appendix.

Table 1 : Historical Flow of Sacramento River into Delta.

T -2 : Estimated Historical Flow of American River at Folsom Dam Site.

T -3 : Historical Flow of San Joaquin River into Delta.

T -4 : Estimated Historical Flows of the Sacramento River at the Navigation Control Point.

T -5 : Historical Flow at Shasta Dam.

T -7 : Storable Flow at Trinity Dam Site.

T -8 : Accretions between Lewiston and Trinity Dam Site.

*Appendix, Reservoir Operation Study, Trinity River Division; Prepared by Sacramento Valley District in December 1953.

the scarcity and cost of water. No distribution system losses were assumed for Municipal and Industrial water beyond the canal side delivery points.

(d) Area and Capacity Curves

(1) San Luis Reservoir

These curves (Plate 18) were developed in April 1950 by the Regional Planning Division. Areas up to 450 feet elevation were planimetered from aerial Survey Maps, Date April 1946, Scale 1: 24,000, having 10-foot contours. Areas above the 450 feet elevation were planimetered from the Pacheco Pass Tactical Map of U. S. Army, Corps of Engineers, Dated 1939, Scale 1: 62,500 with 50-foot contours.

(e) Project Service Area Requirements

(1) Delta-Mendota Canal

Water for the Delta-Mendota Canal is delivered from the Sacramento River to the Tracy Pumps via natural delta channels and the Delta Cross Channel. At the Tracy pumping station, the water is lifted to the canal headworks, a height of approximately 192 feet (static head). From the headworks, the water flows by gravity along the west side of the San Joaquin Valley, a distance of about 117 miles to Mendota Pool on San Joaquin River. The capacity of the canal at its headworks is 4,600 cfs., and it is reduced in size by

progressive stages to a capacity below San Luis Creek of 4,200 cfs. It continues to decrease by stages between that point and Mendota Pool where the capacity is 3211 cfs.

The canal was considered to be inoperative to allow for routine maintenance during December, except during years when the storage in Shasta at the end of the preceding October was less than 1,400,000 A.F. When this condition occurred, full canal capacity was utilized for 15 days during December to pump Delta surplus flows into San Luis Reservoir.

The requirements on the Delta-Mendota Canal in SL30-A are classified into three groups: water for the Exchange Contract; water for the Delta-Mendota Canal service area; and water for the San Luis Unit.

(a) Exchange Contract

The Exchange Contract as used in SL30-A represents the water needed to satisfy the requirements of Schedule I and Schedule II of the "Purchase and Exchange Contract" plus 10% for canal losses. Schedule I was computed by the Regional Branch of Operation and Maintenance in July 1950 as the "useable portion of Schedule I yield with 72% guaranteed". Schedule II represents the estimate

by the Regional Branch of Project Planning of the amount required to satisfy the rightful diversions of the James and Tranquillity Irrigation Districts and other diverters in the Mendota Pool area. The values used in SL30-A for both Schedules 1 and 2 have been changed since SVD40-G was prepared. These changes involve both the canal losses and the magnitude and distribution of the supply. Exchange Contract demands are shown in tables 29, 29A, and 29B.

(b) Lands Along the Delta-Mendota Canal

The requirement for the lands along the Delta-Mendota Canal in SL30-A is 414,000 A.F. per year, including 10% canal losses. This water is primarily for irrigation, both new and supplemental; however, 50,000 A.F. is to be used for waterfowl conservation in the Grasslands Water Association area. The distribution is as follows:

:	Oct:	Nov:	Dec:	Jan:	Feb:	Mar:	Apr:	May:	June:	July :	Aug:	Sept.:	Total
%	7.0	6.0	0	0	0.2	5.8	10.6	11.8	14.0	19.6	16.5	8.5	100.0
1,000 A.F.	29	25	0	0	1	24	44	49	58	81	68	35	414

A 50% deficiency was taken in this supply from April through October in 1924, 1931, and 1934.

The area served by this supply in SL30-A lies generally along the west side of the San Joaquin Valley in San Joaquin, Stanislaus, Merced and Fresno Counties. To avoid undue confusion, it should be pointed out that the "Delta-Mendota Canal Service Area Demand" used in SL30-A differs from its counterpart in SVD40-G not only in magnitude, distribution, and canal losses, but it also differs in the areas served. This change in service area concerns portions of the Little Panoche Creek area which lie above the Delta-Mendota Canal and which were assigned water in the "Trinity Studies" by pumping as part of the Delta-Mendota Canal Service Area. When the San Luis Unit is included in the system it is assumed that this area would be served by utilizing the San Luis facilities. Thus, in SL30-A this "overlap area" is included in the San Luis Unit and would be served by routing "Trinity water" through the San Luis pumps.

(c) San Luis Service Area

The requirement at the head of the distribution systems for the San Luis Service Area in SL30-A is 1,666,000 A.F. per year rounded to 1,665,000 A.F.[1/] As 540,000 A.F. of this requirement can be met from

1/ Revised Controlling Criteria-San Luis Unit. See letter of May 14, 1954 to Assistant Commissioner and Chief Engineer, Denver, from Acting Regional Director.

Power Plant	Dead Storage Acre feet	Capability Kilowatts
Shasta	500,000	218,000
Folsom	90,000	78,000
Trinity	490,000	48,500

(1) Ground-water Pumping in San Luis Area

Since this appendix is primarily concerned with surface water supplies, the following discussion will be limited to listing the assumptions concerning ground water that were used in Operation Study SL30-A.12/

As was mentioned previously, the total water which was assumed to be pumped from ground-water sources is 540,000 A.F. annually. During normal years, this annual supply came from the following sources:

(1) Replenishment of ground water from the east side of the San Joaquin Valley - 213,000 A.F.

(2) Recoverable losses from the main canal - 20% of the total losses.

(3) Recoverable seepage from distribution system losses - 40% of total distribution system losses.

12/ For further information concerning the ground water supply, see Local Water Resources Appendix, San Luis Unit, prepared by San Joaquin Valley District in May 1954.

(4) Recoverable deep percolation - seventeen per cent of the total water delivered at farm headgates or place of use.

During dry years when the deficiencies taken in the import supply reduce the amount of ground water available from recoverable losses and deep percolation, it was assumed that the amount pumped from "Natural Recharge" including reserves could be increased to 340,000 A.F. This would fully compensate for reduced pumping from recoverable import losses and provide a total ground-water supply of 540,000 A.F. during years of deficient water supply. While the water table will drop during dry years, the ground-water supply could be supplemented by increasing the import supply during years of available surplus and transferring such surplus to ground-water storage reserve by reducing ground-water pumping when this additional import water is delivered. Over a period of years this would serve to keep the ground-water withdrawals in balance with the supply. It is emphasized that SL30-A was computed on a "firm yield" basis and that the "surpluses" were not actually included in the study as such and are mentioned to provide background for the ground-water pumping assumption mentioned above. Table 54 shows the water available for this purpose under SL30-A.

The monthly distribution of the above supplies together with dry year supplies pumped from ground water are shown on Table 51.

(j) Adequacy of San Luis Facilities

A study of the results of SL30-A shows that during only two months of the seven year dry period the 1,000,000 acre feet of San Luis Reservoir storage was the limiting factor in regulating surplus Delta flows. The uncontrolled water lost amounted to a 7-year total of 36,000 A.F. See Table 54.

(k) Quality of water

The following is a summary of material presented in the "Land Use and Agricultural Economy" appendix.

(1) Water now used on the lands of the San Luis Unit has salts ranging from 600 ppm to approximately 5,000 ppm and has sodium content ranging from 20% to more than 90%.

(2) The use of project water, which will contain less solids and a lower percentage of sodium than most water now being used, may deflocculate the soil, producing water penetration difficulties. These difficulties will become progressively greater with time but can be partially overcome if local water is mixed with project water starting with a relatively large amount of local water to project water and gradually increasing the amount of project water in the mixture.

CHAPTER III

COLUMN DESCRIPTION

1. General

The columns of this study are arranged in a different order than that used in previous operation studies of the Central Valley Project. This arrangement was selected to adapt the study to Model D Sundstrand accounting machine computation.

A brief history of the manner in which the enclosed study was prepared will aid in its evaluation. Originally, Study SL-30 was prepared in April 1953 in the San Joaquin Valley District office. Operation SL-30 was based on Operation 85 which showed the operation of the San Luis system using the surplus flows indicated by the operation of the Central Valley Project plus Trinity (SVD40-G). From the results of these trial studies, the coordinated study was computed. In January 1954, the study, as submitted by the San Joaquin Valley District office was modified in the Regional Hydrology Branch to reflect the latest data concerning ground-water pumping in the San Luis area. This modification, which involved changing ground-water pumping from a peaking demand curve to a flat maximum, was made by re-operating San Luis Reservoir for the new assumptions without changing the remaining portions of the study. This procedure introduced an inconsistency into the study in that the releases as shown on the unchanged portions of the study no longer coincide exactly with the requirements as shown on the modified portion.

Column Description

The final step was to prepare a new study (SL30-A) which is a modification of SL-30. This copy was prepared on the accounting machine previously mentioned and at this stage it was found that the original study contained several errors. Many small errors were corrected. Major errors which would have involved extensive revisions were simply noted on the original study. Correction of these would not significantly alter the accomplishment, design and cost-benefit ratio of the project.

2. Units used in Operation Study

The units used in this study are, generally, the same as those used in previous coordinated Central Valley Project studies. However, some confusion may arise from the fact that the study was prepared by a modified accounting machine which automatically printed a decimal point thus giving the appearance that all values were carried to hundredths. For example, the units for water (storages, releases, demands, etc.) are 1,000 of A.F. and this is what is shown if the printed decimal point is neglected. In the case of energy generations, usual practice is to carry the calculations to the nearest 0.1 kmwh, which means that the printed decimal is one column too far to the left. To read these generations, therefore, one should either neglect the decimal altogether and read 100,000 kwh or imagine the decimal point shifted one column to the right and read kmwh. The units for capabilities and output factors vary from reservoir to reservoir and are shown on the column heading sheets.

3. Column Description

In the following brief column by column description of Operation Study SL30-A, the "T" numbers used in computing the columns refer to the tables shown in Chapter IV.

Mandatory Release Schedule

Col. 1: Uncontrolled Delta Inflow from Sacramento River

Col. 9 - Col. 10 - Col. 11

Col. 2: Revised San Joaquin and other Delta tributary inflow. Estimated inflow to the Delta from these sources after modification due to the 1945 level of development and other existing and assumed development. T3 + T12 + T13 + T14 - T15 - T16 + T38 - T19 - T20 + T34 + T35

Col. 3: Total uncontrolled Inflow to the Delta.

Col. 1 + Col. 2 (positives only)

Col. 4: Delta uncontrolled Surplus. (Negatives indicate demand on CVP Res.)

Col. 3 - Col. 13

Col. 5: Historical accretion between Shasta and Navigation Control Point.

T4 - T5

Col. 6: Total demand for full navigation and net requirement for 1945 level of diversion and Sacramento Canals above navigation control point.

T21 + T22 - T33 - T37 + T39

4F107-SLC-30

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

HYDROGRAPHIC BUILDING DATA
FORM 7-2234 (MARCH 1937)

Exchange Contract

RUN-OFF OF Schedules 1 and 2 including Losses UNIT 1,000 AF DRAINAGE AREA _____ SQ. MILES

YEAR	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY.	JUNE	JULY.	AUG.	SEPT.	TOTAL	PERCENT MEAN
1921 – 22	44	52	0	13	22	72	127	150	156	168	119	91	1014	
1922 – 23	44	52	↑	↑	↑	88	78	150	156	155	116	90	964	
1923 – 24	44	52				67	97	119	114	129	113	68	538	
1924 – 25	33	51				82	113	150	156	160	116	86	982	
1925 – 26	44	52				87	118	150	128	129	113	71	927	
1926 – 27	44	52				91	127	150	156	167	115	89	1026	
1927 – 28	44	52				77	127	92/158	71/91	129	113	32/37	938	
1928 – 29	43	20/32				74	109	29/121	133/72	136	↑	39/29	935	
1929 – 30	35	51				75	125	50/94	126/26	131	↓	24/39	929	
1930 – 31	33	48		↓		68	37/91	37/105	114	129	113	68	858	
1931 – 32	23/9	42		13		91	127	150	47/109	78/85	114	80	990	
1932 – 33	44	50		8/5		89	126	140	26/109/20	149	113	61/7	769	
1933 – 34	40	52		13		89	125	22/18/95	114	129	113	63	900	
1934 – 35	26/9	37/13		↑		64	73	150	151	158	116	86	923	
1935 – 36	44	52				91	127	↑	↑	156	115	87	1013	
1936 – 37	44	52				36	↑		↓	154	113	83	950	
1937 – 38	44	52				23			156	173	131	86	777	
1938 – 39	44	52		↓		84	↓		127	129	113	68	929	
1939 – 40	43	49	↓		↓	91	127	↓	156	141	113	77	982	
1940 – 41	42	50	0	13	22	46	89	150	156	170	123	87	904	
TOTAL	820	1015	0	260	440	1485	2304	2930	2917	2955	2308	1568	18,992	
MEAN														
PERCENT														

Note: Completed in Table 29A + Table 29B

Table 29

00320

Sed by CUPO as of Jan. 1953

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

HYDROGRAPHIC DISCHARGE DATA
FORM 7-223a – (MARCH 1937)

Revised July 28, 1950

Exchange Contract

Schedule 1 including Losses

RUN-OFF OF _____ UNIT 1,000 AF DRAINAGE AREA _____ Sq. MILES

YEAR	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY.	JUNE	JULY.	AUG.	SEPT.	TOTAL	PERCENT MEAN
1921 – 22	42	52	0	13	22	86	121	148	151	153	109	83	958	
1922 – 23	42	52	↑	↑	↑	82	72	146	151	140	106	82	908	
1923 – 24	42	52				61	91	115	109	114	103	60	782	
1924 – 25	31	51				76	107	146	151	195	106	78	926	
1925 – 26	42	52				81	112	↑	123	114	103	63	871	
1926 – 27	42	52				85	121		151	152	105	81	970	
1927 – 28	42	52				71	121	↓	137	114	103	61	882	
1928 – 29	41	52				68	103	146	150	121	↑	60	879	
1929 – 30	33	51				69	109	140	147	116	↓	60	873	
1930 – 31	31	48				62	102	138	109	114	103	60	802	
1931 – 32	30	42				85	121	146	151	148	104	72	934	
1932 – 33	42	50				83	120	136	150	134	103	60	913	
1933 – 34	38	52				83	119	131	109	114	103	60	844	
1934 – 35	33	50				58	67	146	151	143	106	78	867	
1935 – 36	42	52				85	121	↑	↑	141	105	79	957	
1936 – 37	42	52				30	↑		↓	139	103	75	894	
1937 – 38	42	52				17			151	158	121	78	921	
1938 – 39	42	52				78	↓		122	114	103	60	873	
1939 – 40	41	49	↓	↓	↓	85	121	↓	151	126	103	69	926	
1940 – 41	40	50	0	13	22	40	83	146	151	155	113	79	892	
TOTAL	740	1015	0	260	440	1365	2184	2850	2917	2655	2108	1398	17872	
MEAN														
PERCENT														

00321

Table 29A

R2-376 (Sept. 52)
Bureau of Reclamation

Exchange Contract Schedule 2
Including Losses

HYDROLOGIC DATA _____ YEAR

RUN-OFF OF | UNIT 1000 AF | DRAINAGE AREA Sq. Mi.

YEAR	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	TOTAL
	All Years												
	2					6	6	4	5	15	10	8	56
	No deficiencies were taken in this supply												
TOTAL													
MEAN													
PER CENT													
REMARKS													

00322

TABLE 29-B