May 1950

	PROJECT	Under Ditch	Acres Irrigated by Calendar Year 1940-1949									
			1940	1941	1942	1943	1944	1945	1946	1947	1948	1949
	District #1											
200	Begashibito (Cow Springs)	150	0	0	67	68	67	68	52	43	62	63
	District #2											
126	Jones-Navajo Canyon	126	0	25	51	44	101	111	74	75	88	89
177	Piute Canyon	177	145	72	172	173	14	177	159	110	179	186
102	Shonto Canyon	102	0	0	0	81	93	102	87	89	87	88
	District #3											
140	Lower Moencopi	65	0	43	45	55	55	35	47	38	29	25
145	Moenave-Vanzee	115	72	73	86	115	113	106	100	120	145	128
744	Moencopi-Tuba	640	627	594	578	517	744	581	535	622	304	463
6	Pasture Canyon		0	0	0	0	0	0	5	5	6	6
301	Reservoir Canyon	301	265	247	274	300	276	295	297	271	266	272
25	Tuba City School	25	16	20	21	16	0	11	7	8	7	8
600	Black Falls Proposed											
	District #4											
300	Lower Dennebito	233	67	189	208	184	140	0	0	0	0	0
	District #5											
175	Natoni	100	0	0	62	0	10	35	70	0	55	32
220	Tolani Lakes	? —	100	20	48	71	98	11	107	143	114	0
	District #7											
47	Jeddito	67	63	67	51	54	54	55	54	31	58	62
200	Lakasakod	110	0	0	30	69	61	14	9	17	35	10
	District #8											
800	Dennehotso	637	340	456	302	349	169	182	289	408	333	285
400	Marsh Pass	363	206	281	351	225	83	43	123	129	119	126
100	Segihotsosi	83	0	17	20	20	68	73	39	53	58	71

WR 2589

1941

	PROJECT	Under Ditch	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949
	Acres Irrigated by Calendar Year 1940-1949											
	District #9											
2000	Lower Rock Point	833	619	867	720	544	641	711	195	431	792	701
600	TesNosPos	450	308	418	261	157	242	253	52	98	196	310
250	Tochinlini	190	154	181	181	137	116	143	45	82	208	170
200	Todestani	100	40	26	18	21	8	14	27	31	28	60
340 600	Tothlakan Big Sago	160	0	74	82	0	64	112	25	0	132	80
	District #10											
300	Beautiful Valley	250	42	195	199	149	149	186	35	0	196	206
1720	Chinle	1470	910	1101	1100	847	961	741	607	602	742	832
4300	Many Farms	1616	947	1017	947	391	772	765	1075	1213	1229	1168
100 600	Nazlini Canyon De Chelly	30	17	15	16	11	12	18	31	30	28	28
	District #11											
122	Agua Sol	122	0	0	0	114	114	122	99	87	75	111
1000	Lukachukai-Tohotso	969	712	588	628	673	956	712	414	631	576	586
600	Round Rock	400	288	142	139	221	215	238	161	264	243	343
500	Sehili	400	242	138	186	164	85	200	157	113	114	106
350	Red House	312	152	227	165	193	256	162	88	143	151	138
1050	Wheatfields	1000	711	610	584	471	448	454	430	524	496	550
	District #12											
0	Aneth	150 ~~150~~	0	0	0	150	114	69	36	89	0	52
150	Beclabito	72	22	56	55	0	0	72	0	0	0	0
300	Cambridge	300	122	78	40	52	29	168	0	42	50	68
2000	Captain Tom	1930	971	1056	664	495	612	750	434	445	1071	1184
350	Cove	324	125	107	122	127	128	122	111	58	123	154
770	Cudei	600	224	172	125	150	267	222	259	320	310	289
800	Grey Mesa	800 ~~1000~~	664	709	527	664	563	633	477	40	487	564
16090	Hogback	4574 ~~4872~~	3004	2558	2233	2724	2323	2368	3112	3084	2981	3029
300	Montezuma Creek	300	0	28	0	21	18	0	0	0	17	25
300	Red Rock	300	162	175	191	174	157	131	63	51	137	170
200 150	Red Rock Valley McElmo Ck.	200	35	60	69	48	41	28	16	18	34	64

WR 2590

PROJECT	Under Ditch	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949
	Acres Irrigated by Calendar Year 1940-1949										
District #12 (Continued)											
1000 Sanostee & Beautiful Mt.	800	460	528	581	211	334	371	137	0	234	332
500 Sheep Springs	339	0	0	173	96	133	218	0	77	114	237
50 Stinking Water	50	12	30	30	31	28	32	0	0	32	37
300 Toadlena	275	190	205	227	202	188	176	116	151	151	170
250 Tocito	250	6	128	108	60	95	148	0	0	39	100
300 Tohalsissy	275	46	197	171	74	111	116	0	0	35	68
300 Zilbetod	250	133	147	141	34	39	119	16	16	63	65
District #13											
3275 Fruitland	3275	1268	1534	1461	1525	1513	1436	2198	2298	2413	2612
District #14											
700 Choiska	1000	35	520	529	27	250	93	245	544	741	750
200 Naschitti Drolets #1 & 2	200	69	167	151	11	146	217	61	164	153	217
600 Naschitti, Northern	190	0	85	134	38	133	151	35	90	88	160
250 Naschitti, Southern	50	0	33	30	2	31	30	32	31	28	32
500 Todelto Park	100	0	22	17	17	14	22	39	21	14	17
40 Well 14-A-79	30	22	0	0	6	5	14	12	14	14	10
100 Well 14-M-1	100	50	33	7.5	14	27	28	20	28	18	4
District #15											
22 Crown Point School	22	14	21	12	13	13	10	6	10	11	12
60 Mulholland Well	60	0	0	38	30	43	20	0	6	12	15
34 Standing Rock											
District #16											
150 Chas. H. Burke School	141	57	121	10	14	31	39	21	32	25	19

7407

4857

WR 2591

PROJECT — Acreage Irrigated by Calendar Year 1940-1949

		Under Ditch	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949
	District #17											
210	Cold Fields		173							58	202	210
1300	Cornfields	2150	336	942	1030	796	1051	1250	1160	218	393	390
600	Ganado		444							548	496	494
250	Kinlichee	201	144	91	150	74	18	71	64	88	113	74
400	Klagetoh	35	200	253	300	281	267	212	185	113	180	207
	District #18											
510	Fort Defiance-Black Creek	160	91	118	118	137	137	144	149	118	136	105
750	Houck	350	118	137	155	114	130	48	112	19	21	18
1000	Natural Bridge	28	0	0	16	10	11	8	8	10	30	27
50	Oak Springs	42	31	37	42	39	40	29	26	34	27	12
1000	Red Lake	700	154	301	284	314	265	295	302	268	221	334
100	Whiskey Creek	100	0	28	31	32	24	23	23	22	14	18
600	Crystal	408	224	286	274	260	252	232	275	272	219	211
(2000?)	Sonsela Butte											
		4489										
(46121)												
	Total	33242	1649	18666	17808	15499	16726	16845	15155	15808	18578	19859

WHH 2592

2100

District # 1 Begashibito (Cow Springs)

Estimated cost to complete $90,000

Ultimate acreage 200 & 0

Maximum acreage irrigated to date 68

Present Irrigation reservoir inoperable due to blow sand packing ing pipeline manholes. Water stands in Indian Reservoir above Irrigation development to serve farms and orchards--about 68 acres. Wash to west of reservoir could be diverted to Irrigation reservoir in pipe line through sand to increase water supply.

Sand Dunes encroaching on Irrigation reservoir. Navajos would like storage dam above present farms in mouth of canyon.

Navajo delegates want additional diversion on headwaters of Cow Springs Wash. Water supply not adequate for all.

1950
Estimate

Diversion	10,000 — Alternate
Possible Storage	40,000
Main Canal	20,000
Subjugation, 200 acres	20,000
	~~90,000~~ 90,000

Investigation needed to determine feasibility. Estimate based on reconnaisance only.

WR 2593

May 1950

District #2 — Navajo Jones Canyon

Estimated cost to complete	$50,000
Ultimate acreage	126
Under Canal	126
Acreage cultivated to date	121

All of the land lies on a small group of benches in the bottom of the canyon. Canal is difficult to hold, requiring long bench flumes.

Glen Canyon dam by U.S.B.R. will flood out most of Navajo Jones Canyon. Extensive development should await decision of U.S.B.R. program.

The farmers want a series of small diversions.

	1950 Estimate
Diversion dams & canals	50,000

No subjugation.

WR 2594

May 1950

Paiute Canyon — District #2

Estimated cost to complete $10,000

Ultimate acreage 177

Under canal 177

Maximum acreage irrigated to date 177

Diversions on throats probably need permanent structures.

Canal, series of canal sections, and bench flumes both hard to maintain due to side drainage and flash flood undermining structures.

Land in small parcels; doubtful if much subjugation needed.

Project will probably be flooded out with construction of Glen Canyon Dam by U.S.B.R. Elevations have not been determined. The high line of the reservoir should be established before any extensive development.

1950
Estimates

Diversions	5,000
Main canal and canal structures	5,000
	10,000

WR 2595

May 1950

District #2 Shonto

Estimated cost to complete	$15,000
Ultimate acreage	102
Under canal	102
Maximum acreage cultivated to date	102

Investigation necessary.

	1950 Estimate
Diversion Dam	5,000
Main canal	10,000
	15,000

WR 256

District #3 — Black Falls (Little Colorado)

Estimated cost to complete $122,000

Ultimate acreage 600

Work consists of:

Direct Diversion.

Water supply bad salt content

(Long main canal for a small acreage of good land, other than irrigated pasture.)

Isolated.

	1950 Estimate
Diversion Dam	(o)
Main canal	40,000
Subjugation, 600 A.	60,000
Fencing & Planting	12,000
Domestic Water	10,000
	122,000

WR 2597

May 1950

District #5

Blue Canyon
(Moencopi Wash)

Notes:

Preliminary investigations made to determine elevations, etc., of possible and feasible results.

Flood and silt control dam with additional diversion to Greasewood Lake, west of Tuba--Red Lake Road.

Storage dam 200' high, 300' bottom, 500' crest. Large storage basin above.

Canal --long through sandy country; several siphons necessary. 80' head available for 15 mile canal.

Storage diversion dam in Begashibito would also put water in to proposed Greasewood Reservoir with 7 miles of canal.

Greasewood lake surface area approximately 1½ square miles.

Water by gravity to Reservoir Canyon and Moencopi-Tuba.

Additional water necessary--Additional surveys necessary.

WR 2598

May 1950

District #3 Lower Moencopi

Estimated cost to complete 50,000

Ultimate acreage 160

Under canal 60

Maximum acreage cultivated to date 55

Water supply limited except for flash floods. Dviersion dam apron is in bad shape. Unless expensive repairs are made, the whole diversion will eventually be lost.

Main canal needs cleaning.

Sluice outfalls needs protection.

Waste water outfall structures needs protection.

No subjugation or expansion.

WR 2599

District #3

Moencopi-Tuba
Pasture Canyon
Reservoir Canyon
(Moencopi Wash)

Estimated cost to complete $403,000
(Includes Moencopi-Tuba, Reservoir, and Pasture Canyon Projects)

Moencopi-Tuba:

Estimated cost to complete $27,000

Ultimate acreage 40

Under canal 40

Acreage cultivated to date (Maximum) 626

Direct Diversion—Water supply during the last few years has been inadequate to serve all farms.

Main canal subject to side-hill drainage.
Some subjugation and leveling would be of value.
Surveys have been initiated but not completed to determine available water supply for Pasture Canyon, Reservoir Canyon, and Moencopi Tuba.
It is believed that a common system could be designed, including an infiltration line that would not only conserve but also make a more equal distribution of present water supply possible. Surveys should be completed.

No expansion of present acreage is possible.

Possible diversion site above Tuba-Keams Bridge would pick up additional water but canal would require closed conduit to land. Hopi canal would eliminate a pipe flume

Reservoir Canyon: Estimated cost to complete $136,000

Pasture Canyon: Estimated cost to complete 140,000

Ultimate acreage 301

Under canal 301

Maximum irrigated & cultivated to date 301

Springs and storage located in Pasture Canyon.
Sheep Dip Reservoir storage small—30' plus acre-feet. Crest could be raised 10' for a capacity of 200 acre-feet.

WR 2600

Hopi Reservoir storage capacity 100 acre-feet. Crest could be raised 15' , raising storage capacity to 800 acre-feet.

Studies of water supply necessary to determine proposed use by Tuba School. Doubtful whether water enough for all.

Canal system needs cleaning and release in pipeline in areas of extreme canal loss through project.

Moencopi Tuba and Reservoir should be operated as a unit with equal division of all waters.

Some leveling on project and side hill drainage control.

Extension studies, surveys, and planning necesary

Moencopi Tuba	1950 Estimates	
Diversion	10,000	
Main canal-North 1.8 miles	10,000	
2.0 miles	32,000	
Main canal-South	5,000	
Main canal-Hopi	10,000	
Subjugation, leveling, 300 acres	30,000	
		$97,000
Reservoir Canyon:		
Diversion	20,000	
Main canal-4 miles pipe	126,000	
Subjugation	0	146,000
Pasture Canyon		
3 miles pipe to Reservoir Canyon	95,000	
Hopi Reservoir--20' lift.	65,000	
		160,000
		$403,000

(Estimate Provisional)

Wm 2601

May, 1950

District # 3 — Tuba City School

Ultimate acreage	40
Under canal	25
Maximum irrigated to date	21

Notes: Water supplied by springs, flows through small storage dams.

Some of this water to be utilized in proposed development of Tuba City school.

Main canal systems would conserve water if placed in pipe line.

No busjugation needed. No expansion needed. No construction.

WR 2602

May 1950

District #3 Moenave-Vanzee

Estimated cost to complete	22,000
Ultimate acreage	115
Under canal	115
Maximum acreage cultivated to date	115

Water supplies by springs to storage. French drain below.

Reservoir at Moenava ceased to function in 1947; some water logging behind reservoirs.

Main canal system could be put in pipe lines to conserve water.

Some terracing will be required. SMCO Built new Reso voir in 1950

	1950 Estimate
Distributary system	22,000

WR 2603

May 1950

District # 4 Lower Dennebito

Ultimate acreage 300

Under canal 233

Maximum area cultivated to date 208

No crops in 1946--at the present time and operation and maintenance problem.

Some crops outside of Project fence.

Flume inlet and outlet needs protection and revamping; main canal need extensive cleaning.

Diversion dam will probably need toe protection before many years.

No subjugation or expansion planned other than releveling farms.

Should have operation and maintenance program in the area.

WR 2604

May 1950

District #5 Natoni

Estimated cost to complete 20,000

Ultimate acreage 175

Under canal 100

Maximum acreage cultivated to date 70

Directi Diversion

Water supply limited.

Radial gate in Diversion dam destroyed; needs replacing.

Main canal through deep cut difficult to clean.

Some concrete pipe installed, perhaps on extension of pipeline, would improve condition and operation.

Subjugation areas need some releveling due to wind and blow sand.

No expansion of project planned.

	1950 Estimate
Diversion Dam	2,000
Main canal (Pipe)	8,000
Releveling—100 acres	10,000
	20,000

WR 2605

May 1950

District # 5

Tolani Lakes
(Oraibi Wash)

Ultimate acreage 220

Under canal 220

Maximum irrigated to date 107

Work consists of:

Direct Diversion

Diversion dam buried under many feet of silt by the building up of valley below.
Original plug above diversion diverting Oraibi wash to diversion dam washed out. Water flows in original channel and on to Tolani Lake.
Most farms, abandoned on original project. Farmers opened new area northwest and above diverion utilizing flood waters spread out on area.
Control of Oraibi Wash necessary and expensive before original project can be rehabilitated or used.

No Construction.

WR 2606

May 1950

District #7 Jeddito (Navajo)

Estimated cost to complete $6,000

Ultimate acreage 67

Under canal 67

Maximum acreage cultivated to date 67

Direct Diversion

Diversion dam apron being repaired and abutments protected -- April, 1950

Main canal needs cleaning.

Reloveling of subjugated lands.

Expansion of project impossible due to lack of water.

	1950 Estimate
re-subjugation	6,000

WR 2607

May 1950

District #7 Lakazaood

Ultimate acreage 200

Under canal 100

Maximum acreage cultivated to date 69

Storage and direct diversion

Storage dam and reservoir inoperable--silted up. Concrete pipeline washed out by flood.

Diversion probably needs maintenance.

Main canal structures and improvements necessary.

Extensive new construction on project is not contemplated.

Project abandoned.

WR 2608

District # 8 — Dinnehotso, Laguna Creek

Estimated cost to complete $62,000

Ultimate Acreage 800

Acreage under canal 637

Maximum acreage irrigated to date 455

Work consists of:

Direct Diversion

Diversion dam needs some toe protection

North and south main canal need revamping structures; side hill drainage protection.

Subjugation of 400 acres.

Investigation of a possible infiltration should be made.

Oporation and maintenance of this project needed.

	1950 Estimate
Diversion Dam	2,000
Main canals	20,000
Subjugation, 400 acres	40,000
	62,000

WR 2609

May 1950

District #8

March Pass
(Laguna Creek)

Estimated cost to complete $75,000

Ultimate acreage 400

Under canal 363

Maximum acreage cultivated to date 351

Diversion to storage.

Diversion in good condition; needs some flood protection above. An operation program is very necessary to eliminate silting up of headworks, sluice and canal. Canal silts up causing over-topping of canal banks and serious wash outs.

Realignment of main canal just below diversion would eliminate considerable side-hill canal.

Blow sand area in main canal should be in pipe line, preferably a 24" size.

Some releveling of project is probably needed.

Possibility of raising storage should be investigated.

Operation and maintenance program needed.

	1950 Estimate
Diversion dam	3,000
Feeder canal	11,000
Storage dam	10,000
Main canal 3 mi. 24" concrete	10,000
pipe (1 mi. 24" concrete	31,000
Subjugation-leveling-100 A.	10,000
	75,000

WR 2610

May 1950

District # 8 Segihotsosi

Estimated cost to complete 15,000

Ultimate acreage 100

Under canal 83

Maximum irrigated & cultivated to date 73

Direct Diversion.

Diversion in fari condition--needs some maintenance.
Canal condition unknown; very little work ever done on canal; probably in need of control structures.
Subjugation or leveling of areas needed.
Storage possibilities not known but report have been received as to sites above and below project.

Investigation necessary.

Main canal and structures	10,000
Subjugation or leveling	5,000
	15,000

WR 2611

May 1950

District # 9

Big Sage Mesa
(Tochinlini Wash)

Estimated cost to complete $120,000

Ultimate acreage - - - - 600

Work consists of:

Direct Diversion.

Proposed project would use water now supplying Tochilini Project. A more efficient use of water would result, thereby increasing the acreage by the development of Big Sage Mesa. Stream bed loss of water would also be overcome.

Project is in high country with a short growing season.

Diversion of water would be difficult due toboulder stream mountain stream.

Decision must be made whether or not farmers will move from small, isolated tracts on Tochinlini Project to proposed Project.

	1950 Estimate
Diversion	15,000
Main canal	30,000
Subjugation	60,000
Fencing & preparation of land	15,000
	120,000

WR 2612

May 1950

District #9

Lower Rock Point
(Chinle Wash)

Estimated cost to complete $265,000

Ultimate acreage 2,000

Under canal 833

Maximum acreage cultivated to date 813

Direct Diversion

Water supply limited.

An infiltration line might increase present water supply either in Lukachukai or Chinle Wash.

Program calls for installation of a weir at headworks to increase diversion capacity.

Extensive cleaning of main canal and installation of sluice.

Enlarge and repair storage on lower end of project.
Rebuild main canal from storage to land.
Some releveling and subjugation.
Future investigations should include possibility of connecting with canal and pipe line to Many Farms tailwater; also large storage and silt control dam on Lukachukai wash. No estimate on storage.

	1950 Estimate
Diversion dam weir	10,000
Main canal sluice	15,000
Main canals	20,000
Storage dam	20,000
Infiltration line--2 Mi., 24" dia.	80,000
Subjugation, 1,200 acres	120,000
	265,000

WR 2613

May 1950

District #9 Tes Nos Pos

Estimated cost to complete $65,000

Ultimate acreage 600

Under canal 450

Maximum acreage cultivated to date 418

Direct Diversion

Three diversion dams in need of maintenance. Lower diversion sluice not used.

Main canals system needs rehabilitation in structures.

Small SMCO storage on lower end of project in need of maintenance.

Subjugation of land.

	1950 Estimate
Diversion dams	15,000
Main canals	10,000
Subjugation, 400 acres	40,000
	65,000

WR 2614

May 1950

District # 9

Tochinlini
(Tochinlini Wash)

Estimated cost to complete $12,000

Ultimate acreage 250

Under canal 190

Maximum acreage irrigated & cultivated to date 181

Direct Diversion--a number of small headings; no permanent diversions. Wash boulder strewn headings difficult to maintain.

Canals subject to side hill drainage requiring rebuilding of flumes.

Land in small benchs, scattered--miles up and down wash

No expansion of present project.

Possible to build proposed Big Sage Mesa Project, which would utilize all available water. Diversion necessary whether or not farmers would move to new project.

	1950 Estimate
Canal structures only	12,000

WR 2615

May 1950

District #9

Todestania
(Todestania Wash)

Estimated cost to complete 35,000

Ultimate acreage 200

Under canal 100

Maximum acreage cultivated to date 26

Direct Diversion

Diversions--two diversions are in good conditions; needs installation of two (2) metal shear gates.

Canal-small-- convey water from one drainage to another; badly in need of control structures.

Small storage surveyed in 1939--capacity small. If built would improve project.

Land lies in small parcels on three different streams. Subjugation of land when necessary. Possible utilization of lower land to replace steep land above.

Indian project in valley to the west should be investigated.

	1950 Estimate
Diversion dams	5,000
Storage	10,000
Main canal	10,000
Subjugation	10,000
	35,000

WR 2616

May 1950

District #9

Tothlakan
(Walker Creek)

Estimated cost to complete $20,000

Ultimate acreage 340

Under canal 160

Maximum irrigated under cultivation to date 112

Work consists of:

Direct Diversion
Diversion dam in good condition except for band wheel missing from canal gate.
Feeder canal to storage in bad shape; needs structures to prevent washouts in sandy soils.
Storage dam washed out in several places.
Effectiveness questionable and dike difficult to hold on mountain due to blow sand and wind action.
Main canal subject to washouts from side drainage. Central blow land areas needs structures and maintenance.
Land gradually blowing away; subjugation needed.
No expansion of project due to lack of water.

	1950 Estimates
Diversion	0
Feeder Canal	1,000
Storage	4,000
Main Canal	5,000
Leveling, 100 acres	10,000
	20,000

WR 2617

May--1950

District # 10

Beautiful Valley
(Chinle Wash)

Estimated cost to complete $47,000

Ultimated acreage 300

Under Ditch 250

Maximum irrigated to date 199

Work consists of:

Rehabilitation of main canal system. Sluice -- perhaps rock blanket to protect toe of wier.

Some subjugation or leveling.

1950
Estimate

Diversion Dam	5,000
Main canal & laterals	22,000
Subjugation	20,000
	47,000

WR 2618

May 1950

District #10 Canyon deChelly

Estimated cost to complete 20,000

Ultimate acreage 600

Under canal 250

Maximum acreage cultivated to date ?

Project consists of many small benches of orchard and garden tracts.

Surveys and reconnaisances of area has not bee made.

Canal structures.

	1950 Estimates
Canal structures	20,000

WR 2619

District # 10 Chinle

Estimated cost to complete	$371,000
Ultimate acreage	1,720
Acreage under canal	1,470
Maximum acreage irrigated to date	1,101

Work consists of:
Direct Diversion (Includes Fraziers).
Noxtious weed infestation control questionable.
Siphon to Frazier area washed out, canal system bad.
Present diversion without weir difficult to divert water.
water supply studies necessary to determine feasibility of new floating weir diversion at Chinle.
A new main canal could serve all land dependent on water supply between Chinle and Many Farms, thereby eliminating stream bed losses. Then with a consolida[illegible]creage into a compact unit, additional land might be se[illegible]
Some subjugation.

	1950 Estimate
Diversion Dam ($53,000-1940)	$116,000
Main canal-15 mi.@ $5,000	75,000
Subjugation-1,500 A. @ $100	150,000
Planting and cropping 1,500 A. @ $20	30,000
	$371,000

WR 2620

May 31, 1950

Many Farms Flume —

Notes on study of profile of water surface as run May 19, 1950 by Tony JoJola.

Indications are that flow is from 18 cfs. to 34.5 cfs.

A slight hump has developed at the inlet slowind dam flow.

Original design called for a loss of 1.7' in flume. Profile as run indicates only. .93' loss in present flume, indicating that outlet has raised .8'. Wooden structures shows 1.7' loss at present.

A check profile should be run from outlet of storage dam through flume and on to nearest control below as a guide in replacing present structure. Carry station and show changes in cross sections, construction, water surface and canal bottoms.

Prepare comparative estimates on flume and siphon.

Robert C. Sumner
RCS

WR 2621

May 1950

District # 10

Many Farms
(Chinle Wash)

Estimated cost to complete	$634,000
Ultimate acreage	4,300
Under canal	1,230
Maximum acreage cultivated to date	1,229

Diversion to storage.
Subjugation up to 4,300 acres.
Main canal extension and structures.
Floodway channel.
Possible Chinle Diversion and Main canal to connect to Many Farms to conserve water by eliminating stream bed losses. Partly changable to Many Farms.
Many Farms main canal will upon completion of project waste probably within 12 to 14 miles of Rock Point. Some water might reach Rock Point by delivery through canal and then down the wash. An alternate possibility would be pipe and canal system connecting to Rock Point.

Possibility of diverting Aqua Sol into Many Farms Reservoir was investigated years ago but report of findingsnot available other than it is feasible.

Installation of pumping plant to serve subjugated land above main canal from reservoir.

	1950 Estimate
Many Farms	
Diversion	25,000 } chinle.
Feeder canal-5 miles	30,000 }
Sluice canal	20,000
Storage	30,000
Flume-Chinle Wash--36432-832'	37,000 - 40,000
Main canal-East 4.8 Mi.	
West 6.8 Mi. (11.6)	70,000
Flood ways	40,000
Subjugation, 3200 A. @ $100	320,000
Planting and cropping-1,600 A.	32,000
Pumping plant for 440 acres	
3,000' pipe	30,000
	634,000

WR 2622

May 1950

District #10

Nazlini
(Nazlini Wash)

E-timated cost to complete 10,000

Direct diversion and diversion to storage.

Diversion dam in fair condition.

Main canal in need of structures.

Feeder canl in need of dragline excavation to simplify cleaning.

Storage dam has considerable erosion. Doubtful whether or not it would hold maximum capacity of water. Gate tower will need replacing after several winter freezes.

Land under storage of doubtful gravity and depth.

Land under Direct Diversion on small bench in Canyon connected by a series of long, woodon flumes which are continally in need of replacement. Permanent pipe line would overcome difficulty.

No expansion of project planned.

1950
Estimates

Canal structures and improvement 10,000

WR 2623

May 1950

District #11

Lukachukai
(Lukachukai & Tohotso)

Estimated cost to complete $75,000

Ultimate acreage 1,000

Under canal 969

Maximum acreage cultivated to date 955

Irrigable area should be consolidated into a more compact unit to conserve existing water supply.

Diversion dams in good condition.

Main canals need rehabitation and structure replacement. Wooden structures were burned out; some new canal structures required.

Some subjugation would improve project.

Priest Lake and another small mountain storage has been recommended for investigation and development. Surveys needed.

Other storage reservoirs in the lower valley have been surveyed but rejected as unfeasible.

Lukachukai.	1950 Estimate	
Diversion	3,000	
Main Canal	10,000	
Subjugation, 200 a cres	20,000	
		33,000
Tohotso:		
Diversion	2,000	
Main Canal	10,000	
Subjugation, 200 A.	20,000	
		32,0000
		65,000
Mountain storage		~~10,000~~ 40,000
		~~75,000~~ 105,000

WR 2624

May 1950

District #11 Reported June 8, 1950 Lukachukai

Accompanied by Chick Sandoval, I visited possible mountain storage sites in the Lukachukai and Tohotso Wash tributaries.

Priest Lake,--Lukachukai Wash headwaters--built about 1920, consists of original rotted-out log crib and earthfill dam, no spillway, and basin full of silt. Possible to rebuild and increase height of storage dam with undetermined benefit to Lukachukai. Storage effective at Lukachukai until gate rolled out. Reconnaisance topo survey necessary to determine capacity and drainage area.

Tohotso Drainage--Two small reservoir sites were found with fair damage and fair drainage area above each. Small earth dams at each site would serve as silt and flood control reservoirs; also possible effective irrigation water.

Survey to determine drainage area and capacity of each site necessary.

WR 2625

May 1950

Agua Sol

District #11

Estimated cost to complete 35,000

Ultimate acreage 122

Under canal 122

Maximum acreage cultivated to date 122

Potentialities of project not known--investigation necessary.

		1950 Estimate
Diversion		15,000
Main Canal		10,000
Subjugation	100 acres	10,000
		35,000

WR 2626

May 1950

District #11

Red House
(Lukachukai Wash)

Estimated cost to complete $44,000

Ultimate acreage 350

Under canal 312

Maximum acreage cultivated to date 256

Direct Diversion

Diversion dam is in good condtion, but needs operation to take full advantage of irregular flows.

Main canal o.k. to sluice, but need drop and control structures and side hill drainage structures.

Small storage reservoir need control structures and some revamping.

Subjugation of irrigable areas.

	1950 Estimates
Diversion dam	2,000
Main canal	10,000
Storage	2,000
Subjugation, 300 acres	30,000
	44,000

WR 2627

May 1950

District #11

Round Rock
(Lukachukai Wash)

Estimated cost to complete	$85,000
Ultimate acreage	600
Under canal	400
Acreage cultivated to date	288

Direct Diversion and Diversion to storage.

Diversion dam needs small maintenance.

Feeder canal needs side drain structures and cleaning of canal to standard section.

Main by-pass canal needs side drain structures and c xtensive cleaning.

Storage dam needs raising for increased storage--installation of toe drain.

No expansion of project planned.

	1950 Estimate
Diversion	5,000
Feeder Canal	10,000
Storage dam	40,000
Main canal	10,000
By-pass canal	20,000
	85,000

WR 2628

May 1950

District #11

Sehili
(Sehili Creek)

Estimated cost to complete 45,000

Ultimate acreage 500

Under canal 400

Maximum acreage cultivated to date 282

Direct Diversion

Diversion dam is log crib--needs replacing with permanent diversion.

Main canal very susceptable to side drains; head end should be in concrete pipe--½ mile; other canal structures needed.

Land steep; some subjugation needed.

	1950 Estimate
Diversion Dam	15,000
Main canal	20,000
Subjugation, 100 acres	10,000
	35,000

WR 2629

May, 1950

District # 11 — Wheatfields

Estimated cost to complete $135,000

Ultimate acreage 1,050

Under canal 1,000

Maximum acreage cultivated to date 711

Work consists of: Upper Wheatfields--Wheatfieds Creek.

Direct Diversion

Diversion dam log crib rotted out; needs replacing.
Main canal needs drainage control and some drop structures.
Land steep but some subjugation.
Since extension of main canal to small parcels of land possible with little expense,--feasible.

Lower Wheatfields

Diversion to storage.
Diversion throat difficult to operate; needs permanent diversion.
Structures would be long with poor footing for structures.
Alternate would be enlargement of upper Wheatfields canal and a pipe drop and siphon to supply surplus water to Wheatfields Reservoir--Objections-winter and early spring water would freeze.

Feeder canal--some maintenance difficult to force water through cut.
Storage dam--additional capacity could be had by raising earth dam but additional water not needed.
Main canal--water runds down gully to diversion box; not in need of any improvements unless installations of pipelines to conserve water.
North and south main canal silts up from side drainage every rain. Either build food canal or put canal in pipe line.
Land needs minor subjugation.
No expansion of project anticipated.

WR 2630

District #11 — Wheatfields

	1950 Estimates
Upper Wheatfields:	
Diversion dam	30,000
Main canal	10,000
Subjugation, 200 acres	20,000
	60,000
Lower Wheatfields:	
Diversion dam	30,000
Feeder canal	5,000
Storage dam	10,000
Main canal (Side damage)	20,000
Subjugation, 100 acres	10,000
	75,000
	60,000
	75,000
Total	135,000

WR 2631

May 1950

District # 12 Aneth-San Juan

Estimated cost to complete Cost not known.

Bench of Sau Juan--1,200 to 1,500 acres east of Aneth.

Pump or direct diversion and pipe lines.

Pumpe head 35-50'

Land comparable to Fruitland Project soils.

Diversion or pump project feasibility not determined.

Investigation necessary

WR 2632

May, 1950

District # 12 — Aneth-McElmo Creek

Estimated cost to complete 15,000

Ultimate acreage 150

Under canal 150

Maximum acreage irrigated to date 150

Work consists of:

Small individual headings with long--hard to maintain--small canals and flumes; Low subsistance.

1950
Estimate

Diversion Dam or headings	$10,000
Canaly system	5,000
	$15,000

WR 2633

May 1950

District # 12 Beclabito (Beclabito Wash)

Estimated cost to complete $18,000

Ultimate acreage 150

Acreage under ditch 72

Maximum acreage cultivated to date 56

Work consists of:

Diversion to storage.

Diversion dam dike washed out need control structures.

Desilting plot inoperable. Water bypasses feeder canal and reservoir.

Storage dam gate tower filled with rock for third time, pedistal broken, storage dam needs toe drains

Decision needed whether to operate for stock or farming.

Project and structures in plan and pretty well subjugated.

	1950 Estimate
Diversion Dam	3,000
Desilting area	3,000
Storage Dam	3,000
Feeder Canal	4,000
Main Canal	2,000
Subjugation	3,000
	18,000

WR 2634

May 1950

District #12

Caimbridge
(San Juan River)

Estimated cost to complete $75,0000

Ultimate acreage 300

Under Canal 300

Maximum acreage irrigated to date 150

Work consists of:

Direct Diversion

Possibility of serving with extension of Fruitland canal.

Heading in bad shape due to recession of River.

Main canal in need of structures and side hill drainage central.

Possibly requires some subjugation.

	1950 Estimates
Pipe line	25,000
Main cana.	20,000
Subjugation	30,000
	75,000

WR 2635

May 1950

District #12

Captain Tom
(Captain Tom Wash)

Estimated cost to complete $273,000

Ultimate acreage 2,000

Under canal 1,930

Maximum acreage irrigated to date 1,057

Direct diversion and storage 1,730 acre feet

(A large portion of project below highway 666 would be irrigated by proposed Shiprock Project.)

Estensive study of available water should be made, including raising of Sheep Dip Reservoir a total of 33' and possibly 5,000 acre-feet capacity.

Three diversion dams and feeder canals needed. Distributory system in need of some structures and sluices in feeder canals.

Desilting ponds above Captain Tom Reservoir fill up very quickly; effectiveness questionable.

Two existing diversions below highway inoperable; questionable whether water available for use.

Investigation of Hudson Lake and other mountain storage necessary.

Operation of diversions and Captain Tom Reservoir could be improved with an O. & M. Program.

Some Subjugation needed.

Consolidation of projects in area to utilize aparent inadequate water supply.

	1950 Estimate
Two Grey Hill Diversion	7,000
Toadlena Wash Diversion	15,000
Captain Tom Wash Diversion	10,000
Captain Tom Wash, Lower Diversion	10,000
Sheep Dip Storage Dam	80,000
Sheep Dip Diversion	15,000
Feeder Canals	35,000
Main Canal	10,000
Subjugation	100,000
Captain Tom Storage	- -

WR 2636

District # 12 Cove

Estimated cost to complete	$33,0000
Ultimate Acreage	350
Acreage under Canal	323 (?)
Maximum acreage irrigated to date	128

Work consists of:

Three diversion dams and three miles of main canal need rebuilding.

Some subjugation.

	1950 Estimate
Concrete diversion	3,000
Replace two loose rock diversions	10,000
Main canals--three miles	7,000
Subjugation--128 acres	13,000
	33,000

WR 2637

District #12 Cudia (San Juan)

Estimated cost to complete	$162,000
Ultimate Acreage	770
Acreage under canal	600
Maximum acreage irrigated to date	267

Farmers on the Project have not wanted to have help in the past. However, a new heading or diversion dam would improve operation and perhaps increase acreage. An alternate plan would serve the project by siphon from the proposed Hogback Extension high line. Either plan should increase maximum irrigated.

Work consists of:

Main canals revamped with necessary structures and probably realigned.

Subjugation on some areas necessary.

	1950 Estimate
Siphon to Project— (30" con. pipe 1½ Mi. @ $8.00)	64,000
Main canal, 3 mi. @ $7,000	21,000
Subjugation, 770 acres	77,000
	$162,000

WH 2638

May 1950

District #12

Grey Mesa
(Captain Tom Wash)

Estimated cost to complete $67,000

Ultimate acreage 800

Under canal 800

Maximum acreage cultivated to date 708

Work consists of:

Direct diversion.

Diversion dam--enlarge gates--make some repairs.

Main canal need rebuilding with necessary structures and chutes.
Five miles of main canal.

Subjugation of necessary areas.

(Additional studies in Captain Tom Area needed to determine where and how best to utilize available water.)

	1950 Estimate
Diversion Dam	2,000
Main Canal	25,000
Subjugation	40,000
	67,000

WR 2639

May 1950

District #12 Montezuma Creek

Estimated cost to complete 90,000

Ultimate acreage 300

Under canal 300

Maximum acreage culyivated to date 28

Heading rather difficult to divert water.

Permanent diversion necessary.

Main canal needs rehabilitation through rock cut, which is narrow and difficult to clean.

Sluice below rock cut acts only as a sand trap, and does not pull silt and sand through cut. Needs revamping.

A storage dam below rock cut and sluice has been requested, but surveys to determine feasibility have not been made.

Later system and subjugation would improve project.

	1950 Estimate
Diversion	25,000
Main canal--2 miles	15,000
Storage (?)	20,000
Subjugation, 300 acres	30,000
	90,000

WR 2640

May 1950

District #12

Red Rock
(Red Rock Wash)

Estimated cost to complete 32,000

Ultimate acreage 300

Under canal 300

Maximum acreage cultivated to date 175

Direct Diversion

Diversion dam probably in need of extension maintenance and repairs.

Main canal effected by side hill drainage in need of sluice structure and other control structures.

Subjugation of land.

SLCO has initiated construction of a new diversion in this area--location is unknown.

	1950 Estimates
Diversion Dam	12,000
Main Canal	10,000
Subjugation-- 100 acres	10,000
	32,000

WR 2641

May 1950

Red Rock Valley
(Red Rock Wash)

District #12

Estimated cost to complete 10,000

Ultimate acreage 200

Under canal 200

Maximum acreage cultivated to date 69

On stream storage

Storage acts as desilting structures only, and as diversion dam. Reservoir full of silt for years, no control. Cleaning reservoir would be very expensive.

Main canal in need of control structures.

Subjugation of land.

	1950 Estimates
Main canal	10,000

WR 2642

May, 1950

District # 12 Sheep Springs

Estimated cost to complete $55,000

Ultimate acreage 500

Acreage under canal 339

Maximum acreage cultivated todate 237

Work consists of:

Direct Diversion

Diversion dams proposed

Main canal in need of maintenance and structures.

Subjugation of necessary areas.

	1950 Estimates
Diversion	15,000
Main Canal	15,000
Subjugation	25,000
	55,000

WR 2643

May 1950

District #12

Sanostee
Beautiful Mountain
(Sanostee Wash)

Estimated cost to complete 40,000

Ultimate acreage 1,000

Under canal 800

Maximum acreage cultivated to date 581

Beautiful Mountain--Direct diversion by a number of small Indian-built throats.

Canals subject to side-hill drainage; many small wooden flumes in need of regular replacement.
Land on small benches; some leveling would be valuable.

Sanostee-- Direct diversion--Water supply limited through two diversions and three or four Indian built throats. Permanent diversion needs minor maintenance.

North side canal from upper diversion is of very little use. Three flumes wash regularly due to side hill drainage and flood waters exceeding canal capacity. Very little land used under this canal. Additional construction and maintenance should be deferred until decision is reached on use of land.

Indian heading above upper diversion--some land above and below upper heading.

South side canal subject to washouts from side drains. Flume #1 in bad disrepair. Flume #2 burned out. Lumber furnished in 1950 to replace Flume #2 and repair portions of Flume #1. Very little idle land under south side canal.

Lower heading has no permanent diversion; difficult to maintain.

Main canal extends for four or five miles down valley on north side of wash to small isolated farms. Canals subjected to side hill drains. Farms should be consolidated into a compact unit before any additional development is considered.

Subjugation of land when consolidated.
Investigation of possible storage, flood and silt control sites above Sanostee and Beautiful Mountain.
Reconnaisance necessary.

Sanostee:	1950 Estimate		
Beautiful Mountain			WR 2644
Main canal	10,000		
Subjugation	0	10,000	
Sanostee--Main canal	30,000	30,000	40,000

May 1950

District #12

Stinking Water
(Tocito Drainage)

Estimated cost to complete 15,000

Under canal 50

Ultimate acreage 50

Maximum acreage cultivated to date 32

Direct Diversion

Diversion dam masonry in need of maintenance. Replace wooden headgates.

Main canal in need of many control structures.

Subjugation of land.

	1950 Estimates
Diversion dam	5,000
Main Canal	5,000
Subjugation	5,000
	15,000

WR 2645

May 1950

District 12

Toadlena
(Captain Tom Wash)

Estimated cost to complete $20,000

Ultimate acreage 230

Under canal 275

Maximum acreage cultivated to date 227

Work consists of:

Spring storage and direct diversion.

Hudson Lake washed out surveys required to determine potential.

Toadlena reservoirs needs some maintenance.

Diversions--new permanent structures required.

Main canal system in need of structures

(No expansion of project.)

	1950 Estimates
Diversion Dam	15,000
Main canal	5,000
No subjugation	0
	20,000

WR 2646

May 1950

District #12

Tocito
(Tocito Wash)

Estimated cost to complete 20,000

Ultimate acreage 250

Under canal 250

Maximum acreage cultivated to date 148

Direct Diversion

Total diversion--Earth dike needs maintenance.

Permanent diversion below in good shape--so me maintenance of dikes and bank protection.

Main canals north and south need structures and structure protection.

Land in isolated tracts down valley; could be consolidated into a compact unit for more effective and efficient operation.

Repair Tocito Lake on mountain.

	1950 Estimate
Diversion dam	2,000
Main canal	3,000
Subjugation, 150 acres	15,0000
	20,000

WR 2647

May 1950

District #12 Tohalissy

Estimated cost to complete 30,000

Ultimate acreage 300

Under canal 275

Maximum acreage irrigated to date 197

Work consists of:

Direct diversion

Water supply inadequate due to expansion of Sanostee Project above.

Diversion in good shape. Main canals needs some structures and cleaning.

Subjugation of some lands would improve operation.

Possibility of a silt and flood control structures onthe stream above; but below Sanostee might improve water supply; investigations needed.

	1950 Estimate
Diversion	0
Main Canal	10,000
Subjugation on land (or leveling)	20,000

WR 2648

May 1950

District #12 Zilbetod

Estimated cost to complete 17,000

Ultimate acreage 300

Under canal 250

Maximum acreage cultivated to date 147

Direct Diversion

Diversion dam needs minor maintenance.

Main canal maintenance and control structures.

Some land could have some subjugation or leveling.

Expansion of present 147 acres doubtful due to inadequate water supply.

	1950 Estimate
Diversion Dam	2,000
Main Canal	5,000
Leveling, 100 acres	10,000
	17,000

WR 2649

May 1950

District # 13 — Fruitland Project

Estimated cost to complete $225,000

Ultimate Acreage ~~3,000~~ 3275

Acreage Under Canal 2,800

Maximum acreage irrigated to date 2,586

Fourth Unit Extension of Main Canal --

Work consists of: Subjugation and drainage of 400 acres

Replacement of temporary wooden structures with permanent structures.

Drainage of critical areas;

Subjugation and releveling of some areas.

	1950 Estimates
Main Canal Extension-3 1/3 miles	18,000
Subjugation of 400 acres	40,000
Planting and cropping	8,000
Drainage	9,000
Replacing temporary wood structures drainage, subjugation and releveling	150,000
	$ 225,000

WR 2650

District #14

Todelto Park
(Black Creek Headwaters)

Estimated cost to complete $85,000

Ultimate acreage 500

Under canal 100

Maximum area cultivated to date 39

(Primarily a proposed project; some land under rock basket erosion control structures)

Structures in need of extensive rebuilding.

Proposed project--direct diversion requires diversion dam, main canal structures, and subjugation.

Few areas under stock water tank in valley. Requests for pump, gates, etc., have not been honored.

Necessary to study effect on the Black Creek Valley Project before construction.

	1950 Estimates
Diversion Dam	15,000
Main canal	20,000
Subjugation, 500 acres	50,000
	85,000

WR 2651

C

District # 14 Choiska (Red Willow Wash)

Estimated cost to complete $160,000

Ultimate Acreage 700

Acreage under canal (?)

Maximum acreage irrigated to date 597

Work consists of:

Diversion to storage and diversion of stored water from wash to land 1,580 acre feet.

Upper diversion must be altered to increase diversion capacity.

Increase capacity of feeder canal.

Increase capacity of storage reservoir from 1,000 acre feet to 2,200 acre feet and build necessary spillway.

Pipe line and siphon meeting canal from storage to canal from lower diversion control side drainage.

Lower Diversion: Extend weir to accomodate flood flows. Protect toe of dam with rock blanket.

Pipe line and siphon meeting canal from storage to canal from lower diversion--control side drainage.

Revamp main canal and distributary system including necessary structures.

Subjugation of 700 acres of land.

	1950 Estimate
Upper Diversion	3,000
Feeder Canal 1.25 Mi.	5,000
Storage Dam, Spillway & Toe Drain, 65,000 cu. yd. ~~40,000~~ — 50,000	
Main Canal above lower diversion inc. siphon- 2mi. 30-in pipe 5,00# ft.	10,000
Lower Diversion, lengthen weir	20,000
Main canal, 3 mi. , 4,000	12,000
Subjugation, 700 acres @ $100	70,000
	$ 160,000

WR 2652

C

Navajo Service
Window Rock, Arizona
December 6, 1939

The R. Hardesty Mfg. Co.
Denver, Colorado

Gentlemen:

We are experiencing some difficulty in computing the flow of water through corrugated iron pipe under head. In neither of your handbooks "Handbook of Water Control" nor "Handbook of Culvert and Drainage Practice" is there any information given, that is, that I can find, for calculation of flow through corrugated iron pipe for heads of over five feet.

Ordinarily hydraulic formulas are for smooth pipe. I have used the following formula for short pipe taken from Merrimans, "Treatise on Hydraulics".

$$V = \sqrt{\frac{2gh}{1 + m + m_1 + m_2 + f\left(\frac{l}{d}\right)}}$$

V = Velocity

h	=	45 ft.	= head
m	=	1.78	= Coefficient entrance loss
m_1	=	3.00	= Coefficient for loss due to sudden expansion from pipe to tower chamber.
m_2	=	1.04	= Coefficient for loss due to contraction from tower chamber to pipe.
f	=	.012	= Coefficient of friction, as found by repetition.
l	=	278 ft.	= length of pipe.
d	=	2 ft.	= diameter of pipe

"m" was found from $m = \left\{\frac{1}{c}\right\}^2 - 1$

in which $c = .60$

"m_1" was found from $m_1 = \left\{\frac{1}{c_1}\right\}^2 - 1$

in which $c_1 = .50$

WR 2653

"n"$_2$ was found from $n_2 = \left(\frac{1}{c_2}\right)^2 - 1$

in which $c_2 = .70$

From this formula V = 18.2 feet per second,
and Q = 57.2 cubic feet per second.

We are enclosing a sketch showing the existing conditions of this particular problem.

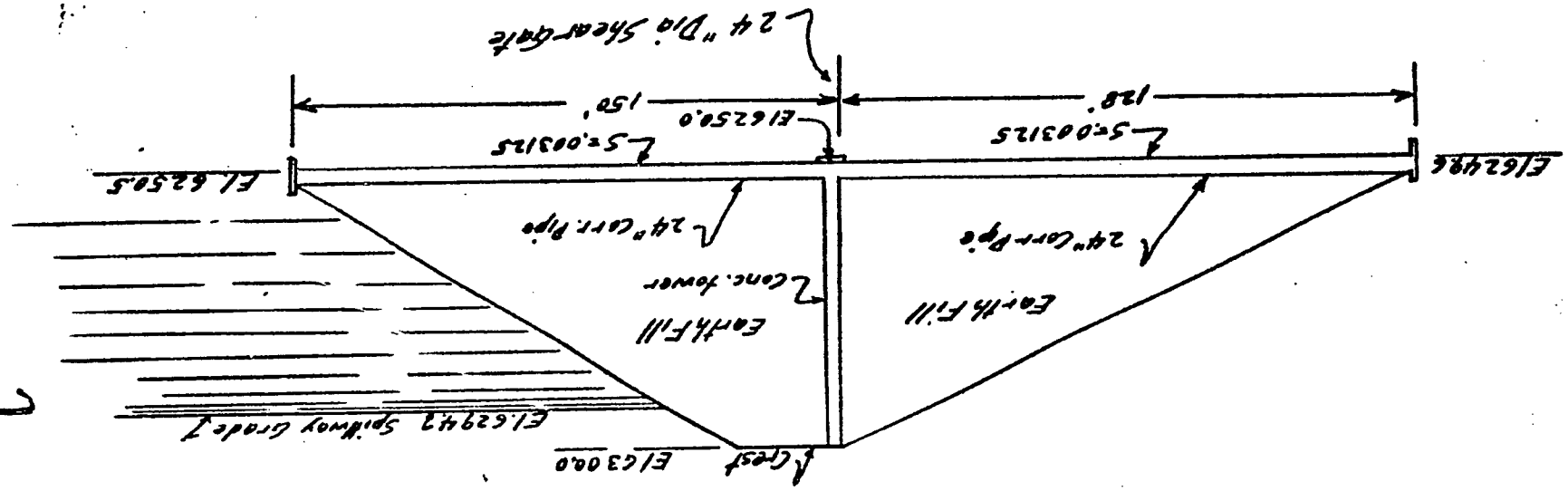
We will appreciate any data, suggestions, or criticisms you may have to offer pertaining to the above, as we are a little dubious about the above calculation.

Respectfully,

A. N. Edmiston,
Assistant Engineer.

ANE/gb

WR 2654



2656

WVR

THE R. HARDESTY MANUFACTURING COMPANY

SALT LAKE CITY - BOISE - EL PASO - PUEBLO

DENVER, COLORADO

December 14, 1939

Mr. A. N. Edmiston
Assistant Engineer
Navajo Service
Window Rock, Arizona

Dear Sir:

We are not acquainted with the formula which you quote in your letter, from Merrimans. However, there are other authorities that will bring us out with practically the same answer that you have obtained, and certainly Merriman is a reliable hydraulic reference.

You stated that it was not possible to solve this problem from the data included in the Handbook of Water Control. We have accomplished the following answer from the handbook.

The problem as you have sketched it is really two problems. In other words, two pipes each operating independently, for as soon as the gate is opened in the well, we find the first pipe discharging into the well from the reservoir, and the second pipe discharging from the well to the toe of slope of the dam. Therefore when the gate is open, we find the water surface in the well dropping until a balance is hit, and equal discharge occurs between both pipes. However, we have not carried it out to this point, for it is close enough to arrive at an answer as follows:

Providing about one-third of the available head, which is 44.4 feet for entrance loss and velocity head, the remainder being used to overcome friction in the pipe, we make a rough try, and thus are enabled to make the assumption for a trial balance that the operating velocity in the pipe will be about 16 feet per second.

Now turn to page 84 of the Handbook of Water Control, and opposite 16-foot velocity, and under the column of $K_e = .5$ for square-cornered entrance (on page 85), we find the velocity head to be 3.98, and the entrance loss to be 1.99, or a total loss of about 6 feet. We will also have this same loss, approximately, at the headgate in the gate well, or a total loss of 12 feet. Deducting this 12 feet from the total head available we have 32.4 feet remaining. Dividing this total amount

of head by the total length of the pipe which will produce friction, 278 feet, we have an "s" or slope per foot of .111/.

Now turn to the chart in the Handbook, page 136, and directly over the slope on the 24" line, we read at the lefthand side of the chart approximately 47 cubic feet per second.

Now as a check, you will remember that we assumed a 16-foot velocity when starting the solution. Therefore by dividing the quantity, 47 cubic feet per second, by an area of 3.14, which is the cross-sectional area of a 2-foot diameter pipe, we have a velocity of 15/ feet per second. Therefore the discharge will definitely be between 46 and 47 cubic feet per second. In other words, you can run the problem through again with a velocity assumed of about 15.5, solve for velocity head, and entrance head, use the remainder for slope, and again enter the chart, and come out with a quantity that will be slightly less than 47 cubic feet per second.

In actual operation we will find that the discharge will be a little less than the above computed quantity, for the reason that the first pipe into the gate well from the reservoir is discharging under a submerged condition, whereas the lower pipe is discharging under a free-flow condition. Therefore more head will be used on the inlet pipe, and less head on the outlet pipe, and when a balance is determined between the two, we will find that they will actually be operating on a quantity a little less than 46 or 47 cubic feet per second.

These figures are on the basis of the reservoir being full. It would be my opinion that you would be more interested in an average discharge when the reservoir is about one-half filled. A similar solution can be made on this basis, and then discharge will vary from this average amount up to, we will say, 45 cubic feet per second , and down to practically zero when the reservoir is empty.

Very truly yours,

THE R. HARDESTY MFG. CO.

M.A.Newell

M.A.Newell
B

WR 2657

May 1950

District #14 — Naschiti Drolets

Estimated cost to complete 40,000

Ultimate acreage 200

Under canal 200

Maximum acreage cultivated to date 217

Drolet #1: Direct Diversion

Diversion dam toe protection needed.
Main canal revamp with structures needed.
Subjugation of some areas necessary.
Long Lake mountain storage would possibly help this project as well as Northern Naschiti. Water was 3' below gate April, 1950. Drainage area small and efficient operation impossible.
No expansion of project planned.

Drolet #2: Direct Diversion

Diversion dam toe protection needed.
Revamp canal system with structures necessary.
Subjugation of some areas necessary.
No expansion of project planned.

LongLake: Natural lake with gate dike and canal.

At present (April, 1950) water stands 3' below outlet gate
Drainage area small-- 2.45 square miles.
Precipitation approximately 20" per year.
A new dam and outlet works could be built with little expense--13' high.
Total capacity 1,639 acre-feet; effective capacity 1,380 acre-feet.
Any benefit from storage would probably be used on lower Lukachukai Mts.
Some flow, with proper operation, might reach Naschiti.
Survey Reservoir and Reconnaisance on drainage below--Estimate:

Tower 13'--3 cubic yards @ $50.	150.00	
70' of 24" diameter concrete pipe @ $6.	420.00	
24" shear gate	100.00	
4 cut-off walls & Stilling pool	300.00	
Embankment--3,400 cu. yds. @ 100	3,400.00	
Riprap, 350 cu. yds. @ $3.00	1,050.00	
	5,420.00	or 5,500.00

WR 2658

Nasohiti Drolets

District # 14

	1950 Estimate	
Drolet No. 1		
Diversion	5,000	
Main canal	5,000	
Subjugation 50 acres	5,000	15,000
Drolet No. 2		
Diversion	5,000	
Main canal	5,000	
Subjugation	5,000	15,000
Long Lake		10,000
		40,000

WR 2659

June 5, 1950

District 14

Naschiti
Long Lake

Accompanied by Bert Coddington, Winkler, Jack South, James Thomas, George Hurlburt, and Charlie Dale (a lone interested Navajo) I visited Long Lake to determine feasibility of increasing storage capacity. Present dam maybe raised and a new gate installed. An alternate plan with a slight increase in storage capacity and drainage area would require a new earth dam east of trail.

Drainage area small for either site. Availability of additional water questionable except in very wet years.

Chased cut drainage over escapement to and through a series of two small lakes on bench below top of mountain. Water course through lakes choked with brush and trees. Second lake must store 3½' of water before it can flow out through 300' rock cut. Little if any water flows out of second lake except in very wet years. Possible to clear right-of-way and build through lakes. Doubtful if storage at Long Lake would be benefitial to any lands below Mosquito Springs Area, now developed 20-25 acres—12 miles to drolets.

George Hurlburt to survey Long Lake week of June 12 and determine drainage area.

Robert C. Sumner.

Est su Roberts

WR 2660

WR 2661

May 1950

District #14 Northern Naschiti

Estimated cost to complete 100,000

Ultimate acreage 600

Under canal 190

Maximum acreage cultivated to date 152

Diversion to toe.
Diversion dam in boulder strewn, steep wash at the base of Lukachukai Mts.
No sluice gate there--dependent on throat to pick up ortion of water.
Does not operate without a dike thrown up above weir. The storing up of water ahead of and entering throat deposits boulders and gravel several feet in depth. This in turn chokes feeder canal and builds up head of water which presses top of dike; and when dike breaks, this creates a flood condition below. It is questionable whether or not we could maintain a sluice in diversion at this site.
Feeder canal has created considerable erosion with the large heads of water turned down it. No structures have been provided.
Diversion below Highway 666 has been washed out several times with big flash floods coming through feeder canal and down drainage into reservoir. This diversion has recently bee repaired.
Storage reservoir in good contion with exception of toe seepage which requires a drain. Reservoir capacity could be increased.
Main canal to farms subject to side hill drainage and in need of control structures.
Some subjugation or releveling necessary.
Possibly a new diversion to storage below Highway 666 would eliminate boulders, but a sluice should be installed, which would need operation.
Partial diversion of main Naschiti Wash above storage with dam and sluice would increase water supply. This water is said to be of a more permanent flow than present diversion. Study of effect on Drolet #1 should be made.
A third diversion to storage has been washed out for a number of years. This was a total diversion consisting of earth dam and canal; no control. Canal silts up, backs up water, which overtops dam.
Possibility of mountain storage at Long Lake has been considered, but no surveys made. Benefit to Northern Naschiti questionable due to small drainage area above and use of water by farmers on step of mountain.
Water in April, 1950, 3' below outlet gates.

	1950 Estimates		
Diversion #1	10,000	Side Drainage	5,000
Diversion #2 (Drolets)	10,000	Subjugation, 200 A	20,000
Feeder canal	20,000		
Storage dam	20,000		
main canal	15,000		100,000

May 1950

District # 4 — Maschiti Southern

Estimated cost to complete 37,000

Ultimate acreage 250

Under canal 50

Maximum cultivated to date 32

Direct Diversion below Drolets #1
Diversion dam needs protection.
Feeder canal--lack of structures has made a large gulley out of canal.
Storage reservoir in operation but needs maintenance.
Main canal needs some small structures.
Southern Maschiti should not be confused with CCCID development three or four miles north which is now inoperative.

	1950 Estimate
Diversion	$
Feeder canal--Structures	20,000
Storage dam	10,000
Main canal	2,000
Subjugation, 50 acres	5,000
	37,000

WR 2662

May 1950

District #14 Well 14-479

Estimated cost to complete $2,000

Ultimate acreage 40

Under canal 30

Maximum acreage cultivated to date 22

Work consists of:

Artisian well to storage; small stoage dams require small maintenance; canal structures need few small structures. land tight--needs treatment from subjugation.

	1950 Estimate
Canal structures	2,000

WR 2663

May 1950

District #14 Well 14A1 1

Estimated cost to complete 5,000

Ultimate acreage 100

Under canal 100

Maximum acreage cultivated to date 59

Work consists of:

Art'sian well to storage.

Small storage dam needs repairing.

Main canal may need some small structures.

Sand tight--needs treatment; some subjugation; some canal structures.

WR 2664

May 1950

District #14 Whiskey Lake

Estimated cost to complete $6,000

In company with Winkler, South, Thomas, Hurlburt and Coddington with Charlie Dale, I visited Natural basin to determine feasibility of proposed storage, finding the following:

Drainage area — 1,469 acres or 2.3 square miles.

Red Willow Wash is fairly permanent flow, which would help deliver water to Tohatchi and Choiska storage with the proper operation.

Storage dam to be 13' high, 350' long —earth fill.

Recommended storage: 1,183 acre-feet with 327 acre-feet below flow line; 800 acre-feet effective storage.

1950
Storage

Gate Tower	150.00
Concrete pipe outlet—	
90' - 24" diameter @ $6.00	540.00
24" diameter Shear gate	100.00
Embankment, 4,000 cu. yd. @ $1.	4000.00
Rip- rap, 260 yds. @ $3.60	780.00
	5,770.00

WR 2665

May 1950

District #15 Mulholland Well

Ultimate acreage 60

Under canal 60

Maximum acreage cultivated to date 30

Artesian well to storage.

Old oil well with original 110 gallon pm flow of water.

Originally private holding, but now held by government. Developed by ECW, CCC & Irrigation.

Any development of doubtful value, although it has been planned in the past to construct a canal system, subjugate land and line reservoirs.

No estimate.

WR 2666

May 1950

District #15 Standing Rock

Ultimate acreage 34
Under canal 34

Maximum acreage cultivated to date 15

Artesian well to storage.

Storage dam capacity-- 15 acre-feet.

Maintenance and construction of few structures.

Further investigation necessary to determine additional work and/or subjugation.

No construction.

WR 2667

May 1950

District #16

Chas. H. Burke
School

Estimated cost to complete _____

Ultimate acreage 150

Under Canal 141

Maximum acreage cultivated to date 121

(Storage from springs—capacity small)

Work consists of:

Distribution system could be improved . At one time a pipeline was planned to conserved a limited supply of water.

Possibility of diverting waters from Bear Springs to same system.

No construction proposed.

2668

WR _____

May, 1950

District # 16

Two Wells
(Near Two Wells Trading Post)

Cost estimate not complete.

Drainage area questionable.

Possible 5,000 acre-feet storage.

Storage dam 57' x400'(length)

Farm land not surveyed.

Land status--?

Further investiation necessary.

WR 2669

May 1950

District #17

Canado
(Rio Pueblo River)

Estimated cost to complete 34,000

Ultimate acreage 600

Under canal 600

Maximum acreage cultivated to date ?

Diversion to storage--3,400 acre feet.

Development for the Canado area should be charged to Cornfields with the exception of a small amount of canal revamping and structures requiring replacing for present operation.

Subjugation of some areas would improve farms.

Possible expansion of present project very small. All expansion listed under Cornfields.

A small quantity of water originating below Canado heading could possibly be picked up in a pipe line or infiltration line. The flow is very small but steady. Additional investigation is necessary.

The present steel siphons, two or three, will need replacing before many years.

Flumes will need maintenance unless replaced under Cornfields program.

Extensive cleaning of entire south side canal unless rebuilt for service of Cornfields.

Average annual water use 1,500-2,00 acre-feet.

Feeder canal should be revamped to carry a larger quantity of water, this is planned under Cornfields program.

Storage dam--Cornfields Program entails raising of storage reservoir capacity from 3,400 acre-feet to 4,500 acre-feet

Main canal, under Cornfields Program, will be enlarged to carry surplus water to Cornfields. This will overcome stream bed losses which has prohibited delivery of any water to Cornfields. North side canal will be extended to Cornfields heading. There will be between Canado and Cornfields some land under canal, not to exceed 300 acres. Construction costs in these areas should be charged to Cornfields, not to Canado.

Agreements should be drawn up on use of Canado storage water and ditch maintenance.

See Cornfields for additional data.
See Cornfields for land above Canado Reservoir.

	1950 Estimate
Main canal below siphon	14,000
Subjugation or leveling 200 A. (old)	20,000
	34,000

WR 2670

May 1950

District #17 Coldfields

Estimated cost to complete 25,000

Ultimate acreage

Maximum acreage cultivated todate 210

Survey needed to determine all possibilities and available water.
Investigation should include operation of Beautiful Valley (Canado) in headwaters of Mazlini Wash.
A diversion dam is needed to replace old washed out dam.
Main canal system and structures needed.
Some subjugation.

	1950 Estimate
Diversion dam	10,000
Main canal	5,000
Subjugation, 100 acres	10,000
	25,000

WR 2671

May 1950

District #17 Cornfields

Estimated cost to complete $ 545,000

Ultimate acreage 1,300

Direct Diversion--possible to use Ganado surplus storage.

This year, 1950, very dry at Cornfields. The wash is wet but no surface water. Indications are that an infiltration line to and possibly above Ganado bridge will improve conditions.

Present program calls for raising Ganado reservoir capacity from 3,400 acre-feet to 4,500 acre-feet.

Ganado main canal will be rebuilt and extended to toe into infiltration line.

A new diversion dam possibly would improve conditions. Sheet file floating wier proposed.

Infiltration line, canal extension, and diversion will be tied into a common system with gates control. Proposed open canal from diversion just below Ganado project will probably need replacing with a long section of pipeline to conserve water.

Main canal below present heading should be rebuilt with necessary structures and extended approximately to Cornfields Day School. Side hill drainage should be controlled.

It is possible that after several years of operation the irrigated area at Cornfields could be increased, dependent on successful operation of planned system and conservation of water.

A maximum of 300 acres of land can be irrigated between Ganado and Cornfields under either the north or south side canal. Surveys are now underway to determine most feasible route.

Subjugation of all lands at Cornfields and above.

	1950 Estimates
Diversion Dam (Ganado)	11,000
Feeder Canal (Ganado)	10,000
Storage (Ganado) 1,00 acre-feet)	70,000
Main canal to Cornfields-north side diversion and pipe line	116,000
Cornfields Diversion	60,000
Infiltrationand pipeline--4½ miles	150,000
Subjugation--1,000 acres	100,000
Pipeline from southside Ganado canal	13,000
Cornfields main canal	15,000
	545,000

WR 2672

May 1950

District #17

Canado
(Rio Pueblo River)

Estimated cost to complete 34,000

Ultimate acreage 600

Under canal 600

Maximum acreage cultivated to date ?

Diversion to storage--3,400 acre feet.

Development for the Canado area should be charged to Cornfields with the exception of a small amount of canal revamping and structures requiring replacing for present operation.

Subjugation of some areas would improve farms.

Possible expansion of present project very small. All expansion listed under Cornfields.

A small quantity of water originating below Canado heading could possibly be picked up in a pipe line or infiltration line. The flow is very small but steady. Additional investigation is necessary.

The present steel siphons, two or three, will need replacing before many years.

Flumes will need maintenance unless replaced under Cornfields program.

Extensive cleaning of entire south side canal unless rebuilt for service of Cornfields.

Average annual water use 1,500-2,00 acre-feet.

Feeder canal should be revamped to carry a larger quantity of water, this is planned under Cornfields program.

Storage dam--Cornfields Program entails raising of storage reservoir capacity from 3,400 acre-feet to 4,500 acre-feet

Main canal, under Cornfields Program, will be enlarged to carry surplus water to Cornfields. This will overcome stream bed losses which has prohibited delivery of any water to Cornfields. North side canal will be extended to Cornfields heading. There will be between Canado and Cornfields some land under canal, not to exceed 300 acres. Construction costs in these areas should be charged to Cornfields, not to Canado.

Agreements should be drawn up on use of Canado storage water and ditch maintenance.

See Cornfields for additional data.
See Cornfields for land above Canado Reservoir.

	1950 Estimate
Main canal below siphon	14,000
Subjugation or leveling 200 A. (old)	20,000
	34,000

WR 2673

May 1950

District #17

Kinlichee
(Kinlichee Wash)

Estimated cost to complete 72,000

Ultimate acreage 250

Under canal 201

Maximum acreage cultivated to date 150

Direct diversion
Diversion dam needs minor repairs and maintenance.
Canal immediately below diversion needs rebuilding or a pipe line.
Siphons to North and West of wash inoperable and needs replacing with larger concrete pipe.
Side hill drainge needs control structures.
Some subjugation
Not much help from farmers on operation and maintenance.
Project in bad condition.

1950
Estimate

Diversion (Flood control in wash)	2,000
Main canal (2 siphons, canals, & turnouts)	50,000
Subjugation 200 acre maximum	20,000
	72,000

WR 2674

May 1950

District #17 Klagetoh

Estimated cost to complete 26,000

Ultimate acreage 1,500

Under canal 350

Maximum acreage cultivated to date 300

Storage--local drainage small

Reservoir does not hold water--seeps into underground channel apparently.

No expansion of project.

Some side-hill drainage control.

Subjugation of some areas would improve project.

	1950 Estimate
Main canal	10,000
Leveling	16,000
	26,000

WR 2675

May 1950

District #18

Black Creek Reservoir
(Black Creek)

(Data from 1945-1947 letters in file)

Notes:

U.S.B.R. Project--10 miles north of Highway 66.
Stream bed elevation 6,422'.
Water surface--maximum 6,512'
Water surface--minimum 6,476'
Draw dam--36'
Surface area--maximum 1,900 acres or 2.9 square miles.
6,000 acres non-Indian land below near Sanders.
48,600 acres-feet storate estimated for project. No maps or other data available.
Water supply questionable.
U.S.B.R. has made surveys.
Recreation project report made by Park Service.
Proposals should be substituted for Houck Project.
Southwestern Development Company of Gallup filed in Black Creek Reservoir site prior to 1908.
Investigation of project, land status, benefitis, etc., necessary

No Estimates.

WR 2676

May 1950

District #18

Fort Defiance
(Bonita Creek)

Estimated cost to complete	41,000
Ultimate acreage	510
Under canal	160
Maximum cultivated to date	159

Direct Diversion from Bonita Creek.

Very small acreage--expansion questionable due to domestic water requirements of Fort Defiance.
Additional flood control reservoirs have been planned by SCCO which may improve water supply.

Black Creek (Black Creek)

Direct Diversion

Present diversion in good condition.
Silting of main canal thereby choking-off diversion of water caused by checking main canal to serve land too high for canal. A sluiceway would help to clean upper end of canal.
Water supply limits size of project, but with the proposed raise of Red Lake additional storage should be available for this project. In order to serve this area and other small areas above, a long canal or pipe line should be built to overcome stream bed losses.
An infiltration line above diversion might have merit. Questionable.
Subjugation of all land.

	1950 Estimates	
Bonita Creek:		
Diversion Dam	1,000	
Main canal	5,000	
Subjugation	0	
		6,000
Black Creek:		
Diversion Dam	0	
Main canal	15,000	
Subjugation--200 acres	20,000	
		35,000
		41,000

WR 2677

District # 18 Crystal (Crystal Creek)

Estimated cost to complete $93,000

Ultimate Acreage 600

Acreage under canal 408

Maximum acreage irrigated to date 275

Upper Crystal:: Work consists of:

Direct Diversion
Diversion Dam--old log crib dam rotting out--construct new dam.
Revamp main canal with pipe drop structures, etc.
Replace flume over Crystal Creek and drop structures below.
Very little, if any, subjugation needed.

Lower Crystal: Work consists of :

Direct Diversion.
Some rock blanket and masonry protection of diversion dam needed.
Som subjugation of small areas would improve project.

(If Sonsella Buttes Reservoir is built, Lower Crystal will be flooded out but farmers could be moved to land under Sonsella Buttes.)

Upper Crystal:	1950 Estimate	
Diversion Dam	15,000	
Main Canal	31,000	
Subjugation leveling 100 acres @ $100	10,000	
		56,000

LLower Crystal:

Diversam Dam Rehabilitation	2,000	
Main canal; cleaning and structures	10,000	
Subjugation-leveling 100 acres @ $100	10,000	
		22,000

Storage: (Above Upper Diversion)

Storage Dam (Earth Fill)	15,000
	93,000

WR 2678

District #18 June 4, 1950 Crystal

In company with Brannan and Coddington, I visited mountain area above Crystal to locate possible mountain storage sites.

Site #1 located --3/4 to 1 mile below Cottonwood Pass. A dam 100' to 150' high would back water up main stream 2,000'. Drainage areas small to inadquate. Maximum flow of stream very small. It was decided to make a quick topo reconnaisance of basin and drainage area.

Site #2 located on top of mountain south of Cottonwood Pass--a small natural basin with a possible dam site of small yardage. Determine drainage area and capacity.

WR 2679

May 1950

District #18

Houck
(Black Creek)

Estimated cost to complete	47,000
Ultimate acreage	750
Under canal	350
Maximum cultivated to date	155

Direct Diversion

Water supply poor; when available farmers are not ready to irrigate. It is hoped that with the development of Black Creek Valley--i.e. Red Lake and Natural Bridge with the proposed canal systems and reservoirs-- a surplus of water will be available for use at Houck. Delivery of water by canal should overcome considerable stream bed losses.

The diversion dam was repaired in 1948 but very little farming has been done since.

Dependent on use, water supply and industry the main canal could be completed with structures for side-hill drainage control and sluices.

A proposed Black Creek Storage Dam by U.S.B.R. would make additional development around Houck possible. Water supply other than flash floods is very small.

Acres Cropped:

Year	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949
	127	117	118	137	154	114	130	48	112	21	18

Rehabilitation and subjugation of project and subjugation of project dependent on water supply. Very low priority.

	1950 Estimate
Diversion Dam	2,000
Main canal	15,000
Subjugation, 300 acres	30,000
	47,000

WR 2680

May 1950

District #18

Natural Bridge
(Black Creek)

Estimated cost to complete 420,000

Ultimate acreage & 1,000

Under canal 28

Maximum acreage cultivated to date 16

Diversaion to storage.

Black Creek Diversion threat difficult to operate. Main channel now on east side of valley and requires long canal from heading to reach water. Requires permanent diversion and channel control; also feeder canal and structures.

Storage dam silted up; small storage capacity. It is proposed to raise storage dam 14', increasing capacity 1,000 acre-feet to 4,200 acre-feet. This would provide water for domestic water supply at Window Rock.

No main canal at present; to reach all of 1,000 acres of arable land would require 17 miles of main canal on both sides of Black Creek with many structures. Arable land in small isolated valleys down to and below Hunters Point.

Main canal system would waste closer to Houck and perhaps provide a small supply of water for that project as well as overcoming stream-bed losses.

Subjugation of all irrigable land.

	1950 Estimate
Diversion & Dike	55,000
Feeder canal	10,000
Storage dam	180,000 ?
Main canal, East	15,000
Main canal, West	40,000
Subjugation, 1,000 acres	100,000
Planting and cropping, 1,000 acres	20,000
	420,000

WR 2681

May 1950

District #18 Oak Springs

Estimated cost to complete 5,000

Ultimate acreage 50

Under canal 42

Maximum acreage cultivated to date 42

Some maintenance on this project, control canal structures needed.

	1950 Estimates
Storage	1,000
Canal	2,000
Leveling	2,000
	5,000

WR 2682

May 1950

District #18

Red Lake
(Black Creek)

Estimated cost to complete	270,000
Ultimate acreage	1,000
Under canal	700

Diversion to storage.

Diversion dam in good condition but headgate capacity should be enlarged. A headgate is scheduled for the south side of diversion dam to serve arable land above storage reservoir.
Feeder canal capacity is small and should be enlarged. New sluice should be installed adequate to clean canal from headworks to sluice.
Storage dam--raise crest 7' to increase capacity from 3,988 acre-feet, (originally)probably 3,000acre-feet, 1950) to 7,500 acre-feet based on old survey. Raising storage dam includes a new outlet tower and pipe, new spillway and standard dam section. Red Lake-Crystal road will have to be relocated above reservoir highwater.
Revamp and relocate main canal through projects. This requires a long canal with siphons and flumes to serve lands east of Black Creek, and a long extension down valley to serve small parcels of land making up the total of 1,000 acres. Capacity should be such that a future extension could serve arable land on down the valley to and including Fort Defiance.
Capacity of reservoir includes torage above that required for Red Lake Project, and in good years with a canal system to overcome stream bed losses. Storage should benefit all Black Creeek Project.

Subjugation of 1,000 acres necessary.

	1950 Estimate
Diversion dam	5,000
Feeder canal	10,000
Storage dam	50,000
Main canal	75,000
Subjugation, 1,000 acres	100,000
Planting & Cropping, 1,000 acres	20,000
	270,000

WR 2683

May 1950

District #18 Sonsela Buttes.

Estimated cost to complete 550,000

Project acreage unknown.

Diversion to Storage

Diversion of Whiskey Creek into basin above road in Chee Dodge Flats; an earth storage dam at present; bridge over Crystal Creek would impound water of Crystal Creek and diverted water from Whiskey Creek, making possible a capacity of 25,000 acre-feet. Arable land under storage has not been surveyed. Estimated 2,000 acres.

Alternate possibility would be the diversion of stored waters to Black Creek Valley by canal over divide and dam drainage to Red Lake. It is believed that water is more urgently needed in Chinle Valley than for alternate site at Whiskey Creek Storage.

	1950 Estimate
Diversion	20,000
Feeder canal	100,000
Storage	200,000
Main canal	30,000
Subjugation, 2000 acres	200,000
	550,000

WR 2684

May 1950

District #18 Whiskey Creek

No cost estimate available.

Ultimate Acreage 100

Under canal 100

Maximum acreage irrigated to date 32

No permanent diversion. (Questionable whether or not permanent diversion would be justified)

Limited water supply and high cost--although additional land available.

Main canal in need of control structures

Land steep--some subjugation.

No construction program.

A large storage dam at the confluence of Crystal and Whiskey Creek would store water at a high elevation for the Chinle Valley. Delivery of water would be difficult other than in tunnel, pipe, or stream bed.

Capacity unknown, available water supply unknown.

An alternate would be a ~~lower~~ smaller dam in Whiskey Creek at the head of the Canyon with Crystal creek plugged and diverted to basin. This would be a cheaper plan and almost as effective, dependent on water supply. This project would utilize water otherwise planned for Sonsela Buttes Project on Crystal Creek.

WR 2685