

COMPLETION REPORT

CANTONMENT CONSTRUCTION
FORT HUACHUCA, ARIZONA

May 10, 1941

Maps filed with Mrs. Carter 12-11-41

HEADMAN, FERGUSON & CAROLLO
ARCHITECT - ENGINEERS

S. S. HEADMAN

PREFACE

PREFACE

207/12

The construction program covered by this project entails the erection of a cantonment at the army post located at Fort Huachuca, Arizona, as authorized by Procurement Authority No. QM 7816 PI-S211A.

The work was supervised by Col. Joseph L. Brooks, Constructing Quartermaster, assisted by Architect-Engineers and Contractors employed on a Fixed-Fee form of Contract negotiated during the month of October, 1940.

Architect-Engineer -- Headman, Ferguson & Carollo
Consulting Engineers
Phoenix, Arizona

Contractors -- Del E. Webb Construction Company
Phoenix, Arizona
and
White & Miller, Contractors, Inc.
Tucson, Arizona

The contractors operated as a joint organization, with Del Webb acting as senior members.

The original project comprised housing for 5240 men and officers, assuming that part of the organizations would be maintained in permanent buildings on the Post.

Studies of personnel housing and cantonment site layout had been made during the year prior to the start of actual construction by the War Department, resulting in a definite location of site with reference to the established Post and the well water supply.

Fort Huachuca, being an isolated area, has been served by its own utility units, as no outside source of such service was available until recently when natural gas and electric power came within the economic reach of the cantonment.

Prior to the start of construction the Post had installed and was operating the following utility service:

Electric power was supplied from a local central generating station consisting of five diesel engine driven units of rather small capacity.

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Natural gas was twenty-two miles distant, and negotiations were under way to extend service to the Post for heating and fuel. This contract was consummated in the latter part of 1940 and the Post and Cantonment supplied with gas as a part of the construction program. The Reception Center (Tent City) was also equipped with gas equipment and served with gas to replace the cannon stoves originally installed.

The sewer system for the Post discharged into two cess-pools which were entirely inadequate and overrunning on the surface of the ground, thereby causing a nuisance and a menace to health. The military and United States Health Board, as well as the Arizona State Sanitary Engineer, condemned this situation; this resulted in the extension of the outfall sewer main of the Post to enable all sanitary sewage to be delivered to the sewage disposal plant constructed under this project.

Water was being supplied to the Post by gravity supply from sources located in the mountains above the Post elevation. These sources were inadequate during summer months and a new well had been drilled at the east gate along the road to Bisbee. This well established a hitherto unbelievable water source (or well field) that has proven to be sufficient to supply the needs of any size cantonment that might be considered at this location.

A second well was in process of being drilled when this project was gotten under way and tentative drawings were prepared by the officer of the Quartermaster General setting forth the pumping layout, piping to the new cantonment site and a gridwork of mains for the area.

No deviation was to be permitted from this plan which called for a twelve inch distribution system and booster pumps arranged for both series and parallel operation. When it was found, however, that pump manufacturers could not meet these requirements, permission was obtained to change the characteristics of the second booster pump to operate as a dual standby for either of the booster pumps at each well location.

The wells have deep well turbine pumping units direct connected to vertical motors. The pumps deliver 500 and 700 GPM respectively. Each well pump has a booster pump having a like capacity against 320 lb./sq.in. for the 500 GPM unit and 120 lb./sq.in.

PART I

GENERAL

SECTION I

Engineering Report

ENGINEERING REPORT

Reports on Annual Rainfall

Records of rainfall have been kept in various U.S. Weather Bureau recording stations located throughout Arizona; they date as far back as 1875. Studies of these records indicate that the rainfall in the same locality varies with the elevation as does the maximum and minimum temperature during the different months of the year.

The Southwest has experienced the effects of the drought which has prevailed in the United States during the past years. Plotted rainfall data indicates that the high and low cycles of rainfall vary on periods of approximately eleven year cycles. The present period is on the rising portion of the precipitation cycle; this is evident in the increased rainfall of the present season over past seasons.

The following tabulation sets forth the average annual rainfall data for Weather Bureau stations in the vicinity of Fort Huachuca based on a record from 1875 to 1928:

Average Annual Rainfall

Month	Fairbanks Elev. 3900	Lewis Springs Elev. 4027	Tombstone Elev. 4500	Tucson U.A. Elev. 2423	Ft. Huachuca* Elev. 5000
Jan	.61	.54	.84	.84	.95
Feb	.36	.62	.87	.36	1.20
Mar	.51	.39	.79	.81	.86
Apr	.26	.16	.54	.36	.27
May	.13	.12	.24	.17	.31
Jun	.62	.63	.46	.25	1.73
Jul	4.22	3.33	3.52	2.40	2.07
Aug	2.54	2.61	3.41	2.23	3.68
Sep	1.10	1.22	1.69	1.08	1.63
Oct	.48	.50	.66	.60	1.47
Nov	.60	.90	.78	.80	1.03
Dec	.60	1.17	.88	1.11	1.52
TOTAL	12.23	8.96	14.43	11.51	16.66

*The last column shows the average rainfall for Fort Huachuca as measured at the Post for the years 1938-40, inclusive.

The following tabulation sets forth the precipitation by months from 1936-40 at Fort Huachuca:

Precipitation by Months

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
1936							2.12	4.48	2.55		1.70	1.15
1937	1.50	.12	1.50			1.21	2.94	4.22	1.95	1.51		1.62
1938	.73	.81	1.39	.12	.12	1.05	1.30	2.21	.57	1.07		1.81
1939	.46	1.01	.43	.18			1.63	4.81	.36	1.67	.50	.18
1940	1.10	2.65	.10	.52	.51	3.07	2.08	2.80	2.75	.17	.90	2.80
Ave.	.95	1.20	.86	.27	.32	1.76	2.07	3.68	2.63	1.47	1.03	1.51

Reports on Wind Velocities and Direction of Prevailing Winds

The following tabulation has been compiled from records kept by the Signal Corps at Fort Huachuca during the past year. The normal wind velocity ranges from six to nine miles per hour with a very short period of velocities ranging up to twenty-five miles per hour.

Wind Velocity
and
Prevailing Direction

Month	1939		Direction	Month	1940		Direction
	Wind Velocity				Wind Velocity		
	Max.	Ave.			Max.	Ave.	
				Jan	12	7	S
				Feb	10	7	S
Mar	15	6	S	Mar	12	8	S
Apr	25	8	SE	Apr	15	9	W-S
May	25	6	SE	May	15	8	S
Jun	15	7	none	Jun	15	7	S
Jul	15	6	S	Jul	15	6	none
Aug	10	6	NE-SE	Aug	20	9	S
Sep	12	8	E	Sep	20	8	S
Oct	12	6	S	Oct	27	9	S
Nov	10	6	NE	Nov	22	6	S
Dec	15	7	S	Dec	15	8	S

Reports on Temperature Variations

The following tabulation sets forth readings taken at the Fort Huachuca Power Plant, located on the Post; these cover a period from 1938 to 1940, inclusive.

Temperature Readings
1938-1940

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1938	High						101	96	90	88	76	72
	Low						62	51	50	41	30	23
	Ave. H						92.3	88.6	82.8	77.5	64.9	59.0
	Ave. L						69.3	66.9	68.2	67.7	46.6	36.6
1939	High	64	76	74	90	94	101	101	98	90	83	76
	Low	10	24	28	38	44	55	58	62	57	49	36
	Ave. H	52.4	62.8	65.4	76.2	84.1	91.0	92.6	90.0	84.7	79.0	71.8
	Ave. L	29.6	37.9	40.6	48.2	56.4	63.4	68.9	66.6	62.6	55.9	44.8
1940	High	72	71	80	87	96	100	100	99	90	90	78
	Low	28	31	32	34	41	50	62	60	58	42	32
	Ave. H	60.5	62.4	67.2	75.1	82.5	89.5	89.5	88.7	84.1	70.7	66.0
	Ave. L	36.5	39.3	41.1	44.5	56.6	62.9	67.0	66.2	63.1	56.0	39.4
1939	High	70	70	80	84	94	102	96	96	98	85	74
	Low	28	17	32	36	49	56	62	61	62	42	24
	Ave. H	57.4	50.3	69.6	78.1	85.7	95.4	91.0	88.4	85.7	75.5	60.7
	Ave. L	35.2	30.2	42.8	50.7	57.8	67.0	67.1	65.5	62.2	52.3	42.9
1940	High	70	80	88	90	96	105	103	98	95	85	76
	Low	26	27	26	37	46	52	56	60	54	38	32
	Ave. H	60.1	60.5	69.5	75.6	86.6	92.3	93.4	89.1	85.7	75.7	69.4
	Ave. L	35.3	37.0	43.2	47.8	59.8	64.7	67.3	65.1	61.9	52.6	38.9

Records for twenty-seven years for the City of Tombstone, which is at the same elevation as Fort Huachuca and only twenty-six miles distant, show the following as average temperatures for the above mentioned period:

Temperature Readings
Tombstone, Arizona

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Ext. Max.	34	65	92	93	100	106	107	104	106	100	90	80
Ext. Min.	9	14	20	28	31	28	52	53	43	30	19	12
Mean. Ext Max	72.4	75.0	81.7	87.4	94.3	101.9	101.0	97.0	95.3	88.4	79	71
Mean. Ext Min	20.8	24.3	26.6	33.8	40.8	50.4	58.7	58.0	51.6	37.9	30	23
						Annual Ext. Max.	107					
						Annual Ext. Min.	9					

Regulations on Sewage Disposal

The State of Arizona does not have any prescribed regulations for sewage disposal. The State Sanitary Engineer acts in an advisory capacity only and has no police power.

Stream Flow Data

There are no streams other than minor creeks flowing from the Huachuca Mountains and these do not flow all year around.

The only large stream flow within a range of twelve miles from Fort Huachuca is the San Pedro River. Stream flow gaugings on this stream are attached.

Topographic and run off Data of Water Shed

Fort Huachuca lies at the foot of the Huachuca Mountains on the north slope. It is located at the mouth of what is known as Post Canyon from which the original fort obtained its gravity water supply. The mountain peaks directly south of the Post rise to a precipitous elevation of 3500 feet. During the winter months the mountains are usually covered with snow which feeds the springs which supply water to Fort Huachuca and the City of Tombstone thirty miles distant.

During the summer months when the rainfall is heaviest the streams carry off water for a period of approximately six weeks during which time there may be flash floods of minor proportions.

(Drainage area - 1,440 square miles)

Year	W.S.P (No. and Page)	Water Year ending Sept. 30			Run-Off in			Calendar Year		
		Maximum Day	Minimum Day	Mean	Maximum Day	Minimum Day	Mean	Maximum Day	Minimum Day	Mean
1913	359-250	846	1.7	52.8	1.7	23,800	1,120	1.7	35.2	25,500
1914	389-169	12,300	2	205	2	148,000				
*1915	409-199									
1916	439-166	1,760	2	47.2	2	34,200	1,760	2	120	95,000
1917	459-168	5,180	2	125	2	90,200	5,180	2	49.7	36,100
1918	479-183	920	1	28.0	1	20,300	920	1	120	67,000
1919	509-220	6,050	1	129	1	93,500	6,050	1	29.5	21,400
1920	509-220	860	2	57.5	2	41,800	860	2	147	106,000
1921	529-157	6,700	1.5	140	2	102,000	6,700	2	38.3	27,800
1922	549-152	1,900	1	50.4	1.5	56,500	1,900	1.5	141	102,000
1923	569-147	3,080	1	58.3	1	41,200	3,080	1	48.6	35,200
1924	589-145	562	.5	34.8	.5	25,300	524	.5	67.4	46,600
1925	609-131	2,400	1	50.8	1	36,800	2,400	1	24.3	17,700
**1926	629-127	26,000	2	170	2	122,000	28,800	2	53.3	56,500
**1927	649-83	2,100	10	71.4	10	51,700	2,050	10	189	137,000
**1928	669-87	350	4	27.7	4	20,000	1,480	4	53.7	30,900
1929	689-95	3,660	6	74.7	6	54,100	3,650	6	35.6	25,900
1930	704-103	3,590	6	73.9	6	53,500	3,590	6	66.1	47,900
1931	719-106	4,090	3	89.7	3	64,900	4,900	3	73.8	55,500
1932	734-114	1,720	6	63.3	6	45,900	1,720	6	100	72,600
1933	749-96	1,430	4	38.9	4	28,200	1,430	4	52.0	37,000
1936	809-169	3,400	3	61.6	3	44,600	3,400	3	39.9	28,900
1937	829-171	3,880	5	77.3	5	55,960	3,880	5	58.3	42,520
1938	859-250	2,290	3	47.8	3	34,600	2,290	3	78.1	56,500
1939	879-	3,080	2	68.8	2	48,800			47.2	34,250

* Published as "San Pedro River near Fairbank, Arizona" 1913 to Sept. 30, 1926; as "San Pedro River at Fairbank, Arizona" Oct. 1, 1926 to Sept. 30, 1928.

** Computed by using unpublished estimates for January 1-21 and 31.

** Record Oct. 1, 1926 to Sept. 30, 1928, from station below mouth of Babocomari River published as "San Pedro River at Fairbank, Arizona".

UNITED STATES DEPARTMENT OF THE INTERIOR
Geological Survey - Water Resources Branch

File No. _____

Summary of yearly discharge, in second-feet, for
San Pedro River at Charleston, Arizona *

(Drainage area - 1,440 square miles)

Year	W.S.P (No. and Page)	Water Year ending Sept. 30			Run-Off in Acre-Feet			Calendar Year			Run-Off in Acre-Feet
		Maximum Day	Minimum Day	Mean	Maximum Day	Minimum Day	Mean	Maximum Day	Minimum Day	Mean	
1913	359-230	846	1.7	32.8	23,800	1.7	35.2	1,120	1.7	35.2	25,500
1914	389-169	12,300	2	205	148,000						
*1915	409-199										
1916	439-166	1,760	2	47.2	34,200	2	128	1,760	2	49.7	93,000
1917	459-158	5,180	2	125	90,200	2	120	5,180	2	120	87,000
1918	479-153	920	1	28.0	20,300	1	29.5	920	1	29.5	21,400
1919	509-220	6,050	1	129	93,500	1	147	6,050	1	147	106,000
1920	509-220	860	2	57.5	41,800	2	58.3	860	2	58.3	27,800
1921	529-157	6,700	1.5	140	102,000	1.5	141	8,700	1.5	141	102,000
1922	549-152	1,900	1	50.4	36,500	1	48.6	1,900	1	48.6	35,200
1923	569-147	3,080	.5	58.3	41,200	.5	67.4	3,080	.5	67.4	48,800
1924	589-145	562	1	34.8	25,300	1	24.3	524	1	24.3	17,700
1925	609-131	2,400	1	50.8	36,800	1	53.3	2,400	1	53.3	38,600
**1926	629-127	28,800	2	170	122,000	2	189	28,800	2	189	137,000
**1927	649-89	2,100	10	71.4	51,700	10	53.7	2,050	10	53.7	58,900
**1928	669-87	350	4	27.7	20,000	4	35.6	1,480	4	35.6	25,900
1929	689-95	3,650	6	74.7	54,100	6	66.1	3,650	6	66.1	47,900
1930	704-103	3,590	6	73.9	53,500	6	73.8	3,590	6	73.8	53,500
1931	719-106	4,090	3	89.7	64,900	3	100	4,900	3	100	72,600
1932	734-114	1,720	6	63.3	45,900	6	52.0	1,720	6	52.0	37,800
1933	749-96	1,430	4	38.9	28,200	4	39.9	1,430	4	39.9	28,900
1936	809-159	3,400	3	61.6	44,600	3	58.3	3,400	3	58.3	42,320
1937	829-171	3,880	5	77.3	55,960	5	78.1	3,880	5	78.1	56,500
1938	859-250	2,290	3	47.8	34,600	3	47.3	2,290	3	47.3	34,250
1939	879-	3,080	2	68.8	48,800	2			2		

* Published as "San Pedro River near Fairbank, Arizona" 1913 to Sept. 30, 1926; as "San Pedro River at Fairbank, Arizona" Oct. 1, 1926 to Sept. 30, 1928.

** Computed by using unpublished estimates for January 1-21 and 31.

** Record Oct. 1, 1926 to Sept. 30, 1928, from station below mouth of Babocomari River published as "San Pedro River at Fairbank, Arizona".

The terrain of the mesa at the foot of the mountains has a uniform slope of approximately three feet per hundred, which is interspersed with arroyos eroded during the past years.

Floods and flood Control

There is no record of floods in this territory and no flood control works have ever been contemplated.

Geological Data

The Huachuca Mountains are a protrusion of granite and limestone extended up through the bed of the valley; they form a southern out-off wall for water in the underground reaches of the San Pedro water shed. No water has been developed in the limestone or granite canyons except for the few springs which have been used in years past for surface water supply. These water sources are limited in their capacity and during the summer months have proven entirely inadequate.

The San Pedro Valley consists of a deposit of sedimentary erosion sand, decomposed granite boulders, and clays of various consistency, all of which are of a porous nature and permit the percolation of water.

This area extends from the Huachuca Mountains north to the Tombstone Hills and from Bisbee in the Mule Mountains west to St. David in the Whetstone Mountains.

Well Records and Logs

Well records indicate that the water level in the entire San Pedro Valley is at a hydraulic gradient equal to the flow line of water flowing through gravel to the San Pedro surface water level. The depth to water at each different well location is, in most cases, equal to the differences in elevation at the site of the well to the river channel less the hydraulic gradient necessary for the water to flow through the underground channel to the stream at its nearest point. The wells at Fort Huachuca verify this situation. (See logs attached)

WELL LOGS

Well No. 1

Date	Depth Drilled	Total Depth	Character of Ground
12/5/38	20'	20'	0'-8' Adobe, 8'-20' Boulder
6	22	42	20-27 Boulder, 27-42 Adobe and boulders
7	23	65	42-65 Adobe and boulders
8	19	84	65-84 Adobe and boulders
9	21	105	84-88 Adobe and boulders, 88-105 Sand Gravel & boulders
12	25	130	105-112 Sand Gravel & boulders, 112-130 Adobe with boulders
13	24	154	130-154 Adobe and boulders
14	19	173	154-170 Adobe and boulders, 170-173 Loose Boulders, Hard
15	18	191	173-191 Loose Boulders, Hard
16	17	208	191-208 Loose Boulders, Hard
19	19	227	208-227 Loose Boulders, Hard
20	21	248	227-248 Loose Boulders, Hard
21	24	272	248-272 Loose Boulders, Hard Adobe, Gravel boulders
22	26	298	272-298 Adobe, Sand, Gravel, and boulders mixed
23	19	317	298-317 Adobe, Sand, Gravel, and boulders mixed
26	18	335	317-319 ditto, 319-335 boulders, hard, and clay
27	20	355	335-355 Boulders, Hard, Clay
28	22	377	355-365 Boulders, Hard, Clay, 365-377 Adobe Gravel
29	21	398	377-398 Adobe with Gravel embedded
30	23	421	398-417 Adobe and Gravel, 417-421 Hard Sand and Gravel cemented
1/2/39	25	446	421-426 Hard Sand and Gravel cemented, 426-446 Adobe Sand
		460	Water raised to this level measured 2/4/39, 446-465 Adobe Sand and Gravel, 465-469 Hard Sand

Date	Depth Drilled	Total Depth	Character of Ground
1/3/39	26'	472'	469-470 Water Gravel and sand showing water at 470 470-472 Sand and gravel compacted
4	25	497	472-488 Compacted sand and gravel, 488-497 Loose gravel and sand - water showing strong at 488
5	25	522	497-522 Loose Gravel and sand
6	18	540	522-524 Loose gravel and sand, 524-540 Hard sand, gravel, boulders
9	25	565	540-545 Hard sand, gravel, boulders, 545-565 Loose sand and gravel
10			Reaming
11			Reaming
12	5	570	565-570 Loose sand and gravel
13	13	583	570-580 Loose sand and gravel, 580-588 Loose boulders
16	16	599	583-590 Loose boulders, 591-599 Loose Water sand and gravel
17	8	607	599-607 Loose water sand and gravel
18	13	620	607-615 Loose water sand and gravel, 615-620 Loose boulders sand and gravel
19	10	630	620-629 Hard Boulders, 629-630 Loose sand and boulders
20	10	640	630-640 Loose sand and boulders
23	15	655	640-645 Loose sand and boulders 645-655 Hard sand
24	19	674	655-674 Loose sand and boulders
25	6	380	674-680 Loose sand and gravel
26	12	692	680-692 Adobe
27	9	701	692-701 Apparent drilling in rock, Hard drilling

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Well No. 2

Depth Drilled	Total Depth	Character of Ground
40'	40'	Conglomerate medium hard
20	60	Clay and gravel
70	130	Sandstone and conglomerate medium hard
70	200	Conglomerate medium hard
70	270	Conglomerate with hard strata
25	295	Conglomerate medium
15	310	Conglomerate with soft strata
30	340	Conglomerate medium
30	370	Sand
40	410	Large Boulders
30	440	Sand and gravel
37	477	Water and conglomerate
45	520	Conglomerate with lots of water
30	550	Hard conglomerate
50	600	Sand conglomerate with water
30	630	Conglomerate Medium with hard strata
20	650	Gravel carrying water
40	690	Hard conglomerate
20	710	Rock

A History of the mines in this territory shows that all abandoned mines in the area have ceased operations because of inability to stand the cost of pumping underground water below the hydraulic gradient above mentioned.

Soil Characteristics

The character of the soil varies from a deposit of boulders cemented with clay and silt to a sandy clay soil. Tests on bearings of this soil indicate the four thousand bearing strength as a safe factor.

When the ground is dry, it is extremely hard and impervious to moisture. When the soil is once saturated, however, the strength greatly diminishes and is not considered satisfactory for roads without a suitable stabilizing material. Suitable decomposed stabilizing material is available at the reservation and is used for all road construction work.

Character of Sand and Gravel

Most of the arroyos on the Post carry large quantities of sand, which is suitable for concrete construction. The gravel in the creek bed is not used for this purpose, but crushed limestone is shipped in from a quarry located in the vicinity of Bisbee. This material is admirably suited for road construction and concrete work.

Location of Sand and Gravel Pits

The nearest crushed stone plant is at Paul's Quarry on the S.P. Railroad between Bisbee and Douglas. The cost of all grades of crushed limestone is ninety cents (90¢) a yard, f.o.b. quarry. The freight from Paul's Quarry siding to Fort Huachuca is \$1.48, making a total cost per yard delivered to the Post of \$2.38

Sand and gravel is procured from the local washes at a cost comparable with rock delivered from Paul's Quarry.

General Land Values

The land adjacent to Fort Huachuca is mostly held by large hold-

ings for grazing purposes and was originally purchased at grazing land values of approximately \$3.00 per acre. This land is held by several large interests and could most likely be valued at from \$5.00 to \$15.00 per acre.

Terrain

Natural drainage is established through years of erosion along definite channels which have formed arroyos cutting across the area in irregular patterns. These washes are not abrupt, but rather of a rolling character with enough width to allow for treatment of landscaping whereby roadways can follow these courses at comparatively easy grades.

The general "over-lot" grading is nominal and should not exceed cuts of over two feet at any point.

Clearing required is negligible since this is mesa land covered with stubble, dry grass, and scattered cactus plants.

There are no swamps or mosquito breeding areas near the vicinity of Fort Huachuca.

Flash floods along the creek bed are experienced during the summer rainy periods, but high land along the creek is available throughout the area. Because of the rapid slope of the ground, there is rapid run-off. High water stages seldom last over periods of more than a few hours.

The area is underlaid with depository material eroded from the mountain crevases. The high ground upon which the cantonment was started encountered cemented conglomerate with large nigger-heads interspersed throughout; this made trenching very expensive. The lower areas which are to be encroached by the extension are on deposits almost free of boulders.

Land has been leased during past years at one dollar per day for approximately seventeen landowners which takes in the whole area from the Fort to Tombstone. Added charges for water and wood privileges may run as high as \$5.00 to \$15.00 per day.

There are not any towns of any consequence within range of twenty miles of the Post. Hence, small liability of infringement of rights or objection to sewer or water encroachments by others.

Transportation

The Post is served by the Southern Pacific Railroad Company over a branch line known as the Lewis Springs Branch. This branch is a single line track serving the Post and Garden Canyon. It is approximately eleven miles long. Lewis Springs is on the main line of the Southern Pacific twenty-five miles west of Naco, Arizona.

State Highway 92 is a paved oil macadam road from Bisbee to Fort Huachuca. This road runs through the Fort proper to the junction point eleven miles north of the Post to Highway 62 which is a gravel road between Nogales and Tombstone. The section from Tombstone to the Fort is being prepared for oiling by the State Highway Department and will soon be completed. U. S. Highway 80 passes through Bisbee, Tombstone, and Tucson.

Labor

Local labor is available through labor union headquarters. This labor is not proficient in all the various trades and lack of skilled mechanics is evident in performance records of work accomplished.

No housing facilities were available for construction organizations, nor were good mechanics available in numbers sufficient to expedite the project except at normal schedules.

Housing facilities for construction organization did not exist prior to the start of the original cantonment project. A complete camp including administrative buildings, for both government officers, architect-engineer, and contractor overhead personnel, and mess hall for four hundred men and barracks for two hundred fifty men were built.

Use of nine barracks in the cantonment was made to house seven hundred fifty men; also four company storehouses and administration buildings and three mess halls care for men on the construction.

Lack of accommodations limited the number of men that could be employed. It also tended to divert the best craftsmen to more comfortable centers.

The scale of wages established for this area is the same as for the whole state of Arizona. (See schedule attached)

WAGES UNDER THE DAVIS-BACON ACT

Asbestos workers	\$1.25 hr.
Blacksmiths	1.20
Boilermakers	1.37 $\frac{1}{2}$
Bricklayers	1.50
Carpenters, journeymen	1.25
Cement finishers	1.25
Electricians	1.12 $\frac{1}{2}$
Helpers, 1st and 2nd years	.62 $\frac{1}{2}$
3rd and 4th years	.75
Elevator constructors	1.25
Helpers	.87 $\frac{1}{2}$
Firemen, portable boiler	.87 $\frac{1}{2}$
Form builders	1.12 $\frac{1}{2}$
Glaziers	1.00
Jackhammermen	.75
Laborers, unskilled	.75
Lathers, metal	1.25
Machinists	1.20
Helpers	.85
Marble setters	1.50
Helpers	.87 $\frac{1}{2}$
Mason tenders	.75
Mortar mixers	1.00
Operators of power equipment:	
Air compressors	1.00
Blade graders	1.25
Cranes or derricks	1.25
Distributors (bituminous surface)	.75
Finishing machines (cement concrete pavement)	1.12 $\frac{1}{2}$
Hoists	1.25
Mixers (10-S or smaller)	.75
Mixers (larger than 10-S)	1.25
Motor graders	1.00
Pumps	1.00
Rollers	1.25
Scrapers	.75
Shovels	1.50
Stone spreaders	1.75
Tractors, 20 HP or less	.65
" over 20 HP but less than 50 HP	.75
" 50 HP or more	1.25
Trenching machines	1.25

Painters	\$1.00 hr.
Pipe layers, concrete and clay	.75
Plasterers	1.50
" tenders	1.00
Plumbers	1.50
Reinforcing rodsetters	1.25
Roofers, composition: 1st hand	1.00
2nd hand	.87 $\frac{1}{2}$
slate and tile	1.00
Sheetmetal workers	1.12 $\frac{1}{2}$
Soft floor layers	1.25
Steamfitters	1.25
Stonemasons	1.25
Structural iron workers	1.37 $\frac{1}{2}$
" finishers	1.37 $\frac{1}{2}$
Terrazzo workers	1.25
Helpers	.87 $\frac{1}{2}$
Tile setters	1.50
Helpers	.87 $\frac{1}{2}$
Truck drivers, 1 $\frac{1}{2}$ tons or less	.68-5/4
over 1 $\frac{1}{2}$ tons but less than 7 cu. yds.	.75
7 cu. yd. but less than 13 cu. yd.	1.00
13 cu. yd.	1.00
13 cu. yd. or over	1.12 $\frac{1}{2}$
Well drillers	1.00
Helpers	.62 $\frac{1}{2}$
Welders	1.37 $\frac{1}{2}$

NOTE: Wages for all classes of labor have been increased from ten to twelve percent as of February 10, 1941.

PART II

DESCRIPTION OF COMPLETED PROJECT

SECTION I

Buildings

BUILDINGS

No.	Building Description	Type	Plan No.	Dimensions	Capacity
<u>TEMPORARY CONSTRUCTION</u>					
700-					
80	Barracks w/Lav.	Std.	1165	29-6x80-0	63 man
26	Mess	"	1127	25-4x93-2	170 man
27	Day Room	A-5	378	25-4x45-2	1 company
27	Storehouse & Co. Adm.	SA-2	376	25-4x51-2	1 company
5	Officers Qtrs w/o Mess	OQ-40	1257	29-6x130-0	40 officers
2	Officers Mess	Std.	1127	25-4x78-10	118 Offrs.
1	Adm. Bldg. (Regt.)	A-10	251	25-4x90-2	2 of 45 Cl.
1	Guard House (Regt.)	GH-2	260.1	25-4x66-2	24 prisoner
2	Infirmary	I-2	279	25-4x90-2	3000 man
1	Fire Station, Brig.	F-2	277	44-2x97-2	3V.18M
1	Tel. and Tel.	TT-1	350	25-4x78-2	25000 man
1	Post Officer	PO-1	298	25-4x87-2	5000 man
1	Post Exchange	E-3	297	99-0x37-0	3000 man
1	Recreation Bldg.	RB-1	510	99-0x37-0	Regt.
1	Theatre	TH-2	1211	37-0x99-0	364 man
1	Service Club	SC-3	1275	99-8x163-8	1 Division
1	Guest House	HH-1	1290	29-6x150-0	30 guests
1	Storehouse	SH-9	322	25-4x108-2	2740 sq.ft.
2	Warehouse--non-insul.	SH-13	324	60-6x153-2	9190 sq.ft.
1	Warehouse--insulated	SH-18	326	60-6x153-2	9190 sq.ft.
1	Motor Repair Shop	SP-2	514	84-0x37-0	4 stall
1	Gas Station	GOS-2	365	9-0x16-0	12,000 gal.
1	Laundry	LDY-3	1400	72-0x216-6	

TEMPORARY CONSTRUCTION * HOSPITAL
(190-Beds on a 250-Bed Plan)

1	Adm. Bldg.	A-1	430	25-4x147-2	
1	Nurses Qtrs.	HQ-24	1240	29-6x150-0	24 nurses
1	E.M. Mess	M-12	444	37-0x144-0	338 man
2	Wards, Std.	W-1	462	25-4x150-6	53 man
4	Wards, Comb. Std.	W-2	463	25-4x150-6	26 man
1	Infirmary	I-2	279	25-4x90-2	3000 man
1	Storehouse M. D.	SH-7	461	25-4x126-2	3196 sq.ft.
1	Dental Clinic	DC-2	472	25-4x111-2	
1	Officers Qtrs.	HQ-17	1252	29-6x140-0	17 officer

No.	Building Description	Type	Plan No.	Dimensions	Capacity
			700-		
2	Barracks w/Lav	HB-54	1204	29-6x150-0	54 man
1	Adm. Co.	A-5	396	25-4x45-2	208 man
1	Boiler House	HB-11	1515	36-0x47-0	
1	Barracks, Med. Detn.	HB-31	1203	29-6x90-0	31 man
1	Ward, Comb.	W-5	463	25-4x150-6	25 man
1	Storehouse	SH-5	460	25-4x126-2	3196 sq.ft.
1	Recreation Bldg.	A-5	378	25-4x45-2	1 company

TEMPORARY CONSTRUCTION

1	Mess Hall	Std.	1127	25-4x93-2	170 man
1	Adm. Bldg. (Regt)	A-10	251	25-4x90-2	2 of 45 Cl.
1	Boiler House (Laundry)	HB-11	1515	36-0x47-0	

PERMANENT CONSTRUCTION

6203-					
1	Finance Building	A-12	1100x	35-0x40-0	
1	Bakery	BAK-1	700-254	38-0x56-0	
1	Cold Storage	CS-1	1265	72-4x90-0	
1	Ice Plant	Std.	1315	72-4x120-0	40-ton

LIST OF BUILDINGS

The following tabulation sets forth by serial number, the type and the identification drawing numbers of the temporary and permanent buildings constructed under this project; the block number refers to the regimental area in which the building may be found;

TEMPORARY BUILDINGS

New Cantonment
Fort Huachuca, Arizona

Group 1

Serial No.	Block No.	Building Description	Type	Plan No.	System of Heating
				700-	
T-1	D	Administration	A-10	251	Gas
T-2	B	Administration	A-10	251	Gas
T-3	1	Str. Hse. & Co. Adm.	SA-2	376	Gas
T-4	1	Ditto	"	"	"
T-5	2	"	"	"	"
T-6	2	"	"	"	"
T-7	2	"	"	"	"
T-8	2	"	"	"	"
T-9	1	"	"	"	"
T-10	1	"	"	"	"
T-11	13	"	"	"	"
T-12	13	"	"	"	"
T-13	13	"	"	"	"
T-14	13	"	"	"	"
T-19	6	"	"	"	"
T-20			FUTURE		
T-21	7	"	"	"	"
T-22	7	"	"	"	"
T-23	7	"	"	"	"
T-24	7	"	"	"	"
T-25	6	"	"	"	"
T-26	6	"	"	"	"
T-27	9	"	"	"	"
T-28	9	"	"	"	"
T-29	8	"	"	"	"

Serial No.	Block No.	Building Description	Type	Plan No.	System of Heating
				700-	
T-30	8	Str. Hse. & Co. Adm.	SA-2	376	Gas
T-31	8	Ditto	"	"	"
T-32	8	"	"	"	"
T-33	9	"	"	"	"
T-34	9	"	"	"	"
T-35	5	Infirmery	I-2	279	"
T-36	12	Infirmery	I-2	279	"
T-37	5	Post Office	PO-1	299	"
T-38	10	Tel. & Tel.	TT-1	330	"
T-39	10	Fire Station	F-2	277	"
T-40	E	Guest House	HH-1	1290	"

(NOTE: Numbers T-15 to T-18, Inclusive, Reserved for Future
T-41 to T-299 ditto)

Hospital Group

T-300	16	Administration	A-1	430	Steam
T-301	16	Administration	A-5	396	Gas
T-302	16	Off. Qtrs. & Mess	HQM-17	1252	Steam
T-303	16	Nurses' Quarters	HQ-24	1240	"
T-304	16	Infirmery	I-2	279	"
T-305	16	Ward	W-2	463	"
T-306	16	"	W-1	462	"
T-307	16	"	W-1	462	"
T-308	16	"	W-5	463	"
T-309	16	"	W-2	"	"
T-310	16	"	"	"	"
T-311	16	"	"	"	"
T-312	16	Hospital Barracks	HB-31	1203	"
T-313	16	"	HB-50	1204	"
T-314	16	"	"	"	"
T-315	16	Dental Clinic	DC-2	472	"
T-316	16	Store House	SH-7	461	"
T-317	16	Store House	SH-5	460	"
T-318	16	Mess	M-12	444	"
T-319	16	Boiler House	HB-11	1515	"
T-320	16	Recreation	A-51	396	Gas

(NOTE: Numbers T-321 to T-492, Inclusive, Reserved for Future)

Group 3

Serial No.	Block No.	Building Description	Type	Plan No.	System of Heating
				700-	
T-493	D	Officers Mess	Std.	1127	Gas
T-494	D	" Quarters	OQ-40	1257	"
T-495	D	" "	"	"	"
T-496	B	" "	"	"	"
T-497	A	" Mess	Std.	1127	"
T-498	A	" Quarters	OQ-40	1257	"
T-499	A	" "	"	"	"
T-500	1	Barracks	Std.	1165	"
T-501	1	"	"	"	"
T-502	1	"	"	"	"
T-503	1	"	"	"	"
T-504	1	"	"	"	"
T-505	1	"	"	"	"
T-518	1	"	"	"	"
T-519	1	"	"	"	"
T-520	1	"	"	"	"
T-521	1	"	"	"	"
T-522	1	"	"	"	"
T-523	1	"	"	"	"
T-524	2	"	"	"	"
T-525	2	"	"	"	"
T-526	2	"	"	"	"
T-527	2	"	"	"	"
T-528	2	"	"	"	"
T-529	2	"	"	"	"
T-530	13	"	"	"	"
T-531	13	"	"	"	"
T-532	13	"	"	"	"
T-533	13	"	"	"	"
T-534	13	"	"	"	"
T-535	13	"	"	"	"
T-536	13	"	"	"	"
T-537	13	"	"	"	"
T-538	13	"	"	"	"
T-539	13	"	"	"	"
T-540	13	"	"	"	"
T-541	13	"	"	"	"
T-542	2	"	"	"	"
T-543	2	"	"	"	"
T-544	2	"	"	"	"

(NOTE: Numbers T-506 to T-517, Inclusive, Reserved for Future)

Serial No.	Block No.	Building Description	Type	Plan No.	System of Heating
T-545	2	Barracks	Std.	700-1165	Gas
T-546	2	"	"	"	"
T-547	2	"	"	"	"
T-548	6	"	"	"	"
T-549	6	"	"	"	"
T-550	6	"	"	"	"
T-551	6	"	"	"	"
T-552	6	"	"	"	"
T-553	6	"	"	"	"
T-554	9	"	"	"	"
T-555	9	"	"	"	"
T-556		FUTURE			
T-557	9	"	"	"	"
T-558	9	"	"	"	"
T-559	9	"	"	"	"
T-560	9	"	"	"	"
T-561	9	"	"	"	"
T-562	9	"	"	"	"
T-563	9	"	"	"	"
T-564	9	"	"	"	"
T-565	9	"	"	"	"
T-566	6	"	"	"	"
T-567	6	"	"	"	"
T-568	6	"	"	"	"
T-569		FUTURE			
T-570	6	"	"	"	"
T-571	6	"	"	"	"
T-572	7	"	"	"	"
T-573		FUTURE			
T-574	7	"	"	"	"
T-575	7	"	"	"	"
T-576	7	"	"	"	"
T-577	7	"	"	"	"
T-578	8	"	"	"	"
T-579	8	"	"	"	"
T-580		FUTURE			
T-581	8	"	"	"	"
T-582	8	"	"	"	"
T-583	8	"	"	"	"
T-584	8	"	"	"	"
T-585	8	"	"	"	"
T-586	8	"	"	"	"
T-587	8	"	"	"	"
T-588	8	"	"	"	"
T-589	8	"	"	"	"

Serial No.	Block No.	Building Description	Type	Plan No.	System of Heating
				700-	
T-590	7	Barracks	Std.	1165	Gas
T-591	7	"	"	"	"
T-592	7	"	"	"	"
T-593	7	"	"	"	"
T-594	7	"	"	"	"
T-595	7	"	"	"	"
T-596	7	Mess Hall	"	1127	"
T-597	7	"	"	"	"
T-598			FUTURE		
T-599	6	"	"	"	"
T-600	6	"	"	"	"
T-601	6	"	"	"	"
T-602	7	"	"	"	"
T-603	7	"	"	"	"
T-604	8	"	"	"	"
T-605	8	"	"	"	"
T-606	9	"	"	"	"
T-607	9	"	"	"	"
T-608	9	"	"	"	"
T-609	9	"	"	"	"
T-610	8	"	"	"	"
T-611	8	"	"	"	"
T-612	13	"	"	"	"
T-613	13	"	"	"	"
T-614	13	"	"	"	"
T-615	13	"	"	"	"
T-616	2	"	"	"	"
T-617	2	"	"	"	"
T-618	1	"	"	"	"
T-619	1	"	"	"	"
T-620	1	"	"	"	"
T-621	1	"	"	"	"
T-622	2	"	"	"	"
T-623	2	"	"	"	"

(NOTE: Numbers T-624 to T-1399, Inclusive, Reserved for Future)

Group 4

T-1400	10	Post Exchange	E-3	297	Gas
T-1401	10	Recreation Bldg.	RB-1	310	"
T-1402	10	Theatre	TH-2	1211	"

Serial No.	Block No.	Building Description	Type	Plan No.	System of Heating
				700-	
T-1403	10	Guard House	GH-2	260.1	Gas
T-1404	10	Service Club	SC-3	1275	Steam
T-1405	1	Rec.	A-5	378	Gas
T-1406	1	"	"	"	"
T-1407	2	"	"	"	"
T-1408	2	"	"	"	"
T-1409	2	"	"	"	"
T-1410	2	"	"	"	"
T-1411	1	"	"	"	"
T-1412	1	"	"	"	"
T-1415	13	"	"	"	"
T-1416	13	"	"	"	"
T-1417	13	"	"	"	"
T-1418	13	"	"	"	"
T-1421	6	"	"	"	"
T-1423	7	"	"	"	"
T-1424	7	"	"	"	"
T-1425	7	"	"	"	"
T-1426	7	"	"	"	"
T-1427	6	"	"	"	"
T-1428	6	"	"	"	"
T-1429	9	"	"	"	"
T-1430	9	"	"	"	"
T-1431	8	"	"	"	"
T-1432	8	"	"	"	"
T-1433	8	"	"	"	"
T-1434	8	"	"	"	"
T-1435	9	"	"	"	"
T-1436	9	"	"	"	"

(NOTE: Numbers T-1413 & T-1414 Reserved for Future
T-1419 & T-1420 ditto
T-1422 ditto
T-1457 to T-1699, Inclusive, Reserved for Future)

Group 5

T-1700		Laundry	LDY-3	1400	Steam
T-1701		Boiler House	HB-11	1515	"
T-1702		Motor Repair	SP-2	314	Gas
T-1703		Gas Station	GOS-2	365	"
T-1704	11	Warehouse	SH-13	324	" (Office only)

Serial No.	Block No.	Building Description	Type	Plan No.	System of Heating
				700-	
T-1705	4	Warehouse	SH-18	326	Gas
T-1706	4	"	SH-13	324	" (Office only)
T-1707	4	"	SH-9	322	None
T-1708	11	Gas Tanks			"
T-1709	10	Gas Pump Station		6203-611	"

PERMANENT BUILDINGS

174		Ice Plant		1315	None
175		Cold Storage		1265	"
248 (249)		Water Tank			"
250		Sewer Sedimentation Tank		6203-633	
				-634-635	"
251		Sewer Pump House		6203-641	
				-642	"
252		Sewer Chemical House		-640	"
254		Sewer Cont. House & Digester		-638-636	
				-637	"
255		Water Booster Pump Hse.		-649	"
256		Water Well House		-646	"
258		Water Chemical House		-647	"
259		Water Res. Booster Pump		-648	"
33		Finance Building		2 Dwgs.	Gas
23		Bakery	BAK-1	254	"

Item	Type	Plan No.	Capacity	Housed*
<u>5 Officers' Quarters</u>	OQ-40	700-1257	200	
25th Infantry (Colored)				74
368th Infantry (Colored)				110
<u>Non-Commissioned Officers' Quarters</u>	---	none	---	
<u>80 Barracks</u>	Std.	1165	5040	
25th Infantry (Colored)				1599
368th Infantry (Colored)				2660
<u>1 Hospital Unit</u>		190-bed unit on a 250-bed plan		
Enlisted men				131
Officers				41
<u>Stables</u>	---	none	---	
<u>Garages, Wagon Sheds and Gun Sheds</u>	---	none	---	
<u>Storehouses and Storage Sheds</u>				
1 Warehouse (Lined)	SH-5	460	3196 sq. ft.	
1 Storehouse M. D.	SH-7	461	3196 sq. ft.	
1 Storehouse	SH-9	322	2740 sq. ft.	
2 Warehouses- Non-insul.	SH-13	324	9190 sq. ft.	
1 Warehouse - Insulated	SH-18	326	9190 sq. ft.	
<u>Power and Pumping Plants:</u>				
3 Enterprise Type GSQ-8 convertible gas-Diesel engines, complete with all accessories and Butane standby storage				700 KW each
1 Wintroath Deep Well Turbine, 22 stage, 8" suction, 12" discharge				700 GPM at 520 ft.
1 United Iron Works, 6" MS-C, Booster Pump, 2 stage, 8" suction, 6" discharge				700 GPM at 270 ft.
1 United Iron Works, 4" MS-C, Booster Pump, 4 stage, 6" suction, 4" discharge				700 GPM at 715 ft. 1070 GPM at 270 ft.

Item	Type	Plan No.	Capacity	Housed*
<u>Tanks and Reservoirs:</u>				
1	Elevated Storage Tank			
	200' NW Int. E Ave. & N R.R. Ave.			
	59' diameter x 25' deep			
	Circular Steel		500,000 gal.	
	Ground Storage Reservoir			
	Near Well #2 West of Bisbee Gate			
	20'5" x 33'6" x 10'0"			
	Reinforced Concrete		50,000 gal.	

* As of May 1, 1941

SECTION 2

Utilities

WATER SUPPLY SYSTEM
Fort Huachuca, Arizona

GRAVITY SUPPLY

The original army post in the Huachuca Mountains was established in March, 1877, in the most westerly canyon on the north side of the range. The intent was to locate at the entrance to Center Canyon, which was the largest of all the north water courses; however, as this was not done, the Post was perpetuated as originally settled. The location was dedicated as an Army Post in October, 1881.

Ample water was available in the early days for the small garrison maintained at the Post and on May 23, 1884, the Reservation was defined with boundary lines along the top of the range of the Huachuca Mountains and out on to the mesa land to the north for a distance of approximately seven miles, an area of something like seventy square miles.

For a period of twenty-five years the supply from Huachuca Creek in Post Canyon was sufficient for the needs of the encampment. In 1911, a diversion works and seven mile pipe line was constructed up to the higher elevations in Center Canyon, which now bears the name of Garden Canyon, though shown on the U.S.G.S. maps as Tanner's Canyon. The headworks was built at springs originating at an elevation of about six thousand feet above sea level from which the water was diverted to a box at the mouth of McClure Canyon. An eight inch steel line was constructed to the Post leading to a 200,000 gallon masonry storage reservoir and a small round tank (20' diameter x 10' deep).

In 1926, the water demand had increased to approximately 300,000 gallons per day and the summer flows during the drought years dropped to somewhere in the neighborhood of seventy thousand gallons per day.

WELL SUPPLY

Water investigations were gotten under way and considerable sums were spent in prospecting for water. Many test holes were sunk in Garden Canyon, as well as Post Canyon, to depths up to one thousand feet without success. A small amount of water was found in one eight-inch well in Garden Canyon; this was dug in 1912 and a pump was installed there. Only seventy gallons per minute could be procured from this well, and then for only short periods of time.

In 1936, the water problem again became acute and a new location was investigated. A deep well (6" casing) was sunk near the east boundary of the reservation at the Bisbee gate. At a depth of five hundred feet a water bearing sand was encountered which was able to supply a good, potable water in quantities beyond the capacity of any test pump that could be inserted in the well and without any appreciable drawdown. A plunger type pump was installed in this well in September, 1938.

This new well field was further developed in March, 1940, by sinking a fourteen inch casing to a depth of 718 feet. At the same level an unlimited water supply was encountered and tests showed a seven hundred gallon per minute delivery with a forty-three foot drawdown, which immediately came back to the original level upon the cessation of pumping. A five hundred gallon per minute pump was placed in this well; it delivered water to a concrete surface "clear-well" from which the water was boosted to the Post reservoir through a new ten inch steel high pressure main approximately twenty thousand feet in length to a second new concrete 250,000 gallon reservoir constructed in connection with this development. The elevation of the well field is about 4630 feet above sea level, while the storage reservoir at the Post is at elevation 5270. The pumping head at the booster pumps is approximately 320 pounds per square inch.

In 1940, further development was carried on and December 10, 1940, the second fourteen inch well was tested. This well was dug to a depth of 711 feet. The normal water level stood at 467 feet below the surface of the ground.

The following test data indicate an unlimited water supply at the depth shown:

WELL NUMBER TWO

Fort Huachuca, Arizona

Test - December 10, 1940

Test No.	Delivery (Gallons per Minute)	Draw Down (Feet)
1	500	23
2	600	28
3	700	34
4	800	40
5	896	46
6	937	46

NOTE: 1. No draw down value created any change in the static water level in Well No. 1 (500 feet distant).
2. Water level recovery to static level in nine minutes after test completed.

The present fourteen inch wells can each deliver from nine hundred to twelve hundred gallons per minute. Five hundred and seven hundred gallon per minute deep well, electric driven, pumping units were installed on each well, respectively.

GROUND STORAGE

A second concrete "clear-well" and booster pump house were constructed in March, 1941, to deliver water to the temporary cantonment area. The clear-wells each have fifty thousand gallon storage capacity and are inter-connected with piping and control valves so that either deep well pump can deliver to whichever reservoir is desired.

CHLORINATION

A concrete chlorination house was installed in which was placed Wallace-Tiernan chlorination units arranged to protect both supplies from this common center. Chlorine is fed directly into the suction header to the booster pumps through definite hand control.

A chlorination unit was also installed at the reservoir site on the Post to treat the gravity supply to the reservoir so that all water for domestic consumption could be properly treated.

BOOSTER PUMPS

The new booster pump house is similar in every detail to the one previously constructed except for the addition of a second booster pumping unit. This electrically driven horizontal pumping unit is suitable for standby to either of the other booster pumps in that its characteristics are seven hundred gallons per minute at 715 feet total dynamic head and 1080 gallons per minute at 270 feet total dynamic head.

METERS

Suitable water meters were installed at the booster pumping station to record the delivery of the booster pumps into either of the transmission mains to the Post proper or to the Cantonment area.

A meter was also installed to measure the gravity water supply so that complete records could be maintained at all times.

ELEVATED TANK

The first booster pump for well No. 2 is capable of discharging seven hundred gallons per minute through a twelve inch cast iron line (Class 150) approximately 9,450 feet to the base of the elevated storage tank, located at elevation 4800, which serves the temporary cantonment area.

This elevated tank is steel and has a capacity of five hundred thousand gallons with the water range between 4887 and 4862. The tank is fifty-nine feet in diameter.

The tank is painted in accordance with Army regulations 95-15, Section XI, dated April 21, 1930, covering MARKING OF OBSTRUCTIONS TO FLYING, and has the required marking lights for night illumination.

CROSS CONNECTION

An eight inch cross connection through a pressure reducing valve - suitably connected - allows gravity water to be fed into the Cantonment distribution system when such water is available, or for emergency conditions.

DISTRIBUTION SYSTEM, CANTONMENT

In October, 1940, a plan was prepared by the Office of the Quartermaster General, Construction Division, (marked Preliminary) setting forth the diagrammatic plan and profile of the water distribution system for a new cantonment area at Fort Huachuca. This plat covered, in general, the same camp layout as was finally built.

The entire distribution system, as layed out above, called for twelve inch, Class C, cast iron mains. This was brought to the attention of the department before actual construction was started and suggestions made that a twelve inch loop with ten inch cross ties and eight inch block mains would be adequate; however, telephonic instructions were received to make no mains less than twelve inch in order to insure adequate fire flows. Hence, twelve inch mains were installed throughout the cantonment area.

Original instructions also stated that all distribution mains shall be cast iron. Just prior to calling for bids a new addenda to the water main specifications was received which directed that competitive prices must be received on cast iron and transite pipe for both transmission and distribution systems. (This was confirmed by telephonic conversation). The basis of award was to be made on the following:

1. Price
2. Delivery
3. Salvage

Transite quoted, giving the lowest price and immediate delivery with salvage equal to cast iron, and hence, the order was placed for this material for the water distribution system. Cast iron pipe in the quantity desired could not be promised within three to five months delivery, which was beyond the date of completion for the cantonment proper.

Gate valves were installed at points indicated on the map of the distribution system (See Dwg. 6203-652) which allowed the segregation of the system for testing, maintenance, and operation.

Fire hydrants were installed as shown on the above map. The hydrants were located so as to permit the servicing of any building in a block with two sources of fire protection when using two hundred fifty feet of fire hose from two hydrants. The hydrants have a three foot bury and are of the non-freezing pattern. Each hydrant has two two-and-a-half inch hose connections and a steamer nozzle.

On January 22, 1941, instructions were received to reduce the size of the mains to eight inch and six inch size and to cut out approximately eleven hydrants; however, the materials were already on the ground as outlined above, and were installed as per the original plans.

SERVICES

All services are of galvanized threaded pipe of sizes called for on the drawings for various types of buildings.

STATISTICS

Additions to water system:

Elevated Storage Reservoir

200 feet NW Intersection of E Avenue & North R.R. Avenue
59' diameter by 25' water depth
Circular steel
500,000 gallon capacity

Ground Storage Reservoir

Near Well #2, West of Bisbee Gate
20'3" x 33'6" x 10'0"
Reinforced Concrete
50,000 gallon capacity

Well No. 2

Size, 14"
Depth, 701 feet
Static Water Level, 463 feet
Capacity, 900 GPM with 46 feet drawdown

No. 2 Turbine Pump

Wintroath Deep Well Turbine
22 stage
8" suction
12" discharge
Capacity, 700 GPM at 520 feet
Direct connected to one 125 HP, G.E., 60 cycle, 3 phase, 2300 V,
1180 RPM, Type KF, motor, model #12F2488; complete with one
125 HP, Square D Motor Starter, 3 phase, 60 cycle, 2300 V,
Type Spec. Cat. #8754

No. 2 Booster Pump

United Iron Works, 6" MS-C

2 stage

8" suction

6" discharge

Capacity, 700 GPM at 270 feet

Direct connected by flexible coupling to one 75 HP, U S Auto Start, 60 cycle, 3 phase, 2300 V, motor, serial #234161; complete with one 75 HP, Square D Motor Starter, 3 phase, 50-60 cycle, 2300 V, Type KHR1X - Cat. #8759

No. 3 Booster Pump

United Iron Works, 4" MS-C

4 stage

6" suction

4" discharge

Capacity, 700 GPM at 715 feet, guaranteed, and/or 1070 GPM at 270'

Connected by flexible coupling to one 200 HP, U S Auto Start, 60 cycle, 3 phase, 2300 V, motor, serial #234160; complete with one 200 HP, Square D Motor Starter, 3 phase, 50-60 cycle, 2300 V, Type KHR2X - Cat. #8759

One G.E. Circuit Breaker and Trip Coil, Type HC-2, Operating Levers #S158080G3, and Switch Board with Push Button Control for two Booster and One Deep Well Turbine Pump

Meters - Booster Pump House

Sparling, 12" main line, flanged tube, meter, #6469, with indicating, recording, and totalizing receiver, metering flow from Booster Pump No. 2

Sparling, 10" main line, flanged tube, meter, #5496, with indicating, recording, and totalizing receiver, metering flow from Booster Pump No. 3

Sparling, 8" main line, flanged tube, meter, #8485, with totalizing receiver, metering flow to Post Area

Water Treatment

Well Supply

- 2 Type MSVE, Wallace & Tiernan, Manual Visible Vacuum Chlorinators, solution feed, serial #K51 and #K52
- 1 Fairbanks platform scales - 500 pound capacity

Spring Supply

- 1 Type MSVE, Wallace & Tiernan, Manual Visible Vacuum Chlorinator, Solution Feed, Serial #K0176
- 1 Type BR, Westco Pump, connected by flexible coupling to a 3/4 HP Century Motor, single phase, 220 volt, 60 cycle, Serial #T8

Transmission Lines

9450 feet or 1.79 miles 12" C.I. mains
One 12" flanged O.S. & Y. valve

Distribution System (including Hospital Area)

Pipe

12" mains, transite	22405 feet - 4.243 miles
8"	2368 .448
4"	768 .145
12" mains, cast iron	225 .043

Valves

41	12" - Hub End - A.W.W.A.
6	8"
71	6"
1	4"
41	Valve Manholes
78	C. I. Valve Boxes

Fire Hydrants

71 John C. Kupferle, No. 75, 5" V.O. with one (1) 4 1/2" nozzle and two (2) 2 1/2" nozzles

PERMANENT CONSTRUCTION
Fort Huachuca - Arizona

Permanent Construction - Post and Cantonment

Film: CC-204

Date: May 1, 1941



Sub-Contract

Water Tank

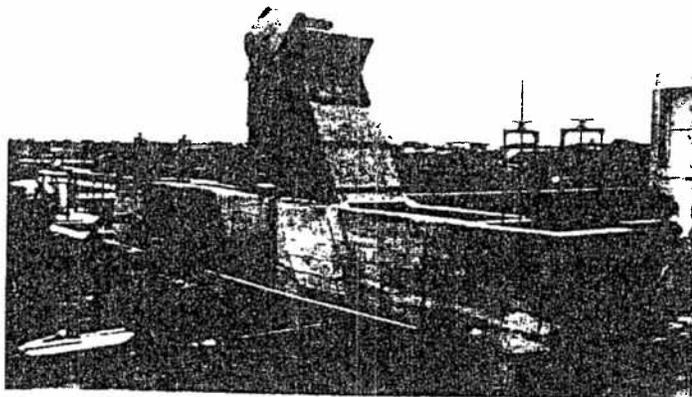
Allison Steel Manufacturing Co.

PERMANENT CONSTRUCTION
Fort Huachuca - Arizona

Permanent Construction - Sewage Plant

Film: CC-220

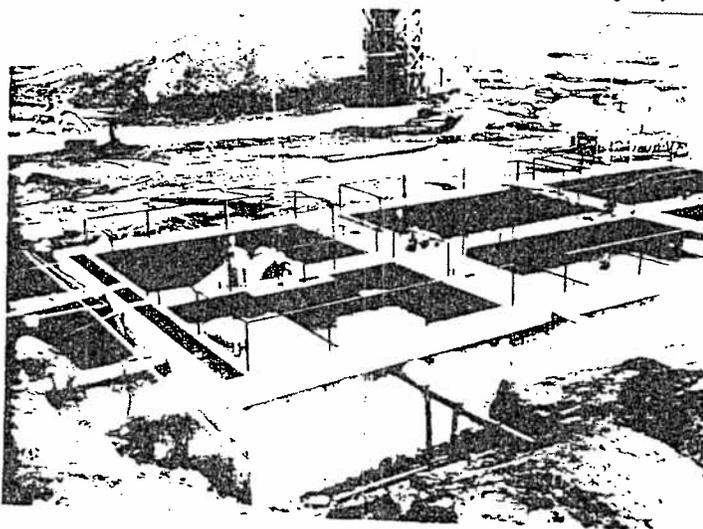
Date: May 1, 1941



Parshall Flume, Screen and Grit Chamber

Film: CC-221

Date: May 1, 1941



Sedimentation Tank

62 63 634 636

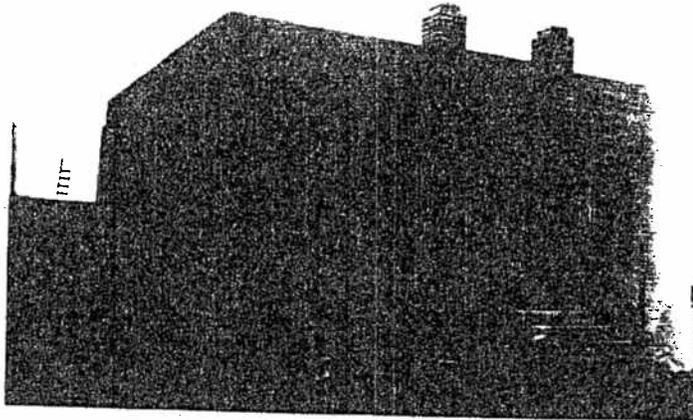
~~CANTONMENT CONSTRUCTION~~

Fort Huachuca - Arizona

Permanent Construction - Sewage Plant

Film: CC-222

Date: May 1, 1941



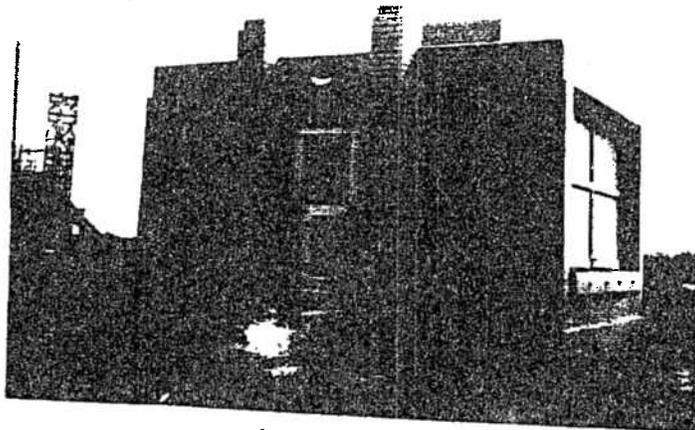
Pump House

Type: ---

Plan Nos.: 6203-641,642

Film: CC-223

Date: May 1, 1941



Chemical House

Type: ---

Plan No.: 6204-643

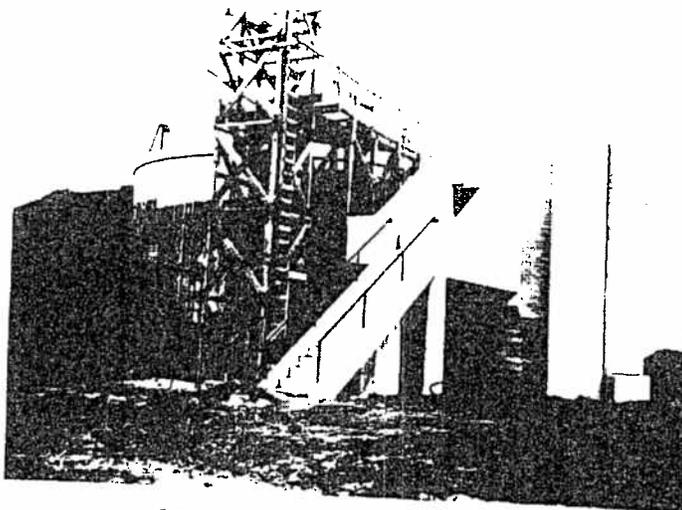
CANTONMENT CONSTRUCTION

Fort Huachuca - Arizona

Permanent Construction - Sewage Plant

Film: CC-224

Date: May 1, 1941

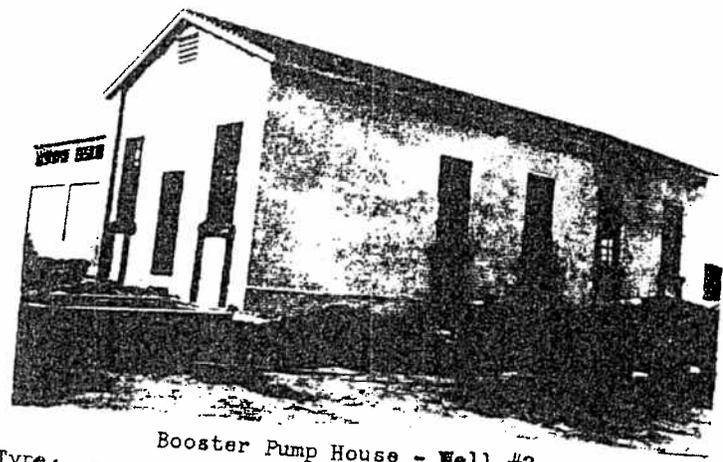


Type: --- Digester and Control House
Plan Nos.: 6203-636,638

~~CANTONMENT CONSTRUCTION~~
Fort Huachuca - Arizona
Permanent Construction - Pumping Plant

Film: CC-240

Date: May 1, 1941

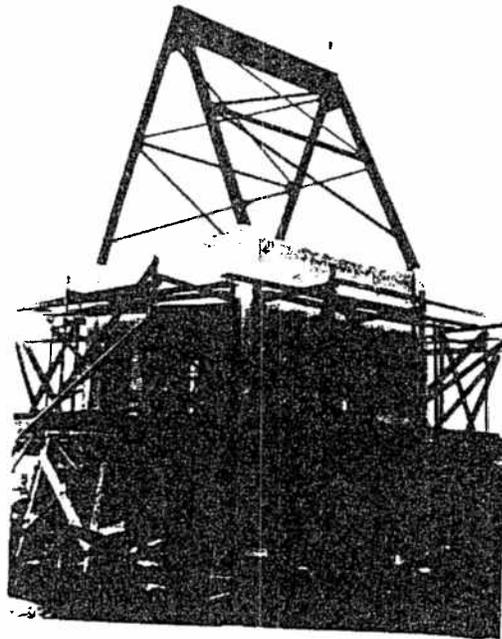


Type: ---
Booster Pump House - Well #2
Plan No.: 6203-649

CANTONMENT CONSTRUCTION
Fort Huachuca - Arizona
Permanent Construction - Pumping Plant

Film: CC-241

Date: May 1, 1941



Type: ---

Well House - Well #2

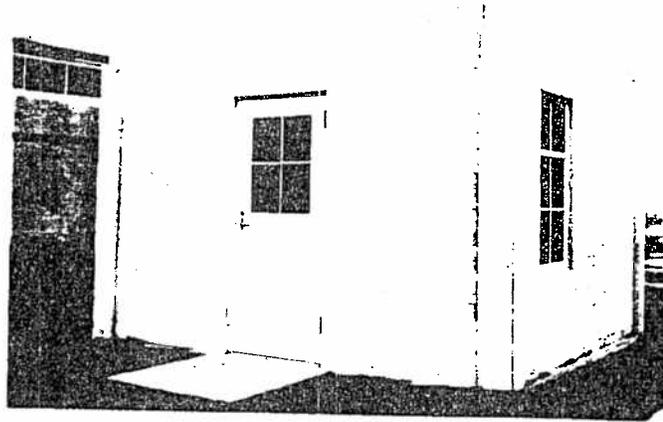
Plan No.: 6203-646

ENVIRONMENT CONSTRUCTION
Fort Huachuca - Arizona

Permanent Construction - Pumping Plant

Film: CC-242

Date: May 1, 1941



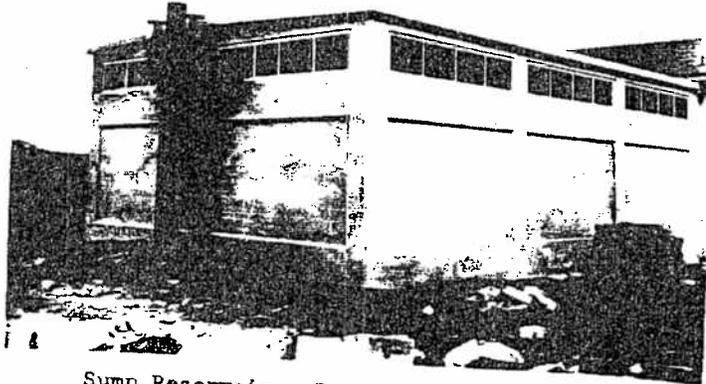
Chemical House - Well #2

Type: ---

Plan No.: 6203-647

Film: CC-243

Date: May 1, 1941



Sump Reservoir - Booster Pump, Well #2

Type: ---

Plan No.: 6203-648

WATER MAIN

SUMMARY

Item	Amount
Transmission	7,105
Distribution - Cantonment	214,289
Distribution - Hospital Area	33,945
TOTAL	<u>255,339</u>

WATER SYSTEM

Item	Unit	Quantity	Unit Cost	Amount
<u>Supply and Transmission</u>				
*Cast Iron Pipe, 12"	lin.ft.	950	3.30	3135
Valve - 12" O.S. & Y., F&D, 125#	ea.	1	226.34	226
Meter at Post	"	1	430.00	430
Lead	cwt.	6.50	17.90	116
Oakum	lb.	13325	.24	3198
			TOTAL	<u>7105</u>

* 8500 feet of 12" C.I. was put in by the CQM

WATER SYSTEM

Item	Unit	Quantity	Unit Cost	Amount
<u>Distribution System - Cantonment</u>				
Transite Pipe, 12"	lin.ft.	19717	7.53	148469
Transite Pipe, 8"	"	1842	5.33	9818
Cast Iron Pipe, 12"	"	225	6.12	1377
Cast Iron Fittings:				
12"x12" Cross	ea.	23	94.31	2169
12" - 1/8 Bend	"	5	44.14	221
12" - 1/16 Bend	"	8	44.14	353
12" - 1/32 Bend	"	1	41.68	42
12" Plugs	"	21	8.73	183
12"x12" Tees	"	3	76.32	229
12" x 8" Tees	"	1	72.18	72
12" x 8" Cross	"	1	63.26	63
12" - 1/4 Bend	"	1	46.66	47
Valves - 12", H.E., AWWA, 150# WWP"	"	33	226.34	7469
Valves - 8", H.E., AWWA, 150# WWP"	"	4	88.61	354
Valve Manhole	"	33	141.64	4674
Valve Boxes - C.I.	"	4	10.39	42
Fire Hydrants	"	63	349.15	21996
Fire Hydrant Protectors - 4 post	"	53	50.73	2689
Fire Hydrant Protectors - 2 post	"	10	19.85	199
Oakum	lb.	120	.24	29
Lead	cwt.	26	17.90	465
8" Cross Connection - Post and Cantonment	ea.	1	2523.50	2324
			SUB-TOTAL	203484
<u>Distribution Services - Cantonment</u>				
3"	ea.	1	205.32	205
2"	"	86	88.39	7602
1 1/2"	"	2	83.78	168
1 1/4"	"	64	42.36	2711
3/4"	"	6	19.82	119
			TOTAL	<u>214289</u>

WATER SYSTEM

Item	Unit	Quantity	Unit Cost	Amount
<u>Distribution System - Hospital</u>				
Transite Pipe, 12"	lin.ft.	2688	7.53	20241
Transite Pipe, 8"	"	526	5.33	2804
Transite Pipe, 4"	"	768	3.91	3003
C.I. Fittings, 12"x12" Cross	ea.	1	94.31	94
Valves, 12" - H.E., AWWA, 150# WWP	"	8	226.34	1811
Valves, 8" - H.E., AWWA, 150# WWP	"	2	88.61	177
Valves, 4" - H.E., AWWA, 150# WWP	"	1	34.27	34
Valve Manhole	"	8	141.64	1133
Valve Boxes, C.I.	"	3	10.39	31
Fire Hydrants	"	8	349.15	2793
Lead	cwt.	1.68	17.90	30
Oakum	lb.	8	.24	2
			SUB-TOTAL	32153
<u>Distribution Services - Hospital</u>				
2 $\frac{1}{2}$ "	ea.	5	128.02	640
2"	"	9	88.39	796
1 $\frac{1}{2}$ "	"	3	83.78	251
1 $\frac{1}{4}$ "	"	2	42.36	85
3/4"	"	1	19.82	20
			TOTAL	33945

WATER SYSTEM

Item	Unit	Quantity	Unit Cost	Amount
<u>Elevated Steel Storage Tank</u>				
Capacity: 500,000 gallons				
Height to bottom: 50'				
Tank erected, including concrete foundations and painting	lot	1	37647.00	37647
Connecting piping and fittings	ft.	50	2.00	100
Valves, 12"	ea.	1	125.00	125
Concrete Valve Box	lot	1	150.00	150
Protective Lighting	"	1	175.00	175
			TOTAL	<u>38197</u>