RETAIN FILES

FEATURE HISTORY

E L C A P I T A N D A M

VOLUME II

ROCK EMBANKMENT

4/28/33
copy /f

November 4, 1932

H. W. Rohl & T. E. Connolly
Contractor El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

Subject: San Diego River Project, El Capitan Feature. Rock embankment, excess of fine material.

Gentlemen:

The California State Engineer's representative, Gerald McKinlay, Senior Engineer of Dam Inspection when, on November 2, 1932, inspecting the placement by the contractor of rock embankment, under Paragraph 65, Contract Drawings and Specifications for the City's El Capitan Reservoir Dam, Spillway and Outlet Works,

> "....This rock fill shall be the most durable rock available in the opinion of the engineer..."

advised that unless the excess of fines being deposited in the structure by the contractor was discontinued it would be necessary for the State to issue positive instructions therefor.

Resident Engineer Harold Wood has been directed to secure compliance with the Senior Inspector's requirements in the matter of excluding excess of fines and undurable rock from the embankment.

Very truly yours,

H. N. Savage,
Hydraulic Engineer.

HNS/f
cc Contractor - El Capitan Dam
cc State Engineer
cc Resident Engineer

4/28/33
copy /f

November 12, 1932

M. W. Rohl and T. E. Connolly
Contractor, El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

Subject: San Diego River Project, El Capitan Feature. Exposed surface of rock embankment.

Gentlemen:

It is provided in Paragraph 65 of the contract specifications for the City of San Diego's San Diego River Project, El Capitan Reservoir Dam, Spillway and Outlet Works in part as follows:

"The exposed surface of rock embankment shall consist of sound, hard, durable rock, carefully selected, faced, hand-placed, bedded and chinked and shall present a neat uniform appearance, all satisfactory to the engineer."

Enclosed is print of City of San Diego's drawing WD-441 on which is indicated the requirements for placing exposed surface of rock embankment on the upstream face of the dam. The surface of the rock embankment above the top of the core wall shall be considered as exposed, and

On the downstream side of the dam the entire surface of the rock embankment both below and above the toe wall shall be considered as exposed.

Very truly yours,

H. N. Savage
Hydraulic Engineer

HNS/f
Encl. WD-441 edited to 11/14/32
cc H.W.Rohl & T.E.Connolly, El Capitan Dam
cc Contractor's Resident Representative
cc City's Resident Engineer

5/15/33
copy /f

March 21, 1933

Messrs. H. W. Rohl and T. E. Connolly
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

Subject: San Diego River Project, El Capitan Feature, rock embankment, placing rock surface.

Gentlemen:

Neither the Contractor's chronic policy in hauling from his quarry and dumping earthy material and decomposed granite as a part of the rock embankment instead of exclusively the most durable rock available; nor

The Contractor's present policy and method of improperly placing rock surface on the exposed earth and disintegrated surface of the upstream slope of the upstream rock embankment at El Capitan dam is in accordance with the requirements of paragraph 65 of the contract specifications, and therefore, neither is satisfactory to the Engineer.

The earthy material and decomposed rock should be prominently eliminated from the surface of the dumped rock embankment either by its complete removal or by sufficient wetting and jet washing to move it all down into the interstices of the rock embankment.

Either method necessarily and properly being at the sole cost of the Contractor, who has presumed to haul and dump earthy and decomposed granite material from the quarry with the rock embankment material contrary to the requirement of paragraph 65 of the contract specifications.

The rock surfacing is not being properly bedded and placed. The Contractor's policy and method of merely spraying a small quantity of water from a road sprinkling truck over the earth and decomposed rock covered surface slope of the rock embankment on which faces rock is to be bedded, obviously fails to remove or properly wet and wash down into the interstices the objectionable surface of earthy and decomposed granite.

The rock surfacing is not being properly faced, hand-placed and chinked.

Very truly yours,

H. N. Savage
Hydraulic Engineer

HNS/p
cc H.W.Rohl & T.E.Connolly
El Capitan Dam
Contractor's Resident Representative
City's Resident Engineer

4/27/33
copy /f

March 22, 1933

Messrs. H. W. Rohl & T. E. Connolly
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

Subject: San Diego River Project, El Capitan Feature, rock embankment, placing rock surface.

Gentlemen:

The Contractor's policy and method of placing rock surfacing on the upstream slope of the upstream rock embankment of El Capitan dam is not in accordance with the requirements of paragraph 65 of the contract specifications, and is not satisfactory.

Before placing rock surfacing on the outside faces of rock embankments, the earthy material and decomposed rock now covering a large portion of the top of the rock embankments and of the area to be surfaced, should be prominently eliminated either by removal or by sufficient wetting and jet washing to move it all down into the interstices of the rock embankment, and at the cost of the Contractor.

The rock surfacing should be properly faced, hand-placed and chinked.

Very truly yours,

H. N. Savage,
Hydraulic Engineer.

HNS/p
cc H.W.Rohl & T.E.Connolly
El Capitan Dam
Contractor's Resident Representative
City's Resident Engineer

4/29/33
copy /f

April 21, 1933

Messrs. H. W. Rohl & T. E. Connolly S 4
4351 Alhambra Avenue
Los Angeles, California

Subject: San Diego River Project,
El Capitan Feature
Rock Embankment, foundation

Gentlemen:

No rock for embankment at El Capitan Dam shall be dumped or placed upon stripped foundation or on top of other rock embankment until such stripped foundation or rock embankment is approved by the Engineer.

Very truly yours,

H. N. Savage,
Hydraulic Engineer.

HNS/p

cc H.W.Rohl & T.E.Connolly
El Capitan Dam
Contractor's Resident Representative
City Manager
City Attorney
City's Resident Engineer

2/1/34
copy /f

July 8, 1933

Messrs. H. W. Rohl & T. E. Connolly S-22
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

Subject: San Diego River Project,
El Capitan Feature, rock embankment
Height of lifts

Gentlemen:

In building the next rock embankment lifts above the present tops of the rock embankments elevation about 650 of El Capitan reservoir dam, you are directed to limit their heights so that their tops will not be above elevation 662.

The above limitations are prescribed in order to maintain the effective width of the rock embankments at the top of the lifts and thus not materially decrease the safety of the structure.

Very truly yours,

H. N. Savage,
Hydraulic Engineer.

HNS/p

4/13/34
copy /f

March 29, 1934

Messrs. H. W. Rohl & T. E. Connolly
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California

S-101

Subject: San Diego River Project,
El Capitan Feature, rock
embankment, completion below
downstream toe wall

Gentlemen:

You are hereby directed and required to complete the rock embankment below the downstream toe wall of the El Capitan reservoir dam on or before April 25, 1934.

Very truly yours,

H. N. Savage
Hydraulic Engineer.

HNS/p

4-30-34
copy/p

H. W. ROHL & T. E. CONNOLLY

Contractors

April 17, 1934

Mr. H. N. Savage,
Hydraulic Engineer,
San Diego,
Cal.

Dear Sir:

The construction and design of the El Capitan dam is such that three drainage tunnels now drain to the downstream toe of the dam and to a sump there provided for by the Contractor and in which he has installed a suction from a 20" pump which is driven by a 400 H.P. motor, obviously heavy equipment. The operation of reclaiming this drainage water has been going on for a year past.

Some considerable period back the Contractor dumped the necessary rock for the toe of this dam in place and hand placed as much of it as was reasonably possible without the blasting operations necessary in this final hand placing, endangering his plant and operation.

Since your letter S-101, you have placed grade stakes over this area. In all except a few instances or sections they disclose more than siffucient fullness of material. Where any deficiency occurred additional rock is being dumped. More than sufficient rock will be deposited than the section of the dam calls for but a portion of the surface will not be hand faced by April 25, 1934 nor thereafter until such time as we are able to move our plant and have no need for the water we are catching there unless you choose to pay us for and guarantee to us in writing the equivalent amount of water we will loose. Of course your letter S-101 is in anticipation of the spillway contractor utilizing the area in question as a dump. We will neither allow nor permit the utilization of our sump, as a dump, until and unless you will guarantee to us the equivalent amount of the water we will loose by so doing.

Yours truly,

H.W.Rohl & T.E.Connolly

T E Connolly (Signed)

8/2/34
copy/f

April 24, 1934

Messrs. H. W. Rohl & T. E. Connolly S-105
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

Subject: San Diego River Project, El Capitan Feature, rock embankment, completion below downstream toe wall

Gentlemen:

Receipt is acknowledged of your letter dated April 17, 1934 in reference to the completion of the rock embankment below the downstream toe wall of the El Capitan Dam.

I am pleased to note your compliance with the request for completing the rock embankment below the downstream toe wall.

It will be agreeable for you to maintain your large pump with necessary sump in its present location below the downstream toe wall.

Very truly yours,

H. N. Savage,
Hydraulic Engineer.

FDP/p

9/20/34
copy /f

September 14, 1934

Messrs. H. W. Rohl & T. E. Connolly S-126
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

Subject: San Diego River Project, El Capitan
Feature, Rock Embankment

Gentlemen:

You are hereby directed not to construct rolled embankment above elevation 743 until the upstream and downstream rock embankments of the El Capitan Reservoir Dam have been brought up to elevation 733, and thereafter the top of the completed rock embankment shall not be more than 10 feet below the top of the rolled embankment.

Very truly yours,

Fred D. Pyle
Hydraulic Engineer.

FDP/f

ESTIMATED CUBIC YARDS OF ROCK
TO ROCK EMBANKMENT

SUMMARY

Year Month	Quarry	Structure Excavation: Bypass Tunnel	Hydraul-ic Fill	Rock Embankment	Outlet Tower	Spill-way	Core Wall	Total
1932								
August	5617							5617
September	53335	100						53435
October	84724	5127						89851
November	110334	6757						117091
December	94810	111						94921
1933								
January	63016	83	3490	5153				71742
February	67462		559			1563		69584
March	25006		113			5069		30188
April	14469		554	142		2347		17512
May	7114		430	39		132		7715
June	80975		255	79	8	4166		85483
July	63535					6088		69623
August	41025					7280		48305
September	31970	118	175	415		5781		38459
October	30270					7641		37911
November	3760		69			409		4238
December						800		800
1934								
January						69		69
February								0
March								0
April	8825					919		9744
May	1820					87		1907
June						5		5
July	11980					409		12389
August	16350					1240		17590
September	33300					1230		34530
October	29200					296		29496
November	5830					20		5850
							762 x	762
Totals	884727	12296	5645	5828	8	45551	762	954817

From core wall January 1993 to November 1934

ESTIMATED CUBIC YARDS RODK
From Rock Quarry to
Rock Embankment

Date 1932	August	September	October	November	December
1		1071	3040	5307	4506
2		1312		4237	4820
3		1310	2788	3727	4720
4			2593	4861	
5			1543	5124	4441
6		1224	1438		4506
7		1953	2420	4861	3943
8		2048	2819	5135	4930
9		1396		5108	
10		1016		4478	
11			3045	4368	
12		1854	3827	4163	
13		1840	3570	5246	
14		1700	3901		
15		1507	3533	4426	
16		1890		3276	4846
17		2315	3286	3701	5008
18			3622	4053	4998
19		2683	3985	4347	4552
20		3045	3617		4966
21		2887	4129	3738	3423
22		2876	3728	4378	4137
23		2845		4568	2620
24	268	3008	4258		4221
25	235	3244	4231	4563	
26	478		3990	4358	4080
27	767	2719	3817		4200
28	306	2688	3727	4641	4410
29	682	2494	3922	4546	3770
30	1365	2410		3124	4080
31	1518		3885		3633
	5617	53335	84724	110334	94810

Rain December 9 - 15 inclusive

ESTIMATED CUBIC YARDS ROCK
From Rock Quarry to
Rock Embankment

Date 1933	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.
1				1927				885	495		530
2	4620	4867	598					420	575	540	555
3	4483	4788	593	2110		3370	1165	345		475	580
4	4961	5008		2362				395		470	555
5	4683	5481		2132		2715	1130	485	545	540	
6	4268	4840	556	2043		3840	1010		510	555	335
7	4714	4483	562	1302		3950	1125	530	510	490	350
8	4603	4541		2247		4470	1140	410			405
9		5008	566			3435	1140	520		560	450
10	4982	4883	425	346		4080	1725	525		2720	
11	4829	4810	520				3675	510		2780	
12	4860	4841				4335	3730	480		3130	
13	1675					3910	3810			2620	
14	5292	3502	598			4400	3915	3375		2445	
15		3596			430	4170	4620	3690	2120		
16		2961			504	4170		3880	2195	2550	
17		1228	394			4640	5425	3690	2765	2785	
18		950			567		4310	3850		2475	
19	2410				940	4665	4480	3405	2720	765	
20			530		562	4560	3180		2900	430	
21			2885			4070	2890	3665	3285	385	
22			2037		772	3795	2660	3500	3145		
23			2189		1055	3525			2315	430	
24			2200		509	2995	2190	2705		405	
25			2100		562		2045	1200	2790	490	
26					667	2180	2270	565	2680	575	
27	3512		1906		546	965	1255	520	635	525	
28			1123			1050	1695	490	610	580	
29			2163			915	2025	420	540		
30			1927			770			635	550	
31			1134				925	565			
	63016	67462	25006	14469	7114	80975	63535	41025	31970	30270	3760

Rained during January 15 to 18 inclusive and from January 20 to 27 inclusive.

ESTIMATED CUBIC YARDS ROCK
From Rock Quarry to
Rock Embankment

Date	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.
1934											
1					505			665	840	1010	640
2								890		1270	1315
3								930		1255	1210
4					385			770	800	530	
5					275				970	735	1145
6								740	1020	840	405
7								700	1145		575
8					290			920	1045	640	415
9								825		1075	125
10					365			460	1490	960	
11				465				475	1550	720	
12				430			435		1085	810	
13				1130			790	955	1295	1200	
14				875			935	740	1160		
15								885	1135	1170	
16				365			505	885		1240	
17				995			885	920	1645	95	
18				875			880	425	1800	1280	
19				1000			150		1795	1780	
20				865			130	305	1805	1555	
21				835			395	615	1715	1495	
22								350	1640	1755	
23				825			805	615		1305	
24				165			1165	550	1770	875	
25							915		1615	650	
26							1005		1805	745	
27							650		1805	1065	
28							785		1260		
29								270	1110	910	
30							815	775		920	
31							735	595		1215	
				8825	1820		11980	16350	33300	29200	5830

No rock hauled from quarry during January, February, March or June.

ROLLED FILL

3-7-35
copy/p

July 31, 1933

From : Hydraulic Fill Engineer

To : Hydraulic Engineer

Subject : San Diego River Project, El Capitan Dam Feature
Top portion of dam, method of construction

Of the 18 hydraulic fill dams which I mentioned in a statement to you on May 24, 1933, I only recall 2 dams that any great amount of topping out was done by the rolled fill method. Terrace and Clear Creek dams were changed from hydraulic fill to rolled fill in about the upper thirds. About 15 feet of the San Pablo, and Upper San Leandro dams was placed as rolled fill.

In changing from hydraulic to rolled fill the depth of water in summit pool was reduced as much as possible without sand stratification. After a few days to allow for consolidation of the puddle material, the excess water was drained off. Dry filling would commence as near the margin of the puddle section as possible, gradually encroaching and bridging over the soft puddle section. When the dry fill became sufficiently firm to sustain the equipment the customary method of spreading, scarifying and rolling was proceeded with as called for in the specifications.

As to the success attending the change from hydraulic fill to rolled fill, the Terrace dam is the only one that any trouble from leakage was encountered. About 10 years ago an article in the Engineering News, described this trouble.

It is my best judgment that a successful union can be effected between the hydraulic fill and rolled earth fill at El Capitan dam providing care is used in selecting the material for the union. The proper material will be determined in the laboratory, that showing the least permeability being used.

D. W. Albert

3-7-35
copy/p

July 24, 1933

From : Resident Engineer

To : Hydraulic Engineer

Subject : San Diego River Project, El Capitan Feature
Building dam above elevation 700

1. On May 4, 1933 a letter was addressed to the Hydraulic Engineer from the Resident Engineer, subject "El Capitan Feature, hydraulic fill between elevations 625 and 700."

2. The contractor has placed about 830,000 cubic yards of hydraulic fill to July 10, 1933, building the fill to about elevation 634. During June the contractor placed about 160,000 cubic yards. Assuming the contractor places hydraulic fill at the rate of 123,000 cubic yards per month from July 1 to December 1, 1933, he then will be up to the anticipated progress schedule prepared by Wood and Albert and in letter to Hydraulic Engineer dated March 5, 1933. If this progress is maintained then the dam will be built to elevation 700 by December 1, 1933.

3. It is deemed by Harold Wood and D. W. Albert to be impractical to continue the semi-hydraulic fill construction methods above elevation 700 because of insufficient beach widths to enable proper sorting of the fines.

4. The contractor could place the 300,000 cubic yards required above elevation 700 by hydraulic methods with the four pumping units he now has, which are capable of placing 37,000 cubic yards per month of 25 days. This would require eight months or from December 1, 1933 to July 31, 1934 to complete the dam to its crest.

To July 10, 1933, about 220,000 cubic yards of spillway excavation material had been placed in the dam below elevation 634. This is 26 per cent of the total hydraulic fill. 17,000 cubic yards of rock were excavated from the spillway along with the 220,000 cubic yards of decomposed granite or 7.7 per cent of rock. It is estimated the total spillway excavation will amount to 743,000 cubic yards. If 7.7 per cent of this, or 57,000 cubic yards is rock, then there remains about 40,000 cubic yards of rock. We have remaining 466,000 cubic yards of decomposed granite.

5. Assuming we can use 26 per cent of silt in the remaining 890,000 cubic yards of hydraulic fill between elevations 634 and 765, then about 231,000 cubic yards of decomposed granite could be placed in the dam, leaving 235,000 cubic yards to be wasted.

6. If the dam above elevation 700 were built by the rolled embankment method with clay 52 feet wide at elevation 700, and 26 feet wide at elevation 765, then 69 per cent of the rolled fill portion of the dam, or 207,000 cubic yards, would be decomposed granite. 153,000 cubic yards might be used in the hydraulic fill from elevation 634 to 700 making a total of 460,000 cubic yards and leaving 6000 cubic yards to waste.

7. Putting this on a cost basis, the hydraulic fill above elevation 700 would cost as follows:

Excavation from spillway 78,000 cubic yards at $0.40 per cubic yard	$ 31,200
Excavation from borrow pit 222,000 cubic yards at $0.40 per cubic yard	88,800
Excavation from spillway wasted 235,000 cubic yards at $0.25 per cubic yard	58,800
Total	$178,800

The rolled embankment above elevation 700 would cost as follows:

Excavation from spillway, 207,000 cubic yards at $0.35 per cubic yard	$ 72,500
Excavation from borrow pit, 93,000 cubic yards at $0.35 per cubic yard	32,500
Excavation from spillway wasted 6,000 cubic yards at $0.25	1,500
Total	$106,500
Difference in favor of rolled embankment	$ 72,300

8. It is recommended that the portion of the dam above elevation 700 be built by the rolled embankment method.

9. Even if the State Engineer would permit no material from spillway excavation in the rolled embankment, the cost would be less than by hydraulic fill method.

Harold Wood
Resident Engineer

D. W. Albert
Hydraulic Fill Engineer

HW/p

3-4-35
copy/p

July 23, 1934

M E M O R A N D U M

Subject: San Diego River Project, El Capitan Feature
Conference July 21, 1934

Met City's Consulting Engineer Louis C. Hill and Assistant Deputy State Engineer W. H. Holmes at the Embassy Hotel, San Diego at 7:30 A.M. July 21, 1934.

Mr. Holmes stayed in San Diego to attend to other business for a few hours and Mr. Hill and I proceeded to Resident Engineer's office at El Capitan Dam where a conference was held with Resident Engineer Harold Wood for about an hour. Mr. Hill was furnished copy of a brief memorandum by Mr. Wood showing progress made on the dam since March 19, 1934, the date of Mr. Hill's last visit to the work. Among other things the memorandum indicated that since the resumption of work on the hydraulic fill June 19, 1934, 17,300 cubic yards of Lakeside borrow pit material and 115,800 cubic yards of local borrow pit material had been placed, making a total of 133,100 cubic yards, and there remains to be placed about 248,000 cubic yards.

We next proceeded to the top of the spillway at El Capitan Dam where we were later joined by Hydraulic Fill Engineer D. W. Albert, Contractor's Consulting Engineer J. B. Lippincott and Contractor T. E. Connolly.

The work was proceeding in a reasonable manner with full hydraulic operation on both beaches. The flow of the material alternating as the pipe lines were extended. Material was being placed on the upstream beach vicinity of N 3300 and on the downstream beach vicinity of N 3600. The hogbox and pumps were being crowded somewhat with the red clayey material and some disintegrated granite from borrow pit area "B". This crowding resulted in occasional clogging of the pipe lines.

Mr. Albert and Mr. Hill were down on the upstream beach for several hours; while Messrs. Lippincott, Connolly, Wood and myself discussed the situation from the spillway level.

Mr. Lippincott was surprised at the percentage of solids carried by the water since the resumption of operations. Based on data furnished by Mr. Connolly as to yardage placed and amount of water used, he found that the water was carrying about 17 per cent solids. It is possible that proper consideration had not been given to the amount of Lakeside material placed direct in the summit pool and the amount of material placed by semi-hydraulicking from the upstream beach which would materially lower the percentage of solids in the full hydraulic operations.

Mr. Lippincott and I then examined the borrow pits vicinity borrow pit area "B". Mr. Lippincott expressed considerable concern over the small amount of borrow pit material remaining and of the safety factors of the dam against sliding. He urged that consideration be given to changing from hydraulic fill to rolled fill

at the earliest practicable moment. He showed me a sketch which had been prepared for Mr. Connolly some months ago on which was indicated a change at elevation about 700 to rolled borrow pit material on the upstream side of the dam and rolled disintegrated granite on the downstream side, with the puddle core crowded up in the middle a matter of 20 feet, more or less, above the base of the rolled fill and then from that elevation up the rolled fill extended across the puddle core section with the rolled borrow pit material for the upstream portion of the dam and rolled disintegraded granite for the downstream portion.

Owing to lack of time, I was not able to show Mr. Lippincott borrow pit area "K" or the area vicinity of the olive orchard, although they were called to his attention. It was also called to his attention that there was a considerable amount of material in borrow pit area "C" which had hardly been touched.

Returned to contractor's camp for lunch where we were joined by Mr. Holmes and City Attorney C. L. Byers, who had arrived separately.

After lunch examined borrow pit areas with Mr. Hill and Mr. Albert. Mr. Albert contended that there were only about 125,000 cubic yards of material suitable for the upbuilding of the puddle core and beaches remaining in the local borrow pits. Mr. Hill asked Mr. Albert as to other sources of borrow pit material and he stated that there was a considerable yardage of suitable material across the river and northwest of El Monte Park, from which the haul would be somewhat greater than from the other local borrow pits. Mr. Albert had previously advised Mr. Hill that continuation of construction of the dam with material from local borrow pits was hazardous but that with the addition of sufficient Lakeside material it might be constructed to about elevation 740 or higher by hydraulic methods. Mr. Albert, however, was in favor of changing to rolled fill as soon as possible, partially in order to conserve the best of the local borrow pit materials for the construction of the rolled upstream portion of the dam. Mr. Albert also pointed out the economies due to rolled fill being 35 cents per cubic yard and hydraulic fill 40 cents per cubic yard.

When we returned to the dam we were met on the spillway by City Manager F.M.Lockwood and Assistant City Attorney Gilmore Tillman.

Mr. Albert, Mr. Hill and Mr. Holmes made soundings in the summit pool and Mr. Wood and I discussed the situation.

About 2:30 P.M. the group, consisting of Resident Engineer Wood, Hydraulic Fill Engineer Albert, Consulting Engineer Hill, Assistant Deputy State Engineer Holmes, City Manager Lockwood, City Attorney Byers, Assistant City Attorney Tillman, Contractor's Consulting Engineer Lippincott, Contractor Connolly and Hydraulic Engineer Pyle met in conference at the guest house at the Resident Engineer's camp. There was no disagreement about changing from hydraulic fill to rolled fill except that Mr. Lippincott, Mr. Connolly and Mr. Albert were in favor of making the change at the

earliest practical date and I was not in favor of changing until the hydraulic fill had been carried up to the highest practical level, about elevation 740 or 750.

Mr. Hill discussed methods of changing from the hydraulic fill to the rolled fill, but without in any way committing himself to the elevation at which it might be desirable to make the change, indicating the change should be delayed as long as possible.

Mr. Hill thought it was very desirable that the puddle core be carried up as a continuous flexible core through the rolled fill which he suggested might be done by cutting through the rolled fill each time after the placing of about 6 or 8 feet of rolled fill to the soft material of the puddle core previously placed and refilling the trench with Lakeside material well compacted with water. This thin core to be only 4 or 5 feet thick and to extend to the top of the puddle core as shown on the drawings.

It was pointed out by me that where impervious rolled fill rested on porous beach material there would be practically no settlement but water could penetrate easily under the rolled fill to the impervious puddle core section; that the water content of the impervious puddle core was variable with considerable water in the upper portions; that as the core consolidated this water would disappear and the impervious puddle core section would settle, leaving cracks in or near the contact between the puddle core and the rolled fill which would be detrimental to the safety of the dam.

It was also my expressed belief that the impervious puddle core section should be carried to the elevation shown on the drawings even if it became necessary to build the upstream and downstream portions of the dam of borrow pit material containing large percentage of disintegrated granite, as the integrity of the dam depended on the construction of an impervious puddle core section to the proper height rather than on a combination of puddle core and rolled fill.

In constructing a narrow core of Lakeside material, as suggested by Mr. Hill, considerable difficulty might be expected and there would be a new class of work to be done which is not covered by schedule items and would affect the economics of the construction.

It was deemed advisable to secure definite field survey estimates as to the quantity of the various grades of borrow pit material remaining in the local pits and to have samples of the material tested to ascertain its suitability for making an impervious rolled fill.

The capacity of the mud pump was discussed and Mr. Albert advised that, owing to the nature of the work, the discharge would probably be automatically reduced, which would be reflected by a decrease in the yardage handled each day.

Mr. Connolly and Mr. Lippincott urged that plans be submitted to the State at once for making the change to which neither Mr. Hill nor I agreed.

Memorandum - 7/23/34

Mr. Hill advised that he was going to Kansas City for about ten days and thought it would be well to take the matter up again after his return and after the amount and suitability of local and other borrow pit materials had been definitely determined.

Mr. Hill returned to Los Angeles with Mr. Holmes.

Fred D. Pyle
Hydraulic Engineer

FDP/f

3-4-35
copy/p

QUINTON, CODE AND HILL - LEEDS AND BARNARD
Engineers Consolidated
Los Angeles, California

July 22nd 1934

Dear Mr. Pyle:

Talked to Holmes on the way here, and had talked a little with Hawley or rather he had to me. The State is going to favor using the hydraulic fill method as long as you reasonably can before changing and I agree with the State.

Continue to use material from the present borrow pits using a larger proportion of coarse material (disintegrated granite) so that the 200,000± yards in the beaches can be obtained from these pits or some others and get the remainder of the fines for the core from Lakeside and place in the core as you did when you brought the core up. The beaches are permeable anyway, if they are a little more so no matter. Keep the pool up all the time, that is the puddle core, not the water only.

Keep the fill up by bringing in Lakeside material daily so that no chance may exist for a run of sand.

In other words get your core material from Lakeside and your beach material from the borrow pits or elsewhere if suitable, but keep the core material up from Lakeside and do not let the depth below the water surface get at any time low enough to bring in any risk of sand runs. Carry it too high rather then too low.

Mr. Albert can do it safely. Have him shut down the work if the impervious core gets too low until Lakeside is brought in and the correct safe level obtained.

Get all the data possible ready so when I come again we can study it. If Mr. Albert holds the job along safe lines and Lakeside material is brought in as he requires - not as the contractor wants - we can safely postpone any change to rolled fill for some time and not delay the contractor. Cut down the width of the core as rapidly as is safe.

You can reach me c/o U. S. Engineers Office, Kansas City.

Yours

L. C. Hill

Write the office when to come again and send copy to K.C. also send copy of this letter to 712 Standard Oil Bldg.

8/6/34
copy/f

July 31, 1934

Messrs. H. W. Rohl & T. E. Connolly
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

S-119

Subject: San Diego River Project, El Capitan Feature, Modification of Top Portion of Dam.

Gentlemen:

Receipt is acknolwedged of your letters dated April 17, 1934 and July 27, 1934 relative to the construction of the El Capitan Reservoir Dam above elevation 700 and requesting information as to modifications from the contract drawings.

Enclosed herewith is print of drawing WD-501, showing certain modifications in dimensions and slopes of the upper portion of the El Capitan Dam and a reduction in the thickness of the impervious puddle core above elevation 700, as approved by the State Engineer on July 10, 1934, and as approved by the City Council July 30, 1934 by Resolution No. 61938, copy enclosed.

You are directed to construct the El Capitan Dam above elevation 700 in accordance with drawing WD-501, as approved by the State Engineer and by the City Council.

Very truly yours,

Fred D. Pyle
Hydraulic Engineer

FDP/f
Encls. (2)
Drawing WD-501
Resolution 61938

8/31/34
copy /f

H. W. ROHL & T. E. CONNOLLY
CONTRACTORS

August 10, 1934

Mr.F.D.Pyle,Hydraulic Engineer,
San Diego,
Cal.

Dear Sir:

For the best interests of all concerned, including the El Capitan Dam structure itself, wherein hazards are daily becoming more acute, and to expedite the speedy change from hydraulic to rolled fill and special core, as we discussed today, the contractors agree as follows:

We will waive any charges for the acquisition of plant or equipment to construct the rolled fill or for salvaging or scrapping our present hydraulic equipment or set up.

We will import Lakeside material and blade it into the core, where it shall be wetted, for 75¢ per cubic yard; measurement to be made in the borrow pit. For such select material, obtained from local borrow pit which you propose to mix and blade into the core with this Lakeside material in about 50-50 proportions, and there wetted, we are to receive the price of 40¢ per cubic yard. For normal rolled fill, as set forth in the contract, the contract price shall govern.

Payment for Lakeside material shall become effective and commence upon the change from the full hydraulic method. We waive none of our rights or claims nor do we set up this price of 75¢ for imported material which has been hauled and placed in the past.

In making this change, we believe we have certain proper rights or claims, but we are waiving them as above solely in the nature of a compromise and to the end that a speedy change to a more desirable type of construction shall be made immediately. Time is the essence of this waiver and undue delay will cause its withdrawal.

We trust that you will press this matter to the utmost with the State and effect an immediate change.

Yours very truly,

H.W.Rohl & T.E.Connolly

T. E. CONNOLLY (Signature)

8/30/34
copy /f

August 15, 1934

TO THE HONORABLE, THE MAYOR AND COUNCIL

OF THE CITY OF SAN DIEGO, CALIFORNIA.

Subject: San Diego River Project, El Capitan Feature, Hydraulic Fill, Construction Methods, Changes.

Gentlemen:

The construction of the hydraulic fill portion of the El Capitan Reservoir Dam reached a point on August 13, 1934 where the integrity of the impervious puddle core section of the dam could not be maintained if hydraulic operations were continued, and the hydraulic placing of material has been discontinued. The water surface of the summit pool was then at elevation about 718, the average elevation of the beaches about 720, and the average depth of the pool as indicated by a six pound weight about 5 feet.

The progress of the work, results accomplished and difficulties encountered during the past month have been observed twice by the City's Consulting Engineer Louis C. Hill, once by Contractor's Consulting Engineer J. B. Lippincott, once each by Deputy State Engineer in Charge of Dams Geo. W. Hawley and State's Consulting Engineer Fred C. Herrmann, and three times by Assistant Deputy State Engineer W. H. Holmes. The City's Hydraulic Fill Engineer D. W. Albert has been on the work practically night and day.

It was deemed essential in order to maintain the safety of the structure to make a change in the method of construction of the hydraulic fill portion of the dam.

The change contemplates the continuation of construction by the placing of rolled embankment on both the upstream and downstream sides of the dam. Between these embankments a central impervious puddle core of select materials will be deposited in water and carried well up above the spillway level, thereby insuring the integrity and characteristics of the impervious puddle core section throughout the entire height of the dam.

The upstream rolled embankment will be constructed of local borrow pit material containing about 30 per cent of fines passing 200 mesh screen. The downstream rolled embankment will be constructed of disintegrated granite containing sufficient fines to pack. The methods and prices for constructing rolled fill are set forth in the contract specifications.

In constructing the puddle core, materials containing about 30 per cent of fines from the local borrow pits will be deposited on the rolled embankments adjacent to the summit pool. The material will be broken down by use of sheep foot tampers and sufficient Lakeside material added to increase the percentage of fines to more than 50 per cent and then the combined materials will be bladed into the summit pool, the surface of which will be kept relatively high and the depth shallow.

The above change was indicated on a drawing submitted to the State Engineer with letter dated August 13, 1934 and was approved by him August 14, 1934.

Contractor H. W. Rohl & T. E. Connolly has expressed a willingness to proceed with the work on a basis which will make practically no change in cost to the City of the embankment portion of the dam remaining to be completed.

Very respectfully,

Fred D. Pyle
Hydraulic Engineer.

FDP/f

8/31/34
copy /f

August 24, 1934

TO THE HONORABLE, THE MAYOR AND COUNCIL

OF THE CITY OF SAN DIEGO, CALIFORNIA

Subject: San Diego River Project, El Capitan Feature, Hydraulic Fill, Construction Methods, Changes.

Gentlemen:

In letter of August 15, 1934, subject, "San Diego River Project, El Capitan Feature, Hydraulic Fill, Construction Methods, Changes" your attention was called to certain change in methods of construction of the hydraulic fill portion of the El Capitan Reservoir Dam in order to maintain the safety of the structure as recommended by Hydraulic Fill Engineer D. W. Albert, City's Consulting Engineer Louis C. Hill and the Hydraulic Engineer, and to the approval of the change by the State Engineer on August 14, 1934.

The change contemplates the continuation of construction by the placing of rolled embankment on both the upstream and downstream sides of the dam. Between these embankments a central impervious puddle core of select materials will be deposited in water and carried well up above the spillway level, thereby insuring the integrity and characteristics of the impervious puddle core section throughout the height of the dam, all as indicated on Drawing WD-511, print attached.

Under the terms of the contract, placing of rolled fill is provided for by Schedule Item 6 at 35¢ per cubic yard and the placing of hydraulic fill is provided for by Schedule Item 5 at 40¢ per cubic yard.

The change contemplated, that is, the construction of the impervious puddle core separately placed between two rolled fills without hydraulic washing and in accordance with details shown on Drawing WD-511 is a change which will increase the cost of the work to the Contractor.

Paragraph 13 of the contract specifications provides:

> "If such changes result in an increase or decrease of cost to the contractor, the Engineer will make such additions or deductions on account thereof as he may deem reasonable or proper, and such action thereon, subject to approval by the Common Council, will be final."

The type of work and method of placement will require some additional select material containing a high percentage of fines which would not otherwise have been required.

The total increase cost to the Contractor for securing such additional amount of fine material is fairly represented by an increase of 35¢ per cubic yard over the contract price for Schedule Item 5.

Enclosed is copy of letter dated August 10, 1934 from H. W. Rohl and T. E. Connolly, signed by T. E. Connolly, stating among other things, that the Contractor would be agreeable to accepting such an increase in payment and would waive any further claim for securing and placing of such select material.

The Contractor also agreed to waive any charges for the acquisition of plant or equipment made necessary by the change of hydraulic methods to rolled fill.

The total cost to the City under the plan submitted, including the construction of the impervious puddle core section, would be about the same as if the full hydraulic method of placement were used throughout the remainder of the construction.

RECOMMENDATION: It is recommended that official approval of the change of construction as indicated on Drawing WD-511 be given; and the Hydraulic Engineer be authorized to issue a change order pursuant to Paragraph 13 of the contract specifications; and the Hydraulic Engineer be authorized and directed to include in each monthly progress estimate a sum equal to 75¢ per cubic yard for all approved selected material delivered by the Contractor from his Lakeside borrow pits and placed during each calendar month after August 13, 1934 in the impervious puddle core between the rolled embankments in accordance with the instructions of the Hydraulic Engineer.

Very respectfully,

Fred D. Pyle,
Hydraulic Engineer.

FDP/f
Encls.
Drawing WD-511
Letter from Contractor 8-10-34

8/30/34
copy /f

August 29, 1934

Messrs. H. W. Rohl & T. E. Connolly
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

S-122

Subject: San Diego River Project, El Capitan Feature, Change Order No. 2. Hydraulic Fill Construction Methods, Changes.

Gentlemen:

In accordance with Paragraph 13 of the contract specifications for El Capitan Reservoir Dam, Spillway and Outlet Works, you are hereby directed to proceed with the construction of the El Capitan Dam in accordance with the contract specifications therefor as changed or modified by Drawing WD-511, print attached.

Enclosed herewith is copy of communication dated August 24, 1934 subject, "San Diego River Project, El Capitan Feature, Hydraulic Fill, Construction Methods, Changes" addressed to the Mayor and Council of the City of San Diego.

Also enclosed is certified copy of Resolution No.62005 of the Council of the City of San Diego adopted August 27, 1934 approving change in design and method of placing material indicated on Drawing WD-511 and approving the Hydraulic Engineer's estimate of the increased cost to the Contractor in connection with the cost of certain portions of the work.

In the construction of the impervious puddle core between the rolled embankments, you are hereby informed that the work is subject to and must be performed to the satisfaction of the Hydraulic Engineer. Methods used in placing material in the puddle core shall be such as in the opinion of the Engineer will produce a proper impervious puddle core and any method which may be required in order to produce a satisfactory core in the opinion of the Engineer shall be accomplished by the Contractor at his expense and without endangering any portion of the structure.

It is understood that all approved select material from Lakeside borrow pits placed during each calendar month from August 13, 1934 in the central impervious puddle core between the rolled embankments in compliance with the requirements of the Hydraulic Engineer will be paid for at the total rate of 75-cents per cubic yard, measurement to be made in the borrow pit, 40-cents per cubic yard to be paid under Schedule Item 5 plus 35-cents per cubic yard under Change Order No. 2.

For all select material which is obtained from local borrow pits and properly placed in said impervious puddle core, payment will be made under Schedule Item 5 at the rate of 40-cents per cubic yard.

It is requested that you acknowledge receipt of this communication and confirm the understandings herein expressed as well as the contents of your communication of August 10, 1934 addressed to the Hydraulic Engineer.

Very truly yours,

Fred D. Pyle
Hydraulic Engineer.

FDP/f
Encls.
Print Drawing WD-511
Letter to Council 8-24-34
Resolution No. 62005

12/7/34
copy /f

H. W. Rohl & T. E. Connolly
Contractors

September, 21, 1934.

Mr. Fred D. Pyle,
Hydraulic Engineer
524 F St.,
San Diego,
Cal.

Dear Sir:

Your plan of the El Capitan Dam, WD-511, shows a change in design resulting in a change in dimensions and quantities.

Does this change come under paragraph 13 or 14 of the Specifications?

What additional time allowance have you set for this additional quantity of embankment?

Yours truly,
H.W.Rohl & T.E.Connolly

T. E. CONNOLLY (Signature)

9-25-34
copy/p

COPY

H. W. ROHL & T. E. CONNOLLY
CONTRACTORS
4351 Alhambra Ave. Los Angeles

September 21, 1934.

Mr. Fred D. Pyle,
Hydraulic Engineer,
524 F St.,
San Diego,
Cal.

Dear Sir:

Confirming receipt of your letter S-122 as you therein requested.

You state "Methods used in placing the puddle core shall be such as in the opinion of the Engineer will produce a proper impervious puddle core and any method which may be required in order to produce a satisfactory core in the opinion of the Engineer shall be accomplished by the Contractor at his expense and without endangering any portion of the structure."

That statement is not agreed to nor is it the basis of our understanding nor will it be agreed to if another change of method is employed.

We reached a common understanding and agreed upon a proper price and method of construction - all as set forth in my letter to you, copy of which you sent to the Council and copy of which was attached to your letter S-122. The method of construction as therein set forth is the method we agree to, not "any method" and if you change to another method involving a change in cost not properly represented by the 75¢ figure we have previously agreed to, then we will expect a properly adjusted figure to adequately compensate for such change as you might make, not "by the Contractor at his expense-".

Yours truly,

H. W. Rohl & T. E. Connolly

(Sighed) T E Connolly

12/7/34
copy/f

September 28, 1934

Messrs. H. W. Rohl & T. E. Connolly
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California

S-129

Subject: San Diego River Project, El Capitan Feature
Modification of Top Portion of Dam.

Gentlemen:

Receipt is acknowledged of your letter dated September 21, 1934 in reference to changes in dimensions and quantities in the El Capitan Reservoir Dam shown on Drawing WD-511.

The change in the height of the embankment, outer slopes of the dam and thickness of the rock on the upstream side of the dam, as indicated on Drawing WD-501 approved by the State Engineer July 10, 1934, were called to your attention in letter S-119 dated July 31, 1934. With this letter there was transmitted to you print of Drawing WD-501 and a copy of Resolution No. 61938 adopted by the Council of the City of San Diego on July 30, 1934 authorizing and approving, in accordance with Paragraph 13 of the Contract Specifications, the changes as shown on Drawing WD-501.

The contract specifications provide no means for extending the time of completion of the contract work except on application by the Contractor. No application has been received to date.

Very truly yours

Fred D. Pyle
Hydraulic Engineer

FDP/f

3-1-35
copy/p

October 2, 1934

From : Resident Engineer

To : Hydraulic Engineer

Subject : San Diego River Project, El Capitan feature
Rolled fill and puddle core

1. On September 28, 1934 the Resident Engineer returned to El Capitan Dam, after being on leave of absence for two weeks. The following are reactions upon again contacting the work.

2. The top of the rolled fill was elevation 749; the top of the puddle core about 747. A review of recent measurements made to monuments on the dam indicated no unexpected movements. There had been considerable rock placement on both faces of the dam. This rock was of rather larger sizes than had been placed for the past several months, and the quantity was about twice that placed per day during the previous several months. This rock was desirable to add weight and stability to the rolled fill section on each side of the puddle.

Upon plotting the magnitude of the movements in the dam, both settlement and outward, against time for August and September, it showed the movement was slightly more than during the latter part of September. This is accounted for by the much larger size of rock being placed and also the much larger quantity and the greater distance that the rock was being dropped. The vibration when rock was dumped was severe enough to be felt to one's knees when standing within thirty feet of where the rock was being dropped. Certainly this vibration would be expected to increase the settlement and outward movement in the dam and not only at the top of the structure but near the bottom as well. Also the water level within the dam is now lower than heretofore.

The writer had a somewhat similar experience with a 300,000 ton rock breakwater when concrete piles were driven thru the rock. The breakwater moved shoreward about 0.1 of a foot total and the movement was in direct relation to the number of piles driven per day which supplied the vibration.

3. The puddle core was covered to about one foot depth of water and was so consolidated that the 1-1/8" tamping stick would penetrate only about four feet when forced by hand.

4. The daily progress of raising the dam had been reduced to less than 0.5 of a foot per day for the past several days. This was in accordance with the Hydraulic Engineer's directions.

5. The material being placed from the northerly end of borrow pit "A" appears to contain more clay and certainly has a greater tendency to form an impervious core. Also it was noted that there were practically no clods along the edges of the puddle. No Lakeside pit material was being hauled but a

sufficient supply of this material was stock-piled in the spillway so that when this will be combined with an equal amount from pit "A" there will be sufficient to complete the core.

6. On September 29, 1934 examination was made of samples from well No. 6 located at N 3500 E 5025, also a review of graphs of per cent of moisture in the core materials taken thru the other previous wells was made. The variation in moisture was not more than expected nor was the amount of moisture surprising as the wells along the upstream margin of the core penetrated thru the beach zone which contain tilted lenses of sandy material which contain water entrapped between their higher outer edges and the puddle core itself as results in any hydraulic fill dam. The fact that well No. 4, located at N 3500 E 5025 stood open for two days after completion on September 16 and was dry in the bottom shows there is no fluid pressure sufficient to cause a flow into the open well nor a rise of the water into this well.

7. With the slowing down of the building of the dam and the drying up and narrowing of the puddle core, I see no reason why the dam should not be completed for catching this season's runoff.

Harold Wood
Resident Engineer

HW/p

12/7/34
copy /f

October 5, 1934

Messrs. H. W. Rohl & T. E. Connolly
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California

S-130

Subject: San Diego River Project, El Capitan Feature, Rolled Fill Embankment

Gentlemen:

You are hereby directed that until further written notice the upbuilding of the rolled embankment section of the El Capitan Reservoir Dam shall not exceed about one-half foot per day.

Very truly yours,

Fred D. Pyle
Hydraulic Engineer

FDP/f

October 5, 1934

Hydraulic Engineer

City Manager
San Diego River Project, El Capitan Feature,
Puddle Core and Rolled Embankment.

During the forenoon of October 4, 1934 a field examination was made of the progress and conditions of the puddle core, rolled embankment and rock embankment of the El Capitan reservoir dam with City's Consulting Engineer Louis C. Hill, Hydraulic Fill Engineer D. W. Albert, Resident Engineer Harold Wood, and Acting Resident Engineer J. W. Williams.

In the early afternoon further examination was made in the field by the above group and Deputy State Engineer Geo. W. Hawley and Assistant Deputy State Engineer W. H. Holmes.

A conference was held in the afternoon at the City's Engineers Camp with all of the above named men and Contractor H. W. Rohl and Contractor T. E. Connolly for the first part of the conference and City Manager Geo. L. Buck and City Attorney C. L. Byers for the last part of the conference.

The rolled embankment was at elevation about 751.5 and the top of the puddle core section was at elevation about 752.5. The puddle core section had been dried up so that practically no free water was in evidence and it had been raised somewhat above the rolled embankment in order to keep water off if the Contractor's water supply pipe line should break and to prevent travel across it which would cause extra weighting of the puddle core material beneath.

At the afternoon conference duplicate samples of materials taken from the 100 foot well at N 3500 and E 5025 in accordance with verbal requests of the State Engineer's representatives were examined and compared with laboratory analysis of the original set of samples. Also with diagram showing the per cent of moisture and per cent of fines of the various samples.

The settlement and horizontal movement to October 2, 1934 of monumented points set on the outside of the embankments were inspected. A number of these points have been in place over a year.

After considerable discussion, the following conclusions as to progress and methods of carrying on the work were reached:

(a) The rock embankment should be kept as close as practicable to the top of the rolled fill.

(b) The upbuilding of the rolled embankment section of the dam should not exceed a half a foot per day.

(c) Up to elevation 763 the material in the puddle core area should be placed on rolled embankments, broken down with sheep foot tampers, water added to bring moisture content up to about 10 per cent, bulldozed into place and lightly compacted. Care should be exercised to see that the material does not become saturated.

(d) Above elevation 763 the rolled fill may extend across the puddle core section.

The State's representatives were non-committal as to approval of rate of progress, stating that they would be controlled to a large extent by the movement of the about sixty monumented points now being established on the dam at their request.

Messrs. Pohl and Connolly stated their intention of completing the dam as rapidly as possible, but of only going to elevation 766, claiming that is the top of the dam according to their contract.

The City Attorney advised that the Hydraulic Engineer has the right to limit the Contractor to a reasonable speed in the upbuilding of the dam.

Arrangements have been made to install and read each day the about sixty monumented points on the embankments to determine settlement and movement of the dam and to furnish the data to the State Engineer promptly.

Fred D. Pyle
Hydraulic Engineer

FDP/f
cc Consulting Engineer L. C. Hill

October 16, 1934

From : Hydraulic Engineer

To : Resident Engineer

Subject : San Diego River Project, El Capitan Feature
Top of dam

Drawing WD-511 as approved by the State Engineer shows the theoretical top of the El Capitan dam at elevation 770, and the theoretical top of the impervious puddle dore about elevation 763.

In staking out the work the actual vertical height of the dam has been increased 1.5% to care for settlement, which has been done in accordance with the last half of the first sentence of Paragraph 62 of the contract specifications. This brings the top of the dam toe elevation 773 over the highest section, decreasing towards the ends to elevation 770.

It is deemed proper, through the central portion of the dam, in order to provide for settlement, that the impervious puddle core material be carried up to about elevation 765 before the transition to rolled fill for the full width is permitted.

The rock embankment both upstream and downstream sides of the dam should be carried to the top of the dam on projected slopes as directed.

The top 8 feet of the dam inside the rock embankments should be of disintegrated granite placed and rolled in the usual manner.

Fred D. Pyle
Hydraulic Engineer

FDP/f

cc City Attorney
T. B. Cosgrove

12/7/34
copy /f

H. W. ROHL & T. E. CONNOLLY
CONTRACTORS

Lakeside, Cal.,
October,31,1934

Mr.Fred D. Pyle, Hydraulic Engineer,
San Diego,
Cal.

Dear Sir:

Your estimate itemization as set forth in your letter S-136 does not seem to conform to the contract requirement.

In reply to my letter of Sept.21, your S-129 set forth the fact that change in design and dimensions of the dam involving increased quantities came under paragraph 13 of the specifications. It is obvious that there is an increased cost in connection with the increased volume due to the increased height of the dam but you have made no effort of determination of the same.

Under paragraph 13 it would seem that you are in duty bound to make some effort to arrive at a proper excess cost. The language of the specifications is-"If such changes result in an increase or decrease of cost to the contractor, the engineer will make such additions or deductions on account thereof as he may deem reasonable and proper. "Due to our method of operation, it is a simple matter to arrive at a proper excess cost in the matter of hydraulic or rolled fill. The matter of the rock cost could not be done as easily. We believe it your duty to follow this change order to its proper conclusion.

You write in your S-129-"extending the time of completion of the contract work". My letter of Sept. 21 wherein I asked what time allowance you set for this additional quantity of embankment was applicable to this change only.

The contract requirement is set forth in paragraph 40 and 41. This change has altered the design as there set forth; increasing the quantities some 40,000 yards, thickening the top of the dam, raising the top of the dam some 6.5 feet as you now tell me the top of the dam will be 773.5 or still 3.5 feet higher than the changed plan shows or calls for.

Obviously the delay for this additional construction comes under paragraph 11 which reads 'If any delay is caused thecontractor ----by unforseen causes beyond the control of the contractor, such delay will entitle the contractor to an equivalent extention of time"-seemingly the definition of this "equivalent extention of time" must be that of the engineer. I am again asking what number of days you construe that to be.

Yours truly,
H.W.Rohl & T.E.Connolly

T. E. CONNOLLY (Signature)

11/20/34
copy /f

November 20, 1934

Messrs. H. W. Rohl & T. E. Connolly
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

S-139

Subject: San Diego River Project, El Capitan Feature, Modification of top portion of dam, increase or decrease in cost to Contractor, equivalent extension of time.

Gentlemen:

Receipt is acknowledged of your letter dated October 31, 1934 in reference to the modification of the top portion of the El Capitan Reservoir Dam required of you by letter S-119 dated July 31, 1934, and requesting that the engineer comply with that portion of Paragraph 13 of the contract specifications reading as follows:

> "If such changes result in an increase or decrease of cost to the contractor, the engineer will make such additions or deductions on account thereof as he may deem reasonable and proper"

and

Asking what number of days will be construed by the engineer as an "equivalent extension of time" because of the additional yardage required in constructing the upper portion of the dam as modified.

Due consideration will be given to all factors affecting the increase or decrease in cost to the contractor because of change required by letter S-119 dated July 31, 1934, and such appropride additions or deductions will be made therefor as may be deemed reasonable and proper.

Paragraph 62 of the contract specifications reads in part as follows:

> "General.- Hydraulic fill, rolled embankment and rock embankment shall be constructed to the heights designated and dimensions shown on the drawings or as directed by the engineer, and proper allowance shall be made for settlement."

An allowance of 1.5% of the height of the embankment was made, which amounted to 3.5 feet for the maximum height of the dam.

The modifications required by letter S-119 dated July 31, 1934 were entirely independent of the allowance for settlement.

Before an extension of time may be considered, a request therefor must be made by the contractor. Moreover, Paragraph 11 of the contract specifications requires that an application for an extension of time "shall be accompanied by the formal consent of the sureties".

It is understood that you do not wish your letter of October 31, 1934 to be construed as an application for extension of time and that you have not made such application.

I am unable to reply to the first paragraph of your letter of October 31, 1934, reading as follows:

> "Your estimate itemization as set forth in your letter S-136 does not seem to conform to the contract requirement."

because of the lack of specific statements and/or objections.

Very truly yours,

Fred D. Pyle
Hydraulic Engineer.

FDP/f

December 10, 1934

M E M O R A N D U M

Subject: San Diego River Project, El Capitan Feature, H. W. Rohl & T. E. Connolly Contract, Modification of top portion of dam. Change Order No. 3.

In view of the statements contained in the Hydraulic Engineer's letter and recommendation to the Council, dated July 18, 1934 in reference to the modification of the top of El Capitan Reservoir Dam and of Resolution No. 61938 adopted by the Council on July 30, 1934, it is deemed proper to consider letter S-119 dated July 31, 1934 to H. W. Rohl & T. E. Connolly ordering them to construct the top portion of the El Capitan Reservoir Dam in accordance with drawing WD-501 and the Council's Resolution as Change Order No. 3, within the meaning of the specifications.

Fred D. Pyle
Hydraulic Engineer

FDP/f

December 11, 1934

M E M O R A N D U M

Subject: San Diego River Project, El Capitan Feature, Modification of top portion of dam (Change Order No. 3) Effect of the Changes.

Under date of July 31, 1934, letter S-119, H. W. Rohl & T. E. Connolly, Contractors for the construction of the El Capitan Reservoir Dam, Spillway and Outlet Works were directed to construct El Capitan Dam above elevation 700 in accordance with drawing WD-501.

This action resulted in a number of changes, a portion of which tended to increase, and a portion to decrease the cost to the Contractor.

Due consideration having been given to the effect of all of the above changes on the cost to the Contractor of the various portions of the work as changed, it is deemed reasonable and proper that the increases and decreases balance, except that the Contractors' cost was increased 25¢ per cubic yard for the 14,500 cubic yards additional rock required, amounting to $3,625.00, which amount will be included in the next estimate.

Fred D. Pyle
Hydraulic Engineer

FDP/f

QUARRY and BORROW PITS

ROCK QUARRY

The City had applied for and received from the United States Department of the Interior a temporary permit for public lands below the El Capitan damsite for use as a quarry site, or sites.

Contractors H. W. Rohl and T. E. Connolly however opened their own quarry on the north side of the San Diego River about a quarter of a mile downstream from the dam, and outside the lands obtained from the Government by the City for quarry sites.

4/21/33
copy /f

November 14, 1932

Messrs. H. W. Rohl and T. E. Connolly
4351 Alhambra Avenue
Los Angeles, California.

Subject: San Diego River Project, El Capitan Reservoir Dam Feature, Spoil Bank Over Borrow Pit "C"

Gentlemen:

In the construction of your hauling road leading from a point on your quarry road immediately east of your camp, upon and along the north abutment of the El Capitan Damsite at about elevation 640, your attention is called to the fact that excavated materials are being wasted over the area of borrow pit "C" as shown on drawing contained in the contract, WD-351.

Very truly yours,

H. N. Savage,
Hydraulic Engineer

HNS/f
cc H.W.Rohl & T.E.Connolly, El Capitan Dam
Contractor's Resident Representative
City's Resident Engineer

4/21/33
copy /f

March 30, 1933

Messrs. H. W. Rohl & T. E. Connolly
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

Subject: San Diego River Project, El Capitan Feature, Hydraulic Fill Material, Borrow Pits.

Gentlemen:

In compliance with your written request dated March 29, 1933, enclosed are prints of City of San Diego's drawing WD-351, sheets 2 and 3, showing borrow pits for hydraulic fill material for El Capitan Dam.

Very truly yours,

H. N. Savage
Hydraulic Engineer.

HW/f
Encl.
WD-351, Sheets 2 and 3

cc H.W.Rohl & T.E.Connolly
El Capitan Dam
Contractor's Resident Representative
City's Resident Engineer

4/21/33
copy /f

H. W. ROHL & T. E. CONNOLLY
Contractors
4351 Alhambra Ave., Los Angeles

March 30, 1933

Mr. H. N. Savage, Hydraulic Engineer,
City of San Diego, California.

Dear Sir:

In order that we may plan our hydraulic fill operations we respectfully request that we be furnished copies of the larger scale drawings of the borrow pit areas "a", "b" and "c", designated on drawing - File No. 2435- D2-W.D.351 accompanying the contract specifications for El Capitan Reservoir Dam, Spillway and Outlet Works.

Very truly yours,

H.W.Rohl & T.E.Connolly

By: H. W. ROHL (Signature)

4/20/33
copy /f

April 14, 1933

Messrs. H. W. Rohl & T. E. Connolly
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

Subject: San Diego River Project, El Capitan Feature, borrow pit "A", interference with County road.

Gentlemen:

Enclosed is copy of letter from Mr. Thomas Whelan, District Attoreny County of San Diego, to the City Council and to the Contractor for El Capitan reservoir dam, in reference to the interference by the Contractor's operations in borrow pit "A" with the County road, without taking proper precautions for protection of the public.

Your attention is invited to contract specifications paragraph "32. ROADS AND FENCES.- . . . . . Roads subject to interference from the work covered by this contract shall be kept open. . . . . ."

Also to contract specifications paragraph "39. COMPLIANCE WITH LAWS.- The Contractor shall conduct the work in compliance with all laws and regulations of the United States, and of the State of California, ordinances of the County of San Diego and ordinances of the City of San Diego, limiting or controlling the work in any manner."

From which it appears that you are responsible for making adequate provisions at your own expense for theprotection of the traveling public on the reach of public highway above the confluence of Chocolate Creek with the San Diego River; and

That you are also responsible for any damages which may result to any persons or property due to your actions or negligence affecting the condition of the County road thru and around borrow pit "A" vicinity of mouth of Chocolate Creek.

Very truly yours,

H. N. Savage
Hydraulic Engineer

HNS/p
cc H.W.Rohl & T.E.Connolly
El Capitan Dam
Contractor's Resident Representative
City's Resident Engineer

4/20/33
copy /f

(COPY)
THOMAS WHELAN
District Attorney

COUNTY OF SAN DIEGO, San Diego, California.

April 7, 1933

The Honorable City Council of the
City of San Diego
W. H. Rohl and T. E. Connolly, contractors
of El Capitan Dam
San Diego, California

Re: Road from El Monte Park to Pine Hills, known as Eagle Peak Road, and also shown on the County Road Map as E-I

Gentlemen:

It has been reported to the Board of Supervisors and to this office by the road superintendent of the Third Road District that the road running from El Monte Park to Pine Hills, known as the Eagle Peak Road, and also shown on the county road map as E-I, has been undermined in several places where the Chocolate Creek comes into the San Diego River.

It is our information that the damage to this road has been done by the contractors working on the El Capitan Dam. It is also our information that the contractors have constructed temporary detours at various times during the progress of the work, but that these detours have not been put back far enough, and that every few weeks the detours are undermined by the steam shovel operators digging into the banks.

This condition has caused great inconvenience to the people who live above the El Capitan Dam, and whose only outlet is over this road. There is also a very dangerous condition where the detour is, at the present, used, where it intersects with the road used by the contractors at Chocolate Creek. This is caused by a blind turn in the contractors' road around which two lines of trucks working on the contract job travel at a high rate of speed.

The contractors working on this job have not taken proper precautions to protect the traveling public on this road, and have failed to even put up warning signs at the dangerous locations on the road.

Since the county road has been destroyed by the City of San Diego or the contractors working under them, without making adequate provisions for the protection of the traveling public, we believe that any damage which may result to any persons from this dangerous condition is the responsibility of the city, and the purpose of writing this letter to the City Council and to the contractors is to notify you that in the event of any damage to any persons by reason of any dangerous condition of this highway, you will be held responsible for the same.

Very truly yours,
THOMAS WHELAN, District Attorney
By E. I. KENDALL, Deputy.

EIK:EP

5/1/34
copy /f

February 27, 1934

Messrs. H.W. Rohl & T. E. Connolly
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California

S-91

Subject: San Diego River Project,
El Capitan Feature, excavation
vicinity of spillway and dam

Gentlemen:

The borrowing by you of any material from the south side of the spillway extension of the El Capitan reservoir dam westerly of the north end of the downstream toe wall in the vicinity of coordinates N 3920 E 4370, is disapproved of, and shall be discontinued at once.

Very truly yours,

H. N. Savage
Hydraulic Engineer

FDP/p

3-7-35
copy/p

August 4, 1934

From : Resident Engineer

To : Hydraulic Engineer

Subject : San Diego River Project, El Capitan Feature
Hydraulic fill, borrow pit material remaining

1. During the period July 30 to August 3, 1934 stadia surveys were made of areas in El Capitan reservoir basin considered possible borrow pit areas. The result of these surveys and assumed depths are tabulated.

Borrow pit material remaining

Pit	Area Acres	Assumed Depth	Cubic yards	Assumed Depth	Cubic yards
A	22.3	5	180,000	3	108,000 x
An	9.6	4	62,000	3	47,000
B	15.9	5	128,000	3	77,000
C	-		68,000		68,000 +
D	6.0	4	39,000	3	29,000
E	24.2	4	156,000	3	117,000
F	20.3	3	98,000	2.5	82,000
K	3.2	4	21,000	3	16,000
L	11.5	4	74,000	3	55,000
		Totals	646,000		491,000

x Sandy material not considered in totals

+ 81,000 cubic yards per drawing WD-351-3 less 13,000 cubic yards placed in dam from area of spillway extension

E Olive orchard and south toward pit D
F Chocolate Creek, west side area
L North of South Fork, Lacappa's field

HW/p

Harold Wood
Resident Engineer

September 13, 1933

From : Resident Engineer

To : Hydraulic Engineer

Subject : San Diego River Project, El Capitan Feature
Hydraulic fill material remaining available

1. The following facts relative to hydraulic fill material remaining available for use in the hydraulic fill portion of El Capitan dam are here presented:

Location	Originally available per drawing WD-351	Remaining available
	cubic yards	
Borrow pit A	850,000	20,000
" " B	216,000	216,000
" " C	81,000	81,000
Northeast of dam	-	50,000
North of Rohl's camp	-	30,000
North of City's camp	-	60,000 +
South of Chocolate Creek Road	-	60,000
	1,147,000	517,000

2. The average height of the hydraulic fill portion of the dam is about elevation 666. Capacity curve indicates a corresponding volume of 1,165,000 cubic yards; actually to build to this elevation has required 1,133,000 cubic yards, indicating the anticipated quantities overran the actual quantities by 32,000 cubic yards, or 2.8 per cent.

Capacity curve indicates a volume of 1,690,000 cubic yards at elevation 750. Applying this same overrun percentage of 2.8 per cent, there would be required an estimated total of about 1,643,000 cubic yards to elevation 750.

1,133,000 cubic yards have been placed, leaving about 510,000 cubic yards to place.

Harold Wood
Resident Engineer

HW/p

CORE WALL

2-14-35
copy/p

July 9, 1932

From : Resident Engineer

To : Hydraulic Engineer

Subject : San Diego River Project, El Capitan Feature
Excavation for puddle core and for core wall

1. On July 9, 1932 Ben F. Wells, superintendent for the contractor on the El Capitan dam, requested that stakes be set for the puddle core and for the core wall.

2. Mr. Wells requested that a trench 36 feet wide be staked in the puddle core excavation. This trench to be 10 feet deep. The core wall trench or main cutoff trench to be 6 feet wide and extending below the bottom of the 36-foot trench.

3. The 36-foot trench to be excavated just across the river bed. The side slopes of this trench should be 1 on 1 making a top width of 56 feet. A 20-foot berm should be along and adjacent to the downstream side of the core wall trench, for space for operating the dragline for making the excavation of the core wall trench.

4. The puddle core excavation is being carried down to decomposed granite with a 50-foot width downstream from the axis and a 100-foot width upstream from the axis. The upstream and downstream side slopes of this excavation are 1 on 1-1/2.

5. The survey party will set stakes for the puddle core and core wall excavation in accordance with this letter.

6. The trench in the bottom of the puddle core excavation will be omitted on each abutment or above about elevation 565 and only the 6-foot core wall trench will be carried down.

7. The sketch shows a cross section of the puddle core and core wall excavations below elevation 565, that are hereby recommended.

Harold Wood
Resident Engineer

HW/p

2-14-35
copy/p

Lakeside, California
September 29, 1932

From : Resident Engineer

To : Hydraulic Engineer

Subject : San Diego River Project, El Capitan Feature
Core wall - copper water stop

1. On September 27, 1932, a letter was written on the above. On September 29, 1932 after a conference with Mr. Savage it was decided to use a more simple form of water stop than that recommended by me for the core wall of the El Capitan Dam.

2. It is recommended that the water stop for the core wall be annealed copper sheets of 20-gauge as specified and 12 inches wide. For the horizontal construction joints the copperrsheets should be set in a vertical plane with 6 inches imbedded in the concrete on either side of the construction joint. For the vertical contraction joints the copper sheets should be formed into a section like a "Z" with two right angles and each leg 4 inches. This stop to be set into the concrete with the two outer edges set in the concrete either side of the joint and with the central portion crossing the contraction joint.

3. The contractor should be notified what copper to order as soon as possible as most of this copper requires three weeks for shipping.

Harold Wood
Resident Engineer

AFE H N Savage 10/3/32

2-14-35
copy/p

October 3, 1938

Mr. Edward Hyatt
State Engineer
401 Public Works Building
Sacramento, California

Subject: San Diego River Project, El Capitan Feature
Application 8-7, core wall excavation

Dear Mr. Hyatt:

State Geologist Chester Marliave and Senior Engineer of Dam Inspection Gerald McKinlay, inspected the City of San Diego's El Capitan reservoir dam trench excavation for core wall foundation between coordinates N 3470 and N 3770 on October 3, 1932.

The following additional excavation requirements were brought by them to the attention of Resident Engineer Harold Wood:

1. Deepening the right or north end of the core wall excavation in an endeavor to encounter harder decomposed rock north of coordinate N 3630.

2. Additional excavation of two or three feet in the lowest part of the trench as now excavated (about mid streambed) using as small amount of powder for shooting as practicable between coordinates 3630 and 3510..

3. Additional excavation in the left or south end of the core wall trench as now excavated between coordinates N 3510 and N 3470.

4. The boulder on the upstream side of the trench vicinity coordinate N 3660 to be removed. An attempt made to concentrate the water entering the trench into two or more 2" diameter riser pipes, or

5. Provide a concrete sump and shaft upstream and outside of the core wall. Disposition of water entering the trench at coordinate N 3660 to be provided for before concreting is commenced.

6. A general cleaning up of the entire length of the trench floor after required additional excavation is accomplished.

State Engineer Edward Hyatt will be notified, also his Los Angeles office upon the completion of the above outlined additional excavation work in order that official inspection may be made by the State Engineer's assistants before any concrete placement is undertaken in the core wall trench.

Very truly yours,

H. N. Savage,
Hydraulic Engineer.

HNS/pf
cc Gerald McKinlay
Senior Engineer of Dam Inspection, Los Angeles, California
Resident Engineer

2-14-35
copy/p

Lakeside, California
October 10, 1932

From : Resident Engineer

To : Hydraulic Engineer

Subject : San Diego River Project, El Capitan Feature
Core wall

1. The first concrete was placed in the core wall of the El Capitan dam on October 7, 1932. The concrete placing began at 12:35 P.M. and continued to 3:00 A.M. October 8, 1932. The concrete placed extended from N 3480 to N 3649 and to elevation 510. There were 3 batches of grout composed of 5 sacks cement and 1040 pounds of sand used at each end of the trench to start the concreting. The grout was broomed over the bottom and splashed about 2 feet up the sides of the trench.

2. The concrete was mixed in the following proportions:

Cement 7 sacks; water 36 gallons average;
1 1/2" rock 1220#; 3/4" rock 1030#; and
sand 1370#

3. Copper water stops consisting of 12 inch width of 20 gauge annealed copper were placed completely around the concrete placed. The vertical stops were bent to form a "Z" and were placed in the two end bulkheads with their lower ends 12 inches above the foundation to prevent galvanic action.

4. Grout holes will be drilled thru the concrete of the first concrete placed. The holes will be in two rows, one upstream 2 feet from the axis (center line of the core wall), and one downstream 1 foot from the axis. The holes in each row will be in general 10 feet apart and staggered with the holes in the other row. At 6 places special spacing of the grout holes will be required to insure penetration at places in the foundation rock that seem to be concentrating the flow of water. The holes will be 25 feet deep into the rock.

5. 2-inch steel grout pipes will be caulked and grouted into the drill holes. The grout pipes will be extended to the downstream side of the unformed portion of the core wall and capped until grouted.

6. Concreting of the core wall over the concrete already placed may preceed placement of concrete in the portions of the trench not yet approved by the State Inspector.

7. Plans for the concreting of the core wall are here outlined. The last or upper 6 feet of the unformed portion of the core wall will be concreted only after the steel columns are set. The steel columns will rest on the concrete of the previous placement. The vertical 7/8" steel bars will be set 35 inches into the top of this upper unformed section of core wall concrete.

The horizontal steel bars will be set above the construction joint at the top of the upper unformed concrete. There will be one bar on each side 30 inches below the joint for spacing the vertical steel bars. The elevation of the top of the unformed core wall will be stepped in increments of 1 foot in order to accomodate the copper water stop in the horizontal construction joint passing thru the lattice bars of the columns.

8. All vertical contraction joints will be spaced not further than 80 feet apart. Each vertical contraction joint will be provided with a copper water stop formed to a "Z" section. The horizontal construction joints will be spaced as frequently as necessary to provide for 8 hours of concrete placing.

9. On top of the unformed core wall concrete forms 5 feet in width and made into panels will be set with their bottoms 5 feet apart and their tops 18 inches apart. This will form a fillet on either wide of the wall. The 5 foot width of panel forms used on the toe walls will be available for the core wall.

10. It is recommended that the details of the construction of the core wall as herein outlined be approved for construction.

Harold Wood
Resident Engineer

October 13, 1932

From : Hydraulic Engineer

To : Resident Engineer

Subject : San Diego River Project, El Capitan Feature
Copper water stop

1. The contract specifications for the El Capitan reservoir dam, spillway and outlet works provide under paragraph 84 and schedule item 46 for copper water stops at vertical contraction joints or horizontal construction joints, as shown on the drawings or as directed by the engineer. No location or types of copper water stop are shown on the drawings.

2. It is deemed proper that for the horizontal construction joints in the core wall, copper sheets 12 inches wide be set in a vertical plane with 6 inches imbedded in the concrete on each side of the construction joint; and

3. That for the vertical contraction joints in the core wall, copper sheets 12 inches wide formed with a 2-inch "V" set in the contraction joint and two 4-inch legs, imbedded in the concrete, one on each side of the contraction joint; and

4. That the distance between vertical contraction joints in the formed portion of the wall shall not exceed 27 feet.

H. N. Savage

FDP/p

2-14-35
copy/p

October 18, 1932

From : Hydraulic Engineer

To : Resident Engineer

Subject : El Capitan Feature, Core Wall spacing
Contraction joints

You have recommended that the vertical contraction joints in the El Capitan reservoir dam core wall spacing may be increased to 32 feet to comply in the major way deemed proper with the contractor's request for multiple of 8 foot reinforced steel columns.

The above recommendation is concurred in.

H. N. Savage
Hydraulic Engineer

HNS/f

4/20/33
copy /f

November 21, 1932

Messrs. H. W. Rohl and T. E. Connolly
4351 Alhambra Avenue
Los Angeles, California.

Subject: San Diego River Project, El Capitan Feature, Core Wall.

Gentlemen:

It is deemed necessary and required to construct the top of the lowest reach of core wall of the El Capitan Dam across the valley floor to at least elevation 570 with necessary provisions for carrying it to a higher elevation if further consideration shows the necessity for so doing.

Very truly yours,

Fred D. Pyle,
Acting Hydraulic Engineer.

FDP/f
cc H.W.Rohl & T.E.Connolly El Capitan Dam
Contractor's Resident Representative El Capitan Dam
Hydraulic Engineer, Washington, D.C.
City's Resident Engineer

2-14-35
copy/p

December 8, 1932

From : Engineer Fred D. Pyle

To : Hydraulic Engineer

Subject : San Diego River Project, El Capitan Feature
Core wall

1. In answer to the contractor's inquiry as to height of concrete core wall across the base of the El Capitan Dam, it was deemed proper to indicate in letter of November 21, 1932 to H. W. Rohl and T. E. Connolly that:

> "It is deemed necessary and required to construct the top of the lowest reach of core wall of the El Capitan Dam across the valley floor to at least elevation 570 with necessary provisions for carrying it to a higher elevation if further consideration shows the necessity for so doing."

2. Paragraph 14 of Resident Engineer's report of November 23, 1932, reads as follows:

> "Mr. McKinlay stated that he would favor the termination of the central portion of the core wall at elevation 547 or at top of the present steel columns. He gave as his reasons for this, the following:
>
> "(1) The core wall will interfere with proper segregation of materials in the puddle core.
>
> "(2) The core wall presents a hazard in case of flood during this winter.
>
> "(3) The stripping method proposed by the contractor presents an extreme hazard to the wall if built higher because of rock striking the wall from blasting."

3. Mr. McKinlay stated to me on December 1, 1932 that the State had no objections if the core wall across the base of the dam terminated at the top of the present 24-foot steel columns, as the State's engineers believe that to have the wall higher would serve no good purpose and would be in the way of the proper placing and sorting of the hydraulic core.

4. Mr. T. E. Connolly inquired December 7, 1932 as to the final decision in reference to height of concrete core wall. He is anxious to start the hydraulic fill about January 1, 1933 and wishes to know definitely about the contemplated height of core wall as it will have a bearing on his method of work. If the wall is to be constructed only to the top of the present reinforcing steel about elevation 550, it may be constructed easily using a dragline with extension boom, but if the wall is to be constructed to elevation 570 or higher a cableway may be required.

5. Mr. McKinlay pointed out that the hydraulic core in the vicinity of the concrete core wall will be plastic and behave as a liquid and because of its specific gravity and height will always exert a pressure to prevent water following along or around the core wall at least 150% in excess of greatest possible water pressure.

6. His conclusions appear proper and there appears to be no requirement for the wall to go higher across the base of the dam than elevation about 550.

Fred D. Pyle
Engineer

FDP/p

4/20/33
copy /f

January 9, 1933

Messrs. H. W. Rohl and T. E. Connolly
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

Subject: San Diego River Project,
El Capitan Feature, concrete core wall, defective concrete.

Gentlemen:

Examination discloses that a portion of the concrete placed in the core wall foundation at cocrinate about N 3780 of the El Capitan reservoir dam, is defective because of voids.

Your attention is called to paragraph 30 of the contract specifications.

Please remove such portion of this work as Resident Engineer Harold Wood may direct.

Respectfully,

H. N. Savage,
Hydraulic Engineer.

HNS/p
cc H.W.Rohl and T.E.Connolly
El Capitan Dam
Contractor's Resident Representative
City's Resident Engineer

4/20/33
copy /f

March 16, 1933

Messrs. H. W. Rohl & T. E. Connolly
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

Subject: San Diego River Project,
El Capitan Feature
Core wall, concrete

Gentlemen:

Examination discloses that a portion of the concrete placed in the core wall between ordinates about N 3288 and N 3320 and between elevations 594 and 599 and also between ordinates N 3308 and N 3304 and elevations 588 to 591 of the El Capitan reservoir dam, is defective because of voids.

Your attention is called to paragraph 30 of the contract specifications.

Please remove such portions of this work as are defective as above outlined.

Very truly yours,

H. N. Savage,
Hydraulic Engineer.

HW/p
cc H.W.Rohl & T.E.Connolly
El Capitan Dam
Contractor's Resident Representative
City's Resident Engineer

4/20/33
copy /f

March 18, 1933

From : Hydraulic Engineer

To : Resident Engineer

Subject: San Diego River Project, El Capitan Feature
Core wall, masonry forming.

In response to importuning by the contractor's attorney, John M. Martin, for an inspection by the State's Senior Engineer of Dam Inspection of the excavated trench for core wall up the left abutment of El Capitan Dam, I succeeded in contacting Mr. Gerald McKinlay by telephone and he authorized me to approve for him the concrete forming in a 40-foot reach up the left abutment of the dam.

Assuming that the contractors might want to start the concrete forming the first thing this morning, I telephoned to the contractors' office late yesterday evening and Mr. Frank Lee assured me he would communicate the authority for forming the concrete to you in order that you might notify the contractors and/or his authorized superintendent last night.

H. N. Savage

HNS/p

4/20/33
copy /f

March 29, 1933

Messrs. H. W. Rohl & T. E. Connolly
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

Subject: San Diego River Project, El Capitan Feature, Core wall - progress.

Gentlemen:

Your attention is invited to the fact that the excavation for and concreting of core wall is not progressing satisfactorily at El Capitan reservoir dam. Portions of the foundation to be excavated are now below the elevation of the summit pool.

Excavation for and concreting of core wall with necessary drill holes and grouting of foundation shall at all times be kept advanced in elevation well above the summit pool elevation.

In accordance with contract specifications paragraph 63 on hydraulic fill, especially that portion reading: "All operations shall be subject at all times to the approval of the Engineer" you are hereby directed to conduct your work in such manner that the excavation for and concreting of core wall shall at all times be kept advanced in elevation above the surface elevation of the summit pool.

Unless the progress of the core wall grout holes and grouting is maintained at all times well above the elevation of the summit pool it will be necessary to stop the hydraulic fill operations until the core wall grout holes and grouting are advanced well above the elevation of the summit pool.

Very truly yours,

H. N. Savage,
Hydraulic Engineer

HW/p
cc H.W.Rohl & T.E.Connolly
El Capitan Dam
Contractor's Resident Representative
City's Resident Engineer.

1/12/34
copy /f

July 21, 1933

S-29

Messrs. H. W. Rohl & T. E. Connolly
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

Subject: San Diego River Project,
El Capitan Feature,
Concrete, wetting

Gentlemen:

Your compliance with that portion of paragraph 87 of the contract specifications for El Capitan Reservoir Dam, Spillway and Outlet Works requiring that concrete be kept moist for at least two weeks or until covered, is requested.

Very truly yours,

H. N. Savage
Hydraulic Engineer.

HNS/p

2-14-35
copy/p

May 16, 1934

From : Hydraulic Fill Engineer

To : Hydraulic Engineer

Subject : Thin core walls in earth dams.

Thirty or more years dealing with dams and dam construction leads me to believe that the utility of thin core walls in earth dams is questionable. Personal observation of failure of a low (about 50 feet) dam with thin core wall (about 12 inches thick) built for the City of Colorado Springs, Colorado, in 1900 or thereabouts, showed that the water seeping through the upstream embankment and coming in contact with the core wall followed laterally along the core wall to a point where rupture of the wall had occurred, and the escaping of this accumulated water under more or less head sluiced away part of the downstream embankment causing complete failure of about one third of the north portion of the dam.

In repairing the dam it was necessary to cut away a portion of the remaining embankment to a point beyond where the embankment had been affected by the failure. In cutting away this embankment the core wall was exposed for several feet (15 or 20) and was found broken and distorted in many places.

When Mr. J. D. Schuyler designed the Los Reys dam, one of the 5 days he designed for the Mexican Light and Power Company of Mexico City, D.F. and constructed by my brother G. L. Albert and myself about 1906 or 1907, a core wall of some nature was deemed necessary. Owing to the inaccessibility of this site, it was thought that a wood diaphragm built of 2x12 planking in three layers forming a laminated structure 6 inches thick, would meet the requirements.

Shortly after the dam was put in service, a leak developed along the outlet culvert and considerable material was washed away before the reservoir could be emptied.

In Making repairs it was found that water seeping through the upstream embankment collected at the core wall or diaphragm and followed along the core wall to the lowest point which was at the intersection of the wall and outlet culvert where the planking or wood diaphragm had been distorted by settlement of earth embankments sufficiently to allow escape of water which followed along the outlet culvert and caused the failure.

In exposing the core wall for some distance both sides of the culvert when making repairs, it was found that the drag or settlement of the earth embankment had distorted and crushed the planking to such an extent as to render it useless. To the best of my recollection this dam was around 60 feet in height and slopes of 1 to 3 upstream and 1 to 2 downstream. The repair was successful and very likely the dam is in service today.

The only earth dam of any considerable height that I know of having a core wall extending to full height of the dam is the

Priest dam on the Hetch Hetchy aqueduct designed by M. M. O'Shaughnessy C.E. A description of this core wall is given in the May issue of Civil Engineering.

This dam was constructed by W. A. Kramer, contractor, with whom I was associated. This core wall was much more massive than the core wall proposed for El Capitan by the late John R. Freeman and being articulated considerable distortion could take place without rupture. In defiance of every precaution this articulating core wall was continuously moving and getting out of shape during the course of construction. Within a few months after completion of the dam the earth settled and pulled away from the core wall, leaving large cracks almost the entire length of the crest of the dam. Just what the condition of the core wall is in the lower reaches of the dam is more or less of a conjecture.

With reverence and greatest respect for the late John R. Freeman, I am firm in my belief that Mr. Freeman would only have insisted that the core wall extend to the full height of the El Capitan dam after an exhaustive investigation and study had proved that no material was available within reasonable cost for making an impervious clay core. Although I find nothing in Mr. Freeman's report to the City of San Diego on El Capitan dam which justifies the above assumption, I distinctly remember that some 10 or more years ago, when assisting Mr. Freeman in his preliminary investigations at El Capitan damsite, when speaking with him about a thin core wall in El Capitan dam he expressed himself in about the following manner.

> "We do not know definitely at this time what may be required in order that an unquestionable safe dam be constructed here, and until we are sure that all conditions are favorable for constructing a dam of such extreme height, we will leave the core wall as proposed and possibly the cost involved of the core wall may be used to better advantage later on."

I am informed that a dam built by the U. S. Reclamation Service in Puerto Rico back in about 1912, was designed with a thin concrete core wall to full dam height, and that during construction the core wall failed causing a great amount of trouble and the dam was successfully completed without core wall.

In view of past experience and observations, I am of the opinion that the use of thin core walls extending to full height of earth dams, either rolled or hydraulic fill, are questionable and are not to be relied upon as insurance against leakage, but that they do cause, when ruptured, a concentration of seepage water to the point of rupture which causes piping or washing out of material which leads to failure of the dam.

D. W. Albert
Hydraulic Fill Engineer

DWA/p

12/4/34
copy /f

H.W.ROHL & T.E.CONNOLLY
Contractors
El Capitan Dam
via Lakeside, California

May 21, 1934.

City Council,
City of San Diego,
San Diego, California.

Gentlemen:

We have just been advised that the Hydraulic Engineer's Order eliminating the reinforced concrete core wall from the El Capitan Dam was made without authority or approval of the City Council.

In order that the contractor may proceed with the construction of the Dam, we respectfully request the City Council to at once approve the Hydraulic Engineer's Order eliminating the reinforced concrete core wall.

Will you kindly at once advise us in writing as to your action in this matter.

Very truly yours,

H. W. ROHL & T. E. CONNOLLY

By T. E. CONNOLLY (Signature)

cc H. N. Savage

cc City Attorney

11/30/34
copy /f

June 4, 1934

TO THE HONORABLE, THE MAYOR AND COUNCIL

OF THE CITY OF SAN DIEGO, CALIFORNIA.

Subject: San Diego River Project, El Capitan Feature, Masonry reinforced core wall elimination. Document No. 288204.

Gentlemen:

Your reference Document No. 288204, being letter dated May 21, 1934 from H. W. Rohl & T. E. Connolly, Contractor for the construction of the El Capitan Reservoir Dam, Spillway and Outlet Works, regarding elimination of concrete core wall from El Capitan Dam.

"Out of abundant caution", the original drawings of El Capitan Reservoir Dam showed a thin masonry reinforced concrete core wall extending up through the Dam to elevation 770.

The State Engineer on December 23, 1932 granted permission to omit that portion of the core wall above elevation 559 across the base of the Dam and up the abutments as controlled by conditions disclosed as the work progressed.

The Contractor was notified not to build the core wall above elevation 559 across the base of the dam and to build it up the abutments as directed from time to time.

The Contractor followed the above instructions and has now completed the entire wall except for an opening for a construction road about elevation 740.

Returned herewith is Document No. 288204.

Very respectfully,

H. N. Savage,
Hydraulic Engineer.

HNS/f

2-14-35
copy/p

July 30, 1934

From : Resident Engineer

To : Hydraulic Engineer

Subject : San Diego River Project, El Capitan Feature
Concrete core wall - absorption test on grout holes

1. On June 19, 1934 Assistant Deputy State Engineer W. H. Holmes requested absorption test on the two grout holes at the extreme south end of the concrete core wall at El Capitan Dam.

2. The following tabulation shows results of the test and data on the holes.

Percolation Test

Grout Hole N 3003 E 5000
Depth in decomposed granite 23.8'
Head in feet from tank to top of decomposed granite 43'
Elevation bottom of hole 729

Date and Time July	To fill tank and pipes gallons	Rate per hour
2 - 8AM	27	
3 - 8 "	24	
3 - 8:30 PM	21	
5 - 8:00 AM	27	
6 - 8:00 AM	24	
6 - 1:30 PM	21	
6 - 3:30 PM	15	7 1/2
7 - 7:30 AM	24	
7 - 9:30 AM	18	9 x

x Water appeared on downstream side of core wall

7 - 11 AM 18

Absorption on July 6 on 12.4 square feet of decomposed granite = .30 gallons per hour per square foot

Grout Hole N 2997 E 5000
Depth in decomposed granite 21'
Head in feet from tank to top of ddcomposed granite 31'
Elevation bottom of hole 738

Date and Time July	To fill tank and pipes gallons	Rate per hour
13 - 9AM	20	
13 1:30 PM	16	
14 8:00 AM	12	
16 8:00 AM	12	
16 10 "	12	6
17 8:00 AM	12	
18 8:00 AM	12	
18 10 "	11	5 1/2

Absorption on July 18 on 10.9 square feet of decomposed granite = .25 gallons per hour per square foot

Harold Wood
Resident Engineer

HW/p
cc-W.H.Holmes

TUNNEL

3-8-35
copy/p

June 6, 1932

From : Resident Engineer

To : Hydraulic Engineer

Subject : San Diego River Project, El Capitan Feature
Outlet tunnel lining

1. A review of drawing WD-410 for the outlet tunnel concrete lining, El Capitan Dam, indicates certain practical considerations which may have been overlooked when the design was drawn.

2. In driving any tunnel section it is almost impossible to maintain any projection within the general line of the excavation. This would be particularly true of the required haunch for the arch abutment shown on drawing WD-410 about 5 feet above the spring line. The innermost projections of these haunches overhangs the side walls and is deemed impractical in decomposed granite.

3. Several hundred feet of the length of the outlet tunnel will require permanent timbering. On June 4 Mr. T. E. Connolly requested a drawing of this permanent timbering. The specifications, paragraph 101, requires a minimum of 8 inches of concrete over the permanent timbering. The contractor is driving the tunnel with a top heading 12 feet high by 10 feet wide inside the square set timbers. The sub-bench below this heading will be shot to a face and thus avoid excessive overbreakage. If this method is carried out then the top of the tunnel would require a timbering of 5 segments resting on wall plates set somewhat above spring line. When the sub-bench is excavated then plumb posts will be set under the wall plates.

4. In laying out the possible permanent timbering certain modifications of tunnel concrete lining is deemed advisable. It is noted that the minimum of 6 inches shown on the drawing for the side wall thickness is in conflict with the specifications. There is 3 inches of concrete required over the steel. The steel requires 1-3/4 inches leaving only 1-1/4 inches between steel and excavation line. Paragraph 72 of the specifications indicates the use of at least rock passing 1-1/2 inch ring for the concrete aggregate. The steel reinforcement is deemed to be not sufficiently removed from the excavation to insure a satisfactory job of pouring the side wall concrete even with smaller rock.

5. It is suggested that the thickness of the tunnel lining be reduced from a maximum of 3 feet to a uniform thickness of 18 inches for the top arch and that the side walls be increased to 12 inches minimum thickness at spring lines making the section more nearly a uniform thickness for the entire lining. This would eliminate the very weak section now existing in the side walls and would have a more uniform strength to resist the internal pressure to which the entrance end of the tunnel may be subjected to during high water while acting as a by-pass tunnel. The area of concrete cross section would be the same.

6. Accompanying this letter is a suggested section for tunnel lining and superimposed thereon is a suggested design for the permanent timbering. There has been kept in mind your executed timbered section for the Otay Reservoir-San Diego Second Main Pipe Line, drawing WD-184.

Harold Wood
Resident Engineer

HW/p

3-9-35
copy/p

June 15, 1932

From : Resident Engineer

To : Hydraulic Engineer

Subject : San Diego River Project, El Capitan Feature
Outlet tunnel, concrete lining at plugs

1. Drawing WD-382 approved by the State Engineer shows the outlet tunnel lining will be very materially increased in thickness at the places where the tunnel plugs will be located.

2. Several weeks ago a letter and drawing pertaining to the location of the El Capitan outlet tower were forwarded to the State Engineer.

3. Since the location of this outlet tower affects the location of the outlet tunnel plugs, it is recommended that consideration at this time be given to the outlet tower location and the exact location of the outlet tunnel plugs be fixed.

4. It is further recommended that the tunnel lining thickness at these plugs be made 4 feet and that drill holes 10 feet in length and spaced about 5 feet apart be drilled normal to the inside of the tunnel and out beyond the concrete plug and that 2-inch steel grout pipes (Schedule Item 40) be set into each of the holes to extend thru the concrete of the tunnel lining for future grouting.

5. It is also recommended that each plug extend 15 feet along the tunnel and that two keyways each 1 foot deep and 3 feet wide be provided in the face of the tunnel lining, extending completely around the tunnel. Grout pipes at intervals of about 8 feet should extend from the downstream side of the future plugs with openings at the back of each of these two keyways for future grouting. All grout pipes should extend beyond the lining and into the tunnel section a maximum of 2 inches and be provided with caps for temporary and future closing. It is deemed that these two groups of pipe caps projecting into the tunnel section will offer no material obstruction to flow. The keyway recesses in the invert should be temporarily concreted with a lean mix of concrete and given a one inch troweled surface of rich mortar for protection during the use of the tunnel for river diversion.

6. A study of the topography indicates the center of the outlet tower might be located a minimum of 55 feet west of the entrance portal face and a minimum of 35 feet northerly from the center line of the tunnel. This would place the upstream face of the upstream plug at 56 feet from the entrance portal or tunnel station 0+56.

Harold Wood
Resident Engineer

HW/p

5/4/33
copy/f

H. W. ROHL & T. E. CONNOLLY
CONTRACTORS

A F F I D A V I T :

July 21, 1932

This will certify that I, J.E.Nelson, have interviewed all citizens of San Diego who have made application for work on El Capitan Dam project and have listed themselves as having had tunnel experience. From all applicants for this class of work, tunnel work, only twelve have had experience enough to justify a tryout and it is my belief that some of that number will prove unqualified.

There is not skilled tunnel men to be had in the numbers required that now live in San Diego.

J. E. NELSON (Signature)

J.E.Nelson

Sworn and subscribed to before

me a Notary Public at San Diego,

California on this 21st day of July 1932

P. A. NAUMAN (Signature)
Notary Public

(SEAL)

5/4/33
copy/f

H.W.ROHL AND T.E.CONNOLLY
CONTRACTORS

July 21, 1932

Mr. H.N.Savage, Hydraulic Engineer
San Diego,
Cal.

Dear Sir:

Acknowledging your letter calling our attention to the fact that the tunnel work was not proceeding at a fast enough rate.

With the help of a few tunnel men who are not citizens of San Diego we have endeavored to make a tunnel crew of local men who have not had adequate experience in this character of work. The result has not been reasonably successful.

For the past few days Mr.J.E.Nelson has interviewed every man who had listed himself to us as having tunnel experience. The list has been exhausted and but twelve men obtained. Mr. Nelson's affidavit is enclosed. We must have more men and skilled men and they will have to be gotten from without San Diego.

Our contract, Section 25, provides,"none but skilled foremen and workmen shall be employed on work requiring special qualifications". Section 16 provides "if the contractor, on account of conditions developing during the progress of the work, finds it impractical to comply strictly with these specifications and applies in writing for a modification of the requirements or method of work, such change may be authorized by the engineer if not detrimental to the work and if without additional cost to the City of San Diego".

Under and by virtue of the above contract provisions we apply herewith for a modification of the citizenship provision or requirement insofar as it pertains to tunnel men. We desire to get skilled tunnel men from whatever source they may be obtained.

Yours very truly,
H.W.Rohl & T.E.Connolly.

T. E. CONNOLLY (Signature)

5/4/33
copy/f

July 23, 1932

Messrs. H. W. Rohl and T. E. Connolly
Contractors, El Capitan Dam,
4351 Alhambra Avenue,
Los Angeles, California.

Subject: San Diego River Project, El Capitan Reservoir Dam, Spillway and Outlet Works, Contract construction.

Gentlemen:

Receipt is acknowledged of your letter dated July 21, 1932, advising of your inability to secure a sufficient number of qualified tunnel men who are citizens of San Diego and requesting authorization to obtain qualified tunnel men who are not citizens of San Diego, for the construction of the El Capitan Dam.

Recognizing the obvious requirement for expeditiously driving and lining the about 25-foot diameter by about 1200-foot long by-pass tunnel feature of your contract to install the El Capitan Reservoir Dam, Spillway and Outlet Works, I shall take pleasure in cooperating in every proper way with the requirements of the job for competent tunnel men.

In order to secure in advance the fullest legal protection alike for the contractor and the requirements of the specifications, it is respectfully suggested that you advertise in one each of the local morning and evening papers for applications from qualified tunnel men.

Failing then to secure the applications for the requisite number of qualified tunnel men, I will endeavor to further your request for authority for employment of qualified tunnel men not available in San Diego up through official channels.

Respectfully,

H. N. Savage,
Hydraulic Engineer.

HNS/p
cc John M. Martin

5/4/33
copy/f

August 15, 1932

H. W. Rohl and T. E. Connolly
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

Subject: San Diego River Project, El Capitan Feature, Outlet tunnel portal structures, steel - detail drawings

Gentlemen:

Enclosed are two prints each of drawings WD-418 and WD-419 sheets 1 to 7 inclusive each, pertaining to steel details of the tunnel portal structures for the El Capitan Reservoir Dam.

Very truly yours,

H. N. Savage,
Hydraulic Engineer.

HNS/p
Encls. (14)
cc and enclosures to Resident Engineer

El Capitan
September 13, 1932

From : Resident Engineer

To : Hydraulic Engineer

Subject : San Diego River Project, El Capitan Feature
Outlet Tunnel - excavation and concrete sections

1. The limits of excavation and concrete quantity payments for the outlet tunnel for the El Capitan reservoir dam are intended to be set by the engineer according to paragraphs 101, 103 and 106 of the specifications.

2. Determination of schedule item quantities for the monthly estimates for the various sections of the tunnel must be made. Attached to this letter are three sheets of drawings on yellow quadrill ruled paper showing the various sections and the yardage for payment for each section. The yardage for each section is as follows:

Item No.	Class	For	Section	Cubic yards per linear foot
14	5	Excavation	Timbered	25.25
14	5	"	Untimbered	23.05
14	5	"	Enlarged	33.18
26	10	Concrete	Timbered	4.38
26	10	"	Untimbered	3.04
26	10	"	Enlarged	10.36
27	11	Invert	Timbered	.82
27	11	"	Untimbered	.82
27	11	"	Enlarged	3.61

The reinforcing steel for the untimbered section and for the enlarged section will be 503.62 pounds per linear foot of tunnel. The reinforcing steel for the timbered section is somewhat less due to the omission of the longitudinal bars in the extrados at the 10-inch timbers which are at 6-foot centers. The timbered section will have 498.53 pounds per linear foot of tunnel. The transverse intrados steel will be in two 33-foot lengths with lap at center of crown. All other transverse steel will be in full lengths.

3. On June 22, 1932 the Resident Engineer received drawing WD-414 showing "timbered tunnel section". This drawing shows the concrete and excavation pay line as inside the permanent timbers.

4. 4" drains at 8' on center are shown thru the side wall immediately above the invert. On September 7 Mr. T. E. Connolly and Mr. Ben F. Wells called at the office of the Resident Engineer and said they objected to the drains as shown on this drawing. They said contract drawings WD-386 on which they had bid showed the drain under the invert.

5. It is recommended that the drain be placed as shown on drawing WD-386 from a point in the tunnel 1+37 which is 8 feet westerly from the downstream side of the lower enlargement to the sump in the floor of the exit portal structure.

6. It is further recommended that the quantities per linear foot of tunnel for the various tunnel sections as herein tabulated be approved as a basis for computation of schedule item quantities.

Harold Wood
Resident Engineer

HW/p

P.S. Steel in tunnel section does not include the laps in the longitudinal steel.

H.W.

5/4/33
copy/f

H. W. ROHL & T. E. CONNOLLY
CONTRACTORS

October 10, 1932

Mr. H. Wood,
Resident Engineer,
El Capitan Dam,
Camp.

Dear Mr. Wood:

Will you please furnish us with two complete sets of Drawings Nos. W.D. 418, sheets 1 to 7 inclusive and W.D. 419, sheets 1 to 7 inclusive which we find necessar for our Steel and Carpenter foremen, during construction, and oblige,

Yours very truly,

H.W.Rohl-T.E.Connolly, Contractors.

Per BEN WELLS (Signature)

5/4/33
copy/f

October 11, 1932

H. W. Rohl & T. E. Connolly,
Contractors, El Capitan Dam
Lakeside, California.

Subject: El Capitan Reservoir Dam, Spillway and Outlet Works, Tunnel Approach and Outlet, Details of Steel.

Gentlemen:

In compliance with your Superintendent, Ben F. Wells' requisition dated October 10, 1932, enclosed are two sets of Drawings WD-418, Sheets 1 to 7 of 7, "El Capitan Reservoir Feature, Hydraulic Fill and Rock Embankment Dam" showing details of steel in tunnel approach;

Also two sets of Drawings WD-419, Sheets 1 to 7 of 7, "El Capitan Reservoir Feature, Hydraulic Fill and Rock Embankment Dam" showing details of steel in tunnel outlet.

Very truly yours,

H. N. Savage,
Hydraulic Engineer

HNS/f
Encls.
WD-418, Sheets 1 to 7 of 7
WD-419, " 1 to 7 of 7

5/4/33
copy/f

November 16, 1932

Messrs. H. W. Rohl & T. E. Connolly
4351 Alhambra Avenue
Los Angeles, California.

Subject: San Diego River Project, El Capitan Feature. Tunnel lining, thickness of concrete over timber.

Gentlemen:

Your attention is specifically called to that portion of paragraph 101 of the Drawings and Specifications for the construction of the El Capitan Reservoir Dam, Spillway and Outlet Works, reading as follows:

> "...No projecting rock or permanent timbering shall encroach closer than 8 inches to the face of the finished surface of the concrete lining..."

Also to print of Drawing WD-414, timbered tunnel section, furnished you before timbering was undertaken, whereon it is also indicated that the minimum thickness of concrete tunnel lining shall be 8 inches over timber sets.

Also to the indicated lack of provision for compliance with the above requirement as indicated by the distance between the steel forms now in place and the timbers which is in some places less than the requirements after making allowance for anticipated settlement of forms.

You are requested to advise this office immediately of your plans to secure the proper thickness of concrete over timber sets.

Respectfully,

H. N. Savage,
Hydraulic Engineer.

HNS/p
cc H.W.Rohl & T.E.Connolly
El Capitan Dam
cc Contractor's Representative
cc City's Resident Engineer

December 19, 1932

From : Resident Engineer

To : Hydraulic Engineer

Subject : San Diego River Project, El Capitan Feature
Outlet tunnel - concrete lining

1. The outlet tunnel concrete lining at El Capitan Dam is being progressed in three operations in the side walls.

2. On November 28 and 29 the first 19 feet from the exit portal was concreted with the portal headwall by placing the concrete with a bucket from the derrick boom of a dragline excavator.

3. On December 8 and 9 the next adjacent 60 feet was concreted, using a Press-Well 3/4 cubic yard concrete gun to place the concrete. The hopper above the gun is fed with concrete by belt conveyor and the conveyor in turn is fed by the transit mix concrete trucks holding 3 barches or about 3 cubic yard each.

4. The mix used from the start of the placement 11:49 A.M. December 8 to 3:30 A.M. December 9 was as follows:

Cement	6 sacks
Sand	1,340 pounds
1 1/2" rock	1,220 "
3/4" rock	1,030 "
Water	32 to 36 gallons

At 3:30 A.M. December 9 the mix was changed to secure better workability. It was then chanted to the following:

Cement	6 sacks
Sand	1,370 pounds
1 1/2" rock	1,000 "
3/4" "	1,250 "
Water	35 to 36 gallons

This mix was used until the section was completed at 10:45 A.M. December 9.

5. The work at this point was interrupted by the flood thru the tunnel.

6. Following the flood it was decided by the contractors to concrete the side walls in three operations as follows:

(1) For a height of 6 feet above the top edge of the invert the side wall is concreted with its bottom set 15 inches back of this edge of the invert and with its inside top edge flush with the inside face of the timber posts.

(2) Above this first placement (1) the concrete is to be placed between the posts and up to about the spring line of the final tunnel lining.

(3) The reinforced concrete lining behind the steel forms will be done in front or inside of this concrete of (1) and (2). The minimum thickness of this (3) concrete will be 8 inches or more at a point 3 feet above the top edge of the invert.

7. On December 16 the following mix was used for the side walls back of the reinforced concrete lining:

Cement	6 sacks
Sand	1,340 pounds
2 1/2" rock	760 "
1 1/2" "	970 "
3/4" "	770 "
Water	30 to 33 gallons

This proved very satisfactory on the toe walls and is being used for all the concrete back of the reinforced concrete lining.

8. On December 18 forms were removed from the concrete lining placed by the gun on December 8 and 9 from Station 11+03 to 11+63 and disclosed this concrete as being unsatisfactory because of excess of water.

9. Extra water was added on December 8 and 9 from time to time at the gun to wash the gun. One shot of water alone was put thru the gun and discharged into the forms. All this water went into the concrete being placed.

10. On December 18 the Resident Engineer reported to Mr. T. E. Connolly this obvious unsatisfactory concrete and was assured by Mr. Connolly that the major troubles causing this faulty concrete had been eliminated by repairing the gasket in the gun hatch and increased air capacity. Mr. Connolly assured him no water would be added to the concrete at the gun. Mr. Connolly stated the concrete placed December 8 and 9 was too dry.

11. On December 18, the following mix was designed and used for the reinforced concrete lining being placed by the gun:

Cement	6 sacks
Sand	1,440 pounds
1 1/2" rock	1,150 "
3/4" "	1,030 "
Water	not over 36 gallons added.

This is judged to be about a 6-inch slump mixture.

12. The gun manufacturing company's representative reported the gun capable of shooting 3 inch slump concrete with 6 inch discharge line with proper amount of air and pressure. The discharge pipe being used is 5 inch diameter.

13. The mix designed on December 18 is working successfully thru the gun and has caused no plugging where the end of the discharge pipe was not embedded in the concrete being placed.

14. It is recommended that the concrete lining between Station 11+03 and 11+63 be drilled into to test its quality and thickness and that pending its final determination that it be not included in Estimate No. 8 for work done in December.

A.F.E. H. N. Savage 12-21-32

Harold Wood
Resident Engineer

HW/p

5/4/33
copy/f

December 21, 1932

H. W. Rohl & T. E. Connolly
Contractors, El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

Subject: San Diego River Project, El Capitan Feature, exploratory tunnels, backfill, Quotation.

Gentlemen:

There is requirement for the backfilling of exploratory tunnels 1 and 2 in the vicinity of the puddle core of the El Capitan Dam with hand placed rock and concrete, or with gunite.

There is also requirement for backfilling tunnels 5, 7, and 8 with hand placed rock or gunite.

Cement used to be paid for under schedule Item 33, and grouting, if required, to be paid for at the respective prices bid in the schedule. The remainder of the work to be paid for as extra work at an agreed price per cubic yard in place.

Please quote price per cubic yard in place for backfilling exploratory tunnels 1 and 2 with hand placed rock, the interstices to be filled with 1:3:6 concrete; and

As an alternate, a price per cubic yard for filling exploratory tunnels 1 and 2 with about 1 to 8 gunite; also

Please quote price per cubic yard in place for filling exploratory tunnels 5, 7 and 8 with hand placed rock; and

As an alternate, a price per cubic yard for filling exploratory tunnels 5, 7 and 8 with 1 to 8 gunite.

The prices you quote are not to include the 15 per cent which will be added by the City when payment is made in accordance with paragraph 14 of the contract specifications.

For your information the average cross section of the tunnels is about 6.5 feet by 4 feet and the volume about one cubic yard per foot of length.

Tunnels 1 and 2 will be filled for a probable length of 91 and 97 feet respectively, and tunnels 5, 7 and 8 for a length of 81, 141 and 75 feet respectively.

Very truly yours,

H. N. Savage
Hydraulic Engineer

HNS/p

5/4/33
copy/f

January 3, 1933

Messrs. H. W. Rohl and T. E. Connolly
Contractors, El Capitan Dam,
4351 Alhambra Avenue
Los Angeles, California.

Subject: San Diego River Project, El Capitan Feature, drilling holes in tunnel lining for inspection.

Gentlemen:

You are directed to drill with concussion drills, holes in concrete lining of the outlet tunnel of the El Capitan Dam, for inspection purposes, at points and to depths as directed by the Hydraulic Engineer thru the Resident Engineer Harold Wood. All holes to be drilled within four days of time of direction by the Resident Engineer.

The above work is to be performed in accordance with paragraph 122 of the contract specifications, and will be paid for under schedule item 43.

Very truly yours,

H. N. Savage,
Hydraulic Engineer.

FDP/p

cc H.W.Rohl and T.E.Connolly
El Capitan Dam
Contractor's Resident Representative
City's Resident Engineer

5/4/33
copy/f

January 9, 1933

Messrs. H. W. Rohl and T. E. Connolly
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

Subject: San Diego River Project,
El Capitan Feature, exploratory
tunnels Nos. 1 and 2, backfill
with concrete.

Gentlemen:

In accordance with oral discussion of the backfilling of exploratory tunnels El Capitan reservoir dam;

You may proceed to backfill tunnels Nos 1 and 2 with concrete placed pneumatically.

Concrete to be paid for as schedule item 26.

Cement to be paid for as schedule item 33.

Very truly yours,

H. N. Savage,
Hydraulic Engineer.

HNS/p
cc H.W.Rohl and T.E.Connolly
El Capitan Dam
Contractor's Resident Representative
City's Resident Engineer

3-11-35
copy/p

January 25, 1933

From : Resident Engineer

To : Hydraulic Engineer

Subject : San Diego River Project, El Capitan Feature
Outlet tunnel, overbreak

1. The measurements of overbreak in the timbered section of the outlet tunnel at El Capitan dam have been computed to give the volume of overbreak. This data is here given up to and including the last concrete placed which was on January 16, 1933.

2. The total overbreak Station 1+29 to 7+00, and 9+61 to 11+73 was 800 cubic yards, or an average of 1.02 cubic yards per foot of tunnel. The neat concrete section of the timbered section, including invert is 5.7 cubic yards per foot of tunnel. The overbreak is 18 per cent of the concrete lining to date.

3. By way of comparison, the following is given on overbreak in other tunnels:

Richmond, California, 41 foot vehicular tunnel
overbreak 61 per cent of concrete lining

Hoover Dam, diversion tunnels. C. H. Vivian, in Compressed Air Magazine, December 1932, page 4010

". . . 394,000 cubic yards of concrete . . . for lining. About 77 per cent or 303000 cubic yards will be paid for . . . 91,000 cubic yards will have to be placed because of overbreak."

This is 23 per cent of concrete lining.

4. It has been previously stated by the Resident Engineer that the overbreak in the outlet tunnel was remarkably small due to care used in excavating and timbering.

5. On the basis of yield of 1.09 cubic yards per batch of concrete, there has been placed in the above length of 783 feet of tunnel about 5006 cubic yards of concrete. For this same length of tunnel there would have been 4463 cubic yards required in the neat lining and invert section. Adding the 800 cubic yards of overbreak volume, the total known required concrete is about 5263 cubic yards, or a difference of 257 cubic yards. Considerable lagging, blocking and cribbing is in place in the overbreak space.

6. In general it is indicated that the overbreak has been well filled except for the places noted in the Resident Engineer's letters of January 7 and 14, 1933.

Harold Wood
Resident Engineer

HW/p

4/20/33
copy /f

April 7, 1933

Messrs. H. W. Rohl & T. E. Connolly
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California

Subject: San Diego River Project, El Capitan Feature
Outlet tunnel lining

Gentlemen:

The El Capitan reservoir outlet tunnel lining remains incomplete and you are hereby directed to immediately proceed with and complete the lining in accordance with the contract specifications.

These directions apply particularly to the enlargement section, Station 1+03 to 1+31; the untimbered section about Station 7+00 to 9+58 and those several sections of arch lining not completed and not in accordance with contract specifications, located as follows:

Between Stations		
2+07	and	2+17
2+98	"	3+04
3+48	"	3+51
4+60	"	4+70
4+96	"	5+04
6+30	"	7+00
11+47	"	11+57

and at such other locations as may be disclosed as the work progresses.

Reinforcing steel bars in the intrados of the arch lining are not imbedded in the concrete but exposed in the crown of the arch between Stations 2+47 and 2+57 and on the left or south side of the crown between Stations 4+20 and 4+24.

You are directed to properly form the two keyways in the enlarged section of tunnel between Stations 1+03 and 1+31 in accordance with drawing WD-423 sheet 2 of 2.

Your attention is invited to that portion of paragraph 110 contract specifications reading as follows:

> ". . . . . Because of the high velocities of water possible it is required that unusual precautions be taken to have an exceptionally smooth finish. Immediately after the removal

of forms the surface of the concrete lining, except in the keyways hereinafter specified, shall be rubbed with a carborundum stone of suitable fineness to remove all projections and rough places to the satisfaction of the engineer."

This applies particularly to those places where the forms have been allowed to shift or where the forms were improperly set causing an offset in the lining and at places where the plates covering the openings in the steel forms were improperly set in position causing a recess in the concrete lining and at edges of portions plastered.

In lieu of 4-inch drains at 8-foot intervals through the side walls of the tunnel lining as shown on Drawing WD-414, for that portion of the tunnel between Stations 1+31 and 3+55, and between Station 8+19 and exit portal, you may drill at your expense weep holes 1-1/4 inch in diameter at 8-foot intervals along the length of both sides of the above reach of the tunnel. These drilled weep holes shall extend through the concrete floor of the tunnel and about one foot from the inside of the side wall intersection with the floor. Many of the holes already drilled by you through the floor are satisfactory, but many will require re-drilling to leave them open.

You are invited to review my letter dated January 3, 1933 subject: Drilling holes in tunnel lining for inspection. Compliance on your part with this letter is expected.

Very truly yours,

H. N. Savage,
Hydraulic Engineer

HNS/p
cc H.W.Rohl & T.E.Connolly
El Capitan Dam
Contractor's Resident Representative
City's Resident Engineer

5/1/34
copy/f

July 8, 1933

Messrs. H. W. Rohl & T. E. Connolly
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

S-21

Subject: San Diego River Project, El Capitan Feature, Tunnel grouting

Gentlemen:

After you have properly completed the concrete lining of the timbered section of the by-pass tunnel at El Capitan Dam between tunnel stations 0+56 and 6+60, there will be requirement for drilling holes with concussion drills, placing grout pipes and grouting thru the concrete lining.

The location, angles and depths of the grout holes will be indicated and staked by the Engineer.

The drilling and grouting will consist of two steps:

(a) Drilling and grouting with 60 pounds pressure per square inch to completely fill all shrinkage cracks between the concrete tunnel lining and rock. This will require the drilling of sets of 4 holes in the arch portion of the tunnel, the sets placed about 20 feet apart; and

(b) After the above is completed and sufficient time has elapsed for the grout to harden, the drilling and grouting of 10-foot grout holes with 100 pounds pressure per square inch to fill seams and crevices in the rock surrounding the tunnel. This will require the drilling of sets of 6 holes in the tunnel, spaced intermediate between the sets of holes for the first step in grouting.

In addition, after all the grouting is completed, there will be requirement for drilling drainage holes in the floor.

The work is to be done in accordance with paragraphs 119 to 123 inclusive of the contract specifications.

Payment will be made in accordancw with paragraphs 121 to 123 inclusive of the contract specifications.

This work should be completed before October 1, 1933.

Very truly yours,

H. N. Savage,
Hydraulic Engineer.

HNS/p

5/1/34
copy/f

July 21, 1933

Messrs. H. W. Rohl & T. E. Connolly S-26
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

Subject: San Diego River Project,
El Capitan Feature, tunnel
grouting.

Gentlemen:

Supplementing letter dated July 8, 1933, S-21, on grouting of the by-pass tunnel at El Capitan reservoir dam;

Herewith is stationing and locations of the holes for both the 60-pound and the 100-pound pressure grouting.

Very truly yours,

H. N. Savage,
Hydraulic Engineer.

HNS/p
encl.

HW/p
7-21-33
5/1/34
copy/f

SAN DIEGO RIVER PROJECT, EL CAPITAN FEATURE
BY-PASS TUNNEL

Location of holes for 60 pounds pressure grouting per letter July 8, 1933, S-21

Station	LEFT Distances from center line of crown										RIGHT
	17.6	13	9	6	3	0	3	6	9	13	17.6
0+60	x			x				x			x
0+80	x			x				x			x
1+08	x	x							x		x
1+28	x			x			x				x
1+44	x		x				x				x
1+60	x			x				x			x
1+80	x			x				x		x	x
2+00	x			x				x			x
2+22	x	x			x				x		x
2+40	x		x				x				x
2+58	x				x			x			x
2+80	x			x			x				x
3+00	x				x			x			x
3+18	x			x					x		x
3+40	x			x			x				x
3+60	x			x				x			x
3+80	x			x				x			x
4+00	x			x				x			x
4+20	x				x			x			x
4+42	x				x			x			x
4+60	x			x			x				x
4+78	x			x			x				x
5+00	x				x			x			x
5+20	x				x			x			x
5+42	x			x				x			x
5+60	x			x				x			x
5+80	x			x			x				x
5+98	x				x			x			x
6+20	x			x			x				x
6+42	x			x				x			x
6+60	x				x			x			x

Holes are to be drilled radially to the axis of the tunnel at the distances from the center line of crown measured along the intrados as above. Depth of holes to reach the rock.

HW July 13 1933

HW/p
7-21-33
5/1/34
copy/f

Location of holes for 100 pounds pressure grouting per letter July 8, 1933, S-21

Station	Distances from center line of crown
0+68	(10' each side of center line of arch
0+90	(
1+10	(20' each side of center line - horizontal
1+28	(
1+50	(8' each side of center line of invert
	(
1+68	(for all rings
1+88	(
2+11	(
2+32	(All holes 10 feet deep and at right angles
2+50	(and radially to axis of the tunnel
	(
2+70	
2+92	
3+10	
3+30	
3+48	
3+68	
3+90	
4+10	
4+30	
4+50	
4+70	
4+90	
5+10	
5+29.5	
5+50	
5+68	
5+90	
6+10	
6+30	
6+50	

HW July 14, 1933

3-15-35
copy/p

El Capitan Dam
July 21, 1933

From : Resident Engineer

To : Hydraulic Engineer

Subject : San Diego River Project, El Capitan Feature
Outlet tunnel - seepage thru lining

1. On July 21, 1933, measurements of seepage thru the north side wall of the outlet tunnel at El Capitan dam was measured as follows:

Tunnel Station	Gallons per minute	Location
9+04	6.00	Inner end exploration tunnel 7
6+30	0.27 total 3 streams	14 feet west of axis of dam produced.
5+15	0.07	101 feet east of axis of dam produced.
5+00	0.05	116 feet east of axis of dam produced.

Elevation of summit pool 639

2. It should be remembered that the weep holes have not been opened and many are as yet undrilled.

3. This data was requested by Gerald McKinlay. Measurements will be made at ten day intervals.

Harold Wood
Resident Engineer

3-11-35
copy/p

El Capitan Dam

July 24, 1933

Messrs. H. W. Rohl and T. E. Connolly
Contractors
El Capitan Dam

Subject: San Diego River Project, El Capitan Feature, concrete

Gentlemen:

You are hereby notified to accomplish the deposition of concrete in the outlet tunnel at El Capitan Dam so that there will be concrete with aggregates graded as required by the specifications, in the tunnel lining.

Your attention is called to requirements of paragraphs 75, 81 and 87 of the contract specifications.

Unless compliance with these requirements is had immediately, it will be necessary to issue an order to stop this portion of the work.

Harold Wood
Engineer

D. W. Albert
Hydraulic Engineer

Delivered to R. Colgate of H. W. Rohl and T. E. Connolly at 8:12 P.M. by H. L. Harper in the presence of no one, July 24, 1933.

Directions complied with at _____ 1933

_____ cubic yards placed before letter delivered.

_____ cubic yards placed after letter delivered.

3-11-35
copy/p

El Capitan Dam

July 27, 1933

Messrs. H. W. Rohl and T. E. Connolly
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California

Subject: San Diego River Project, El Capitan Feature, Outlet Tunnel concrete lining

Gentlemen:

You are hereby notified to stop placing of concrete materials into forms for the El Capitan Outlet Tunnel until compliance is had with the requirements of the contract specifications and with letter of Resident Engineer dated July 24, 1933.

R. W. Carter
Inspector

Harold Wood
Resident Engineer

Delivered to O. C. Steves of H. W. Rohl and T. E. Connolly at 2:17 P.M. July 27, 1933 by R. W. Carter in presence of D. W. Albert.

Directions complied with at 2:17 P.M. July 27, 1933.

____0____cubic yards placed before letter delivered.

_____cubic yards placed after letter delivered.

3-15-35
copy/p

August 22, 1933

From : Resident Engineer

To : Hydraulic Engineer

Subject : San Diego River Project, El Capitan Feature
Outlet tunnel - seepage thru lining

1. The following is measurement of seepage thru El Capitan outlet tunnel concrete lining made August 21, 1933:

Station	Side	Amount of seepage gallons per minute
5+00	North	0.06
5+15	"	0.21
6+30 hole 1	"	2.5
" 2		0.04
7+56		10.0
9+04		7.15
	Total	19.96

Harold Wood
Resident Engineer

HW/p

cc-State Engineer 9-18-34

12/16/33
copy /f

November 21, 1933

Messrs. H. W. Rohl & T. E. Connolly
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

S-64

Subject: San Diego River Project, El Capitan Feature, tunnel lining.

Gentlemen:

You are hereby notified that the following portions of the concrete lining of the El Capitan flood by-pass tunnel have been improperly executed and are herewith rejected:

Invert, north side, about 8 feet of invert from Station 1+98 to Station 2+19.

Invert, south side, about 7 feet of invert from Station 1+62 to Station 1+67.

North side wall, strip about one foot wide, 10 feet above invert from Station 6+00 to Station 6+16.

South side wall, rock pocket indicated about 8' x 8', 7 feet above invert at Station 6+27.

North side wall, rock pocket indicated about 4' x 1.5' just above invert Station 4+70.

North side wall, rock pocket indicated about 3' x 3', 8 feet above invert at Station 3+38.

In accordance with the provisions of paragraphs 17 and 30 of the contract specifications you are required to immediately remove and rebuild the above described improperly executed work at your own expense.

Care shall be exercised in removing and replacing the defective work to so key in the replacement work that the full strength of the tunnel lining will be maintained.

Very truly yours,

H. N. Savage,
Hydraulic Engineer.

HNS/p

12/16/33
copy /f

November 22, 1933

Messrs. H. W. Rohl & T. E. Connolly
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

S-66

Subject: San Diego River Project, El Capitan Feature, tunnel grouting.

Gentlemen:

You are hereby instructed to continue at an early date with the completion of the grouting of the by-pass tunnel at El Capitan Dam in accordance with instructions contained in my letter dated July 8, 1933, subject: "San Diego River Project El Capitan Feature, Tunnel Grouting. S-21".

You are also instructed that after the defective concrete work described in my letter dated November 21, 1933, subject: "San Diego River Project, El Capitan Feature, Tunnel Lining. S-64" has been completed and sufficient time has elapsed for the concrete to gain the necessary strength that additional drill holes and grouting will be required at the location of each portion of replacement work.

Care shall be exercised to prevent pressure at the grout holes exceeding the amounts stated in my letter dated July 8, 1933, S-21.

Very truly yours,

H. N. Savage
Hydraulic Engineer

HNS/p

H. W. ROHL & T. E. CONNOLLY
CONTRACTORS

December, 8, 1933

Mr. H.N. Savage, Hydraulic Engineer,
San Diego,
Cal.

Dear Sir:

The portions of tunnel lining listed in your letter S-64 which you state "have been improperly executed and are herewith rejected" do not bear out your contention.

This concrete was correctly proportioned, mixed and placed properly under your supervision and accepted as such.

This concrete has failed due to usage of excessive grout pressure as ordered by you and placed under your direction. There is no question as to this as the portions which cracked lifted and cracked while the grouting was being carreid on under your direction.

In as much as the cost of this repair work will be less than $1000.00 I am proceeding with this work on your order and will bill you for same under paragraph 14 of the Contract.

Yours truly,
H.W.Rohl & T.E.Connolly.

By T. E. CONNOLLY (Signature)

1/2/34
copy/f

December 15, 1933

Messrs. H. W. Rohl & T. E. Connolly
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

S-75

Subject: San Diego River Project, El Capitan Feature
Outlet Tunnel, lining.

Gentlemen:

Receipt is acknowledged of your letter dated December 8, 1933 in reference to responsibility for portions of rejected improperly executed lining in the flood bypass tunnel of the El Capitan reservoir dam which you were notified to remove and rebuild by my letter to you dated November 21, 1933, S-64.

Your attention is invited to that portion of paragraph 17 or the contract specifications reading as follows:

> ". . . . . Work or material that does not conform to the specifications, although accepted through oversight or otherwise, may be rejected at any state of the work. . . . . ."

Also to paragraph 30 of the contract specifications, reading as follows:

> "30. REMOVAL AND REBUILDING OF DEFECTIVE WORK.- The contractor shall remove and rebuild at his own expense and part of the work that has been improperly executed, even though it has been included in the monthly estimates. If he refuses or neglects to replace such defective work, it may be replaced by the City of San Diego at the expense of the contractor, and the contractor and his sureties shall be liable therefor."

You are hereby notified that my letter to you dated November 21, 1933, subject: San Diego River Project, El Capitan Feature, Tunnel Lining. S-64, is not withdrawn or modified.

You are also notified that the above mentioned letter is not an extra work order under paragraph 14 of the contract specifications; and

That all extra work orders issued by the Hydraulic Engineer in accordance with paragraph 14 of the contract specifications distinctly state that they are issued as extra work orders in accordance with paragraph 14 and distinctly authorize the particular work to be performed.

Very truly yours,

H. N. Savage
Hydraulic Engineer.

HNS/p

5/1/34
copy /f

H. W. ROHL & T. E. CONNOLLY
CONTRACTORS

December,20,1933

Mr.H.N.Savage, Hydraulic Engineer,
San Diego,
Cal.

Dear Sir:

Acknowledging your letter,S-75; the pertinent wording in paragraph 17 as quoted by you is "that does not conform to the specifications"- and of paragraph 30 is "work that has been improperly executed".

Opening up and repairing the sections listed by you does not disclose defective work. The concrete is dense, homogenous and in part the cracks have split the aggregate, not merely following through the matrix.

Because of the fact that the low pressure grouting was taking too much grout, in the opinion of your representatives, some holes were not grouted to refusal. The operation was stopped while still taking grout. The net result was that you did not consolidate the shell of rock around the periphery of the tunnel before commencing the high pressure operation. This was made wholly apparent by the blowing back of air and water when the high pressure grouting was going on. The cracking and lifting of areas you indicated occurred at the time of the high pressure grouting and blowing back through the cracks took place. There is no question as to when or how the cracking took place. The concrete was simply tested to failure in those areas due to an undue pressure being brought to bear because of the insufficiency of the low pressure grouting- at your direction.

There remains one area untouched which the contractor requests the Hydraulic Engineer to inspect with him and it will be drilled out and opened up in your presence. We will cut a sample from any portion of the area you indicate for your testing laboratory to test and determine its proper fitness and sufficiency under the specifications.

Obviously the Hydraulic Engineer cannot expect the Contractor to pay for mistakes of others and if the sample tests out, meeting specification requirements, we certainly will expect due and proper compensation for the extra work entailed.

Yours very truly,
H.W.Rohl & T.E.Connolly

T. E. CONNOLLY (Signature)

August 17, 1934

From : P. Beermann

To : Hydraulic Engineer

Subject : San Diego River Project, El Capitan Feature
Bipass tunnel safety

1. The portion of the El Capitan dam bipass tunnel upstream from about the axis of the dam is of primary importance.

2. A developed section directly over the central alignment of the tunnel is shown on the attached drawing (unnumbered).

3. The entire section of tunnel between section 0+14 near the upstream end and station 7+00, being about 90 feet downstream from the axis of the dam, is timbered section as indicated on drawing WD-414.

4. Computations have been made of the stress in the tunnel lining with the following results: Note - steel has not been taken into consideration. Cain method for arch stresses used.

(1) Top of tunnel

	Pressure head feet	Thickness in inches	Stresses in lbs/sq in. Crown Intrados	Crown Extrados	Abuthent Intrados	Abuthent Extrados
Fixed ends	200	8	1600	1820	2060	1560
including	100	8	800	910	1030	780
shear	50	8	400	455	515	390
	200	18	570	810	1070	370
	100	18	285	405	535	185
Note-8" sections is over timbers only	50	18	142	202	267	92

(2) Tunnel floor

It was assumed that because of the method of construction used the floor could be considered a hinged arch. The stressed are indicated below. For comparison the stresses derived by means of the cylinder formula are indicated.

Hinged	200	12	1260	3120	2220	2220
ends	100	12	630	1560	1110	1110
(Fowler diagram)	50	12	315	780	555	555
Cylinder	200	12	2210	2210	2210	2210
formula	100	12	1105	1105	1105	1105
	50	12	553	553	553	553

All stresses are compression

(3) Tunnel sides

The actual construction of the sides of the tunnel resulted in much thicker sections than called for on the drawings on account of excavation being backfilled solid and the actual stresses are not susceptible of computation but are believed to be materially less than those in the tunnel floor.

5. At the axis of the dam from the center of the tunnel about elevation 565 to maximum water surface during peak flood, about elevation 765 is 200 feet. On the outside asseumption that full water pressure can come upon the tunnel lining. Maximum stress (a) in the top of tunnel over timbers, where minimum thickness of covering ecists, is 2060 pounds per square inch at the abutment intrados. (b) In the top of tunnel regular section only 1070 pounds per square inch at the abutments intrados. On account of the small length of the 8 inch section and longitudinal reinforcing,as shown on WD-414, no great importance need be attached to the above indicated stress of about 2000 pounds per square inch, which is still below failure of concrete containing 1.4 barrels of cement per cubic yard. (c) In tunnel floor maximum indicated stress is computed to be about 3120 pounds per square inch on the basis that full reservoir head can have access uniformly to the underside of the floor.

6. It is not believed that pressures from dead load of material overlying the tunnel on account of its nature and grouting of interstices between tunnel lining and ground would be as great as the pressure from the maximum water surface.

7. Low pressure grouting consisted of generally drilling a set of 4 holes spaced one about 6 feet each side of the crown and one about 17.5 feet each side of the crown in the side lining. Sets of holes were spaced about 20 feet apart. Low pressure grouting was then done under 60 pounds. The holes were drilled thru concrete to rock.

8. High pressure grouting was done thru holes 10 feet deep drilled radially. Sets of 6 holes consisted one 10 feet each side of crown, one 20 feet each side of crown and one 8 feet each side of center line of invert. The set were generally spaced about 20 feet apart and grouting was done under 100 pounds pressure.

9. About 22,200 cubic feet of grout were taken in the tunnel.

10. It should be noted that failure of the floor upon the application of grouting pressure of 100 pounds per square inch equivalent to 230 feet of static head resulted only in 2 places of local failure between Station 2+00 to 2+20, and 1+62 to 1+93 when a crack appeared in the south part of the invert, and was possibly due to uneven application of pressure. Everywhere else in the tunnel floor the application of grout under the equivalent head of 230 feet of water was successfully resisted by the concrete lining.

11. Every care should be taken to see that the drain holes in the floor are open.

12. For comparative purposes only, attention is called to the fact that application of the cylinder formula, which gives lower maximum stresses, to the lining at Hoover dam results, on the assumption of full hydrostatic head of 600 feet, in compressive stresses of about 3400 pounds per square inch in the tunnel lining, and at Owyhee dam under 325 feet head to about 1850 pounds per square inch.

13. It may be assumed that reservoir level will gradually rise and the effect thereof on the tunnel lining can be observed over a material length of time. Should an undue amount of water find its way into the tunnel, further grouting may have to be done but no difficulty should be experienced because the tunnel lining will be nearly everywhere exposed. Similarly should any distress be evident in the floor, provision for reinforcing can then be made.

14. It is therefore concluded that the top and sides of tunnel are safe to carry maximum possible loads and that the tunnel floor is safe provided drainage is properly provided and functions.

15. Attached is a record of concrete tests made on tunnel lining which indicate a concrete having a strength of about 2350 pounds per square inch.

16. Attached is memorandum dated June 9, 1932 indicating thickness of tunnel linings at several other locations.

P. Beermann

PB/p
encls.

August 18, 1934

CONCRETE CYLINDER TESTS FROM TUNNEL

Cylinder No.	Station		Test in pounds/square inch 7-day	28-day	3 months	Location
200, 201, 202	3+73	5+46	1770	3180	4100	Invert
203, 204, 205	11+20		920	2010		Lining
206, 207, 208	10+60		920	1620	2070(a)	"
209, 210, 211	6+30	5+70	1110	1850	2460(a)	"
212, 213, 214	3+35	2+77	1060	1990	2660(a)	"
219, 220, 221	0+46	1+03	980	1730	2360(a)	"
346, 347, 348	9+30	9+58	1000	1770	2310	"
361, 362, 363	8+80	8+30	1700	2140	2970	"
364, 365	8+00			1980 1720		"
366, 367, 368	8+30	7+84	885(b)	1550	2140(c)	"
381, 382, 383	7+00	7+44	940	1620	1980	"

(a) Low strength due to mix use semi-liquid consistency

(b) Water cement ratio greater than 1

(c) Mix determined by contractor

P. Beermann

PB/p

June 9, 1932

MEMORANDUM

Tunnel - thickness of lining

Name	Size & shape inside diameter tunnel	Specification thickness lining	Reinforcing steel	Remarks
Gibson dam	29.5 radius circular	18" minimum	?	Serves as shaft spillway, no timbering shown
McKay dam	10 1/4X14	6" minimum 12" floor	?	Stump horseshoe no timbering shown
Echo dam	14x14 horseshoe	8" minimum 12" average	?	No timbering shown
Owyhee dam	22x22 horseshoe	12" minimum 18" average	None shown	
		8" minimum 12"	?	Less thickness where tunnel is not part of shaft spillway
WallKill Catskill Water Supply	13.3x17 elongated horseshoe	8" minimum over timber	?	Heavy timber grade tunnel
Rondout Pressure tunnel	14.5' radius	24" over steel plate	?	Very wet stretch
Shandoken Tunnel, Catskill Water Supply	10.25x11.3 horseshoe	21" over timber 9" floor	?	Thru earth. Bents 5' on center. Am.Soc. C.E.Trans. Vol. 92
Moffet	16x23±	None		Heavily timbered
Covington Ky.	29x22±	24" side and top, no floor	7/8"-12" on center none on sides	Timber for crown left in place

PB/p

P. Beermann

3-12-35
copy/p

August 23, 1934

From : Resident Engineer

To : Hydraulic Engineer

Subject : San Diego River Project, El Capitan Feature Outlet tunnel - grouting

1. As requested by the Hydraulic Engineer in memorandum dated August 21, 1934, here is report on grouting done in portion of El Capitan outlet tunnel.

2. The east face of the entrance portal structure is station 0+00 and all stationing refers to this point.

3. On July 3, 1933 the Resident Engineer addressed a letter to the Hydraulic Engineer and recommended certain grouting be done in the outlet tunnel.

4. On July 8, 1933 the Hydraulic Engineer addressed a letter S-21 to the contractors giving directions relative to grouting in the outlet tunnel. Paragraph 2 of this said letter requires the locations, angle and depth of all grout holes to be as indicated by the Engineer.

5. On July 13, 1933 the Resident Engineer addressed a letter to the Hydraulic Engineer and gave tabulations showing locations of holes for grouting with low pressure air and with the 100 pounds per square inch air pressure. He further recommended that the holes be drilled in accordance with these tabulations which were worked out in detail so the holes would miss the tunnel segment timbers.

6. The following tabulation shows the location and depth of low pressure grout holes and the cubic feet of grout placed in each hole.

EL CAPITAN RESERVOIR DAM SPILLWAY AND OUTLET WORKS

High Pressure Grouting at Tunnel Plug

	North					℄		South		
Station	ft. 27	20	17.5	10	6.5		6.5	10	17.5	20	27 ft.
1+10		5		2				134			
1+28		45		2						1	
1+10.5	7		1		4		4		1		1
1+21.5	14		21		41		3		2		30
Total	21	50	22	4	45		7	134	3	1	31

	Floor			
	8	6	6	8
1+10	22			5
1+28	1			40
1+10.5		1	6	
1+21.5		2	2	
Total	23	3	8	45

Total grout 397 cubic feet. All holes 10 feet deep.

9-22-34
copy/p

COPY

August 23, 1934

From : Resident Engineer

To : Hydraulic Engineer

Subject : San Diego River Project, El Capitan Feature
Outlet tunnel - grouting

1. As requested by the Hydraulic Engineer in memorandum dated August 21, 1934, here is report on grouting done in portion of El Capitan Outlet Tunnel.

2. The east face of the entrance portal structure is station 0+00 and all stationing refers to this point.

3. On July 3, 1933, the Resident Engineer addressed a letter to the Hydraulic Engineer and recommended certain grouting be done in the outlet tunnel.

4. On July 8, 1933, the Hydraulic Engineer addressed a letter S-21 to the contractors giving directions relative to grouting in the outlet tunnel. Paragraph 2 of this said letter requires the locations, angle and depth of all grout holes to be as indicated by the Engineer.

5. On July 13, 1933, the Resident Engineer addressed a letter to the Hydraulic Engineer and gave tabulations showing locations of holes for grouting with low pressure air and with the 100 pounds per square inch air pressure. He further recommended that the holes be drilled in accordance with these tabulations which were worked out in detail so the holes would miss the tunnel segment timbers.

6. The following tabulation shows the location and depth of low pressure grout holes and the cubic feet of grout placed in each hole.

TABLE A

Low Pressure Tunnel Grouting, except invert

Station	North 17.5' ft	ft³	13' ft	ft³	9' ft	ft³	6' ft	ft³	3' ft	ft³	3' ft	ft³	South 6' ft	ft³	9' ft	ft³	13' ft	ft³	17.5' ft	ft³
0+33.5																				422
+60	6.6	0					5.5	3					5.2	2					6.5	80
+80	4.4	2					1.5	591					0.2	7					1.6	2
1+08																				
+28	2.5	0					3.2	3			2.5	3							3.2	0
+44	3.2	3			4.6	7					3.2	844							3.7	2
+60	3.6	0					4.1	776					2.4	0					2.7	0
+80	3.7	0					3.3	601					2.7	3			6.3	2	4.2	0
2+00	4.5	0	2.6	2			2.4	2					2.4	2					2.7	0
+22	2.3	0							2.3	0					3.2	0			2.2	0
+40	2.7	0			4.6	2					3.2	0							3.5	2
+60	3.3	2							2.4	0			4.0	0					3.5	2
+80	2.6	3					3.2	3478			3.1	3							4.4	0
3+00	4.7	0							3.1	0			3.2	0					3.2	0
+18	4.2	0					3.4	0							2.1	2			4.5	0
+40	3.0	2					3.3	0			4.5	1337							1.6	3
+60	4.4	0					2.3	0					1.6	0					3.1	0
+80	4.4	0					2.4	14					4.7	0					2.3	11
4+00	4.0	2					2.6	0					2.7	0					2.6	0
+20	3.3	0							2.6	0			3.2	0					3.3	0
+42	1.6	1							2.4	2			3.2	0					3.3	0
+60	4.1	0					3.4	1			2.6	3549.5							3.1	6
+78	4.0	0					3.7	0			2.6	0							3.7	2
5+00	3.6	0							4.6	811			6.2	3					2.7	3
+20	3.6	0							3.6	0			4.5	3					1.6	3
+42	3.2	3					3.3	5					3.0	3					4.3	3
+60	4.7	4					4.4	53					3.1	6					3.0	8
+80	3.7	16					3.1	0			3.3	2209							4.2	7
+98	3.5	0							3.7	0			2.4	4					4.3	14
6+20	4.0	0					2.2	0			3.6	1846							3.6	2
+42	2.8	0					2.7	302					2.0	0					4.4	11
+60	2.2	0							2.2	1571.5			4.1	38.5					2.6	18
Unfinished holes							6.0		1.4				5.4						1.4	
Total	108.4	38	2.6	2	9.2	9	66.0	5829	28.3	2384.5	28.6	9795	66.2	71.5	5.3	2	6.3	2	101.0	601

Sand was used only in the very free grouting holes. Total linear feet of holes drilled = 421.9. Total cubic feet of grout used = 18,730. 1515 pounds sand. 5 sacks cement per batch. 60 pounds minimum pressure.

LOW PRESSURE INVERT GROUTING

Station	8' south of center line	8' north of center line	
0+92	4	1	0+92 to 4+60
1+44	3	0	grouted with
1+60	2	0	mixture of 5
1+80	5	0	sacks cement
2+00	3	1	to 1550 pounds
2+20	0	1	of sand
2+40	1	0	
2+64	1	0	
2+82	0	22	
3+00	0	2	
3+23	7	0	
3+40	2	0	
3+58	1	3	
3+83	0	7	
4+04	0	3	
4+20	1	0	
4+40	3	4	
4+60	7	0	
4+80	2	8	4+80 to 6+42
5+00	6	11	grouted with
5+20	5	4	neat cement
5+40	9	4	80 sacks used
5+60	6	10	
5+80	6	8	
5+98	3	9	
6+07	9	3	
6+18	7	2	
6+42	12	8	
	105	111 =	216 cubic feet

The 56 holes average 1 foot deep = 56 feet of hole

7. All holes for grouting were radial to the axis of the tunnel and normal to the inside surface of the concrete.

8. The low pressure grouting was done between August 5 to September 16, 1933.

9. The following tabulation shows the location and depth of high pressure (100 pounds per square inch) grout holes and cubic feet of grout placed in each hole. All holes for high pressure grout were 10 feet long. The high pressure grouting was done with neat cement.

TABLE B
High Pressure Tunnel Grouting
except invert

Distances from center line

	South			North	
Station	20'	10'		10'	20'
0+68	1	0		29	28
0+90	498	0		3	12
1+10	0	134		2	5
1+28	1	0		2	45
1+50	139	7		2	3
1+68	3	1		1	24
1+88	411	4		2	2
2+11	21	0		0	1
2+32	2	0		3	2
2+50	2	0		5	0
2+70	3	2		0	1
2+92	2	1		0	3
3+10	17	4		0	10
3+30	25	1		4	3
3+48	1	5		1	0
3+68	2	0		2	3
3+90	213	2		2	1
4+10	1	4		1	2
4+30	27	0		4	1
4+50	1	0		1	2
4+70	6	1		1	2
4+90	1	1		10	1
5+10	4	0		3	3
5+29.5	3	61		2	2
5+50	1	2		0	23
5+68	5	2		2	8
5+90	1	2		3	1
6+10	3	4		1	8
6+30	46	4		1	94
6+50	4	0		3	0
Total	1444	242		90	290 = 2066 cubic feet

	25'	15'	10'	5'	℄	5'	10'	15'	25'	
6+04	14	5	4	2	1	1	2	5	0	
6+14.5	6	55	6	6	2	2	1	1	1	
6+25	3	4	3	1	0	1	6	0	167	
6+35	24	2	1	2	2	1	16	0	0	
Total	97	66	14	11	5	5	25	6	168	= 397

Total high pressure 2463 cubic feet

All 156 holes were 10 feet deep = 1560 feet of hole

TABLE D
High Pressure Invert Grouting

station	North side 8'	North side 3'	South side 3'	South side 8'	
0+68	1			2	
0+90	2			4	
1+10	22			5	
1+28	1			40	
1+50	0			2	
1+68	3			0	
1+88	159			157	
2+11	0			0	
2+32	0			2	
2+50	1			1	
2+70	0			0	
2+92	0			1	
3+10	1			19	
3+30	23			204	
3+48	8			0	
3+68	5			2	
3+90	2			7	
4+10	0			0	
4+30	1			0	
4+50	1			0	
4+70	8			8	
4+90	19			8	
5+10	2			1	
5+29.5	6			1	
5+50	0			0	
5+68	8			13	
5+90	4			3	
6+10	3			1	
6+30	3			2	
6+50	14			22	
6+04	3	2	3	1	
6+14.5	3	3	2	1	
6+25	0	3	14	0	
6+35	11	4	1	0	
	314	12	20	507	= 853 cubic feet

All holes were 10 feet deep = 760 feet.

This grouting was started October 25, 1933.

10. The tunnel grouting was done between August 5 and November 20. 1933.

11. The drill holes amounted to 2798 feet and were paid for under schedule item 43.

12. The grouting amounted to 22,262 cubic feet and was paid for under schedule item 45.

13. There were 918 feet of 2" pipe and 7610 sacks of cement used.

Harold Wood
Resident Engineer.

HW/p

3-8-35
copy/p

September 17, 1934

From : P. Beermann

To : Hydraulic Engineer

Subject : San Diego River Project, El Capitan Feature
Cost of outlet tunnel plug according to specification drawing

1. Specification drawing WD-383 indicates two fifteen foot plugs 180 feet apart, the intervening space filled with grouted masonry.

2. The estimated cost, based on unit prices bid in the schedule, is as follows:

3,240	cubic yards rock masonry in tunnel plugs	at $6.00	$19,440
35,000	cubic feet grout	1.00	35,000
2,500	barrels cement	1.90	4,750
2,500	feet grout pipe	1.00	2,500
540	cubic yards concrete including cement	7.30	3,942
200	cubic feet grout	1.00	200
1,000	feet grout pipe	1.00	1,000
			$66,832

Difference in cost of cast iron pipe only over 40 foot plug 2520 x 140 x .04		14,112
Credit		80,944
Estimated cost 40' plug	$6,200	
Saving in steel pipe and piers 140 feet at $40	5,600	11,800
Additional estimated cost of plug according to specification drawing over 40' plug		$69,144

PB/p

P. Beermann

September 24, 1934

Messrs. H. W. Rohl & T. E. Connolly S-127
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

Subject: San Diego River Project, El Capitan Feature, Bypass Tunnel Lining, Repairs.

Gentlemen:

You are hereby notified that the repairs now being made by you to the concrete lining of the bypass tunnel at El Capitan Reservoir Dam between Station 6+60 and the tunnel exit portal are not satisfactory.

Very truly yours,

Fred D. Pyle
Hydraulic Engineer.

FDP/f

OUTLET WORKS

3-7-35
copy/f

March 17, 1932

From : P. Beermann

To : Hydraulic Engineer

Subject: San Diego River Project, El Capitan Feature
Circular outlet tower design.

1. Preliminary stress and cost investigations of octagonal tower versus circular tower at El Capitan indicate that because of the methods used by the State Department of Water Resources in determining the stresses in octagonal shapes, the circular tower will be considerably cheaper on account less materials required.

2. The tower as shown at present and directly over the outlet tunnel has a clearance of about 23 feet, whereas the tunnel requires 25 feet for unobstructed flow.

3. The great weight of the tower requires heavy temporary construction for support during the time the outlet tunnel is used for diversion purposes, and no advantage is gained thereby. It seems therefore advisable to offset the tower rather than have it straddle the tunnel.

4. The expensive interior division walls shown on the preliminary drawings serve only to hold the screens. This can be accomplished much more economically and effectively by placing screens, if required, directly over the tower openings. It seems therefore advisable to omit the interior walls.

5. With the tower offset and interior walls eliminated, it appears advantageous to construct a circular tower, inside diameter = 12 feet. This would require only a rearrangement of the service mains and result in a saving of about 30 per cent in cost and a tower of utmost simplicity of operation.

RECOMMENDATION: It is recommended that detail drawings be developed for a wet tower circular in shape, but otherwise similar to Barrett reservoir tower.

P. BEERMANN (Signature)
P. Beermann

PB/p

3-7-35
copy/f

PB/p
3-17-32

San Diego River Project

El Capitan Dam Outlet Tower Comparison

Costs only

Description	Estimated Cost	Remarks
1. Present tower octagonal shape	$ 29,000	Obstructs tunnel. Large amount of steel required.
2. Tower similar to (1) but heavier. Octagonal	36,000	Would straddle tunnel
3. Circular tower similar to (2)	28,000	
4. Circular tower 12' inside diameter. H.N.Savage style, only circular in shape	20,000	Tower offset to one side. Add additional pipe required

NOTE: On account of the methods used by the State to determine stresses in octagonal shapes, circular tower becomes considerably cheaper.

P. BEERMANN

4/23/34
copy /f

September 29, 1932

From : Hydraulic Engineer

To : Purchasing Agent

Subject: San Diego River Project, El Capitan Feature
Requisition for outlet tower auxiliary valve

Enclosed is requisition for one auxiliary valve to be installed in the outlet tower of the El Capitan reservoir, also copy of specifications for the valve.

If you will advise as to the number of additional copies of the specifications that will be required, they will be furnished by this office.

The valve should be available in San Diego by December 15, 1932.

Estimated cost $300.00.

Funds available under Ordinance No. 42.

H. N. Savage
Hydraulic Engineer.

FDP/p
Encls. (2)
Requisition for auxiliary valve
Copy of specifications

N O T I C E

NOTICE IS HEREBY GIVEN, that sealed proposals will be received at the office of the Purchasing Department of the City of San Diego, California, in the City Hall of said City, until_____ o'clock_____M., of the_____day of_____, 19___, for:

The furnishing of

1 - 6" #4067E extra heavy Crane Special brass flanged ends non rising stem wedge disc gate valve, or equivalent, and with a 32" high indicating type floor stand and 1-1/2" round rod brass extension stem measuring 145 feet from center line of gate valve to floor line, complete with couplings, and shaft boxes, stem, guides and supports, and all required nuts, bolts, washers and miscellaneous items. Delivered F.O.B. San Diego, California, in good and acceptable condition all in conformity with the attached specifications.

. . . . . .

DETAIL SPECIFICATIONS

1. REQUIREMENT.- It is required that there shall be furnished in accordance with these specifications and drawings hereinbelow listed a wedge gate disc valve with non rising stem and appurtenances for the El Capitan Reservoir Outlet Tower. The valve and appurtenances shall be delivered F.O.B. San Diego, California on or before December 15, 1932.

2. GATE VALVE.- The gate valve shall be a #4067E extra heavy Crane Special brass, non rising stem wedge gate disc valve, or equivalent in the opinion of the engineer. Both flanges of the valve shall be faced and one flange drilled. There shall be provided for attachment to the valve on the drilled flange a four foot length of Class "C" cast iron pipe and a suitable gasket of "Garlock" manufacture, or equivalent in the opinion of the engineer.

3. STEM.- The manufacturer shall provide a 1-1/2" stem, Crane rod brass or equivalent in the opinion of the engineer. The center line of the valve will be 145 feet below the base of the operating stand and the stem shall be of sufficient length to extend thru the operating stand. The stem shall be provided at 24 foot intervals with solid brass vertical shaft boxes. Manganese bronze couplings at 12 foot intervals, necessary brass keys, and 7 bronze thrust washers, and special yoke coupling connection of stem to valve. A steel lock nut washer and brass or bronze nut shall be provided at the top of the valve stem. The design of couplings, shaft boxes, yoke, and miscellaneous items shall be satisfactory to the engineer.

4. STEM GUIDES AND SUPPORTS.- The manufacturer shall provide cast iron bronze bushed stem guides and required cast iron stem

guide supports with necessary nuts, bolts, washers and shims. All anchor bolts, other bolts and nuts which are submerged, shall be of bronze. The design for the guides and supports shall be satisfactory to the engineer.

5. OPERATING STAND.- The manufacturer shall provide a hand operated cast iron indicating type operating stand with 16" hand wheel. He shall provide all necessary anchor bolts, nuts and washers required for complete installation.

6. MISCELLANEOUS APPURTENANCES.- The manufacturer shall provide all necessary miscellaneous appurtanances for complete installation of the valve, stem and operating stand.

7. SHOP DRAWINGS.- Each bidder shall submit with his proposal detail drawings of the complete valve, stem, operating stand and miscellaneous assembly details. Failure to submit detail drawings with the bid may cause its rejection, as the interests of the City of San Diego may require. The manufacturer to whom award is made shall not begin manufacture until approval of the detail drawings by the engineer is first obtained.

4/23/34
copy /f

September 29, 1932

From : Hydraulic Engineer

To : Purchasing Agent

Subject: San Diego River Project, El Capitan Feature
Requisition for 30" x 30" sliding gate.

Enclosed is requisition for one 30" x 30" sliding gate to be installed in the outlet tower of the El Capitan Reservoir, also copy of specifications for the gate.

If you will advise as to the number of additional copies of the specifications that will be required, they will be furnished by this office.

The gate should be available in San Diego by December 15, 1932.

Estimated cost $1,600.00.

Funds available under Ordinance No. 42.

H. N. Savage
Hydraulic Engineer.

FDP/p

Encls. (2)
Requisition for 30" x 30" sliding gate
Copy specifications

N O T I C E

NOTICE IS HEREBY GIVEN, that sealed proposals will be received at the office of the Purchasing Department of the City of San Diego, California, in the City Hall of said City, until 10 o'clock A M., of the 15 day of October, 1932, for:

Furnishing of

1 30" x 30" Cast Iron or Cast Steel Sliding Gate with Bronze or Stainless Steel stem, and equipped with bronze bushed cast iron stem guides, torsion guide, and roller bearing two speed operating stand with indicator,

delivered F.O.B. San Diego, California, in good and acceptable condition, all in conformity with the attached specifications.

. . . . . .

EL CAPITAN RESERVOIR DAM
OUTLET TOWER

SLIDING GATE

Proposal A

1. 30" x 30" rectangular flange frame Case Iron sliding gate, to withstand 194 feet head and operate under a differential head of 75 feet, complete with 2-1/2" rolled bronze stem, operating stand, and other appurtenances and miscellaneous items, delivered F.O.B. San Diego, California.

   1 at _____ each $_____

Proposal B

1. 30" x 30" rectangular flange frame, cast steel sliding gate, to withstand 194 feet head and operate under a differential head of 75 feet, complete with 2-1/2" rolled bronze stem, operating stand, and other appurtenances and miscellaneous items, delivered F.O.B. San Diego, California.

   1 at _____ each $_____

Proposal C

1. 30" x 30" rectangular flange frame cast iron sliding gate, to withstand 194 feet head and operate under a differential head of 75 feet, complete with 2-1/4" stainless steel stem, operating stand, and other appurtenances and miscellaneous items, delivered F.O.B. San Diego, California.

   1 at _____ each $_____

Proposal D

1. 30" x 30" rectangular flange frame cast steel sliding gate, to withstand 194 feet head and operate under a differential head of 75 feet, complete with 2-1/4" stainless steel stem, operating stand, and other appurtenances and miscellaneous items, delivered F.O.B. San Diego, California.

   1 at _____ each $_____

DETAIL SPECIFICATIONS

1. REQUIREMENT.- It is required that there shall be furnished in conformity with these specifications a 30" x 30" sliding gate with stem and operating stand and appurtenances for use in the El Capitan Reservoir Dam Outlet Tower. Delivery shall be made F.O.B. San Diego, California on or before December 15, 1932.

2. MATERIALS.- The materials used to construct the gate and appurtenances shall conform to the following requirements:

(a) Gray iron castings shall conform to the standard specifications for gray iron castings, Serial Designation: A 48-29 of the American Society for Testing Materials.

(b) Steel castings shall conform in all respects to Class B Medium Grade, Serial Designation: A 27-24, of the American Society for Testing Materials.

(c) Manganese bronze shall have a tensile strength of 60,000 pounds per square inch, elastic limit 30,000 pounds per square inch, elongation 20 per cent in 2 inches.

(d) Bronze for seat facings shall be of a composition best adapted to the required service, and shall be satisfactory to the engineer.

(e) Stainless steel shall conform to the standards of the American Society for Testing Materials and shall be satisfactory to the engineer.

(f) Materials not covered in this paragraph shall be satisfactory to the engineer.

3. TYPE AND DETAIL OF GATE.- The general type of gate required shall be as shown on Table 8, page 13 of the Chapman Valve Company's catalog on Coffin Products Sluice Gates, (January 1929 edition),

or equivalent in the opinion of the engineer, and it shall be of cast iron or cast steel as selected. The center line of the disc will be at Elevation 571, and the bottom of the operating stand at Elevation 765. The gate shall be placed on the exterior of the tower, the slope of which is 18 inches in 100 feet. The gate shall be suitable to withstand a head of 194 feet, and operate under a differential head of 75 feet. (Back pressure on gate - 119 feet). It shall be provided with a rectangular flange frame, adjustable side wedges for seating pressure, and stops at bottom.

4. DISC.- The disc shall be of cast iron or cast steel, as selected by the engineer, and shall have a flat plate with horizontal and vertical ribs. The ribs and plate shall be of ample section to withstand the full pressure without distortion and a factor of safety of not less than six shall be used in the design of the disc. Bronze seat facings shall be driven into dovetail grooves machined in the face of the disc and further secured with brass rivets. The disc shall have tongues on each side extending the full length of the disc and these tongues shall be accurately machined all over. The disc shall have a pocket cast in the center, heavily reinforced ribs into which shall be fitted a solid manganese bronze thrust nut threaded and keyed to the stem. Proper provision shall be made to take up any play, and the design shall be satisfactory to the engineer. The disc shall be fitted with three wedges on each side. The wedges shall be of solid bronze and shall be of the adjustable type. They shall be provided with tongues on the back to slide in vertical keyways, machined in the disc, and shall be secured to the disc by shouldered steel studs and bronze nuts. They shall have solid bronze adjusting bolts. The wedges shall be machined all over and shall make accurate contact with

the bronze wedge facings attached to the guides.

5. FRAME.- The frame shall be rectangular of the standard flange type with rear face machined and drilled to attach to concrete, and the front face machined to take the sliding gate guides. The frame shall be of cast iron or cast steel, as selected, of ample section to prevent distortion, shall be cast in one piece, and shall be satisfactory to the engineer. Bronze seat facings shall be driven into dovetail grooves machined in the front face of the frame and further secured with brass rivets. The front face of the frame shall be machined on the vertical sides to fit the guides and shall have holes drilled and tapped for the guide studs. Keys shall be provided between the frame and the guides to prevent lateral movement of the guides.

6. GUIDES.- The guides shall be reinforced with heavy ribs at points of contact with the side wedges of the disc, capable of taking the whole thrust due to water pressure and wedging action. Heavy bronze wedge facings shall be attached to the guides at points of contact with the side wedges and these wedge facings shall be machined all over and shall make accurate contact with the side wedges.

7. OPERATING STEM.- The gate shall have a rising stem 2-1/2" diameter if of manganese bronze, of 2-1/4" diameter if of stainless steel, as selected by the engineer. The stem shall withstand safely, without buckling, the whole thrust due to closing the gate under the maximum operating head. The stem shall have the threads cut in a lathe, 2 threads to the inch, Acme standard, or equivalent in the opinion of the engineer.

8. COUPLINGS.- The different sections of each stem shall be joined together by solid manganese bronze couplings. The couplings

shall be threaded and keyed to the stems and all couplings shall be interchangeable, so that any coupling will fit any section of stem, and couplings can be replaced without the necessity of fitting.

9. STEM GUIDES.- The manufacturer shall furnish cast iron stem guides, bronze bushed, and adjustable in two directions and cast iron brackets for stem guides. The unsupported lengths of the stem shall not exceed 10 feet if a 2-1/4" stem is used, and shall not exceed 11 feet if a 2-1/2" stem is used. A torsion guide shall be provided near the base of the operating stand, designed to be approved by the engineer, and the stem shall be suitably enlarged to take guide recesses or grooves as may be approved by the engineer.

10. MISCELLANEOUS APPURTENANCES.- The manufacturer shall also provide all necessary nuts, bolts, anchors, washers and miscellaneous items for complete installation of the gate, stem and operating stand. All nuts and bolts where submerged shall be of bronze.

11. OPERATING STAND.- The operating stand shall be Chapman Type N 32 Roller Bearing Two speed floor stand (similar to type shown on Page 27 of Chapman Valve Company's Catalog on Coffin Products Sluice Gates, January 1929 edition), or equivalent in the opinion of the engineer.

12. STEM SUPPORTS.- Stem supports shall be provided at each guide and their design shall be such as not to weaken the stem and shall be subject to approval by the engineer.

13. MACHINING AND ASSEMBLING.- All parts entering into the sliding gate shall be carefully and accurately machined to jigs and templates and all like parts shall be absolutely interchangeable so that repair parts can be furnished at any time which can be

attached in the field without any fitting, chipping, or re-machining. All anchor bolt holes shall be accurately drilled by template to the layout called for on the drawings. The bronze seat facings in the frame and disc shall be carefully scraped or ground to a water tight joint.

14. TESTING.- The manufacturer shall make such tests as may be required by the engineer, and all such tests shall be satisfactory to the engineer. Any materials failing to pass the tests prescribed by the engineer will be rejected and the manufacturer shall substitute proper materials therefor, satisfactory to the engineer.

15. SHOP DRAWINGS.- Each bidder shall submit with his proposal detail drawings of the complete gate, stem, operating stand and appurtenances. Failure to submit detail drawings with the bid may cause its rejection, as the interests of the City of San Diego may require. The manufacturer to whom award is made shall not begin manufacture until approval of the detail drawings by the engineer is first obtained.

4/23/34
copy /f

PURCHASING DEPARTMENT
CITY OF SAN DIEGO

San Diego, California

October 20
19 32

Mr. H. N. Savage
Hydraulic Engineer
City of San Diego

Dear Mr. Savage:

We are tabulating below bids received on 1-30" x 30" Sliding Gate and 1-6" Gate Valve, and for your reference and information we are attaching hereto the original bids together with all letters and blue prints furnished.

Will you kindly return all papers with your recommendation as to award:

	Bid "A"	Bid "B"	Bid "C"	Bid "D"	Bid
Southern Mach.Co.	$2689.20	$2751.60	$2991.00	$3052.80	
Pelton Water Wheel Co.	2012.00	2049.00	2172.00	2216.00	
Mach.Pipe & Supply Co.	1513.00	1645.00	2370.00	2505.00	
Crane Co.	No bid				$395.00
Western Metal Supply Co.	1409.00	1562.00	1861.00	2014.00	368.70

Very truly yours,

A. RAY SAUER JR. (Signature)
A. Ray Sauer, Jr.

Purchasing Agent

hjs/gw

EL CAPITAN RESERVOIR DAM OUTLET TOWER
APPURTENANCES

Tabulation of Bids

Name	Address	30"x30" Sliding Gate					6" Gate Valve	
		Make	A	B	C	D	Make	Bid
Southern Machinery Co. (x)	San Francisco	Vernon Tool Co.	$2689.20	2751.60	2991.00	3052.80		
Pelton Water Wheel Company (x)	San Francisco	Pelton	2012.00	2043.00	2172.00	2216.00		
Machinery Pipe & Supply Company	San Diego	Michigan Valve & Foundry Co.	1513.00	1645.00	2370.00	2505.00		
Crane Company	San Diego						Crane	395.00
Western Metal Supply Co.	San Diego	Chapman	1409.00	1562.00	1861.00	2014.00	Chapman	368.70

(x) Exceptions to specifications in letter attached.

924

4/23/34
copy /f

October 24, 1932

From : Hydraulic Engineer

To : Purchasing Agent

Subject: San Diego River Project, El Capitan Feature
Gate and valve for outlet tower. Award of Contract.

Consideration has been given to your letter dated October 20, 1932 submitting bids received for 30" x 30" sliding gate, and 6" gate valve for the El Capitan Reservoir outlet tower.

RECOMMENDATION: It is recommended that the bid of Western Metal Supply Company for 30" x 30" cast iron sliding gate with bronze stem, operating stand and accessories, their Proposal A for $1,409.00, be accepted subject to their furnishing complete detail assembly drawings showing the specification requirements such as

(1) Stem nut at or near center of gate

(2) Gate stops at bottom

(3) Thickness and detail dimensions of plate

(4) Stem supports

(5) Indicator on floor stand

(6) Miscellaneous items, viz: nuts, bolts, couplings, gasket brackets, guides, stem details

It is also recommended that the bid of Western Metal Supply Company for 6" Chapman extra heavy bronze gate valve with bronze stem, floor stand and accessories for $368.70, be accepted.

H. N. Savage,
Hydraulic Engineer.

HNS/p

5/4/33
copy/f

October 26, 1932

Messrs. H. W. Rohl and
T. E. Connolly
Contractors El Capitan Reservoir Dam
4351 Alhambra Avenue
Los Angeles, California.

Subject: San Diego River Project,
El Capitan Feature, construction
of Outlet Tower

Gentlemen:

Please advise as to your program relative to the construction of the outlet tower at El Capitan reservoir dam, and especially when you expect to have requirement for the 30" saucer valves which will be furnished by the City and will be installed by you in accordance with paragraph 89 of the contract specifications and installation paid for under schedule item 49 in order that the City may order the valves in ample time.

Very truly yours,

H. N. Savage,
Hydraulic Engineer.

HNS/p
cc Resident Engineer
Harold Wood

4/30/34
copy /f

October 27, 1932

From : Hydraulic Engineer

To : Purchasing Agent

Subject: San Diego River Project, El Capitan Feature
30" Saucer Valves for Outlet Tower.

1. Enclosed is requisition for six 30" saucer valves, various lengthe, and cast steel covers with brass bypass, and bronze seat, and mescellaneous items, delivered F.O.B. San Diego, to be installed in the outlet tower of the El Capitan reservoir, also copy of specifications for the valves.

2. If you will advise as to the number of additional copies of the specifications that will be required, they will be furnished by this office.

3. The valves should be available in San Diego by January 30, 1933.

4. Estimated cost $1,500.00.

5. Funds are available under Ordinance No. 57.

H. N. Savage
Hydraulic Engineer.

HNS/f
Encls.(2)
Requisition fof 6 - 30" saucer valves
Copy specifications

ccCity Manager

11-14-32
p
4/27/34
copy /f

EL CAPITAN RESERVOIR DAM

OUTLET TOWER

30" SAUCER VALVES

1. 30-inch cast iron saucer valves, various lengths, and cast steel covers with brass bypass, and bronze seat, and miscellaneous items, delivered F.O.B. San Diego

6 at _____lump sum $_____

DETAIL SPECIFICATIONS

1. REQUIREMENT.- It is required that there shall be furnished in accordance with these specifications and drawings hereinbelow listed 30-inch saucer valves for the El Capitan Reservoir Outlet Tower. The valves and covers shall be delivered F.O.B. San Diego on or before_____193__.

2. LIST OF DRAWINGS.-

WD-426 Sheet 3 of 5. 30" Saucer Valves

3. MATERIALS.- The materials required by these drawings and specifications shall conform to the following requirements:

(a) Gray iron castings shall conform in all respects to the standard specifications for gray iron castings, Serial Designation: A 48-29, of the American Society for Testing Materials.

(b) Steel castings shall conform in all respects to Class B Medium Grade, Serial Designation: A 27-24, of the American Society for Testing Materials.

(c) Bronze castings shall be cast in dry molds and shall consist of United States Government bronze having a composition of about 88 parts of copper, 10 parts tin and 2 parts zinc and having the following physical properties: A minimum tensile strength of 30,000 pounds per square inch and minimum elongation in two inches of 14 per cent.

(d) Structural steel shall conform in all respects to structural steel for buildings, Serial Designation: A 9-24, of the American Society for Testing Materials.

(e) Brass castings shall consist of 88 parts of copper, 10 parts of zinc and 2 parts of tin, and a minimum tensile strength of 30,000 pounds per square inch.

4. SAUCER VALVES.- The 30-inch saucer valves and covers shall be built according to details and dimensions shown on the plans and shall be free from blow holes and other defects. Water seals shall be cast on as shown on the drawing. The bronze seat shall be accurately machined and the screws shall be countersunk. The valves shall be entirely satisfactory to the engineer. Unsatisfactory valves will be rejected and the manufacturer shall replace such valves at his own expense.

5. CAST STEEL COVERS.- The covers shall be cast steel and shall be accurately made in accordance with the drawings. The brass bypass shall be made as shown and shall have a steel staple cast in. The complete covers shall be satisfactory to the engineer and defective covers shall be replaced by the manufacturer at his own expense.

6. ANCHOR BOLTS.- The manufacturer shall furnish all necessary anchor bolts, nuts, washers and lead gaskets and miscellaneous items required for the complete installation of each unit.

3-7-35
copy/f

INTER-DEPARTMENTAL COMMUNICATION Nov. 17, 1932

From : A. Ray Sauer, Jr.

To : H. N. Savage

Subject: 30 x 30 Cast Iron Sliding Gate & Gate Valve

PURCHASING DEPARTMENT

We have not sent to the Council a Resolution covering acceptance of the bid for 30" x 30" cast iron sliding gate and 6" bronze gate valve, referred to in your letter of October 24, pending receipt of information requested by you in your letter of October 24, Subject, "San Diego River Project, El Capitan Feature Gate and Valve for outlet tower. Award of Contract."

For your information we are sending you herewith copy of letter received from the Chapman Valve Company together with blue prints referred to. Will you please advise with this information if you wish to make a final recommendation of accepting the bid of the Western Metal Supply Company, proposal for $1409.00.

H. J. SCHAPER (Signature)

hjs/gw

encs

3-8-35
copy/p

November 18, 1932

From : A. V. Goeddel

To : Mr. H. N. Savage, Hydraulic Engineer
(Attention: Mr. Pyle)

Subject : Report on cost of appurtenances for outlet tower, etc. El Capitan Dam

Monday, November 14th, the Council considered a communication from the City Manager recommending the adoption of a resolution authorizing the Purchasing Agent to advertise for bids for saucer valves, etc., as recommendec by the Hydraulic Engineer. No action was taken apparently because the Councilmen wanted a definite report regarding the cost of these appurtenances, and covering the cost of appurtenances previously purchased and appurtenances which will be required later.

The City Manager explained to the City Council about the contract specifying that the City furnish certain appurtenances. This had been explained previously. Undoubtedly it will require frequent additional explanations.

I would appreciate receiving from you, for transmittal to the Mayor and Councilmen, a special report on this subject showing:

1. List of appurtenances purchased, showing cost.

2. List of appurtenances for which bids are to be advertised now (saucer valves, etc.) showing estimated cost.

3. List of additional appurtenances which will probably be required later, together with cost estimate.

Please furnish one original and seven carbon copies.

AVG/dk

A. V. Goeddel

3-8-35
copy/p

November 22, 1932

From : Acting Hydraulic Engineer

To : City Manager

Subject : San Diego River Project, El Capitan Feature Appurtenances, cost of

Reference is made to your letter of November 18, 1932 requesting report on cost of outlet tower and tunnel appurtenances for El Capitan reservoir dam.

In preparing the specifications for the El Capitan reservoir dam, spillway and outlet works, it was deemed advisable for the City to furnish certain appurtenances, to be placed by the contractor. Reference for details is made to letter of September 15, 1932 to the City Manager on "Funds for purchase of outlet tower and tunnel appurtenances."

1. Bids have been asked and received for: Total price
   1 30"x30" cast iron sliding gate with stem and stand
   1 6" extra heavy gate valve with stem and stand — $1,777.70

2. Requirement exists at present for the purchase of 6 - 30" cast iron saucer valves and covers for placement in the outlet tower. Estimated cost — 1,600.00

3. There will be requirement for purchase by the City and for placement by the contractor as the work progresses of the following appurtenances:

	Estimated cost
(a) 2 - 36" saucer valve covers	300.00
(b) 2 - 42" saucer valve covers	400.00
(c) 1600 feet 5/8" chain, sheaves and miscellaneous assemblies	1,000.00
(d) Remodeling 2 - 30"x24" hydraulically balanced valves (originally purchased by the City for the Sutherland work) for service as line valves	1,500.00
(e) 2 large gate valves	2,500.00
(f) 1 winch and miscellaneous equipment	500.00
(g) Purchase of blind flanges and special work at lower end of outlet pipes	2,000.00
Total of above	$11,577.70

As the work develops, conditions may arise which will call for appurtenances other than those listed and proper study and recommendations will be made when appropriate.

Fred D. Pyle
Acting Hydraulic Engineer

FDP/f
City Manager furnished 8 copies
for Mayor, Councilmen and City Clerk

4/27/34
copy /f

PURCHASING DEPARTMENT
CITY OF SAN DIEGO

San Diego, California

November 22
19 32

Mr. H. N. Savage
Hydraulic Engineer
City of San Diego

Dear Mr. Savage:

We are tabulating below bids received on Six 30" Saucer Valves, and for your reference and information we are attaching hereto the original bids together with all letters furnished.

Will you kindly return all papers with your recommendation as to award:

Standard Iron Works	$2275.00
Southern Machinery Co.	2070.00
Machinery Pipe & Supply Co.	1990.00
Enterprise Foundry Co.	1342.00

Very truly yours,

A.RAY SAUER, JR. (Signature)
A. Ray Sauer, Jr.

Purchasing Agent

w

encs

4/27/34
copy /f

November 26, 1932

From : Acting Hydraulic Engineer

To : Purchasing Agent

Subject: San Diego River Project, El Capitan Feature
Outlet Tower, bids for 6 saucer valves

1. Reference is made to your letter of November 22, 1932 asking for recommendation on four bids received for 6 - 30" saucer valves for the El Capitan Reservoir Outlet Tower.

2. In the low bid of the Enterprise Foundry Company it is stated in their proposal ".....hereby propose and agree to furnish one 30 inch cast iron saucer valves, various lengths, and cast steel covers.....for the lump sum of $1,342.00."

3. Provided the above lump sum bid quotation is for the six saucer valves and covers, manufactured in conformity with the plans and specifications, it is recommended that award be made to the low bidder, the Enterprise Foundry Company, for the furnishing of the six 30" saucer valves and covers.

Fred D. Pyle
Acting Hydraulic Engineer

FDP/p
cc Hydraulic Engineer
Washington, D. C.

CONTRACT

THIS AGREEMENT, Made and entered into at The City of San Diego, State of California, this 3rd day of January 1933, by and between THE CITY OF SAN DIEGO, a municipal corporation in the County of San Diego, State of California, the party of the first part, and hereinafter sometimes designated as the City, and

ENTERPRISE FOUNDRY COMPANY, a corporation,

party of the second part, and hereinafter sometimes designated as the Contractor, WITNESSETH:

That for and in consideration of the covenants and agreements hereinafter contained on the part of said City, and the sums of money hereinafter designated to be paid to said contractor by said City, in manner and form as hereinafter provided, said contractor hereby covenants and agrees to and with said City to furnish and deliver to said City:

Six (6) 30" Saucer Valves of various lengths, and cast steel covers with brass bypass and bronze seat and miscellaneous items, delivered f.o.b. San Diego, for installation in the outlet tower of El Capitan Reservoir, in accordance with the specifications hereto attached, marked Exhibit "A" and made a part hereof.

Said contractor hereby agrees to furnish and deliver the Saucer Valves and appurtenances, hereinabove described, at and for the following price, to-wit: One thousand three hundred forty-two dollars ($1,342.00).

Said contractor agrees to deliver the Saucer Valves and appurtenances, hereinabove described, within twenty (20) days from and after the date of the execution of this contract.

And said City, in consideration of the furnishing and delivery of said equipment by said contractor according to the terms of this contract, and the faithful performance of all the obligations and covenants by said contractor herein undertaken and agreed upon, and the acceptance of said equipment by said City, will pay said contractor, in warrants drawn upon the proper fund of said City, the sum of One thousand three hundred forty-two dollars ($1,342.00), said sum to be payable as follows:

Upon the completion of delivery of the equipment hereinabove described, and the acceptance of the same by the Council of said City, seventy-five per cent (75%) of the said contract price shall be paid said contractor, and twenty-five per cent (25%) of the whole contract price shall remain unpaid until the expiration of thirty-five (35) days from and after the completion of said contract and the acceptance of the said equipment thereunder by the Council, when on proof that the contract has been

fully performed, the balance remaining shall be paid to said contractor.

Said contractor hereby agrees that it will be bound by each and every part of this contract, and deliver and cause to be delivered all of said material and equipment, as herein specified.

No interest in this agreement shall be transferred by the contractor to any other party, and any such transfer shall cause annulment of this contract, so far as The City of San Diego is concerned. All rights of action, however, for any breach of this contract are reserved to said City.

It is mutually agreed by and between the parties hereto that in no case unauthorized by the Charter of The City of San Diego, or the general laws in effect in said City, shall said City, or any department, board or officer thereof, be liable for any portion of the contract price; also that no extra work shall be done by said contractor unless authorized and directed by resolution of said Council to that effect.

IN WITNESS WHEREOF, this contract is executed by The City of San Diego, acting by and through the members of the Council of said City, under and pursuant to a resolution authorizing said execution, and the said contractor has caused this instrument to be executed, and its corporate name and seal to be hereunto affixed, by its proper officers, thereunto duly authorized, the day and year in this agreement first above written.

THE CITY OF SAN DIEGO.

By JOHN F. FORWARD, JR.

ALBERT W. BENNETT

LEROY E. GOODBODY

JOSEPH J. RUSSO

JOHN R. BLAKISTON

DAN ROSSI

(SEAL)
ATTEST:

ALEEN H. WRIGHT
City Clerk.

By FRED W. SICK
Deputy.

Members of the Council.

ENTERPRISE FOUNDRY COMPANY

ATTEST:

By R. E. KROECK - ASST.SEC.

I hereby approve the form of the foregoing contract, this 31 day of Dec., 1932.

C. L. BYERS
City Attorney

By GILMORE TILLMAN
Assistant City Attorney.

EXHIBIT "A"

DETAIL SPECIFICATIONS

1. REQUIREMENT. - It is required that there shall be furnished in accordance with these specifications and drawings hereinbelow listed 30-inch saucer valves for the El Capitan Reservoir Outlet Tower. The valves and covers shall be delivered F.O.B. San Diego on or before within 20 days.

2. LIST OF DRAWINGS. - WD-426 Sheet 3 of 5. 30" Saucer Valves.

3. MATERIALS. - The materials required by these drawings and specifications shall conform to the following requirements:

(a) Gray iron castings shall conform in all respects to the standard specifications for gray iron castings, Serial Designation: A 48-29, of the American Society for Testing Materials.

(b) Steel castings shall conform in all respects to Class B Medium Grade, Serial Designation: A 27-24, of the American Society for Testing Materials.

(c) Bronze castings shall be cast in dry molds and shall consist of United States Government bronze having a composition of about 88 parts of copper, 10 parts tin and 2 partszinc and having the following physical properties: A minimum tensile strength of 30,000 pounds per square inch and minimum elongation in two inches of 14 per cent.

(d) Structural steel shall conform in all respects to structural steel for buildings, Serial Designation: A9-24, of the American Society for Testing Materials.

(e) Brass castings shall cosist of 88 parts of copper, 10 parts of zinc and 2 parts of tin, and a minimum tensile strength of 30,000 pounds per square inch.

4. SAUCER VALVES. - The 30-inch saucer valves and covers shall be built according to details and dimensions shown on the plans and shall be free from blow holes and other defects. Water seals shall be cast on as shown on the drawing. The bronze seat shall be accurately machined and the screws shall be countersunk. The valves shall be entirely satisfactory to the engineer. Unsatisfactory valves will be rejected and the manufacturer shall replace such valves at his own expense.

5. CAST STEEL COVERS. - The covers shall be cast steel and shall be accurately made in accordance with the drawings. The brass bypass shall be made as shown and shall have a steel staple cast in. The complete covers shall be satisfactory to the engineer and defective covers shall be repalced by the manufacturer at his own expense.

6. ANCHOR BOLTS. - The manufacturer shall furnish all necessary anchor bolts, nuts, washers and lead gaskets and miscellaneous items required for the complete installation of each unit.

3-7-35
copy /f

January 20, 1933

Western Metal Supply Company
7th and K Streets
San Diego, California.

Subject: San Diego River Project, El Capitan Feature, outlet tower - gates.

Gentlemen:

Receipt is acknowledged of letter addressed to you dated January 18, 1933, from the Cahpman Valve Manufacturing Company, requesting approval of certain drawings, duplicate prints of which were enclosed.

Item 1. Sluice Gates. Drawings B-32536, L-14511, M-14561, S-13529, B-32537, E-32538, S-10969, S-10970 and S-11295.

On Drawing B-32536, 16-3/4" anchor bolts are shown for fastening of the flanged frame to concrete. These bolts are evidently listed under item "M" of Drawing B-32537. It is requested that at least four of these bolts be 18 inches long and that all anchor bolts be provided with washers next to the head in the concrete.

No anchor bolt holes are shown thru the flanged frame on Drawing B-32536.

No play has been allowed for the expansion and contraction of the stem.

No assembly drawing is shown giving details of setting clearances.

Item 2. B-17305, B-4007, B-32907, S-10969, S-10970 and S-11291.

The four foot length of Class "C" cast iron pipe shown on Drawing B-32907 need only be 3'4⅛" long and it is requested that it be cut to such length.

Expansion of stem should be provided for.

With changes noted the drawings submitted are approved for manufacture and one print of each of the above are hereby returned.

Very truly yours,

H. N. Savage,
Hydraulic Engineer

PB/p
encls. (15)

4/26/34
copy /f

2-7-33

From : Hydraulic Engineer

To : Purchasing Agent

Subject: San Diego River Project, El Capitan Feature
36" and 42" saucer valves for outlet tower

1. Enclosed is requisition for two 36" and two 42" saucer valves, and cast steel covers with brass bypass, and bronze seat, and miscellaneous items, delivered f.o.b. San Diego, for installation in the outlet tower of El Capitan reservoir, also copy of specifications for the valves.

2. If you will advise as to the number of additional copies of the specifications that will be required, they will be furnished by this office.

3. The valves should be available in San Diego not later than April 15, 1933.

4. Estimated cost $2,500.00.

5. Funds are available under Ordinance No. 133.

6. The following concerns may wish to bid on these valves:

Standard Iron Works	San Diego
National Iron Works	"
Southern Machinery Company	"
Western Metal Supply Company	"
Machinery Pipe & Supply Company	"
Vernon Foundry Inc.	Hollydale, Calif.
Enterprise Foundry Co.	San Francisco
U.S.Cast Iron Pipe Company	Los Angeles

H. N. Savage
Hydraulic Engineer.

HNS/p
encls.(2)
Requisition
Copy of specifications

3-8-35
copy/p

EL CAPITAN RESERVOIR DAM OUTLET TOWER

36" and 42" Saucer Valves

1. 36-inch cast iron saucer valves, and cast steel covers with brass bypass, and bronze seat, and miscellaneous items, delivered f.o.b. San Diego

   2 at Two Hundred Eighty-three Dollars each $566.00

2. 42-inch cast iron saucer valves, and cast steel covers with brass bypass, and bronze seat, and miscellaneous items, delivered f.o.b. San Diego

   2 at Three Hundred Eighty-Eight Dollars each $776.00

Total $1342.00

DETAIL SPECIFICATIONS

1. REQUIREMENTS.- It is required that there shall be furnished in accordance with these specifications and drawings hereinbelow listed two 36-inch and two 42-inch saucer valves for the El Capitan reservoir outlet tower. The valves and covers shall be delivered f.o.b. San Diego on or before April 15, 1933.

2. LIST OF DRAWINGS.-
WD-426 Sheet 1 of 5. 42" Saucer Valves
WD-426 Sheet 2 of 5. 36" Saucer Valves

3. MATERIALS.- The materials required by these drawings and specifications shall conform to the following requirements:

(a) The castings shall conform in all respects to the standard specifications for cast iron water pipe and special castings, of the American Water Works Association adopted May 12, 1908, with subsequent amendments, except for the following: The chemical composition of the iron shall be within the following limits:

	Minimum	Maximum
Sulphur		.10%
Phosphorus		.90%
Manganese	.5%	.65%
Silicon	1.2%	1.70%

(b) Steel castings shall conform in all respects to Class B Medium Grade, Serial Designa tion: A 27-24, of the American Society for Testing Materials.

(c) Bronze castings shall be cast in dry molds and shall consist of United States Government bronze having a composition of about 88 parts of copper, 10 parts of tin and 2 parts zinc and having the following physical properties: A minimum tensile strength of 30,000 pounds per square inch and minimum elongation in two inches of 14 per cent.

(d) Structural steel shall conform in all respects to structural steel for buildings, Serial Designation: A 9-24, of the American Society for Testing Materials.

(e) Brass castings shall consist of 88 parts of copper, 10 parts of zinc and 2 parts of tin, and a minimum tensile strength of 30,000 pounds per square inch.

4. SAUCER VALVES.- The saucer valves shall be made from standard cast iron Class C 90° elbows and shall have inserted in the flange end a machined bronzed seat securely fastened, all as indicated on the drawings. They shall be built according to details and dimensions shown on the plans and shall be free from blow holes and other defects. The bronze seat shall be accurately machined and the screws shall be countersunk. The valves shall be entirely satisfactory to the engineer. Unsatisfactory valves will be rejected and the manufacturer shall replace such valves at his own expense.

5. CAST STEEL COVERS.- The covers shall be cast steel and shall be accurately made in accordance with the drawings. The brass bypass shall be made as shown and shall have a steel staple cast in. Such staple shall have attached to it a 3-foot length of 3/8-inch round close link chain with K & B connecting links at each end. The complete covers shall be satisfactory to the engineer and defective covers shall be replaced by the manufacturer at his own expense.

5/5/33
copy/f

February 18, 1933

Messrs. H. W. Rohl and T. E. Connolly
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

Subject: San Diego River Project, El Capitan Feature, outlet tower.

Gentlemen:

Enclosed are prints of Drawings WD-400, WD-423 sheets 1 and 2 of 2, WD-424 Sheets 1, 2 and 3 of 3, for the outlet tower at El Capitan reservoir dam; and

Print of Drawing WD-425 showing reinforcing steel detail for base of the tower.

The excavation for the tower will be paid for under Schedule items 9 and 14 and the remainder of the work under appropriate schedule items.

Please advise as to when you expect to commence excavation for the tower and when you expect to commence concrete work on the tower so that the necessary gates and appurtenances may be secured by the City of San Diego.

Very truly yours,

H. N. Savage,
Hydraulic Engineer.

FDP/p
encls. (7)
WD-400
WD-423 sheets 1 and 2 of 2
WD-424 sheets 1, 2 and 3 of 3
WD-425
cc H.W.Rohl & T.E.Connolly, El Capitan Dam
cc Contractor's Resident Representative
cc City's Resident Engineer

4/24/34
copy /f

March 8, 1933

From : A. Ray Sauer, Jr., Purchasing Agent

To : H. N. Savage, Hydraulic Engineer

Subject: BIDS FOR SAUCER VALVES

PURCHASING DEPARTMENT

The following bids were received for Saucer Valves in accordance with your request and Resolution 59708:

	2-36"	2-42"	Total
Machinery Pipe & Supply Co.	$990.00	$1300.00	$2290.00
Sidney E. Mayer Mach. Co.	896.00	1160.00	2056.00
Standard Iron Works			1919.50
Consolidated Steel Corp.Ltd.	812.00	1104.00	1916.00
Long Beach Iron Works	735.78	955.24	1691.02
Enterprise Foundry Corp.	665.00	990.00	1655.00
Reliable Iron Foundry	735.00	907.80	1642.80
Southern Machinery Co.			1596.60
Vernon Foundry Inc.	566.00	776.00	1342.00
" " " Alt.Bid	526.00	696.00	1222.00

You will note that the low bidder, the Vernon Foundry Incorporated, Hollydale, California, also submitted an alternate bid which is a total of $120.00 lower than the regular bid. The regular bid is in accordance with specifications as prepared by you and the alternate is the same except that covers would be made of steel plate fabricated and welded in place of cast steel.

The bids as received were accompanied by checks of different bidders, for 5% of bids, except that none of them were certified and therefore, the bids are not strictly legal. However, after receiving your recommendation of award, we are going to recommend that although the checks could not be certified because of the bank holiday and the bids are therefore not legal, that the Purchasing Agent be authorized to purchase from the low bid. If this is in accord with your recommendation will you please advise, also when recommending award, if you concur in the recommendation that we would make regarding the Purchasing Agent beming authorized to purchase in the open market.

We would htank you to give us a prompt reply on this so that we may submit bids and recommendation to the City Manager not later than Friday morning, March 10.

A. RAY SAUER, JR. (Signature)
A. Ray Sauer, Jr.
Purchasing Agent

hjs/gw

3-9-33

From : Hydraulic Engineer

To : Purchasing Agent

Subject: San Diego River Project, El Capitan Feature
36" and 42" saucer valves

Consideration has been given to your letter dated March 8, 1933 submitting bids received for saucer valves on March 8, 1933 in accordance with my request dated February 7, 1933, and Resolution No. 59708, to be installed in the outlet tower of El Capitan Dam.

The contractor at El Capitan Dam is now excavating for the outlet tower and the valves, which are to be placed in the base of the tower, will be required within thirty days in order that the contractor be not delayed.

RECOMMENDATION:

It is recommended that the bid of Vernon Foundry Incorporated to furnish the valves and covers according to the drawings and specifications accompanying your notice to bidders, for the sum of $1,342.00 be accepted.

In the event that award cannot be made on bids received, it is further recommended that the Purchasing Agent secure authority to purchase the saucer valves in the open market.

H. N. Savage
Hydraulic Engineer

HNS/p

3-7-35
copy/f

March 2, 1933

From : Testing Engineer

To : Hydraulic Engineer

Subject: San Diego River Project, El Capitan Feature, Saucer Valves

Inspection at the new municipal pier, of saucer valves and covers for El Capitan reservoir outlet tower, as requested in your letter of Feb.25, was made on Mar. 1.

Dimensions in general checked with those given on the drawing which accompanied your letter. An exception was the thickness of the covers, which varied in places from the 1-5/8" required, up to 2". Also, the loops of the eye bolts, which are evidently of forged material, varied somewhat in diameter, being about 1/16" short of the required 1" diameter at the top, and about that much more than 1" at the base.

The drawing indicates that the brass by-pass should be fully machined up the sides, to a diameter at the top of 3-7/8". These pieces were machined only to the 3" diam. dimension at the top of the cover, leaving a shoulder there, and running up unmachined to a 4" diam. at the top. It would seem that these pieces should be machined clear to the top, to ensure close fitting in their bearings.

The machined 4" strips on the under side of the covers, for the seating of the valves on their supports, were free from flaws and imperfections in the metal. The feel of the machined surface under the fingers did not indicate a very fine texture, but I would judge that it may be of sufficient fineness to serve its purpose.

The tops and edges of the covers were of rough unfinished appearance, with some pitting, and small fissures, in the metal. I would not judge however, that these are of such extent as to render the piece defective, and require rejection.

As I have not had practical working experience with the requirements in detail of finish, for castings of this kind, it might be well to have the points covered in the last two paragraphs reviewed by some one familiar with such details.

Copy of specifications and print of Drawing WD-426, sheet 3 of 5 forwarded with your letter, are returned herewith, as requested thereon.

My recommendation would be for acceptance of the valves, subject to completion of machining on the by-pass pieces, as referred to in Par. 3; and subject to review of finish details, as referred to in Par. 6, if you consider this desirable.

J. Y. JEWETT (Signature)

jyj/b

4/27/34
copy /f

3-4-33

From : Hydraulic Engineer

To : Purchasing Agent

Subject: San Diego River Project, El Capitan Feature
30" saucer valves and covers

The six 30" saucer valves and covers for El Capitan outlet tower, manufactured by the Enterprise Foundry Company of San Francisco, and delivered to the Municipal Pier on February 23, 1933, have been inspected and it is recommended that they be accepted.

H. N. Savage
Hydraulic Engineer

HNS/p

5/5/33
copy/f

March 6, 1933

Messrs. H. W. Rohl and T. E. Connolly
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

Subject: San Diego River Project, El Capitan Feature. Outlet Tower, furnishing of appurtenances.

Gentlemen:

It is contemplated that the following appurtenances in the outlet tower of El Capitan reservoir dam will be furnished and placed by the contractor, and payment will be made under the respective schedule items:

(a) Class C Cast Iron Pipe:

42"	1 - 4	foot	length
	2 - 5	"	"
	2 - 8	"	"
	1 - 11	"	"
	1 - 12	"	"
36"	1 - 4	"	"
	2 - 8	"	"
	1 - 11	"	"
	1 - 12	"	"

(b) Ladder rungs and guards

(c) 72 - 1"Ø hooks in interior of tower as shown on drawing WD-424 sheet 1 and 6 feet above each 30" saucer valve and above sliding gate

(d) 6 - 1"Ø "U" supports in tower roof

(e) 4 - 1-1/4" Ø "U" supports in tower roof

(f) 13 covers for openings in operating floor

(g) 7 - 2x2x1/4 rim angles in openings in tower floor

(h) Pipe railing as indicated (12-foot sections 2 feet long, 2 sections 9'6" long with 1 vertical post at center of each, 2 sections on interior platforms 11'6" long with 3 vertical posts each. The last 2 sections of railing to be removable.

Messrs. H. W. Rohl
and T. E. Connolly -2 3/6/33

Additional cast iron pipe and appurtenances will be required for placing in tunnel in plug.

The following appurtenances will be furnished by the City and placed by the contractor in the outlet tower under Schedule Item 49:

2 - 42" saucer valves and covers

2 - 36" saucer valves and covers

6 - 30" saucer valves and covers

1 - 30" x 30" sliding gate, stem, guide and operating stand

1 - 6" gate valve with pipe, stem, guides, and operating stand (valve to be placed about elevation 620) (not shown on drawings)

1 - 10" 25# I-beam 20'11" long (under roof of tower with
2 - 10" 25# I-beam 10'4-1/2" " (sheave ring and supporting straps.

1 - 12" 31.5# I-beam 13' long in tower platform support

8 - 3" I-beams 5' long with clevices for valve cover supports

4 - 1-1/4"ø eye bolts in bottom of tower operating floor

12 - 7/8"ø hot bent hooks in columns of tower top

4 - 3/4"ø eye bolts at elevation 757.25 and 750.25
2 - 1"ø eye bolts at elevation 749.5 in edge of platform

All necessary chain

12 - chain sheaves

8 - 12" x 12" cast iron vents

1 - Hand winch

Additional appurtenances will be furnished by the City for placing in the tunnel plug.

Please advise when appurtenances to be furnished by the City should be delivered.

Very truly yours,

H. N. Savage,
Hydraulic Engineer

FDP/p

cc H.W.Rohl & T.E.Connolly, El Capitan Dam
Contractor's Resident Representative
City's Resident Engineer

5/5/33
copy/f

H. W. ROHL & T. E. CONNOLLY
CONTRACTORS

El Capitan Dam
Via - Lakeside, California
March 21, 1933.

Mr. H.N.Savage
Hydraulic Engineer
In charge Water Development
City of San Diego, California.

Dear Sir:

In reply to your letter dated Feb. 18, 1933, please be advised that on or about April 15th., we will commence concrete work on the Outlet Tower.

Kindly furnish us immediately with detail drawings of the cast iron pipe and special castings to be furnished by us under bid schedule Item 48.

Very truly yours,

H.W.Rohl and T.E.Connolly

H. W. ROHL (Signature)

5/5/33
copy/f

March 23, 1933

Messrs. H. W. Rohl & T. E. Connolly
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

Subject: San Diego River Project, El Capitan Feature, outlet tower, construction.

Gentlemen:

Receipt is acknowledged of your letter dated March 21, 1933 in reply to my letters dated October 26, 1932 and February 18, 1933 inviting you to indicate your program and dates for excavation and construction of the outlet tower of El Capitan Dam.

Your letter states that you expect to commence concrete work on or about April 15, 1933.

The delivery of the saucer valves which go in the base of the outlet tower, and of other appurtenances, will be expedited.

Due to the short time intervening between your reply to my above dated letters, and the date fixed by you for commencing concrete work, the saucer valves may not be received within the time you indicate you will have need for them.

Very truly yours,

H. N. Savage,
Hydraulic Engineer.

HNS/p
cc H.W.Rohl & T.E.Connolly
El Capitan Dam
Contractor's Resident Representative
City's Resident Engineer

5/5/33
copy/f

March 23, 1933

Messrs. H. W. Rohl and T. E. Connolly
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

Subject: San Diego River Project, El Capitan Feature
Outlet Tower and Tunnel Plug, cast iron pipe.

Gentlemen:

In accordance with your request of March 21, 1933, the following cast iron pipe and special castings will be required in the outlet tower and tunnel plug at El Capitan Dam, to be furnished and placed by the Contractor, payment to be made under contract schedule item No. 48:

OUTLET TOWER (as per letter dated March 6, 1933)

42" Class C cast iron pipe, bell and spigot

1 - 4 foot length
2 - 5 " "
2 - 8 " "
1 - 11 " "
1 - 12 " "

36" Class C cast iron pipe, bell and spigot

1 - 4 foot length
2 - 8 " "
1 - 11 " "
1 - 12 " "

TUNNEL PLUG

42" Class C cast iron pipe, bell and spigot

1 - 5.3 foot lenght
1 - 6 " "
1 - 8 " "
1 - 8.23 " "
1 - 10 " "
4 - 12 " "

42" Class C cast iron pipe, flange and spigot, flanges drilled American Standard

2 - 12 foot lengths

2 - 42" Class C cast iron 45° angles, bell and spigot 90" radius

2 - 42" Class C cast iron blind flanges, flanges drilled American Standard and tapped for 3" pipe.

36" Class C cast iron pipe, bell and spigot

2 - 8 foot lengths
1 - 8.73 " "
1 -10.37 " "
1 -11 " "
4 - 12 " "

36" Class C cast iron pipe, flange and spigot flanges drilled American Standard

2 - 12 foot lengths

2 - 36" Class C cast iron 45° angles, bell and spigot 90" radius

4" Class C cast iron pipe, bell and spigot

5 - 12 foot lengths
1 - 8 " "

4" Class C cast iron pipe, flange and spigot flanges drilled American Standard for 4" valve

1 - 8 foot length

The above material to be in accordance with paragraph 131 of the contract specifications reading as follows:

131. CAST IRON PIPE AND SPECIAL CASTINGS.-Cast iron pipe and special castings shall be of hub and spigot type, except that cast iron flanges shall be provided drilled for connection to valves, and shall be Class C and shall conform in all respects to the Standard Specifications for Cast Iron Water Pipe and Special Castings of the American Water Works Association adopted May 12, 1908, and as modified except for the following: (a) the chemical composition of the iron shall be within the following limits:

	Minimum	Maximum
Sulphur		0.10%
Phosphorus.....		0.90%
Manganese.....	0.5%	0.65%
Silicon	1.2%	1.7%

(b) Flanges for connection to gate valves and main outlet valve shall be cast on the special castings and shall conform in all

respects to the "American Standard" of January 1, 1914. The cast iron pipe and special castings will be paid for at the unit price bid, which shall include the cost of the necessary yarn, lead for connections, complete in place and ready for operation.

Very truly yours,

H. N. Savage,
Hydraulic Engineer.

FDP/p
cc H.W.Rohl & T.E.Connolly
El Capitan Dam
Contractor's Resident Representative
City's Resident Engineer

5/4/33
copy/f

April 1, 1933

Messrs. H. W. Rohl & T. E. Connolly
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

Subject: San Diego River Project,
El Capitan Feature, outlet tower
appurtenances.

Gentlemen:

Certain of the appurtenances listed in letter dated March 6, 1933 as being furnished by the City of San Diego, to be placed by the Contractor in the outlet tower at El Capitan dam under contract schedule item 49, especially two 42-inch saucer valves and covers and two 36-inch saucer valves and covers, are promised to be delivered to you at El Capitan Dam f.o.b. trucks early in April 1933.

It is understood that your price of five cents per pound for schedule item 49 is based on f.o.b. truck delivery by the City of San Diego at El Capitan and that you will arrange to unload valves and other appurtenances promptly upon arrival.

Very truly yours,

H. N. Savage,
Hydraulic Engineer.

HNS/p
cc H.W.Rohl & T.E.Connolly
El Capitan Dam
Contractor's Resident Representative
City's Resident Engineer

4/23/34
copy /f

4-27-33

From : Hydraulic Engineer

To : Purchasing Agent

Subject: San Diego River Project, El Capitan Feature
6" extra heavy duty gate valve with floor stem and brass extension stems

The 6" extra heavy duty gate valve with floor stem and brass extension stems for El Capitan reservoir dam outlet tower, furnished by the Western Metal Supply Company of San Diego, and delivered to the Municipal Pier April 18, 1933, has been inspected and it is recommended that it be accepted.

H. N. Savage
Hydraulic Engineer

FDP/p

4/24/34
copy /f

5-16-33

From : Hydraulic Engineer

To : Purchasing Agent

Subject: San Diego River Project, El Capitan Feature
36" and 42" saucer valves for outlet tower

The two 36" and two 42" saucer valves for El Capitan outlet tower, manufactured by the Vernon Foundry Company, Inc. delivered May 8, 1933 to Contractors H. W. Rohl & T. E. Connolly at the job, have been inspected and it is recommended that they be accepted.

H. N. Savage
Hydraulic Engineer.

FDP/p

3-8-35
copy/p

6-12-33

From : Hydraulic Engineer

To : Purchasing Agent

Subject : San Diego River Project, El Capitan Feature
Outlet Tower, appurtenances

Requirement exists for the purchase of appurtenances and delivery to El Capitan damsite for installation in the outlet tower of El Capitan reservoir dam, as follows:

(a) 1 - 10" 25# I-beam 20'11" All as shown on drawing WD-424
2 - 10" 25# I-beam 10'4½" sheet 2 of 3

(b) 1 - 12" 31.5# I-beam 13' long

(c) Miscellaneous appurtenances as shown on drawing WD-459

Steel for items a, b and c should be of structural grade.

(d) BBB 5/8" ø close link electric welded chains in the following lengths:

1 - 25' with 2 standard 3/4" K&B connecting links (each with
1 - 50' 3/4" ring at one end,
1 - 75' and each a 3/4" dia-
1 - 100' meter clevis with nut
1 - 125' bolt and washer and
1 - 150' having a minimum clear-
1 - 175' ance of 1-1/2" attached
2 - 206' to the other end.)
2 - 216'

See drawing WD-426 sheet 5 of 5.

(e) 12 sheave assemblies as shown on drawings WD-426 or equivalent with pawl and sheave wheel to fit chains.

(f) 1 compound geared handwinch, Pacific Foundry Co. manufacture or equivalent, capacity 5000#, with asbestos lined steel band brake all as shown on page 61 Figure 255 of Marron, Rickard & McCone Co. Catalog #28. Drum length to take 200' of BBB 5/8" chain.

(g) 8 - 12" x 12" cast iron foundation vents.

Certificates of weights of all items should be furnished. Funds are available under Ordinances 57 and 133. As many drawings as requested will be furnished from this office.

It is recommended that the above items be advertised for bids and made avilable as soon as possible.

H. N. Savage
Hydraulic Engineer

FDP/p
encls.(3) Drawings WD-424 sheet 2 of 3; WD-426 sheet 5 of 5; WD-459
cc City Manager
Accountant

June 15, 1935

From : Resident Engineer

To : Hydraulic Engineer

Subject: San Diego River Project, El Capitan Feature
Outlet Works 6" gate valve

1. On June 12, 1933 a letter of instructions relative to 6" gate valve for El Capitan Outlet Works, was received from the Hydraulic Engineer, together with 4 manufacturer's blue prints.

2. Drawing B-17305 of the 6" valve shows no flange drilling. Inspection of the valve and parts at the Broadway Pier in San Diego on June 14, 1933 was made and it was found that the gate valve flange is properly drilled with twelve 13/16" holes on 10-5/8 bolt circle with 2 holes up. This drilling corresponds with the drilling shown on drawing B-32907 for the cast iron pipe flange.

3. Drawing B-32907 shows the valve stem 145 feet long. This will require the gate to be set with its center at elevation 620.02 as evidently the inclination of the stem from vertical was neglected in computing stem length.

4. The location of this gate stem will be 7'6-7/8" from center of the tower and on a line 2 feet northeasterly from a line thru center of tower and slide gate stem. This latter line is center line of one of the tower bays. This location of the gate valve stem will give sufficient clearance between the two floor stands, provided the operating handle of the large floor stand is toward the center of the tower.

5. The 4 blueprints will be kept in the Resident Engineer's office until installation is complete.

6. The expansion and contraction of this 1-1/2" bronze stem will amount to about 1/2" for 50° range of temperature. There appears to be no provision for taking care of this increase in length between bonnet of valve and top bushing of the floor stand. The floor stand should be set at a time whem the stem is at its maximum length so that when contraction occurs the strains will come as tension on the stem and stuffing box of the valve rather than as compression reacting against the valve bonnet.

HAROLD WOOD (Signature)
Harold Wood
Resident Engineer

HW/p

4/20/34
copy /f

ROHL-CONNOLLY CO.
Contractors

El Capitan Dam,

June 21, 1933.

Mr. H. N. Savage,
Hydraulic Engineer,
San Diego, California.

Dear Sir:

Will you please furnish us with two prints of drawing WD 400 of the Outlet Tower, and oblige,

Very truly yours,

H.W.Rohl & T.E.Connolly

T. E. CONNOLLY (Signature)

4/20/34
copy /f

June 22, 1933

Messrs. H. W. Rohl & T. E. Connolly
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

S-16

Subject: San Diego River Project, El Capitan Feature, Outlet Tower, Drawing.

Gentlemen:

In compliance with your request dated June 21, 1933, enclosed are two prints of City of San Diego's Drawing WD-400, edited to 2-20-33, San Diego River Project, El Capitan Feature, Outlet Tower.

Very truly yours,

H. M. Savage
Hydraulic Engineer.

F/f
Encl. WD-400 (2)

4/20/34
copy /f

ROHL-CONNOLLY CO.
Contractors

June 23, 1933

Mr. H. N. Savage,
Hydraulic Engineer
San Diego, California.

Dear Sir:

Will you please furnish us with three tracings showing the balance of the Tower Steel, and oblige,

Very truly yours,

H.W.Rohl & T.E.Connolly

Tretzel (Signature)

4/20/34
copy /f

June 23, 1933

Messrs. H. W. Rohl and T. E. Connolly
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

S-17

Subject: San Diego River Project, El Capitan Feature, Outlet Tower, drawings, Reinforcing steel.

Gentlemen:

In compliance with your request dated June 23, 1933, enclosed are three prints of each three drawings showing reinforcing steel details for San Diego River Project, El Capitan Feature, Outlet Tower.

Very truly yours,

H. N. Savage
Hydraulic Engineer.

FDP/p
encl.(9)

4/24/34
copy /f

July 8, 1933

Messrs. H. W. Rohl & T. E. Connolly
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California

S-23

Subject: San Diego River Project, El Capitan Feature, outlet tower, 30-inch saucer valves, ladder rung spacing.

Gentlemen:

To correct an inadvertant oral statement made by the City's Resident Engineer to your Resident Superintendent Mr. O. C. Steves relative to the setting of the 30-inch saucer valves in El Capitan reservoir outlet tower;

You are directed to so construct the tower that the concrete brackets under the saucer valves will be monolithic with the tower.

After each bracket has had sufficient time to set, then the saucer valve will be set thereon and the tower wall concrete formed monolithically around the saucer valve flanges. It will not be permitted to leave holes in the outlet tower for setting the valves later on.

Ladder rungs on the tower will be set twelve inches apart as indicated on the drawings.

Very truly yours,

H. N. Savage,
Hydraulic Engineer.

HNS/p

4/24/34
copy /f

July 8, 1933

Messrs. H. W. Rohl & T. E. Connolly S-25
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

Subject: San Diego River Project, El Capitan Feature, outlet works, laying cast iron pipe.

Gentlemen:

In order to provide for the two construction joints between the outlet tower and tunnel of El Capitan reservoir dam, it is deemed advisable that the pipes be laid with the bell ends downstream. The saucer valves for the base of the tower, furnished by the City, and the cast iron pipes, which were furnished by the Contractor in accordance with letter of the Hydraulic Engineer dated March 23, 1933, requires the pipes to be laid with the bells downstream.

In view of the above, that portion of the contract specifications paragraph 132 reading "In laying pipe the bell shall be laid upstream" will be disregarded.

Very truly yours,

H. N. Savage
Hydraulic Engineer.

HNS/p

4/24/34
copy /f

H. W. ROHL & T. E. CONNOLLY
CONTRACTORS

July,18,1933

Mr.H.N.Savage,Hydraulic Engineer,
San Diego,
Cal.

Dear Sir:

To prevent any possible misconstruction of your letters S-23 and S-24 wherein you state,"To correct an inadvertant oral statment made by the City's Resident Engineer to your Superintendent-" it is my desire to set forth the facts surrounding the cases listed and in the light thereof "inadvertant oral statements"cannot be applied.

To make up a reinforcing steel list for a portion of the spillway above elevation 680, I had Mr.Folling, Sales Manager for the Pacific Coast Steel Company come down from Los Angeles to go over your plans with your Resident Engineer and our Superintendant. To order proper lengths of steel without waste, it was necessary that location of construction joints be established. After considerable thought and discussion, not inadvertantly, these were established and a steel list based thereon was decided upon. As the steel had not been cut and bent at the time of receipt of your letter no harm has been done nor additional cost entailed and your instruction will be followed.

Relative to construction of concrete brackets under saucer valves; " will be monolithic with the tower.". This instruction will be followed but it is not a correction of any inadvertant statement made by Mr.Wood.

On your drawing WD-400 File No.2528 D-2, approved by you, showing detail of tower and bracket, you have the following note-"Provide 6" seat for bracket". Obviously if a seat in the tower wall is to be provided for the bracket, it was the clear intent to construct the bracket in the recess left for it. If poured monolithic no seat or recess could be provided nor would be needed. I construe your letter S-23 as an authorization to delete that instruction shown on your approved plan and will construct monolithically instaed of providing a seat unless advised to the contrary.

Yours very truly,
H.W.Rohl & T.E.Connolly

T. E. CONNOLLY (Signature)

cc City Manager
City Attorney
JMM

4/24/34
copy /f

H. W. ROHL & T. E. CONNOLLY
CONTRACTORS

July,20,1933

Mr.H.N.Savage, Hydraulic Engineer,
San Diego,
Cal.

Dear Sir:

The change in moving the location of the outlet tower has so changed the character of the cast iron pipe required that the provision of paragraph 131 of the Specifications,"and shall be Class C and conform in all respects to the Standard Specifications of the American Water Works Association-" is no longer applicable.

I submit herewith copies of the quotation and information on the original layout and a later letter from the Manufacturers at the time of placing the order for the changed pipe. Their contention is that this pipe line is now so largely made up of specials that it becomes a special job and departs from the Standard Specifications.

Originally but two specials were contemplated in an approximate 800,000 pounds. The revised list for the present plans now has but 14 standard pieces out of a total of 40 pieces, in a total weight of 227,550Opounds. Numerically 35% of the pieces are standard and 65% are specials. The actual tonnage now is but 28% of the original. By weight 42% of the tonnage now is standard and 58% specials. These figures would seem to amply support the manufacturers contention. In addition there is now additional caulking and pouring of a greater number of joints than standard would have required.

This change has caused an added cost of practically 50% above what standard pipe would have cost.

In view of the above we believe a change order covering this item should be issued and the entire item put on an extra work basis. We submit this matter for your consideration, requesting such an order.

Yours very truly,
H.W.Rohl & T.E.Connolly

T. E. CONNOLLY (Signature)

4/24/34
copy /f

July 21, 1933

Messrs. H. W. Rohl & T. E. Connolly
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

S-27

Subject: San Diego River Project, El Capitan Feature, Outlet Tower, location of ladders.

Gentlemen:

On Drawing WD-423 Sheet 1, of the El Capitan Reservoir Dam Outlet Tower, a ladder is shown on the north inside wall of the gate well. This ladder should be on the inside of the south wall and should extend from elevation 612 downward to elevation 574 inclusive. These 39 rungs should be set in the center of the south wall. No guards are required for this ladder.

Six ladder rungs on the outside of the gate well should be set in the center of the south wall between elevation 612 and 607 inclusive. No guards are required here.

On Drawing WD-424 Sheet 3, the location of three ladders is shown. Two on the outside and one on the inside of the tower. Drawing WD-424 Sheet 1 shows the ladder on the inside of the tower extending from the operating floor to the platform at elevation 757. Seven rungs are required for this ladder, between elevation 757 and 751 inclusive. The drawings show ladder rungs and guards on the inside of the tower below the platform at elevation 750. This ladder offsets diagonally in eight rungs from the position shown in plan of platform elevation 750 to position shown below the platform which is centered five inches southwesterly from the center line of the entrance adit. This ladder from elevation 750 to 573 inclusive required 178 rungs and 102 guards. The guards extend from elevation 748.33 to 578 inclusive. Detail of guards and rungs are shown on drawing WD-424 Sheet 3.

The ladder on the outside of the tower extends from the operating floor at elevation 765 to a platform of structural steel at elevation 753, and then continues down the outside of the tower between elevation 755 and 614 at a position so the vertical center line of the ladder will be two feet to the southwest of and parallel to the center line of the 30-inch gate stem. This ladder will require 154 rungs and 85 guards of standard dimensions and 2 guards above the iron platform at elevations 753.83 and 755.5, which 2 guards will be bent to parallel the outside of the platform. The above arrangement required only one ladder on the outside of the tower.

Details for the iron platform on the outside of the tower at elevation 753 are shown on Drawing WD-466.

Ladder rungs, guards and platform will be paid for at the unit price bid for structural steel, Schedule Item No. 34.

Very truly yours,

H. N. Savage,
Hydraulic Engineer.

HNS/p

4/24/34
copy /f

July 21, 1933

Messrs. H. W. Rohl & T. E. Connolly S-28
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

Subject: San Diego River Project, El Capitan
Feature, Outlet Tower, appurtenances

Gentlemen:

Transmitted herewith are copies of Drawings WD-465 and WD-466 showing in detail miscellaneous appurtenances and ladder rungs and guards to be furnished and placed by the contractor in the El Capitan Outlet Tower.

Referring to my letter to you dated March 6, 1933, subject: "San Diego River Project, El Capitan Feature, Outlet Tower, furnishing of appurtenances", it has been deemed advisable to increase item (d) to 12 - 1"Ø "U" supports to be placed where directed by the Resident Engineer;

Decrease item (f) to 12 covers, placing a guard rail around the entrance to the tower instead of a cover;

Modify item (h) pipe railing as indicated on Drawing WD-466.

Very truly yours,

H. N. Savage,
Hydraulic Engineer.

HNS/p
encls.(2) WD-465, WD-466

4/24/34
copy /f

July 22, 1933

Messrs. H. W. Rohl & T. E. Connolly S-30
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

Subject: San Diego River Project, El Capitan Feature, construction details

Gentlemen:

Receipt is acknowledged of your letter dated July 16, 1933 advising of your intended compliance with construction detail of reinforcing steel at junction of spillway floor with side lining El Capitan Reservoir Dam, as shown on Drawing WD-449 Sheet 6 of 7, and as indicated in my letter dated July 8, 1933, S-24, subject: Spillway side wall footing" and your willingness to pour the bracket under the saucer valves monolithically as indicated in my letter dated July 8, 1933, S-23, subject: Outlet tower, 30-inch saucer valves, ladder rung spacing".

The monolithic method of constructing the seat under the saucer valves was deemed to entail less expense to the Contractor on account of the depth and quantity of reinforcing steel indicated on Drawing WD-400, and on account of the necessity of supporting the saucer valve while the horizontal leg extending thru the tower wall is being concreted at the time the wall is being poured.

If, however, you prefer to construct a seat in the tower wall and then, after the forms are stripped around the seat, pour the bracket, before proceeding with the tower wall construction, it is made optional to the contractor to use the method as indicated for the bracket on Drawing WD-400.

In either case the valve must be seated on its base before the tower construction may proceed.

Very truly yours,

H. N. Savage
Hydraulic Engineer.

HNS/p

4/24/34
copy /f

July 25, 1933

Messrs. H. W. Rohl & T. E. Connolly
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

S-31

Subject: San Diego River Project, El Capitan Feature, outlet tower - copper water stop and keyways.

Gentlemen:

You are hereby directed to install 20-gauge annealed sheet copper water stop 12 inches wide in the center of all horizontal construction joints in the outlet tower at El Capitan Dam.

The water stop shall be set in a vertical position with 6 inches embedded in concrete each side of the construction joint. The sheets forming the water stop shall be joined as per contract specifications paragraph 84. Payment will be made at the unit price bid in the schedule.

In addition to the copper water stop, satisfactory keyways shall be installed in each horizontal construction joint in the outlet tower.

Very truly yours,

H. N. Savage,
Hydraulic Engineer.

HNS/p

August 4, 1933

TO THE HONORABLE, THE MAYOR AND COUNCIL
OF THE CITY OF SAN DIEGO, CALIFORNIA.

Subject: San Diego River Project, El Capitan Feature Outlet Works, Cast iron pipe and special castings. Change Order No. 1.

Gentlemen:

The location of the outlet tower at El Capitan reservoir dam was changed from directly over the by-pass tunnel as indicated on the contract drawings, to a point alongside the tunnel. This change was made, with the concurrence of the California State Engineer, as a matter of economy and in accordance with that portion of paragraph 98 of the contract specifications reading as follows:

> "98. CONCRETE IN OUTLET TOWER.- The outlet tower shall be constructed according to the drawings and/or as directed by the engineer. The exact location of the outlet tower will be determined by the engineer when further data are available. . . . . "

If the tower had been constructed over the tunnel the cast iron pipe would have been standard bell and spigot except for two 45° angles and four flanged joints.

As approved by the State Engineer and now being constructed four 45° angles, four flanged joints and twenty short lengths varying from four feet to eleven feet, are required, and the standard lengths of pipe are correspondingly decreased.

Paragraph 13 of the contract specifications reads as follows:

> "CHANGES.- The engineer may, without notice to the sureties on the contractor's bonds, make changes; (a) in the designs or material or machinery; (b) in the plans for installation or construction; (c) in quantities or character of the work or material required. The changes in plans for installation or construction may also include (a) modification of shapes and dimensions of canals, dams and other structures and excavations therefor; (b) the shifting of locations to suit conditions disclosed as work progresses. No changes affecting the cost in excess of $1,000 will be made by the engineer without the approval

of the Common Council. If such changes result in an increase or decrease of cost to the contractor, the engineer will make such additions or deductions on account thereof as he may deem reasonable and proper, and such action thereon, subject to approval by the Common Council, shall be final. Extra work or material shall be charged for as hereinafter provided."

Since the 45° angles and the short lengths of pipe cost materially more than standard lengths of straight pipe, and there are more joints to be leaded, I am constrained to the opinion that there is justification for issuing a change order under paragraph 13 of the contract specifications limited to the additional cost of the pipe and the lead joints.

RECOMMENDATION: It is recommended that you officially approve the change in the requirements for cast iron pipe and special castings due to change in location of the outlet tower and authorize the Hydraulic Engineer to issue the necessary change order to the contractor in accordance with the provisions of paragraph 13 of the contract specifications for the construction of El Capitan reservoir dam, spillway and outlet works.

Respectfully,

H. N. Savage,
Hydraulic Engineer.

HNS/p

5/11/34
copy /f

August 8, 1933

Messrs. H. W. Rohl & T. E. Connolly S-33
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

Subject: San Diego River Project, El Capitan Feature, Outlet Tower, Subcontracts.

Gentlemen:

Enclosed is copy of my letter dated August 8, 1933 to Johnson Engineering Construction Company, 4703 Grey Drive Los Angeles, California, replying to letter signed by J. W. Johnson dated August 5, 1933 enclosing copy of his letter dated August 5, 1933 to H. W. Rohl & T. E. Connolly, Contractors, El Capitan Dam regarding subcontract work on outlet tower.

Very truly yours,

H. N. Savage,
Hydraulic Engineer.

HNS/f

4/24/34
copy /f

August 16, 1933

Messrs. H. W. Rohl & T. E. Connolly
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

S-37

Subject: San Diego River Project, El Capitan Feature, outlet works, cast iron pipe and special castings.

Gentlemen:

Receipt is acknowledged of your letter dated July 20, 1933 stating your belief and giving your reasons why a change order should be issued to cover the additional cost to the contractor of cast iron pipe and special castings to be furnished and placed by the contractor in the base of the outlet tower and in the tunnel plug of El Capitan reservoir dam.

In accordance with that portion of paragraph 98 of the contract specifications, reading as follows:

> "98. CONCRETE IN OUTLET TOWER.- The outlet tower shall be constructed according to the drawings and/or as directed by the engineer. The exact location of the outlet tower will be determined by the engineer when further data are available. . . . ."

the locatinn of the outlet tower was changed from directly over the by-pass tunnel to a point alongside the tunnel.

If the tower had been constructed over the tunnel, two 45° angles and four flanged joints would have been required.

As now being constructed, four 45° angles, four flanged joints and twenty short lengths varying from 4 feet to 11 feet are required.

Since the 45° angles and the short lengths of pipe cost somewhat more than straight pipe of standard lengths and there are more joints to be leaded, I am constrained to the opinion that there is justification for issuing a change order under paragraph 13 of the contract specifications limited to the additional cost of the pipe and lead joints; but

There is no justification for issuing an extra work order under paragraph 14 of the contract specifications.

Very truly yours,

H. N. Savage,
Hydraulic Engineer.

HNS/p

4/24/34
copy /f

August 16, 1933

Messrs. H. W. Rohl & T. E. Connolly
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

S-38

Subject: San Diego River Project, El Capitan Feature, Change Order No. 1, Outlet Works Cast Iron Pipe and Special Castings.

Gentlemen:

In accordance with paragraph 13 of the contract drawings and specifications for El Capitan Reservoir Dam, Spillway and Outlet Works, and Resolution of the Council No. 60588, copy attached, and Document No. 284249, copy attached, notice is hereby given you that the furnishing and laying of 36-inch and 42-inch cast iron pipe in the outlet works, as listed in the Hydraulic Engineer's letter to the Contractor dated March 23, 1933, subject: Outlet Tower and Tunnel Plug, cast iron pipe - will be considered as a change order within the meaning of paragraph 13 of the contract specifications, in so far as the size, extra angels and lengths of pipe may increase or decrease the cost to the contractor, and the engineer will make such additions or deductions on account thereof as he may deem reasonable and proper.

Immediately upon the completion of the work, please furnish this office copies of statements for the 36-inch and 42-inch cast iron pipe and special castings, and a detailed statement supported by cost data indicating the amount of increase or decrease in the cost to the contractor, for use by the engineer in determining the amount of addition or deduction to be made on account of this change order.

Very truly yours,

H. N. Savage,
Hydraulic Engineer.

HNS/p
Encls.(2)

9/20/33
copy /f

NOTICE TO THE CITY OF SAN DIEGO TO WITHHOLD

and verified statement of claim of W J Burke & Co., Inc., against Johnson Chimney Construction Co., sub-contractor and Rohl-Connolly, general contractors, on the El Capitan Dam project.

State of California (
) SS
County of Los Angeles (

W. J. Burke, being duly sworn, deposes and says: That he is the President of W J Burke & Co., Inc., claimant herein;

That the said W J Burke & Co., Inc. has furnished certain materials to be used in the erection and construction of that certain structure, to-wit, a dam, for the City of San Diego as owner, situated in the County of San Diego, State of California, on the following described property, to-wit:

> El Capitan Dam, on the San Diego River, at a site known as El Capitan, 30 miles northeast of San Diego, known as El Capitan Dam, as per bids opened on April 11, 1932, by the City Council of the City of San Diego, owner;

That between about the 20th day of July, 1933 and about the 26th day of August, 1933, the said W J Burke & Co. sold and delivered to Johnson Chimney Construction Co. and/or W. Johnson, a sub-contractor on the above-described work furnishing certain labor and materials under a contract with H W Rohl and T E Connolly, the general contractors on the above-described work, the aforesaid materials and being, to-wit: rental of 60 sets of Williams Form Clamps; spreader rods, cones, etc., in the sum of $68.06, which said sum is and was the reasonable market value thereof; and that each and all of said materials were used in, upon or about the construction of said dam;

That nothing has been paid on account of the above-mentioned materials, leaving a balance still due, owing and unpaid to said W J Burke & Co., Inc., from said contractor, on account of materials so furnished, in the sum of $68.06 after deducting all just offsets and credits, and which said sum of $68.06 has not been paid.

AND YOU ARE HEREBY NOTIFIED to withhold from any moneys and/or bonds due or that may become due from you for the construction of said dam a sum of money and/or bonds sufficient to pay the claimant herein the said sum of $68.06 as provided by law.

Dated at Los Angeles, California, this 18th day of September, 1933.

WILLIAM J. BURKE (Signature).
As President of W J Burke & Co Inc

Subscribed and sworn to before me this 18th day of September, 1933.

HARRIET S. ELDER (Signature).
Notary Public in and for said
County and State

(SEAL)

3-19-35
Copy/m

San Diego, California

October 5, 1933.

Mr. H. N. Savage,
Hydraulic Engineer,
San Diego, Calif.

Dear Sir:

I have this date written to one Wm. J. Burke, president of the W. J. Burke & Company relative to their claim filed with the City for material furnished to the Johnson Chimney Construction Co., alleged to be a subcontractor on the El Capitan Dam project. I advised him to file a claimwith the contractors and in the event that he actually furnished material to the subcontractor of Rohl and Connolly, and in the event that the bill is unpaid by said subcontractor, it would appear to me proper that Rohl and Connolly pay the bill.

Until you hear further from me regarding the subject, there is nothing in the way of duty for you to perform in connection with the claim. In the event that the matter is not straightened out by the time the holdback money is due the contractor, we may then at that time withhold payment.

Yours very truly,

C. L. Byers,

C. L. Byers,
City Attorney.

CLB/M

12/18/33
copy /f

December 12, 1933

Messrs. H. W. Rohl & T. E. Connolly
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

S-71

Subject: San Diego River Project, El Capitan Feature, outlet tower. Painting of appurtenances.

Gentlemen:

In accordance with the provisions of paragraph 136 of the contract specifications for the construction of El Capitan Reservoir Dam, Spillway and Outlet Works, you are directed to paint metal appurtenances furnished and installed by the Contractor and exposed to the air, as follows:

Appurtenances on and above the outlet tower floor, including rim angles in the floor, floor opening covers both sides, pipe railing and railing chain, hand grabs at ladders and miscellaneous items, to be painted with two coats of aluminum bronze over required shop coat of red lead and oil.

Appurtenances below the outlet tower floor, including ladder rungs and guards, hooks, platform railings, platform at elevation 753 and miscellaneous items, to be given a coat of Biturine over the shop coat of red lead and oil. Where the metal has not as yet received a shop coat of red lead and oil, at the option of the Contractor a priming coat of Biturine Primer may be used.

Very truly yours,

H. N. Savage,
Hydraulic Engineer.

HNS/p

3-8-35
copy/p

H. W. ROHL & T. E. CONNOLLY

Contractors

September 28, 1934

Mr. Fred D. Pyle
Hydraulic Engineer
San Diego, California

Dear Sir:

As discussed with you and the State Engineer and his principal assistant yesterday, it is imperative that I begin the installation of the cast iron pipe in the tunnel plug immediately. My desire is to install and bed the pipes in concrete so there will be some eight feet of the tunnel taken up and then leave the remainder of the plug open until such time as permission is granted by the State to complete the closure.

Would you please favor me with a pipe listing and diagram of the order in which you wish the various lengths installed and set grade and line so I can proceed at once.

It is my belief that two thirds of the tunnel opening remaining and the possibility of putting head on it up to the spillway level would pass as much water as the full tunnel opening would have with the slight head that was contemplated it might have on it during operation of either of the last two winters. So I feel that we have the same factor of safety as regards ultimate capacity as well as a considerable storage basin behind the dam to act as control.

Would you please favor me as above at once.

Yours truly,

H.W.Rohl & T.E.Connolly

TEC

By T. E. Connolly

October 2, 1934

Messrs. H. V. Rohl & T. E. Connolly
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

S-129

Subject: San Diego River Project, El Capitan Feature, Outlet pipes in tunnel.

Gentlemen:

Attached is copy of sheet 1 of 2 Drawing WD-423 on which are indicated in red and blue the lengths of pipe and the order required at the upstream end where connection is made to the existing pipe in the outlet tunnel of El Capitan Dam, as follows:

Northerly 42" pipe:	1 - 8.23 foot length	B & S
	1 - 45° bend	
	2 - 12 foot lengths	"
	1 - 6 "	"
	1 - 12 "	" S & F
Southerly 42" pipe:	1 - 5.3 "	" B & S
	1 - 10 "	" "
	1 - 45° bend	
	2 - 12 foot "	"
	1 - 8 "	"
	1 - 12 "	" S & F
Northerly 36" pipe:	1 - 12 "	" B & S
	1 - 10.37 "	"
	1 - 45° bend	
	2 - 12 foot "	"
	1 - 8 "	" S & F
Southerly 36" pipe:	1 - 12 "	" B & S
	1 - 8 "	"
	1 - 8.73° "	"
	1 - 45° bend	
	2 - 12 foot "	"
	1 - 11 "	" S & F

The 4-inch cast iron pipe should extend thru the tunnel plug. The lower end will be an 8-foot bronze piece and will be furnished by the City and installed by the Contractor.

The 36-inch and 42-inch pipe is to be supported on piers prior to concrete encasement. Laying of the pipe should proceed from upstream to downstream.

No work obstructing the bypass tunnel shall be undertaken until permission is given by the Engineer.

Very truly yours,

Fred D. Pyle
Hydraulic Engineer.

FDP/p
cc City Manager
City Attorney
Special Water Counsel

3-7-35
copy/f

12-1-34

From : Hydraulic Engineer

To : Purchasing Agent

Subject: San Diego River Project, El Capitan Reservoir Dam Spillway & Outlet Works, Reservoir Gauge

Requirement exists for the painting directly onto the El Capitan Reservoir Dam Outlet Tower, a reservoir gauge and markings to be similar to sample available in the Hydraulic Engineer's office.

The gauge shall be 2 feet wide and the procedure in painting shall be equivalent to the following:

1. Wire brush the entire area under the painted portion.

2. Brush area under painted portion with saturated solution of zinc sulphate and after this has thoroughly dried brush off.

3. Apply and thoroughly brush in one coat of Fuller's Gilsonite.

4. Apply one coat white Concreta after adding only sufficient of No. 910 Concreta Reducer to spread.

5. Apply one coat white Concreta after adding 1 quart of linseed oil to each gallon and brush out to a thoroughly smooth finish.

6. Apply black gauge markings with Fuller Durable Industrial black enamel.

The background of the gauge proper shall be white.

Ample time shall be left between successive coatings to permit thorough drying of the materials.

The work should be done by a thoroughly competent sign painter and should be inspected on the ground prior to his placing of bid. Attention shall be called to the fact that the exterior face of the outlet tower slopes and that markings will have to be adjusted accordingly.

Check elevations required will be given by the City.

Funds are available under Ordinance No. 550.

Fred D. Pyle
Hydraulic Engineer

PB/p

December 10, 1934

M E M O R A N D U M

Subject: San Diego River Project, El Capitan Feature, H. W. Rohl & T. E. Connolly Contract, Outlet Works, Cast Iron Pipe and Special Castings, (Change Order No. 1).

Paragraphs 131 and 134 of the contract specifications for the construction of the El Capitan Reservoir Dam, Spillway and Outlet Works provides for furnishing and laying cast iron pipe and special castings. Schedule Item 48 provides for cast iron pipe and special castings complete in place. Contract drawing WD-386 shows four 48-inch cast iron pipes in the pipe embedment in the tunnel.

As originally planned the outlet tower was located directly over the outlet or bypass tunnel and four 40-inch cast iron pipes passed from the tower through the tunnel plug. Two of these pipes turned upward into the tower with 1/8 bends and the other two were straight.

The outlet tower was relocated on the north side of the bypass tunnel, which materially increased the number of special castings and made necessary the use of many short lengths of pipe.

Change Order No. 1 was issued August 16, 1933 to H. W. Rohl and T. E. Connolly for furnishing and laying the cast iron pipe as changed.

The attached tabulation compiled with the invoice of the United States Pipe and Foundry Company to H. W. Rohl and T. E. Connolly, which gave a lump sum price of $7,256.00, as supplemented by their letter of November 21, 1934 giving the price per pound for the various items shows that the extra cost to the Contractor of the pipe f.o.b. Los Angeles Pier was $1400.04.

It is presumed that the cost of delivery from Los Angeles Pier to the job was not increased by the increase in the number of short joints of pipe and in the number of specials.

Owing to the nature of the work it was not possible to segregate and keep seperate the actual increase in labor and material costs of laying the pipe in place.

The contractor has now completed the furnishing and laying of all cast iron pipe and special castings required in the outlet works.

It is deemed equitable that the labor and material cost of placing and laying the pipe was increased $250.00 because of the change in the location of the outlet tower.

The changes in the furnishing and laying of cast iron pipe and special castings in the outlet works of the El Capitan Dam in accordance with Change Order No. 1 dated August 16, 1933, letter 5-38 has resulted in an increase of cost to the contractor of $1,650.04, which amount will be included in the next estimate.

Fred D. Pyle
Hydraulic Engineer

FDP/T

11/28/34
copy /f

SAN DIEGO RIVER PROJECT, EL CAPITAN FEATURE
H. W. ROHL & T. E. CONNOLLY CONTRACT
OUTLET WORKS, CAST IRON PIPE AND SPECIAL CASTINGS
(CHANGE ORDER NO. 1)

Pieces	Size, Length, Special	Length Piece	Diameter 36"	Diameter 42"	Weight Lb.	Price	Base	Increase	Increase Cost
4	42" B&S Pipe C	12'		48.0	34,450	$0.0225	.0225	0	$ 0
2	36" F&S "	12'	24.0		12,495	0.032		0	0
5	36" B&S "	12'	60.0		32,800	0.022	.022	0	0
1	42" " "	12'		12.0	8,750	0.0225		0	0
1	42" " "	4'		4.0	3,330	0.032		0.0095	31.635
2	42" " "	5'		10.0	8,150	0.032		0.0095	77.425
1	42" " "	8'		8.0	5,990	0.0325		0.01	59.90
1	42" " "	11'		11.0	7,770	0.0275		0.005	38.85
1	42" " "	5.3'		5.3	4,060	0.032		0.0095	38.57
1	42" " "	6.0'		6.0	4,540	0.032		0.0095	43.13
1	42" " 1/8 Bend	6.2'		6.2	4,800	0.067		0	0
2	42" Blank Flanges	0			2,900	0.087		0.0645	187.05
5	4" B&S Pipe C	12'			1,341	0.0225		0	0
2	42" Flg&S	12'		24.0	16,705	0.0325		0	0
1	42" B&S Pipe	8'		8.0	6,070	0.0325		0.01	60.70
1	42" " "	8'		8.0	5,920	0.0325		0.01	59.20
1	42" " "	8.2'		8.2	6,000	0.0325		0.01	60.00
1	42" " "	10'		10.0	7,200	0.0275		0.005	36.00
1	36" " 1/8 Bend	6.2'	6.2		3,575	0.067		0.445)	160.875)
1	36" " " "	6.2'	6.2		3,575	0.067		0)	0)
1	4" " Pipe	8'			180	0.0325		0.010	1.80
1	4" F&S "	8'			190	0.0375		0	0
1	36" B&S "	4'	4.0		2,570	0.0315		0.0095	24.415
2	36" " "	8'	16.0		9,110	0.0315		0.0095	86.545
1	36" " "	11'	11.0		6,150	0.027		0.005	30.75
1	42" " 1/8 Bend	6.2'		6.2	4,800	0.067		0.0445	213.60
2	36" " Pipe	8'	16.0		9,150	0.0315		0.0095	86.925
1	36" " "	8.7'	8.7		4,910	0.0315		0.0095	46.645
1	36" " "	10.4'	10.4		5,760	0.0265		0.0045	25.92
1	36" " "	11'	11.0		6,020	0.027		0.005	30.10
Total			173.5	174.9	229,261				$1400.035

989

If tower had been constructed as originally planned, two 1/8 bends and four flange and spigot pipes would have been required.

There were no changes in 12' lengths of pipe whether B&S or F&S or in 4" pipe.

One 42" and one 36" 1/8 bends considered as required if change had not been made.

Number of joints	36"	42"	Total
If standard lengths	14	14	28
As laid	17	19	36
Extra because of change	3	5	8

OUTLET TOWER AND OUTLET TUNNEL

Appurtenances furnished by City

Weights

Item	Weights pounds	
6 - 30" saucer valves	26,677	
1 - 30x30" sliding gate comp.	7,890	
1 - 6" extra heavy gate "	1,902	
2 - 36" saucer valves "	28,780	65,249
1 - 10" eye beam 20'11" 2 - 10" " " 10'4½"	1,230	
1 - 12" " " 31'6"	415	
Miscellaneous appliances sheet 459	472	
1 winch	870	
8 - 12x12 vents	100	
Sheaves	690	
6 bundles chain	5,559	
Miscellaneous parts for chain	35	9,371
Blank flanges, tie back bolts and rings at downstream end 36" pipe		1,738
Troiel pipe in tunnel plug		74
	Total	76,432 pounds

SPILLWAY

4/28/33
copy /f

January 6, 1933

Messrs. H. W. Rohl and T. E. Connolly
Contractors, El Capitan Dam
4351 Alhambra Avenue,
Los Angeles, California.

Subject: San Diego River Project, El Capitan Feature, spillway excavation.

Gentlemen:

In compliance with the provisions of paragraph 52 of the contract specifications for the El Capitan reservoir dam, spillway and outlet works, you are advised that no excavation shall be started in the spillway of the El Capitan dam until directed by the engineer.

It is intended to use all suitable materials in the spillway directly in the dam in accordance with the requirements of the above paragraph of the specifications and your attention is specifically invited thereto so that you may plan your dam operations in compliance therewith.

Very truly yours,

H. N. Savage,
Hydraulic Engineer.

HNS/p
cc H.W.Rohl & T.E.Connolly
El Capitan Dam
Contractor's Resident Representative
City's Resident Engineer

4/28/33
copy /f

H. W. ROHL & T. E. CONNOLLY
CONTRACTORS

January 12, 1933

Mr. H. N. Savage, Hydraulic Engineer,
City of San Diego, California.

Subject: San Diego River Project, El Capitan Feature, Spillway Excavation.

Dear Sir:

Referring to your letter of January 6th, 1933, subject, spillway excavation; we must be promptly furnished with exact lines and grades for the spillway excavation as we will require at least ninety days for preparatory work before such material can be placed in the embankment. Flags in place now, in answer to this same request some months back, do not show lines or grades.

Very truly yours,

H.W.Rohl & T.E.Connolly

H. W. ROHL (Signature)

T. E. CONNOLLY (Signature)

4/28/33
copy /f

January 17, 1933

Messrs. H. W. Rohl and T. E. Connolly
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

Subject: San Diego River Project,
El Capitan Feature, spillway
excavation.

Gentlemen:

In accordance with request contained in your letter dated December 12, 1932, Resident Engineer Harold Wood was furnished on December (January) 14 tentative location of the El Capitan reservoir spillway, and requested to locate it on the ground so that you may undertake your preparatory work.

Very truly youts,

H. N. Savage,
Hydraulic Engineer.

HNS/p
cc H. W. Rohl & T. E. Connolly
El Capitan Dam
Contractor's Resident Representative
City's Resident Engineer

4/28/33
copy /f

January 30, 1933

Messrs. H. W. Rohl and T. E. Connolly
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

Subject: San Diego River Project, El Capitan Feature, Spillway Excavation.

Gentlemen:

In accordance with your written request of January 12, 1933 the spillway for the El Capitan Reservoir Dam has been staked and you may undertake your preliminary work at any time.

The work is subject to modification of shapes and dimensions and the shifting of locations to suit conditions disclosed as work progresses as provided for in the specifications.

Very truly yours,

H. N. Savage,
Hydraulic Engineer.

HNS/f
cc H.W.Rohl & T.E.Connolly
El Capitan Dam
Contractor's Resident Representative
Resident Engineer

4/28/33
copy /f

H. W. ROHL & T. E. CONNOLLY
CONTRACTORS

San Diego, Calif.,
March 29, 1933.

Mr. H. N. Savage
Hydraulic Engineer
City of San Diego
San Diego, California

Dear Sir:

Re: El Capitan Dam Reservoir
Spillway and Outlet Works

On December 12, 1932 and Jan. 12, 1933, the Contractors made written request for plans, lines and grade stakes for the spillway structure of the El Capitan Dam. To date only tentative stakes purporting to show lines and grades above elevation 640 have been received. No stakes or other information has been furnished to show lines or grades below elevation 640.

Unless accurate detail plans and stakes for the entire spillway structure are immediately furnished, the Contractors will suffer a direct and unavoidable extra cost on account of the failure of the City to provide the necessary instructions and information for carrying on the work.

Very truly yours,

H. W. ROHL & T. E. CONNOLLY

By H. W. ROHL (Signature)

4/28/33
copy /f

April 1, 1933

Messrs. H. W. Rohl & T. E. Connolly
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

Subject: San Diego River Project, El Capitan Feature, spillway drawings.

Gentlemen:

Receipt is acknowledged of your letter dated March 29, 1933 requesting accurate detail plans and sketches for the entire spillway structure of El Capitan reservoir dam be furnished immediately.

Prints of the drawings for El Capitan reservoir dam spillway, except for the lower end, as approved by the State Engineer on March 21, 1933, were furnished you with letter dated March 29, 1933.

The stakes for the spillway, except for the lower end, were set in January 1933 and you were so advised by letter dated January 30, 1933. These stakes agreed closely with the preliminary stakes set in September 1932.

Prints of the drawings showing the lower end of the spillway will be furnished to you as soon as approved by the State Engineer and the lower end of the spillway will be staked out.

Very truly yours,

H. N. Savage,
Hydraulic Engineer.

HNS/p
cc H.W.Rohl & T.E.Connolly
El Capitan Dam
Contractor's Resident Representative
City's Resident Engineer

4/20/33
copy /f

April 13, 1933

Messrs. H. W. Rohl & T. E. Connolly
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

Subject: San Diego River Project, El Capitan Feature, spillway excavation

Gentlemen:

You are directed to refrain from unnecessary heavy shooting of detached masses of rock and disintegrated granite in the excavation of the spillway for El Capitan Dam which might cause slides of material into the excavation from outside the neat lines as staked, and may result, where the section to be lined is required to be excavated to greater dimensions than specified because of disturbing the foundation by excessive shooting, in cavities requiring filling with concrete at the Contractor's expense.

Very truly yours,

H. N. Savage
Hydraulic Engineer.

HNS/p

cc H.W.Rohl & T.E.Connolly
El Capitan Dam
Contractor's Resident Representative
City's Resident Engineer

August 29, 1933

From : Resident Engineer

To : Hydraulic Engineer

Subject : San Diego River Project, El Capitan Feature Spillway, classification of excavation

The contract specifications for El Capitan Dam provide for two classifications applicable to spillway excavation - Class 1 and Class 2. However Class 1 material is indicated as being of two kinds - "solid rock . . . . . ledge rock in place that cannot be loosened except by wedging, barring or blasting" and "detached masses of solid rock more than one cubic yard in volume."

Test borings, exploration tunnels, surface boulders and surface erosion visible in many places indicated, before bids were received, that disintegrated granite would constitute a very large portion of the spillway and north abutment excavation and that considerable ledge rock would be encountered in the by-pass tunnel in the south abutment; and

That many boulders and detached masses of rock would be encountered in the excavation of the spillway and abutments. Materials encountered in actual excavation have shown no variation from that indicated before bids were received.

The spillway excavation, as disclosed to date, consists of one to two feet of top soil and projecting hard granite boulders. The top soil gradually changes to disintegrated gray granite of varying hardness, in which material occur boulders of hard granite either singly or in groups. The hard boulders are scattered thruout the excavation and the difference in hardness between these and the disintegrated granite is prominently well defined. However the appearance from a distance of a portion of the excavation suggests rock. Inspection, however, clearly indicates the soft nature of the material and the practically complete disintegration of the bonding material. All such material, shot or unshot, readily breaks down into coarse sand. This is clearly shown on photograph EC-452 and 455. All disintegrated granite has a hollow sound when struck with a hammer, almost like earth, while the hard boulders ring true rock.

A considerable portion of the disintegrated granite can be excavated by power shovels without primary shooting, but is most readily excavated when shot lightly or lifted with black powder about 1/3 to 1/2 pound to the cubic yard.

In the process of loading disintegrated granite - shot or unshot - and dumping, it breaks down to a corase sandy material with only occasional lumps larger than a man's head. These lumps are easily crumbled.

Each the disintegrated granite and top soil, when placed in the hydraulic fill portion of the dam, is readily washed by the water from the hydraulic monitor leaving very little coarse material larger than a man's fist on the beach, except for fragments of boulders and lumps of softer material not broken apart. Neither rock boulders from the spillway, by-pass tunnel excavation, nor ledge rock from the quarry are suitable for hydraulic fill material in the dam.

The boulders vary in volume from a few cubic feet up to 10 or more cubic yards. Those over about 3 cubic yards in size are broken by the contractor for loading into trucks by secondary drilling and shooting with dynamite. Owing to the volume and number of large boulders encountered, both on the surface and in the body of the excavation, the secondary shooting is very extensive.

The solid rock portion of the spillway excavation, consisting of boulders and fragments of boulders, are loaded by the contractor on trucks separately from the disintegrated granite and placed in the rock embankment portion of the dam.

The amount of rock excavated from the spillway and placed in the rock embankment portion of the dam is determined by counting the truck loads and estimating the average volume of rock as if in place, in the loads. This material is considered as excavation Class 1. The disintegrated granite and top soil is considered as excavation Class 2.

All detached masses of rock found in the spillway excavation and as loaded by the contractor is satisfactory material for use in rock embankment.

None of the material from the spillway excavation, except for the boulders, is suitable for inclusion in the rock embankment.

There would be no question if excavation was encountered in the spillway of the type in evidence in the quarry from which material is being taken for rock embankment.

There are two kinds of rock in the quarry - massive, and shattered. The massive rock can only be loosened by blasting while the shattered rock in place can only be loosened "by wedging, barring or blasting."

The rock in the quarry requires about 1.75 pounds of powder to the cubic yard for primary shooting, the massive rock requires much secondary shooting and the shattered rock but little, if any.

EXAMINATION OF SPILLWAY EXCAVATION AUGUST 5, 1933

On August 5, 1933 the Resident Engineer received the letter of the Hydraulic Engineer dated August 3, 1933 relative to classification of excavation for structures.

On August 5, 1933 an examination was made of the excavation for El Capitan reservoir dam spillway.

There were present Engineer Fred D. Pyle, Hydraulic Fill Engineer D. W. Albert, Rockfill Inspector H. L. Harper, Chief of Party L. H. Hill, Assistant Engineer P. Beermann, and Resident Engineer Harold Wood.

Twelve photographs were taken by L. H. Hill - EC-450 to 461 inclusive. (see list attached)

EXAMINATION AUGUST 19, 1933

On August 19, 1933 an examination was made of the excavation for the El Capitan reservoir dam spillway.

Those present were Fred D. Pyle, Harold Wood, D. W. Albert, H. L. Harper, L. H. Hill and Paul Beermann.

Five photographs were taken by L. H. Hill, EC-474 to 478 inclusive.

Fred D. Pyle
Engineer

Harold Wood
Resident Engineer

H. L. Harper
Inspector Rock Fill

D. W. Albert
Hydraulic Fill Engineer

P. Beermann
Assistant Engineer

L. H. Hill
Chief of Party.

HW/p

SPILLWAY EXCAVATION

Photographs by L. H. Hill August 5, 1933, 3 to 5 P.M.

Photograph No.	Location Elevation	Camera North	East	Remarks
450-451	780	4210	5030	Shovel 8 N4440 E5180 Elevation 780 digging in unshot bank Shovel 12 N4350 E5320 elevation 725 bank shot, some solid rock
452	780	4270	5040	Shovel 7 N4440 E5090 elevation 780 digging in unshot bank Shovel 8 N4440 E5180 elevation 780
453	780	4270	5040	Drill hole No. 6 in unshot bank Shovel 7 N4440 E5090 elevation 780 digging in unshot bank
454		4380	5030	Shovel 7 loading easily
455	780	4320	5150	Shovel 8 loading easily
456	745	4290	5200	Shovel 12 in shot material T E Connolly and R Hazard to east of picture
457	745	4345	5360	Residual boulders N4390 E5400
458	745	4340	5420	East end of cut isolated boulders T E Connolly and R Hazard to east of picture elevation 745
459	West of east spoil bank			East spoil bank
460	West of west spoil bank			West spoil bank
461				General view of west portion of spillway discharge channel

9-8-33
Copy/m

COPY

September, 1, 1933

Mr. Harold Wood, Resident Engineer,
Lakeside,
Cal.

Dear Sir:

Your letter, EC 8, is returning to us the information we gave your inspectors-namely that cracks were appearing and settlement taking place in the north side of the spillway cut.

We gave that information to them with the end in view of obtaining proper action in the matter, What are you going to do ?

Before the spillway was opened up the contractors protested that you were staking an unstable slope. I pointed out what I believed to be a plane of weakness which would define a natural and stable slope and asked you to utilize it. An unnatural slope was staked and cracks now appearing follow the plane I pointed out to you.

The contractors have pointed out to you, your general corps, the Hydraulic Engineer, members of the Council, and your attorneys that the staking of the now established slope would result in an unstable condition and create an unwarranted hazard. Visiting engineers, our consulting engineers, and visiting geologists have stated the slope to be unstable.

Great care has been exercised in handling this excavation. Slope has been maintained and only the lightest of shooting employed. Slides are occuring on natural slips after a true slope has been established. Excessively hard nodules have been blasted so that they have been cut to slope without dislodgement. The slope has never been subjected to blasting shock, but the lightest of shooting done and that away from the slope. Now with 75ft. of cut yet to be made cracks are appearing, starting from the present deck of the spillway cut and extending up and back some 125 ft. behind the top of the slope. Your removal of a few of the surface boulders above the slope line was wholly inadequate. Before this cut was deepened the slope could have been laid back easily. It now becomes a real problem.

We can but follow the lines you have staked under our contract but we protest the establishment of the present slope.

It is unstable and constitutes an increasing menace to life, limb and property. It constitutes a menace to the lives of ourselves and our employees, to the destruction of our plant and equipment and to the damage or destruction of any concrete we may have placed before a slide occurs. Should any such happening take place we hold you responsible for the loss and damage done.

This whole amount of cracked material may not slide during our construction period but it could well occur thereafter under circumstances that would menace your entire structure. There is potentially enough material in this slide area to dam the entire spillway throat to the height of the top of the dam. Were flood conditions on when this should occur you could well have your dam overtopped - a disaster.

Since speaking of this matter today with Mr. Savage and Mr. Cosgrove, a slip some 50 ft. long and 10 ft. back has come in from the edge of slope back. It is at Mr. Savage direction that I am bringing this matter to your attention.

We believe this situation is becoming increasingly grave and in the premises demands action on your part.

cc H N S
City Atty.

Yours very truly,
H.W.Rohl & T.E.Connally.

T.E.Connelly (Signed)

TEC/c

5/1/34
copy/f

September 15, 1933

Messrs. H. W. Rohl & T. E. Connolly
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

S-45

Subject: San Diego River Project, El Capitan Feature, Spillway Excavation.

Gentlemen:

Your recent policy of wasting solid rock of Class 1 and Class 4 excavation, from the spillway excavation of El Capitan Dam is disapproved of and if continued deductions will be made from your monthly estimates for durable rock wasted.

All durable rock encountered in the excavation of the El Capitan reservoir dam spillway shall be hauled and placed in the rock embankment portion of the dam in accordance with the provisions of paragraphs 52 and 65 of the contract specifications.

This order is effective at 6:00 A.M. September 16, 1933.

Very truly yours,

H. N. Savage
Hydraulic Engineer.

HNS/f

12/8/33
copy /f

November 24, 1933

Messrs. H. W. Rohl and T. E. Connolly S-67
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

Subject: San Diego River Project, El Capitan
Feature, Cut Off Trench Spillway
Station 5+10.

Gentlemen:

You are hereby directed to refrain from placing concrete in the El Capitan spillway cut off trench at Station 5+10 until trench excavation has been approved by the State Engineer's office.

Very truly yours,

H. N. Savage
Hydraulic Engineer.

HNS/f

December 10, 1934

From : Hydraulic Engineer

To : Resident Engineer

Subject: San Diego River Project, El Capitan Feature,
H. W. Rohl & T. E. Connolly Contract,
Classification of Spillway Excavation.

Please prepare the H. W. Rohl & T. E. Connolly Contract progress estimate for the month of November for work done on the El Capitan Reservoir Dam, Spillway and Outlet Works in accordance with the enclosed memorandum dated December 10, 1934 subject, "San Diego River Project, El Capitan Feature, H. W. Rohl & T. E. Connolly Contract, Classification of Spillway Excavation".

Fred D. Pyle
Hydraulic Engineer

FDP/f

cc City Attorney
Special Water Counsel

4/19/33
copy/f

March 28, 1933

Messrs. H. W. Rohl & T. E. Connolly
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

Subject: San Diego River Project,
El Capitan Feature, spillway
drawings

Gentlemen:

Enclosed for your information and use are prints of drawings WD-449 Sheets 1 to 7a inclusive and WD-450 showing the details of spillway at El Capitan Dam, except for the lower end, as approved by the State Engineer on March 21, 1933.

Very truly yours,

H. N. Savage,
Hydraulic Engineer.

FDP/p
cc H.W.Rohl & T.E.Connolly
El Capitan Dam
Contractor's Resident Representative
City's Resident Engineer
encls.(8)

3-13-35
copy/p

May 5, 1933

From : Engineer Fred D. Pyle

To : Hydraulic Engineer

Subject : San Diego River Project, El Capitan Feature, Spillway, discussion with California State Engineer's Deputies

On May 1, 1933 I met Mr. Geo. W. Hawley, Deputy State Engineer in Charge of Dams, and Mr. Gerald McKinlay, Senior Engineer of Dam Inspection, and discussed with them on the ground at El Capitan Dam the design of the spillway below Station 10+37 to which point it had been approved by the State Engineer on March 21, 1933.

The locations of the end of the spillway as submitted to the State Engineer on April 5, 1933 at Station 11+74 and as suggested by Mr. McKinlay on April 17 to coordinate E 3700 or Station 18+85, were pointed out on the ground; also the relative elevations of the spillway channel to the toe wall and the distance from the north end of the toe wall to the proposed end of the spillway at Station 11+74.

Mr. Hawley wished to know the capacity of the lower end of the spillway as submitted and was advised that it was considered ample for 25,000 cubic feet per second and that the probability of larger floods was extremely remote.

Mr. Hawley expressed the idea that the spillway was entirely too short; that there would be extensive erosion at the end of the spillway; that the lining should be extended to Station about 15+50 with a cutoff wall extending to solid material similar to that encountered in the foundation of the toe wall.

Mr. Hawley also expressed himself in favor of some provisions being made in the floor of the spillway to dissipate a portion of the velocity of the water and that a channel should be excavated from the end of the spillway to the river vicinity Station 24.

He also expressed apprehension that the water jump from the discharges in excess of 25,000 cubic feet per second would go over the sides of the spillway channel and the eddies created would erode much of the material between the spillway and the toe wall.

Mr. Hawley's attention was directed to the theoretical backwater curves from the flood flows in the San Diego River channel vicinity Station 24 and points further west along the river channel; and to the effect of the backwater on the velocity of the water at the end of the spillway which would indicate that

the paving might be shortened to Station 14 or even shorter without creating undue hazard. Station 15+50 is about 475 feet west of the north end of the toe wall and Station 14 is about 350 feet.

Mr. Hawley was advised that with a discharge of 25,000 cubic feet per second there would be considerable backwater from the river along the toe wall of the dam and that with a discharge of 70,000 cubic feet per second the backwater would be about the top of the toe wall.

He was also advised that the boulders taken out of the excavation might be arranged as a breakwater between the spillway and dam to advantage in reducing the possibility of the damage by floods of over 25,000 cubic feet per second.

Mr. Hawley was also advised that nothing was known as to the foundation conditions for the cutoff wall at the end of the spillway lining, also that owing to the comparatively low velocities at the end of the lining, due to the relative elevations of the floor of the spillway channel and backwater from the river below, there was no occasion for the cutoff wall extending to a greater depth than 10 feet.

Mr. Hawley stated that his office would be willing to consider plans submitted for spillway channel extending to Station 15+50 but could not advise as to their acceptability until they had been checked by his technical staff.

Fred D. Pyle
Engineer

FDP/p
cc Resident Engineer

5/21/34
copy /f

May 5, 1933

TO THE HONORABLE, THE MAYOR AND COUNCIL
OF THE CITY OF SAN DIEGO, CALIFORNIA.

Subject: San Diego River Project, El Capitan Feature
Spillway extension. Resolution 60011

Gentlemen:

In accordance with Resolution 60011, reading:

"That, in connection with spillway specifications for El Capitan Reservoir, the Hydraulic Engineer is hereby requested to furnish the Council with the following information:

"(1) Schedule of quantities, items and price and estimate of total original bid schedule price.

"(2) Schedule of quantities, items and price and estimate of total cost of spillway as changed and extended to the elevation now desired by the Hydraulic Engineer and required by the State Engineer."

the following information is submitted:

Following is a statement of the contract schedule items, quantities, prices and estimate of total original bid schedule for those portions of the contract schedule pertaining to El Capitan reservoir spillway, exclusive of excavation which was to be paid for principally in embankment.

Schedule Item	Work or Material	Amount
17.	Mass concrete Class 1 in overflow spillway outlet tower base and elsewhere. 18,000 cubic yards at $4.80 per cubic yard 17,500 cubic yards applicable to spillway	$84,000.00
18.	Concrete Class 2 in spillway, side lining and retaining walls. 3,000 cubic yards at $9.00 per cubic yard	27,000.00
19.	Concrete Class 3 in floor lining of spillway 6,000 cubic yards at $4.80 per cubic yard	28,800.00
22.	Concrete Class 6 in cutoff walls under spillway 1,200 cubic yards at $4.80 per cubic yard	5,760.00
33.	Cement in place in the work 30,000 barrels at $1.90 per barrel	57,000.00

Portions of following:

34.	Reinforcing steel	
35.	Structural steel	
36.	4" drain tile in place	
37.	6" drain tile in place	18,440.00
38.	8" drain tile in place	
39.	12" drain tile in place	
40.	2" steel grout and drain pipe	
45.	Grouting by air pressure	
46.	Copper water stop	
	Total cost for spillway structure	$ 221,000.00

The following excavation quantities, prices and costs were applicable to spillway:

Schedule Item	Work or Material	Amount
1.	Excavation Class 1 solid rock originating in structure excavation including placing and sorting in dam. 40,000 cubic yards at $1.00 per cubic yard 20,000 cubic yards applicable to spillway	$ 20,000.00
3.	Excavation Class 2, earth, overburden, sand, gravel and other excavation originating in structure excavation including placing and sorting in hydraulic fill. 350,000 cubic yards at $.40 per cubic yards 326,000 cubic yards applicable to spillway	130,400.00
8.	Excavation Class 4 cutoff trench excavation under spillway including placing and sorting in dam. 5,000 cubic yards at $2.00 per cubic yard	10,000.00
11.	Excavation Class 2, earth, overburden, sand, gravel and other excavation originating in structure excavation and wasted. 34,000 cubic yards at $.25 per cubic yard 14,000 cubic yards applicable to spillway	3,500.00
13.	Excavation Class 4 cutoff trench excavation under spillway and wasted. 500 cubic yards at $1.50 per cubic yard	750.00
	Total cost of excavation including placing 351,000 cubic yards of material in the dam and wasting 14,500 cubic yards	$ 164,650.00

Contract drawing WD-382, approved by the California State Engineer on February 29, 1932, and contract drawing WD-385 are a part of the bound copy of contract specifications under which H. W. Rohl & T. E. Connolly are constructing El Capitan Reservoir Dam, Spillway and Outlet Works.

These drawings show the spillway channel lining to a point about 230 feet west of the west end of the spillway overflow crest. An extension is indicated on each drawing by the following wording "Extend lining as directed by the engineer" and "Detailed structural and hydraulic drawing for the spillway channel, discharge end, are to be developed and submitted for approval by State Engineer before construction."

Contract specifications read in part as follows:

"29. QUANTITIES AND UNIT PRICES.- The quantities noted in the schedule of proposal are estimates for comparing bids, and no claim shall be made against the City of San Diego for excess or deficiency therein, actual or relative....."

"94. CONCRETE IN OVERFLOW SPILLWAY.- The overflow spillway shall be constructed to the grades and dimensions shown on the drawings or prescribed by the engineer....."

In accordance with the above notations, on February 2, 1933 detail structural and hydraulic designs showing the spillway as extending about 300 feet further than indicated on the contract drawings and down to elevation 575 (Station 10+37) were submitted to the State Engineer, which had been provided for as above, and, after modification, were approved by him on March 21, 1933 on condition that the spillway lining would be extended to a still lower elevation.

On March 29, 1933 the Contractor was furnished prints of the drawings as approved by the State Engineer and was advised that the State Engineer had indicated he would require a somewhat further extension of the spillway channel.

The following is a statement of the estimated schedule items, quantities and prices on the basis of spillway structure to the point (Station 10+37) approved by the California State Engineer on March 21, 1933:

Schedule Item	Work or Material	Amount
17.	Mass concrete Class 1 in overflow spillway 12,700 cubic yards at $4.80 per cubic yard	$ 60,960.00
18.	Concrete Class 2 in spillway side lining 2150 cubic yards at $9.00 per cubic yard	19,350.00
19.	Concrete Class 3 in floor lining of spillway 5,720 cubic yards at $4.80 per cubic yard	27,456.00

Schedule Item	Work or Material	Amount
22.	Concrete Class 6 in cutoff walls under spillway 2,230 cubic yards at $4.80 per cubic yard	$ 10,704.00
33.	Cement 25,300 barrels at $1.90 per barrel	48,070.00
	Portions of the following:	
34.	Reinforcing steel	
35.	Structural steel	
36.	4" drain tile in place	
37.	6" drain tile in place	
38.	8" drain tile in place	19,460.00
39.	12" drain tile in place	
40.	2" steel grout and drain pipe	
45.	Grouting by air pressure	
46.	Copper water stop	
	Total cost for spillway structure to point approved by California State Engineer	$ 186,000.00

The following excavation quantities, prices and costs are applicable to the spillway to the point (Station 10+37) approved by the California State Engineer.

Schedule Item	Work or Material	Amount
1.	Excavation Class 1 solid rock originating in structure excavation including placing and sorting in dam. 25,000 cubic yards at $1.00 per cubic yard	$ 25,000.00
3.	Excavation Class 2, earth, overburden, sand, gravel and other excavation originating in structure excavation including placing and sorting in hydraulic fill. 530,000 cubic yards at $.40 per cubic yard	212,000.00
13.	Excavation Class 4 cutoff trench excavation under spillway and wasted. 3,500 cubic yards at $1.50 per cubic yard	5,250.00
	Total cost of excavation including placing 555,000 cubic yards in the dam and wasting 2,500 cubic yards	$ 242,250.00

To date no written notice has been received from the Contractor objecting to such work under the contract schedule items, nor has he requested in writing instructions that such work be done under the provisions of paragraph 13 of the contract specifications. The Contractor's legal representative, Mr. John M. Martin, has

verbally requested that, since the cost of the spillway extension exceeds $1,000, the Contractor be notified of the change in accordance with the provisions of paragraph 13 of the contract specifications, which requires the approval of the Council.

There appear to be four ways of providing for the extension of the spillway structure:

(1) Change order under paragraph 13 of the contract specifications which provides that if such changes result in an increase or decrease of cost to the Contractor, the Engineer will make such additions or deductions on account thereof as he may deem reasonable and proper.

(2) Extra work order under paragraph 14 of the contract specifications which provides the Contractor will be paid the cost of the work to him plus 15 per cent for profit, superintendence, and general expense.

(3) Change order under paragraph 13 of the contract specifications to be issued after an agreement has been entered into with the Contractor that he will accept, as full satisfaction for the work indicated, payment at respective unit prices bid in the contract without additions or deductions therefrom.

(4) Separate contract after due advertising and receipt of bids.

The first method is dependent upon the keeping of accurate costs of the work and involves the question of the direction of the work. If the City is to take into account the increased or decreased cost to the Contractor, the Hydraulic Engineer must not only determine what the increased or decreased cost is, but the City should exercise appropriate control and direction of the work in order that the City be protected.

In the second method the work must be controlled and directed by the Hydraulic Engineer and the entire actual cost to the Contractor must be determined.

The first two methods involve undue responsibilities and risks and the practical difficulty of determining costs of the spillway extension, especially with a large portion of the excavation going into the hydraulic fill with material from other sources, make these two methods inadvisable.

Thr third and fourhh methods are independent of cost and direction of the work as affecting cost because the amount to be paid will depend solely upon the quantities and contract prices and not upon the cost of the work to the Contractor.

Due to the notations on the contract drawings, to the specification references and to the schedule quantities stated in the contract, and the fact that the extension is of exactly the same type of work as indicated on the drawings, it appears that the contract contemplated and provided for the extension of the spillway structure for a considerable distance past the plan of spillway as shown on contract drawing WD-385.

RECOMMENDATION: It is recommended that, provided the Contractor H. W. Rohl & T. E. Connolly agree to excavate the spillway and construct the spillway structure to the point (Station 10+37) approved by the California State Engineer on March 21, 1933 at contract schedule prices without additions or deductions therefrom, the Hydraulic Engineer be authorized to issue, under the provisions of paragraph 13 of the contract specifications for El Capitan Reservoir Dam, Spillway and Outlet Works, a change order to the Contractor covering the additional work to Station 10+37.

Respectfully,

H. N. Savage,
Hydraulic Engineer.

HNS/p

5/4/34
copy/f

July 8, 1933

Messrs. H. W. Rohl & T. E. Connolly S-24
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

Subject: San Diego River Project, El Capitan Feature, spillway side wall footing

Gentlemen:

To correct an inadvertant oral statement made by the City's Resident Engineer to your Resident Superintendent Mr. O. C. Steves relative to construction joint in the El Capitan reservoir spillway side wall;

It will not be permitted to make a construction joint at or below the top of the spillway floor level, nor less than three feet above spillway floor level.

The intent is to have the lower three feet of side wall and side wall footing monolithic.

Very truly yours,

H. N. Savage,
Hydraulic Engineer.

HNS/p

5/4/34
copy/f

August 10, 1933

TO THE HONORABLE, THE MAYOR AND COUNCIL

OF THE CITY OF SAN DIEGO, CALIFORNIA.

Subject: San Diego River Project, El Capitan Feature, spillway model.

Gentlemen:

The California State Engineer in letter dated July 20, 1933 returned the City's drawings for the El Capitan reservoir dam spillway discharge channel, approved, with the following suggestion:

> "The importance and magnitude of the spillway structure is such that we believe you would be fully justified in making a model of the prototype on such a scale that the hydraulic properties of the spillway, including the channel, could be carefully studied as a basis for such modifications in the structure as may be found desirable and necessary. It might be found from flow observations through such a model that training walls of moderate height and equally spaced in the entry section would materially improve the hydraulic properties of this section and tend to minimize the turbulence which it is believed will occur if such walls are not constructed. Likewise, more competent knowledge of the behavior of the discharge end of the spillway might result in a design that would very materially minimize the erosion that probably will occur during periods of peak flow."

In order to determine the most economical detailed design for reservoir spillways of relative great discharge capacity, demonstration by the use of small scale models has become general engineering practice.

After experimentation with models of the generic spillway designs, modifications, improvements and material economies were made effective in the Colorado River Project, Hoover dam;

City of Los Angeles Bouquet Canyon dam;

Los Angeles County Flood Control dams San Gabriel No. 1 and No. 2; and

City of Pasadena Pine Canyon dam.

The cost of making and demonstrating a model of El Capitan spillway as generically designed, and conducting tests before the concrete reinforced lining is formed, as suggested by the State Engineer, is estimated at about $1,000.00.

George W. Hawley, C.E., Deputy State Engineer in Charge of Dams, has been cooperatively and increasingly persistent that the City of San Diego determine by reduced size model spillway the hydraulic effectiveness and maximum economies possible to accomplish by modifications of generic design developed for the El Capitan reservoir spillway.

In view of the importance, magnitude and estimated cost of the El Capitan spillway, which is about $250,000, I am constrained to concur with the California State Engineer and the Deputy State Engineer's suggestions and requirements and in the City's compliance therewith.

RECOMMENDATION: It is recommended that $1,000.00, or so much thereof as may prove necessary to expend, be provided and made available at once from the El Capitan dam bond fund for the purpose of making a very small model of the El Capitan reservoir spillway and for conducting the tests required to determine the most economical detail design for the El Capitan spillway.

Respectfully,

H. N. Savage
Hydraulic Engineer.

HNS/f

5/1/34
copy/f

H. W. ROHL & T. E. CONNOLLY
CONTRACTORS

Lakeside, Cal.,
August,22,1933

Mr. H.N.Savage, Hydraulic Engineer,
San Diego,
Cal.

Dear Sir:

Would you please furnish me with steel cutting list for the spillway above elevation 680.

Yours very truly,
H.W.Rohl & T.E.Connolly

T. E. CONNOLLY (Signature)

11/1/33
copy /f

September 13, 1933

Messrs. H. W. Rohl & T. E. Connolly S-44
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

Subject: San Diego River Project, El Capitan Feature, spillway, reinforcing steel.

Gentlemen:

In accordance with your request dated August 22, 1933, enclosed are prints, in duplicate, of drawing WD-476 sheets 1 to 6 inclusive, showing the reinforcing steel required for that portion of the El Capitan reservoir dam spillway east of Station 7+40, except for the anchors under the floor and side walls.

Very truly yours,

H. N. Savage,
Hydraulic Engineer.

FDP/p
cc-H.W.Rohl & T.E.Connolly
El Capitan Dam
Contractor's Resident Representative
City Manager
City Attorney
City's Resident Engineer

encls. (12) to Contractor's El Capitan office only

10/4/33
copy /f

September 22, 1933

Messrs. H. W. Rohl & T. E. Connolly S-46
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

Subject: San Diego River Project, El Capitan
Feature, spillway, concrete

Gentlemen:

In connection with the placing of concrete in the El Capitan reservoir dam spillway, your attention is invited to that portion of the contract specifications reading as follows:

> "75. PLACING.- . . . . . "Workable" concrete shall be poured and immediately spaded to place with suitable tamping bars, shovels, or forked tools until it completely fills the forms, closes snugly against all surfaces and is in perfect and complete contact with any steel used for reinforcement. Where smooth surfaces are required a suitable tool shall be worked up and down next to the form until the coarser material is forced back and a mortar layer is brought next to the form. Both placing and tamping shall be done with a special view to obtaining the densest concrete and smoothest surfaces practicable. . ."

Your full compliance with the above is required.

Provision should be made for adequate lighting for concrete placing operations.

Very truly yours,

H. N. Savage,
Hydraulic Engineer.

FDP/p
cc H.W.Rohl & T.E.Connolly, El Capitan Dam
Contractor's Resident Representative
City's Resident Engineer
City Manager
City Attorney

3-8-35
copy/p

October 13, 1933

M E M O R A N D U M

San Diego River Project, El Capitan Feature
Spillway model, cost to October 10, 1933

An investigation of the records indicates that the model of the El Capitan reservoir dam spillway has cost to October 10, 1933 about $660.00 divided as follows:

Materials and supplies	$185.00
Labor	470.00
Electric power	5.00
Total	$660.00

Fred D. Pyle
Engineer

FDP/p

3-8-35
copy/p

October 19, 1933

From : P. Beermann

To : Hydraulic Engineer

Subject : San Diego River Project, El Capitan Feature
Spillway model

1. The discharge capacity of the spillway of the El Capitan Dam has been investigated experimentally by means of the model spillway at Riverview pumping station, and theoretically using Hind's theory on side channel spillways.

2. In observing the flow in the model, the following facts should be borne in mind:

(a) Scale reduction is 1/48 of natural scale.
(b) Discharge reduction is about 1/16000 of natural discharge.
(c) Area reduction is about 1/2300 of natural cross sectional area.
(d) Velocity reduction is about 1/7 of natural velocity.
(e) Entrained air in model practically none, while entrained air provision in natural spillway due to the height of fall being 48 times greater should be about 25% (A.J. Wiley, P. 932, 1926 Transactions Am.Soc.C.E.)

3. A test made of the spillway as designed showed that the water had a tendency to climb at the outer edge of the discharge channel just downstream from and opposite the downstream edge of the ogee crest, and was then deflected gradually to the opposite side of the channel in its lower reaches.

4. In an effort to correct this, the discharge channel was narrowed by the insertion of a guide board.

5. It was desired to know the effect on the discharge due to this narrowing, as indicated on print of attached drawing WD-449 sheet 2 of 7.

6. The experiment carried out in the field on October 12, 1933 with a proportionate reproduction of an 83,000 c.f.s. flood flow indicated a very smooth discharge throughout the spillway channel.

7. By comparison of water surface elevations and interpolation the discharge with narrowed channel exclusive of provision for entrained air is about 15% less than with channel as designed and approved by the State Engineer. This would mean a deduction in safe capacity with water in reservoir at elevation 763, reservoir contour 210, or with 13 feet over the crest, from 83,000 c.f.s. to about 71,000 c.f.s. With provision made for entrained air, the discharge would be still further reduced to something less than 70,000 c.f.s.

8. Similarly, with 12 feet passing over the crest, the discharge of 70,000 c.f.s. in the spillway as now designed would be

reduced to less than 60,000 c.f.s. with narrowed channel, the water surfaces being about the same as in spillway as now designed.

9. On the attached drawing are indicated the relative average flow lines of an 83,000 c.f.s. flood with the narrower channel and as now designed, without correction for entrained air.

10. Recommendation: Inasmuch as it seems undesirable to materially decrease the spillway capacity, it is suggested that an experiment be made to improve the flow in the existing channel.

P. Beermann

PB/c

3-8-35
copy/p

October 23, 1933

From : Resident Engineer

To : Hydraulic Engineer

Subject : San Diego River Project, El Capitan Feature Spillway - test anchors

1. Two sets of four test anchors each were placed at El Capitan dam. Set "A" were drilled and a levee built around the four holes spaced at each corner of a four foot square. The space was flooded with water. Set "B" were drilled so the holes were at each corner of a four foot square. These holes were left dry.

2. The location of the test was in a portion of the spillway about elevation 650 and was picked as being representative of the decomposed granite for the entire spillway.

3. The 1-inch square deformed steel bars were grouted in with a mixture of 1 part of quick setting cement to 3 parts of sand.

4. The set "A" were tested on Sunday, October 15, 1933 and the testing was personally supervised by the Resident Engineer.

The set "B" were tested on Sunday, October 22, 1933 and the testing was personally supervised by Mr. L. H. Hill.

It was necessary to conduct these tests on Sunday when the hydraulic press was available from the contractor's shop and when the pressure gauge was available from the Standard Iron Works.

5. The pulling was done by using the contractor's hydraulic press which has a capacity of 60 tons with a gauge pressure of 5000 pounds per square inch and applying the ram pressure to a 16-inch simple beam to reverse the direction of power to an upward pull. The cross beam of the press had to be blocked to the ground to carry the load. See photograph taken October 15, 1933.

6. The following table gives the results of the tests on the several lengths of anchors:

Anchor No.	Location		Length Imbedded	Gauge Pressure	Pull Pounds	Remarks
1	Set A	NW	7.0	1800	43,200	Set A - ground
2		SW	5.0	800	19,200	Wet
3		NE	3.5	2000	48,000	
4		SE	3.5	1200	28,800	
5	Set B	SW	7.0	2850	68,400x	Set B - ground
6		SE	5.0	2200	52,800x	Dry
7		NE	3.5	1700	40,800	
8		NW	6.0	1350	32,400	

x Nos. 5 and 6 did not move. All others failed at load indicated.

7. An examination of the grout around the 1-inch square deformed bars of the anchors indicates that the bars which failed pulled from the grout. The grout did not shear from the side of the hole.

8. The results of these tests indicate that a 1-inch square deformed anchor imbedded 3.5 feet into grout in holes drilled into the decomposed granite of the spillway floor and side walls as indicated on print of drawing WD-449, sheet 6, will develop sufficient bond to develop close to the elastic limit of the steel.

9. Appreciation is hereby expressed to the Standard Iron Works for their cooperation in loan of pressure gauge.

Harold Wood
Resident Engineer

HW/f
cc-L. C. Hill

7/5/34
copy /f

July 3, 1934

Messrs. H. W. Rohl & T. E. Connolly S-116
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

Subject: San Diego River Project,
El Capitan Feature, Spillway
Completion of excavation and
concrete lining

Gentlemen:

You are hereby directed to undertake and to complete before October 10, 1934 that portion of the El Capitan reservoir dam spillway located northerly and westerly from the spillway crest, including the uncompleted portions of the spillway excavation and the uncompleted portions of the side lining and floor lining.

Very truly yours,

Fred D. Pyle,
Hydraulic Engineer.

FDP/p
cc H.W.Rohl & T.E.Connolly
El Capitan Dam
Contractor's Resident Representative

MISCELLANEOUS APPURTENANCES

October 22, 1934

H. W. Rohl & T. E. Connolly
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California

S-135

Subject: San Diego River Project, El Capitan Feature, Pipe railing

Gentlemen:

Enclosed is print of working drawing No. 2677 showing in red the location of holes to receive pipe railing at the north end of the El Capitan dam; and

Print of drawing WD-390 indicating holes 1nft in concrete on the north side of tunnel exit portal to receive pipe railing.

The height and spacing of horizontal rails and painting shall be the same as for railing installed on the outlet tower.

The pipe railing is to be placed as required in paragraph 128 of the contract specifications, and payment will be made at the unit price bid therefor.

Very truly yours,

Fred D. Pyle
Hydraulic Engineer

FDP/p
encls.(2)
cc-City Manager
City Attorney
Special Water Counsel

ACCIDENTS

2-5-35
copy/p

July 20, 1932

From : W. M. Bonham, Chief of Party

To : Resident Engineer

Subject : San Diego River Project, El Capitan Feature Tunnel, near premature blast.

1. On shift #2 July 19, 1932, exit heading there was a near premature blast at about 2:30 P.M.

2. The holes were all loaded with electric delayers in the primers; the electric lights were being removed, and the charge wired up to the firing wires. There was a flash and one of the men, who was connecting up the charge to the firing wires, was burned. Fortunately, the current was not strong enough to set off the charge.

3. I have talked to a number of the men on the shift and all declare that the light wires did not come into contact with the firing wires. The firing switch, from all evidence discovered was off and locked. The firing wires are on the opposite side of the tunnel from the lifht wire except at the portal. At the portal the wires are protected in a good way.

#. There are two explanations for the near accident:

(1) That the man taking down the lights let the cord fall into the water, and the electricity from the light wires, finding broken insulation, was carried by the water. Three men felt the shock.

(2) That static electricity might have been located in the track by the mucking machine, and the current of electricity carried by the steel and water.

W. M. Bonham

WMB/p

2-5-35
copy/p

July 21, 1932

From : Resident Engineer

To : Hydraulic Engineer

Subject : San Diego River Project, El Capitan Feature
Outlet tunnel - electric blasting

1. Attached to this letter is report by Tunnel Inspector W. M. Bonham covering incident in connection with tunnel blasting which occurred on the second shift of July 19, 1932. The tunnel safety rules as issued by the Industrial Accident Commission of the State of California, under Rule 720 "Blasting" gives certain instructions relative to the use of detonators for firing the charges and the wiring and switches for use in connection with firing the detonators with electricity.

2. Inspection of the electrical equipment being used and the methods of using this equipment for detonating the shots in the tunnel have been checked from time to time by the Resident Engineer and the Tunnel Inspector W. M. Bonham. This equipment has been found to be in proper working order and to comply with the Industrial Accident Commission's rules.

3. Immediately upon receiving the report on a near premature blast in the tunnel heading, I made a thorough investigation in company with Mr. Bonham and the contractor's chief electrician, and we could find nothing in the electrical equipment that might have caused any chance for detonating a blast prematurely.

4. I conferred with the shift foreman, Mr. Steve Cassovitch, who is in charge of the work as tunnel superintendent and who was on duty at the time, and learned from him that apparently the whock which was felt by the several men on the shift was entirely derived from lighting wires coming in contact with the water in the tunnel. The lighting circuit is supplied by electric energy at a pressure of 110 volts and it is quite questionable as to whether this voltage, if applied directly to the wire of the detonators, would cause the blast. The energy for the blasting is supplied at a pressure of 440 volts.

5. The contractor's superintendent Ben F. Wells also made a personal investigation of the conditions which might have lead to a premature blast and was convinced that ahenace of such an accident was quite remote with the electrical equipment present in the tunnel. Mr. Wells issued instructions, however, to renew certain of the lighting wires to preclude any possibility of men being shocked by stray electric currents reaching the water in the tunnel.

6. As a precaution, as is usually the custom, the blasting wires are on an opposite side of the tunnel from the electric light wiring and every precaution seems to be taken to safeguard the men.

Harold Wood
Resident Engineer

HW/p

2-5-35
copy/p

December 30, 1932

From : Senior Draftsman, H. V. Newcomb

To : Resident Engineer

Subject : San Diego River Project, El Capitan Feature
Report of accident to contractor's employes

At 8:45 A.M. December 30, 1932, City of San Diego's Instrumentman W. H. Simpson and I were going into the entrance El Capitan outlet tunnel to inspect the clearance etc. on tunnel lining timbers about 600 feet in from the entrance end.

When about 200 feet into the tunnel there was a severe explosion which was alarming as no blasting was expected at that time and the concussion seemed more severe than an ordinary shot.

Very shortly a contractor's employee came running toward us and hurried on to the entrance portal to get truck ready to carry men reported to be injured to the contractor's local emergency hospital. He was followed by Ralph Rockwood the contractor's timekeeper, who was limping and with foot very bloody. I offered to help him and he said help get the other fellows out. Two other men were being carried out to the entrance portal badly injured from their appearance. They were placed in car and taken to the contractor's local emergency hospital.

Contractor H. W. Rohl came just after the injured men left and I told him two men had been seriously injured by an explosion. He proceeded into the tunnel.

Mr. Simpson and I went back into the tunnel and found that the explosion had occurred at about 587 feet into the tunnel from the entrance portal on the north side. The explosion had scattered parts of scaffold around near the front and ahead of a truck which was standing at about Station 5+83, and at the north side of the tunnel invert there was part of invert blown out from north edge of invert as if the explosion had occurred there. There was no evidence of damage to the truck which was headed toward the entrance portal. Acetyline and oxygen gas tanks for welding were intact.

HVN/p

H. V. Newcomb

2-5-35
copy/p

January 5, 1933

From : Hydraulic Engineer

To : Resident Engineer

Subject : San Diego River Project, El Capitan Feature
Accident Reports

1. In event of a material or major accident to either the City's staff or contractor's forces, an immediate telephone report is required from the Resident Engineer's office to the Hydraulic Engineer's office.

2. In case of a major accident such as recently occurred in the tunnel, a generic and immediate report in writing is also desired in order that I may dutifully answer inquiries from the City's officials and other properly interested parties.

H. N. Savage

HNS/f

2-5-35
copy/p

January 10, 1933

From : Hydraulic Engineer

To : City Attorney

Subject : El Capitan Dam Construction, Contract, Industrial Accident Commission Report

Enclosed is copy of an official report from the Industrial Accident Commission to H. W. Rohl and T. E. Connolly dated January 6, 1933, following an explosion in the El Capitan by-pass tunnel.

It is assumed that the responsibility for unsafe construction conditions and the accomplishment of safety requirements for their correction and safe construction policies and methods rests upon the contractor and the State and its agencies.

I shall be glad to have an opportunity to discuss this abd other matters concerning the El Capitan Dam contract with you on the ground at the dam at your early convenience.

H. N. Savage
Hydraulic Engineer

HNS/f
encl. Copy letter Industrial Accident Commission
1/6/33

3/30/34
copy /f

January 20, 1933

Industrial Accident Commission
State Building
Los Angeles, California.

Attention: J. Wesley Gebb, Engineer

Subject: San Diego River Project, El Capitan Reservoir Dam Spillway and Outlet Works.

Gentlemen:

In response to your official letter dated January 10, 1933, enclosed are City of San Diego's El Capitan Reservoir feature, hydraulic fill rock embankment dam Drawing WD-382 and WD-383, on which latter has been indicated also plan of tunnel and colored concrete placement as of date of the explosion accident, December 30, 1932.

Also enclosed is clipping from San Diego Union, December 25, 1932, showing pictures of El Capitan Reservoir by-pass tunnel.

Duplicate copies of the above drawings have been furnished the contractor.

Very truly yours,

H. N. Savage
Hydraulic Engineer.

HNS/f
Encls. (3)
Drawing WD-382
WD-383
Clipping San Diego Union - 12/25/32

cc H. W. Rohl & T. E. Connolly
Contractors El Capitan Dam
Lakeside, California.

4/6/34
copy/f

STATE OF CALIFORNIA
Department of Industrial Relations
INDUSTRIAL ACCIDENT COMMISSION
Los Angeles

Jan. 24, 1933.

H.N.Savage, Hydraulic Engineer,
City of San Diego,
San Diego, Calif.

Dear Mr. Savage:

We acknowledge receipt of your letter dated Jan. 30, 1933, enclosing drawings WD-382 and WD-383; also clipping from the San Diego "Union" of Dec. 25, 1932, for which please accept our thanks.

If, at any time, we can be of service to you, please do not hesitate to call upon us.

Yours very truly,

J. WESLEY GEBB
(J. Wesley Gebb)
ENGINEER.

JWG-PSP.

5/3/33
copy/f

February 8, 1933

Messrs. H. W. Rohl & T. E. Connolly
Contractors El Capitan Dam
4351 Alhambra Avenue
Los Angeles, California.

Subject: San Diego River Project, El Capitan Feature, Workmen's Compensation and Indemnity Insurance.

Gentlemen:

Your attention is invited to paragraph 38 of the contract specifications for the El Capitan Dam, reading as follows:

> 38. WORKMEN'S COMPENSATION AND INDEMNITY INSURANCE.- The Contractor shall furnish the City of San Diego with a certificate of the insurance carrier with whom said contractor is carrying a policy of insurance, acknowledging full liability and covering all employees connected with the work specified in this contract, and insuring said contractor against loss or liability by reason of the Workmen's Compensation Insurance and Safety Act of 1917, said certificate of the insurance carrier to bear the date of the expiration of said policy.

Please immediately furnish the information provided for as above indicated.

Very truly yours,

H. N. Savage,
Hydraulic Engineer.

HNS/m
cc H. W. Rohl & T.E.
Connolly, El Capitan Dam
John M. Martin, Attorney
City's Resident Engineer

SAFETY

4/4/34
copy/f

STATE OF CALIFORNIA
Department of Industiral Relations
INDUSTRIAL ACCIDENT COMMISSION
Los Angeles

August 24, 1932.

W. H. Rohl & T. E. Connolly,
Lakeside,
Calif.

ATTENTION BEN F. WELLS, SUPT.

Gentlemen:

On August 18, 1932, I inspected your tunnel, and quarry workings at the El Capitan Dam, San Diego County, and found certain unsafe conditions, which are listed herewith, together with safety requirements for their correction:

TUNNEL - AT BOTH EAST & WEST PORTALS.

1. Some gears, sprockets, chains, and shafting of the mucking machines are exposed to contact. Said exposed parts must be guarded, as required by Tunnel Safety Rule 712, and General Safety Orders 1, 2, 6, and 8.

BLOWER AT EAST PORTAL.

2. Motor and blower drive pulleys unguarded. Motor and blower drive pulleys must be guarded, as required by General Safety Order #3 (c) and Tunnel Safety Rule 712.

3. Drive belt unguarded. Drive belt must be guarded, as required by General Safety Order #2 and Tunnel Safety Rule 712.

MAIN DYNAMITE MAGAZINE.

4. The main dynamite magazine does not comply with the State Explosive Law (Tunnel Safety Rule 717, Order 1104, Section 3 (c) and (b)), in that magazine is neither fireproof nor bullet proof, and is too close to buildings housing employees and others. The main dynamite magazine must be made fireproof and bullet proof, as required by Section 3 of Tunnel Safety Rule 717, and the amounts of explosives which may be lawfully had, kept, or stored in said magazine must be reduced to correspond with the quantity and distance table on page 20 of the Tunnel Safety Rules (Section 3 (b)), or all dynamite must be removed to the quarry premises and stored in a tunnel magazine, as hereinafter specified under:

QUARRY WORKINGS.

5. The main dynamite and powder magazine shall be a tunnel, where no person or persons are employed. The door of such tunnel magazine shall be fireproof, and have printed thereon the works: "Magazine",

"Explosives", "Dangerous", as specified in Quarry Safety Rule 626, Section 3 (c).

MAIN CAP MAGAZINE.

6. Blasting caps and electric detonators must be stored in a similar tunnel magazine, located at least 100 feet from the main dynamite magazine.

7. Main powder and cap magazines must be located not less than 100 feet from any other structure housing men.

SECONDARY CAP AND DYNAMITE MAGAZINES.

8. Explosives, in quantities not exceeding one hundred pounds, for daily use in adobe shots, block-holing, or other small shots, must be stored in stout and tight boxes with hinged lids, as specified in Quarry Safety Rule 627 (b), (c), and (d). It is recommended that the boxes be painted "red", and mounted on skids, or provided with handles, for facility in moving. Post or paint signs on boxes reading: "Magazine". "Explosives". "Dangerous".

MISCELLANEOUS RULES FOR QUARRYMEN.

9. Post Miscellaneous Rules for Quarrymen on bulletin boards placed where all quarry workers will see Rules and bulletins, as required by Quarry Safety Rule 611. These Rules are being mailed to you.

We are enclosing herewith one copy each of General Safety Orders, EngineeSafety Orders, Quarry Safety Rules, Tunnel Safety Rules, and are sending you, under separate cover, one copy each of Miscellaneous Rules for Quarrymen, placard form in English, Shop Bulletin No. 1 entitled "Responsibility of Employees in Preventing Accidents", which must also be posted on your bulletin board, Information for Employees, Calif. Safety News, Resuscitation Chart; (kindly post on bulletin board), and "Safety First Rules for Using and Handling Explosives".

Yours very truly,

J. WESLEY GEBB

(J.Wesley Gebb)
ENGINEER.

JWG-PSP
4 encs.
6 sep.ml.

CC H. N. Savage, Hydraulic Engineer,
City of San Diego,
524 "F" St.,
San Diego, Calif.

4/4/34
copy/f

STATE OF CALIFORNIA
Department of Industrial Relations
INDUSTRIAL ACCIDENT COMMISSION
Los Angeles

ORDER TO CORRECT UNSAFE CONDITIONS OR TO SHOW CAUSE

To W. H. Rohl & T. E. Connolly, Los Angeles, Calif., Oct. 6, 1932

Lakeside,

California.

ATTENTION BEN F. WELLS, SUPT.

YOU ARE HEREBY NOTIFIED that an inspection of your place of employment located at El Capitan Dam, Lakeside, California made on the 28th day of September, 1932, by J. Wesley Gebb Engineer attached to this Commission, shows the existence of unsafe conditions which must be corrected as hereinafter appears. These unsafe conditions of your place of employment constitute a menace to the lives or safety of any person or persons employed thereabout and such places of employment, machines, devices or apparatus, are being operated or used in violation of the Workmen's Compensation, Insurance and Safety Laws of the State of California, and the Safety Rules and Orders of the Industrial Accident Commission of the State of California;

NOR, THEREFORE, YOU ARE HEREBY DIRECTED to comply with the requirements hereinafter set forth, and to notify this Commission in writing to that effect on or before October 15, 1932, or to show cause, if any you have, in writing, onor before said date, to this Commission at its office above noted, why an order should not be made forthwith by this Commission, adopting said requirements as a special safety order or orders of this Commission, prohibiting the use of said equipment in its unsafe condition and directing the attachment to said equipment of a notice to such effect. If you desire an oral hearing before this Commission upon said requirements, in place of the hearing in writing provided above, you are hereby directed to file a request in writing with the Commission at its office above noted, for such oral hearing before said date.

The requirements for the correction of the aforesaid unsafe conditions appear on the attached sheets.

T. W. OSGOOD (Signature)
Assistant Superintendent of Safety

Enc.
CC Mr. H. N. Savage, Hydraulic Engineer,
City of San Diego,
524 "F" St.,
San Diego, Calif.

STATE OF CALIFORNIA
Department of Industrial Relations
INDUSTRIAL ACCIDENT COMMISSION
Los Angeles

Oct. 6, 1932.

W. H. Rohl & T. E. Connolly,
Lakeside,
Calif.

ATTENTION BEN F. WELLS, SUPT.

Gentlemen:

On Sept. 28, 1932, I inspected your working places at El Capitan Dam, Lakeside, Calif., and found certain unsafe conditions, which are listed herewith, together with safety requirements for their correction:

CORE WALL TRENCH.

1. Caps and powder KEPT together, in open, near core wall trench. Powder and caps must be stored separately in regulation magazines, located at least one hundred feet from trench. Magazines must be kept at least one hundred feet apart.

2. Steel tools used to open dynamite boxes. Dynamite boxes must be opened only with wooden wedges, or copper or bronze chisels, as required by General Construction Safety Orders 1104 and 1105 enclosed herewith.

3. Electric wires running to pump are lying on the ground. Wires must be supported on poles at an elevation of not less than twelve feet above ground, as required by Electrical Safety Orders 703-10 and 706-1 (i).

EXPLOSIVES STORED AT EAST AND WEST PORTALS OF TUNNEL.

4. Blasting caps, electric detonators, dynamite, and primers stored together, in the open, on the tunnel level, near the portals. Detonators, dynamite, and primers must be stored, separately, in stout and tight boxes, having hinged lids, as required by Tunnel Safety Rules 717 and 718.

5. No caps or electric detonators shall be stored within fifty feet of other explosives.

6. No caps or electric detonators shall be transported with other explosives, except when being carried to the face for immediate use, as required by Tunnel Safety Rule 718 (d).

7. Explosives must be stored not less than one hundred feet from tunnel portals, and electric, gas or air shovels and any other place where automobile trucks, or employees are customarily at work.

MAIN POWDER MAGAZINE AND
MAIN CAP MAGAZINE.

8. No signs posted. Signs must be posted, or painted on magazines, reading: "Magazine". "Explosives". "Dangerous". Letters must be not less than six inches high, as required by General Construction Safety Order 1104, Sec. 3 (a).

MAIN POWDER MAGAZINE.

9. Main powder magazine is not ventilated. Sufficient openings for ventilation must be provided. These openings must be screened in such manner as to prevent the entrance of sparks or fire through them, as required by General Construction Safety Order #1104, Section 3 (a).

ROCK AND SAND PLANT.

10. Flywheels of rock crushers not guarded. Flywheels of rock crushers must be guarded as required by General Safety Order #9.

LARGE DRIVE BELT FROM ENGINE TO PLANT.

11. Belt exposed on one side. Belt must be guarded on both sides by standard railings at least three and one-half feet high, set at least 15" and not over 18" from moving belt. All exposed pulleys must be guarded in similar manner, as required by General Safety Orders 2 and 3 (c).

SAND CONVEYOR.

12. Runway along side conveyor has no railings. Standard two-rail railings, three and one-half feet high, must be provided, as required by General Safety Order #13.

TAKE-UP BELTS OF CONVEYOR.

13. Take-up belts of conveyor unguarded. Exposed points of contact between pulleys and belt must be guarded, as required by General Safety Orders 2 (a) and 3 (c).

GEARS.

14. All gears, where exposed to contact, must be guarded as required by General Safety Order #1.

SHAFTING.

15. All shafting exposed to contact must be guarded as required by General Safety Order #6.

AUTOMOBILE TRUCKS.

16. Automobile trucks must be regulated, and all drivers trained in safe driving practices, so that all employees of both contractors,

and of the City of San Diego, may have the maximum of protection.

We are enclosing herewith a copy of General Construction Safety Orders.

Yours very truly,

J. WESLEY GEBB

(J.Wesley Gebb)
ENGINEER.

JWG-PSP.

CC Mr. H. N. Savage, Hydraulic Engineer,
City of San Diego,
524 "F" St.,
San Diego, Calif.

Encl.

STATE OF CALIFORNIA
Department of Industrial Relations
INDUSTRIAL ACCIDENT COMMISSION
Los Angeles

Dec. 15, 1932.

W. H. Rohl & T. E. Connolly,
Lakeside, Calif.

ATTENTION BEN F. WELLS, SUPT.

Gentlemen:

On Dec. 8, 1932, I inspected your working places at El Capitan Dam, San Diego County, Calif., and found certain unsafe conditions, which are listed herewith, together with safety requirements for their correction:

ELECTRIC DETONATORS.

1. Five electric detonators stored in an open pasteboard box, lying in the open, on a bank, west of the core wall trench.

CAPS.

2. A box of caps stored on a shelf between two posts, just inside the east portal of the tunnel.

DYNAMITE.

3. An open box of dynamite stored on a jumbo, or mounted platform, less than one hundred feet from the east portal of the tunnel.

CAPPED FUSE AND DYNAMITE TOGETHER.

4. Capped fuse, and dynamite lying on the ground, in the open, behind a boulder, between two roads, near the northern end of core wall trench. The dynamite was in an open box and the capped fuse on the ground, less than six feet from the dynamite. This careless storage of explosives has persisted so long on this job that we are forced to insist that you comply strictly with General Construction Safety Order 1104, Section 2, and Section 3 (c), which read:

> "Sec. 2. Except only at an explosive manufacturing plant, no person shall have, keep or store, at any place within the State, any explosives unless such explosives are completely enclosed and encased in tight metal, wooden or fibre containers, and, except while being transported, or within the custody of a common carrier pending delivery to consignee, shall be kept and stored in a magazine constructed and operated as hereinafter described, and no per-

"son having in his possession or control, any explosives, shall under any circumstances permit or allow any grains or particles thereof to be or remain on the outside or about the containers, in which such explosives are contained".

"Section 3 (c). Magazines of the second class shall consist of a stout box, and not more than one hundred pounds of explosives shall at any time be kept or stored therein, and, except when necessarily opened for use by authorized persons, shall at all times be kept securely locked. Upon each such magazine there shall at all times be kept conspicuously posted a sign with the words "magazine" "explosives" "dangerous" legibly printed thereon."

5. Compliance with this Calif. State Statute is accomplished by the construction of boxes of 2" x 12" material, large enough to hold not over two 50 pound boxes of dynamite. Provide rope or metal handles for each end of box. Provide a hinged cover with a hasp, so that cover can be kept secured when no employee has custody of the box of explosives. Bolt the hinges and hasps to the box; place the bolts so that the nuts are inside of the box, and protect them with suitable washers.

6. A box which contains dynamite or black blasting powder must be kept at least fifty feet from a box containing ordinary blasting caps, or electric detonators.

7. Explosives (caps and powder) must be kept in boxes until required for immediate use.

8. The words "Magazine", "Explosives", "Dangerous", must be legibly printed on each box, so that all employees and others are aware of the contents of boxes.

TERMINATING METAL CONDUIT AT MOTORS.

9. Terminating metal conduit at motors shall properly enter and be secured to a terminal box or casing, attached to the motor frame, and enclosing the motor terminals or leads, as required by Electrical Safety Order 711-2 (b).

NONCURRENT-CARRYING METAL PARTS.

10. Exposed noncurrent-carrying metal parts of motors and control equipment shall be permanently grounded in compliance with Electrical Safety Orders 704, and 711-8

TUNNEL.
UNDERGROUND LIGHTING CONDUCTORS.

11. LIGHTING CONDUCTORS. Conductors of all services, feeders, and sub-feeders of underground lighting installations shall be approved rubber-covered wire (weatherproof wire will not be permitted) and shall be installed to conform to the orders applying to similar conductors for underground power installations. The conductors of branch circuits of underground lighting systems shall be approved rubber-covered wire. These circuits shall be run as far as possible to one side of the track or walking space, and shall be maintained at the greatest height practicable. Conductors, when not run in conduit, shall be substantially supported on glass insulators or large porcelain knobs. (The ordinary small knobs used in house wiring will not be permitted). There shall be no exposed live parts at any of the light or switch locations, or at any point along the conductors.

PORTABLE LIGHTS.

12. Flexible cord shall not be used, except where portable lights are necessary. When such portable lights are required, the cord shall be of an approved type especially designed for rough usage in wet locations (such as "type S"), the socket shall be of standard weatherprpof type, and the lamp shall be enclosed in a substantial guard provided with a hook and suitable handle.

LIGHTING SWITCHES INSTALLED UNDERGROUND.

13. All switches installed underground shall be of approved safety type suitable for the conditions under which they are required to operate. Ordinary snap, tumbler, or push button switches shall not be used in damp places, unless they are installed in water-tight fittings. Panel boards shall be of the approved dead-front type.

SOCKETS.

14. Sockets in underground lighting systems shall be of approved weatherproof type. The screw shell contact of all sockets shall be connected to the grounded conductor of the circuit.

AUTOMOBILE TRUCKS.

15. Your attention is again directed to the necessity for having braking devices on all trucks carrying rock from the quarry kept in the best possible working condition.

VENTILATION OF COYOTE HOLES IN QUARRY.

16. We direct your attention to Quarry Safety Rule 604, which was mailed to you, on Aug. 24, 1932, and to Mine Safety Order #1726, which is being mailed herewith. These orders and rules require that ample ventilation shall be provided in all underground workings in quarries and mines.

We thank you for your past cooperation, and stand ready, at all times to help you make your working places safer.

Yours very truly,

J. WESLEY GEBB

(J.Wesley Gebb)
ENGINEER.

JWG-PSP
Enc.

CC W. H. Rohl & T. E. Connolly,
4351 Alhambra Ave.,
Los Angeles, Calif.

CC H. N. Savage, Hydraulic Engineer,
City of San Diego,
524 "F" St
San Diego, Calif.

STATE OF CALIFORNIA
Department of Industrial Relations
INDUSTRIAL ACCIDENT COMMISSION
Los Angeles

January 6, 1933.

W. H. Rohl & T. E. Connolly,
Lakeside,
San Diego County,
Calif.

ATTENTION T. E. CONNOLLY.

Gentlemen:

On January 4, 1933, I inspected your working places at El Capitan Dam, San Diego County, and found certain unsafe conditions, which are listed herewith, together with safety requirements for their correction:

MAIN CAP & DETONATOR MAGAZINE AT QUARRY.

1. Magazine is neither fireproof nor bulletproof. Walls of two inch by twelve inch lumber must be built around magazine. A space at least twelve inches wide must be left between cap house and protecting walls, and the space between filled with sand. A twelve inch barricade wall must be built in front of magazine door.

2. Door and front walls of magazine, where exposed, must be covered with corrugated iron, as required by Quarry Safety Rule 626, Section 3 (c).

POST WARNING SIGNS.

3. Electric light must be placed at least five feet from caps and electric detonators, as required by Quarry Safety Rule 627 (i).

4. Electric light wires must clear ground level by at least twelve feet, as required by Electrical Safety Orders 703-10 and 706-1 (i).

5. Compressor drive pulleys, flywheel and belt unguarded. Provide standard two-rail railings 3½ ft. high, placed at least 15 inches, and not over 18 inches from moving parts, as required by Quarry Safety Rule 612, General Safety Orders 2 (c) and 3 (c), and 9.

EAST PORTAL OF TUNNEL.

6. Foot passageway around jumbo near east portal is muddy and slippery and hazardous; old lumber and timber has accumulated.

Shovel out mud in passageways, and remove waste timber and lumber, as required by Tunnel Safety Rule 721 and General Safety Order #15.

SECONDARY CAP & DYNAMITE MAGAZINES NEAR TUNNEL.

7. These magazines must be kept locked at all times, except when an authorized foreman or powderman is present at magazines.

8. The keys to these magazines must be in the custody of the shift foreman, or of the shift powderman. These duly authorized foremen or powdermen may issue to any miner, such an amount of explosives as may be required by that miner in the performance of his duties.

9. The person issuing the explosives must keep a complete, itemized, and accurate record of the amounts issued, and to whom issued, and on what dates, and must see that any unused explosives are returned to the magazines, and that no explosives, or ingredients, are taken by the miner to any point not necessary to the carrying on of his duties.

Yours very truly,

J. WESLEY GEBB

(J. Wesley Gebb)
ENGINEER.

JWG-PSP.

CC W. H. Rohl & T. E. Connolly,
4351 Alhambra Ave.,
Los Angeles, Calif.

CC H. N. Savage, Hydraulic Engineer,
City of San Diego,
524 "F" Street,
San Diego, Calif.

3/30/34
copy /f

STATE OF CALIFORNIA
Department of Industrial Relations
INDUSTRIAL ACCIDENT COMMISSION
Los Angeles

January 10, 1933.

H. N. Savage, Hydraulic Engineer,
524 "F" St.,
San Diego, Calif.

ATTENTION HAROLD WOOD, RESIDENT ENGINEER.

Dear Sir:

If it be in order, and without inconvenience to you, we request that you kindly have made for us, by your engineering force at the El Capitan Dam, a rough sketch of the diversion tunnel, showing:

1. A full length view of the north wall of the tunnel (a side elevation), showing conditions that existed on the morning of Dec. 30, 1932 (approximately); showing concrete in place, and sections where no concrete had been placed; showing and giving the number of the station where the explosion of Dec. 30, 1932, occurred.

2. A transverse cross-section of the tunnel near the station where explosion happened.

3. A horizontal plan of the tunnel floor, near station where explosion occurred, and showing the jumbo mounted on the truck, the 60 h.p. tractor, and the truck on which the concrete gun was mounted, approximate location of welding tanks, and place where concrete was broken from invert by force of explosion.

This sketch map is for the purpose of explaining conditions to our legal department, and will be kept in the confidential files of the Industrial Accident Commission.

We do not expect you to spend time and money on an elaborate map; we ask but a rough sketch.

Please have sketch drawn on tracing cloth, or tracing paper, as we require at least six copies for our records, and thus we can have prints made by our office engineer.

We thank you for your many courtesies, and invaluable assistance.

Yours cordially,
J. WESLEY GEBB
(J.Wesley Gebb)
ENGINEER.

JWG-PSP

4/6/34
copy/f

STATE OF CALIFORNIA
Department of Industrial Relations
INDUSTRIAL ACCIDENT COMMISSION
Los Angeles

Jan. 24, 1933.

W. H. Rohl & T. E. Connolly,
Lakeside,
San Diego County,
Calif.

ATTENTION T. E. CONNOLLY.

Gentlemen:

On Jan. 20, 1933, I inspected your working places at El Capitan Dam, San Diego County, Calif., and found certain unsafe conditions, which are listed herewith, together with safety requirements for their correction:

CAP AND DETONATOR MAGAZINE AT QUARRY.

1. Door and adjoining front wall of magazine not fireproof. Door and adjoining front wall of magazine, where exposed, must be covered with corrugated iron, as required by Quarry Safety Rule 626, Section 3 (c).

CAP & DYNAMITE MAGAZINES AT WEST PORTAL OF TUNNEL.

2. Cap and dynamite magazines at west portal of tunnel unlocked. All magazines containing explosives must be kept locked at all times, except when an authorized foreman or powderman is present at magazine.

COMPRESSOR ROOM AT WEST PORTAL OF TUNNEL.

3. Idler pulleys and belts exposed to contact on one side. All sides of exposed pulleys and belts must be guarded, as required by General Safety Orders #2 (c) and 3 (c).

COMPRESSOR ROOM AT QUARRY.

4. Idler pulley and belt exposed to contact on one side. There is a break in the steel guard railing opposite flywheel. Exposures must be guarded, as required by Quarry Safety Rule 612, and General Safety Orders #2 (c), 3 (c), and 9.

Very truly yours,

J. WESLEY GEBB
(J. Wesley Gebb) ENGINEER

JWG-PSP
CC W.H.Rohl & T.E.Connolly,
4351 Alhambra Ave.,Los Angeles.
CC H.N.Savage, Hydraulic Engineer,
City of San Diego, 524 "F" St.,San Diego,Cal.

STATE OF CALIFORNIA
Department of Industrial Relations
INDUSTRIAL ACCIDENT COMMISSION
State Building, Civic Center
Los Angeles

March 10, 1933

W. H. Rohl & T. E. Connolly,
Lakeside,
San Diego County, Calif.

ATTENTION O. C. STEVES, SUPT.

Gentlemen:

On March 7, 1933, I inspected your working places at the El Capitan Dam, San Diego County, and found certain unsafe conditions, which are listed herewith, together with safety requirements for their correction:

OUTLET FOUNDATION SHAFT.

1. Approximately 18 sticks of 40% dynamite stored in an open dynamite case within 5½ ft. of an open dynamite case containing one full box of caps, one partly filled box of caps containing 26 caps of No. 6 strength, 6 capped fuse, and 15 No. 6 Electric blasting caps, located approximately sixty feet from edge or collar of shaft excavation.

All explosives, except when being transported to the face for immediate use, when in lots of one hundred pounds or less, must be stored in stout tight boxes, of not less strength than 2" x 12" lumber, having hinged lids and locks.

Magazines must be kept detached and located at least one hundred feet from where men or equipment are working. A magazine containing caps must be kept at least 100 feet from a magazine containing dynamite.

MAGAZINE NEAR EAST PORTAL OF TUNNEL.

2. Magazine is built of one inch lumber, is neither fireproof nor bullet proof; door is unlocked; no signs on magazine. Found inside magazine in the northwest corner, four full unopened cases of 50 pounds each, of 1-1/2" x 12" Giant Special Gelatin V.L.F. 40% strength dynamite, together with one open case of 40% dynamite, three-quarters full, and one open case of 40% dynamite one-quarter full.

Found in the southeast corner of said magazine, one full box of No. 6 California caps (100 caps) and one box of 6# California caps containing approximately seventy caps. Both boxes of caps were open.

In lieu of this illegal magazine, construct a tunnel magazine, having a corrugated iron door. Keep door locked. Paint sign on door reading: "MAGAZINE". "EXPLOSIVES". "DANGEROUS". Store no caps in magazine.

Yours very truly,

J. WESLEY GEBB

(J.Wesley Gebb)
ENGINEER.

JWG-PSP.

CC W. H. Rohl & T. E. Connolly
4351 Alhambra Ave.,
Los Angeles, Calif.

CC H. N. Savage, Hydraulic Engineer,
City of San Diego,
524 "F" Street,
San Diego, Calif.

EQUIPMENT

4-27-33
copy/p

May 10, 1932

San Diego River Project - El Capitan Feature

CONTRACTOR'S EQUIPMENT

The contractor has moved onto the work to date the following equipment:

			Rental Prices		
#	2	Northwest gasoline shovels 1-1/2 cubic yard buckets	8.50	per	hour
#	1	Thew gasoline shovel, 1 cubic yard bucket	7.50	"	"
#	2	Caterpillar 60 HP tractors	2.00	"	"
#	2	McMillan graders - 4 cubic yard	1.75	"	day
#	3	Autocar trucks 5 cubic yard	18.00	"	"
	2	Sterling trucks 7 cubic yard	22.00	"	"
#	3	Sterling trucks 10 cubic yard	25.00	"	"
	1	White truck 4 cubic yard	15.00	"	"
#	1	Ford truck 1-1/2 ton	8.00	"	"
#	1	Ford truck pick-up body	7.00	"	"
	2	Drill sharpeners with forges and grinders Ingersoll-Rand	3.00	"	"
#	1	Scarifier	2.00	"	"
	1	Dragline bucket 1-1/4 cubic yard - Page	2.00	"	"
	1	10 HP Fairbanks-Morse gas engine	1.00	"	"
	1	Gould pump 2 x 1-1/2 Triplex	1.00	"	"
	1	McMillan bulldozer for 60 HP tractor	3.50	"	"
100' #		5758 feet 2" second hand wrought iron pipe	.20	"	"
#	3	Blasting batteries	.25	"	"
		1731 feet 1-1/4" round hollww drill steel	1.50	"	"
1000' #		5037 feet 7/8" hexagon hollow drill steel	1.00	"	"
		1998 feet 1" hexagon hollow drill steel	1.25	"	"
#		Miscellaneous 2" pipe fittings			
#	1	desk and 2 chairs	10.00	"	month
#	1	Underwood No. 5 typewriter			
#	1	Sundstrand adding machine			

1	Lietz transit and split leg tripod		
1	Berger Y level and tripod		
1	200' steel tape; 1 - 100' steel tape	$1.00 per day	
# 1	3' x 5' drafting table		
# 1	310 cubic foot Denver air compressor	10.00 "	"
# 3	325 cubic foot Ingersoll-Rand air compressor	10.00 "	"
# 2	225 cubic foot Ingersoll-Rand air compressor	7.50 "	"
# 1	small office and tool house 10' x 20'		
1	USACO air compressor complete with tank and hose for inflating tires	.25 "	"
# 1	Portable electric and acetylene welding outfit	1.00 "	"
# 1	Yukon electric refrigerator for camp		

Items used on Chocolate Creek road work and Extra Work Orders Nos. 1 and 2

4-27-33
copy/p

HARRY C. COLLINS MACHINERY CO.

2013 Santa Fe Avenue

Los Angeles.

May 13th, 1932

Mr. H. N. Savage
Hydraulic Engineer
524 F Street
San Diego, California

Subject: San Diego River Project, El Capitan Dam
Rental equipment

Dear Mr. Savage:

Replying to your letter of May 11th, I am returning herewith list presented, and am pleased to give you rental prices (per day of eight hours), which includes labor, fuel oil, lubrication and repairs. These are the amounts that are secured by local contractors when doing work for Counties and States, and are based on the equipment being in good operating condition.

There have been some bids offered for rental of 10% under these prices. However, in most cases it was on machinery that was pretty well worn out and not in condition to function for a full eight-hour day.

I wish to thank you for the enclosed copy of drawings and specifications. Any time I can render you any service or assistance, do not hesitate to call upon me, and I trust the information given you herewith will serve the purpose for which you wish it.

Very truly yours,

HCC:L

Harry C. Collins (Signature)

President
HARRY C. COLLINS MACHINERY CO.

8-15-33
Copy/m

1062

COPY

SAN DIEGO RIVER PROJECT-EL CAPITAN PROJECT

Contractor's Equipment

Well drilling equipment for quarry (all new)

3 well rigs

	#1 Armstrong well rig	#2 Armstrong well rig	#3 Armstrong well rig
equipment for:			
Sand bucket	1	1	1
3' well bit	1	1	1
6' " "	1	1	1
24' " "	1	1	1
Starter casing 10"-6' long	1	1	
bit pullers 6' long 150# steel	2	2	2

Well tool sharpener shop (all new)

2 Distillate furnaces for heating large well bits - all sheet steel fire clay lined compressed air draft, cost estimate - $100.00 each $200.00

2 Small steel cranes for handling heavy bits, Cost about $75.00 each 150.00

1 Tempering trough cost about 10.00

1 Drill bit sharpener (Armstrong Mfg. Co. Model 8 belt connected to 25 H.P. Westinghouse Electric Motor equipped with G.E. starting box and switch

32 Extra drill bits (Armstrong 1A 3½ C S Waterloo)

Rock Drill Sharpening Shop

1 Gardner Denver furnace model DF-1ddistillate (new)

1 Ingersoll Rand furnace No model size about same as above (old)

1 Ingersoll Rand air driven drill sharpener 50 series 6399 (new)

1 Ingersoll Rand air driven drill sharpener size same as above (old)

1 Ingersoll Rand air driven drill 7" emery grinder

2 Tempering troughs $10.00 each $20.00

Shed roof 20' x 36' no sides

Tractors - crawling type

#1 1 - Cletrac crawler tractor 30 with bulldozer attachment (old)
1 - Caterpillar 30 leaning road blade (new) drawn by above

#6 Caterpillar 60 Tractor (used) 10' Fresno grader attachment

#7 Caterpillar 60 Tractor (used) 10' Fresno grader attachment

#5 Caterpillar 60 Tractor (used) 10' Fresno grader attachment
1 - 10' bulldozer attachment

1 - Allis Chalmers 35-4 cylinder Tractor crawler (Monarch tractor)

TRUCKS (Apparently Company equipment)

14 - Sterling dump trucks Nos. 1 to 14 inclusive, all 4-cylinder about 40 H.P. all with ribbed steel rock type bodies.

2 - Sterling dump trucks Nos. 31 and 33, both 4-cylinder about 40 H.P. sheet steel muck dump bodies (not ribbed)

6 - Sterling dump trucks Nos. 15-17-18-20-24-25, all 6-cylinder about 60 H.P. all with ribbed steel rock type bodies.

1 - Sterling flat rack No. 51 with tank 6'x12'x8' about 3400 gallons capacity

2 - Auto cars #41 and 44, 6-cylinder, Model 60 S.H.S. Engine 30-484 plain steel muck dump truck

2 - Auto car #42 and blank 6-cylinder Model 60 S.H.S. Engine 30-484 ribbed steel rock type body

1 - Auto car # Blank 6-cylinder Model 60 S.H.S. Engine 30-484. No body truck being repaired.

1 - White car #31 4-cylinder 60 H.P. plain steel muck dump body

1 - " " #32 4- " 40 H.P. flat rack stake body

1 - " " #34 4- " 40 H.P. plain steel muck dump body

1 - " " #35 4- " 40 H.P. ribbed steel rock type body

1 - " " #36 4- " 40 H.P. in shop for repairs (4 solid rubber tires)

1 - Ford pick-up #18 steel delivery body

1 - Ford truck # blank 4-cylinder 22 H.P. flat rack stake body 6 wheels

1 - " " #52 4- " 22 H.P. steel delivery body 6 "

1 - " " #56 4- " 22 H.P. " " " 4 "

1 - Utility trailer, 12 wheels with heavy platform and stake bed (no engine)

1 - Western Pipe & Steel Co. combination oil and gas supply tank trailer and sheet steel oil house, gas tank, 6'x8'x8' 2000 gal.

1 - Pacific Tank & Pipe Company " " " " " "

5 - New welded steel dump (muck) bodies about 3 cubic yard capacity

TRUCKS (Contractor)

3 - Morelands 6 cylinder about 65 H.P. with concrete mixed in transit bodies #10-#11 and #12

3 - Morelands #70, 71 and 72 (45.94 H.P. Model H6 with 3 cubic yard steel dump bodies, 6 wheels

1 - Brockway #73 about 50 H.P. with 3 cubic yard steel dump body, 6 wheels

2 - Moreland #63 and 64 about 85 H.P. with 3 cubic yard steel dump body 6 wheels

2 - General motors Corporation Truck #61-#62. 60 H.P. 3 cubic yard steel dump bodies, 6 wheels

1 - American La France #69 45 H.P. 4 wheels

CONCRETE MIXERS AND EQUIPMENT

1 - Jaeger non-tilt, 10 sack capacity (10-DL 433-50) powered by

1 - LeRoy 4 cylinder about 20 H.P. gas engine

- Main Mixing Plant -

2 - Smith mixers (1 cubic yard capacity each, electric driven by

2 - 20 H.P. motors 2 Westinghouse safety switches and starting boxes

1 - Steel rock storage bin 20'x20'x7' high (top of housing structure) 300 ton capacity set on 16" steel eye beams.

1 - Steel material chute from storage binds to weighing machine

1 - Weighing machine and water measuring unit.

1 - Unit sack cleaner (Handy Sack Baler Co.)

1 - Sack bundler

1 - Steel delivery chute from mixers to trucks

1 - Small platform scale, 750#, Fairbanks Morse

3 - Push trucks (Howe Scale Co.)

1 - Frame structure 79'x25'x14' housing mixing plant 3"x12" floor joists set 2' cc with 2" floor

WATER TANKS (Corrugated galvanized)

1 - New Corr. Gal. water tank diameter 9'4" height 8' capacity 4000 gallons
2 - " " " " " " 8'0" " 8'6" " 3000 "
1 - " " " " " " 8'0" " 7'0" " 2640 "

STEAM SHOVELS, Gas, Electric and Air

Make and Number	Type	Power	Capacity cu. yd.	Remarks
#1 Lima "101"	Dragline Cat.	Waukesha 110 H.P. gas		
#7 Lorain (Thew 75B) center drive	Dipper Cat.	90 H.P. gas	1-1/4	1 extra 1 cu yd dipper
#1 Marion electric Type 480	Dipper Cat.	Electric	80 cu ft	Bucket #181960F
#2 Marion Electric Type 480	Dipper Cat.	Electric	80 cu ft	" "
#8 Lorain (Thew 750) Center drive	Dipper Cat.	Waukesha 125 HP gas	1-1/4	
#6 Northwest	Dipper Cat.	110 HP gas	1-1/2	Equipped with 2 cu yd dipper
#9 Northwest	Dipper Cat.	110 HP gas	1-1/2	" " "
Erie air operated	Dipper Cat.		5/8	No Company number (delivered Hazard Const.Co. possibly rented
Electric mucking machine 298 R 696	Dipper with belt conveyor	50 HP Elec GE Mag. switch	1/2	(old)mounted on track trucks
Electric mucking machine with Sullivan air hoist	Dipper with belt conveyor	60 HP Elec GE Mg. switch	1/2	(old) mounted on track trucks
1 #11 Lorain (Thew 750)			1-1/4 yd bucket	2 extra 1¼ cu yd dippers (used)
				1 extra clamshell 3/4 cu yd bucket (old)
				1 extra M.P. McCaffey dipper (used)
				Extra Missabe dipper & stick & boom for Lorain shovel (used) 1-1/4 cu yd
				Extra Lorain stick

Air Compressors (Stationary)

1 #3 Sullivan Class W.J.3, Size 20-12-14, Shop #3762 Powered with G.E. 200 H.P. Elec. Induction Motor #150956 60 Cy. 440 Volt 242 Amp. G.E. Elec. Starting Box and Switch Connected to Riveted Steel Air Storage Tank 5x16 Galvanized Water Cooling Tank 8W x 7H. At Quarry.

1 #1 Sullivan Class W.J.3, Size 14x8-3/4x10, Shop #10586 Short belt driven #1 R.M. 100 H.P. Elec. Motor 440 Volts 1000 R.P.M. B. & P. Starting Box & F.M. Switch. R.S. Air Storage Tank 5x16, Galvanized Water Cooling Tank 8W x 6H. Fairbanks Morse Water Pump air operated Size 6x4x2, 3½ Long x 14 High x 12 Wide.

1 #2 Sullivan, Size 16-9-3/4x10, S hop #10597. #2 G.E. 100 H.P. Elec. Motor 440 Volts 60 Cy. Trumbell Type C. Stand. Compen Salor G.E. Switch. R.S. Air Storage Tank 4x13.

No. 1 7 2 Housed in Frame Structure 20x35x10 at Tunnel Exit.

Air Compressors (Portable)

1-R #317 2 Cyl. 10 in. 2 in. stroke 100# at 425 R.P.M. with 4 Cyl. Gas Eng. #11R. R.P.M. 1080 R.S. Air Storage Tank 4x13.

1 Gardner Type V Twin 2 with 4 Cyl. Buda Gas Eng.

1-R 2 Cyl. 5 3/8 x 6P Cap. 100# Air with 4 Cyl. Waukesha Gas Eng. Model Gu. 46B.

2-1-R 2 Cyl. Comp. 8" bore x 6" stroke No. P.P. 82550. Cap. 100# at 630 R.P.M. Expanding Coupling to 4 Cyl. Waukesha Gas Eng. Model 46B 5 3/8" bore x 6¼" stroke Gas fuel tank and air storage tank.

1-R 2 Cyl. with 4 Cyl. Waukesha Eng. Model K.U. 2090 No. 68106. Jan. 1924 R.S. Air Storage Tank 4x12.

Sullivan Comp. V Type Twin 2 with 4 Cyl. Gas Eng. Gas fuel tank and air storage tank.

1-R 2 Cyl. 5 3/8" x 6¼" with 4 cyl. Gas Eng. Model G.U. 46B No. 131424 Feb. 1928 Gas fuel tank and air storage tank.

1-R Comp. 2 Cyl. 5 3/8" x 6¼" Powered with Waukesha 4 Cyl. Gas Eng. Model G.U. 46B.

Small Gas driven air compressor and tank for motor tires (in shop) Model F.T. Eng. No. 11376.

AIR DRIVEN JACKHAMMERS WET & DRY

1--Denver (Waterliner) Model 511.

1--Denver (Dry) A 1 S 49#352073.

1--I.R. (Dry) A 1 S 49#367838.

1--I.R. (Wet) No. 48. I.R. (Wet) No. 48.

3--Denver (Wet) (Waugh) Model 17 Series 185.

1--Chicago Pneumatic (Wet) Model 5 Series 501.

1--Chicago Pneumatic (Wet) Model 5 Series 511.

Contractors Equipment--Pumping Plants.

1-Fairbanks Morse Motor Driven Turbine Pump with Induction Motor Serial #104876 Frome U120 U.H. Type 40 H.P. 1800 R.P.M. 3 Phase 60 Cy. 440 Volt 40 H.P. Constant Duty 40 Centi. 125% over load 2 Hrs. 55 Centi. Full Load Amp. 47.5 F.L. Speed 1732 R.P.M. Direct Connected to about a 6" Vertical Turbine Pump.

1-General Electric 400 Motor Driven Centrifugal Pump with H.P. Motor Model No. 18314 Type 1-E 15B Form K. 3 Phase 60 Cy. 2200 Volt 89 Amp. 40% Overload 1175 R.P.M. Motor No. 4402383.
1-Byron Jackson Centrifugal Pump Intake 18" Discharge 14" 200 foot head pump lift Capacity 700 G.R.M. at 1140 R.P.M. Pump #82722. Dec. 1, 1924 Gen. Elec. Starter & Switch #2092412 G.R. 1034 Type N.R. 1039 Form J.3.P.1.

1-Triplex 6" Plunger Pump Geared (Gould pump Seneca Falls New York Belt Connected to H.P. Electric Induction Motor 440 Volt 90 Amp. 1150 R.P.M. (Mechanical Installitation Co.) Complete with Westinghouse Safety Switch and General Electric Starting Compensator.

2-Fairbanks Morse Air Driven Plunger Water Pump 6"x4"x2"-3½"x14"x12"
1- " " " " " " " " " " " " "
1- " " " " " " " " " " " " "
1-Star Electric Induction Motor & Switch 7½ H.P. 220/440 Volt 3 Phase 60 Cy. belted to 1 3" Centrifugal Pump (Single Stage)

1-2" Centrifugal Pump Power driven (old) in stock room.

1-G.E. Motor 7½ H.P. Connected to 1 Centrifugal pump 3".

1-Howel Motor 1 H.P. Direct Conn. to 1 Centrifugal 1" pump (in A.1. shape.).

1-G.E. Ind. Motor 85 H.P. No. 104467 Type 1-10-85-A 720 Form K 60 Cy. 22.8 Amps. 2080 Volts. G.E. Compensator No. 1450780 Gr. 1034 Type N.R. 2723 Form H.5 P.1 for Induction Motor Type 1 Form K, H.P. 85.

1-8" Byron Jackson Single Stage Centrifugal pump 22" of 10"-6 Ply. Rub. belt.

4-Union Iron Works-8x19½ Slim Pumps with 100 H.P. Motor 60 Cy. -3 Pha. 440 Volt with starter.

2-6x13 B-J Slim pumps with 75 H.P. Motors 60 Cy. 3 Phas. 440 Volt with starter.

5-Joshua Hendy No. 1 Giants 7x4 Complete.

4-Steel Barges. 9x16x36.

Pattern Shop & Saw Mill.

1-38" Belt driven band saw (American Wool Work and Mach.Co. Registered 19) (Sold by Smith Booth Usher Co. L.A.) Powered by 5 H.P. Western Elec. Ind. Motor Type K.T. 160. 3 Phase 60 Cy. 1800 R.P.M.

6-Concrete push buggies. 2 wheel, 5 Cu.Ft. Capacity.

1-Frame Structure 7'x12'x10' High Boarded up & down Tool Shop.

Main Repair Shop.

1-Monotrol Lathe 16" with 6 foot carriage Electric Motor Belt connected.

1-Bradford Lathe 24" with 10 foot carriage Electric Motor Belt connected. (H.M. Mach.Co.)

1-Yankee grinder for drills & tools (Style No. 44 Serial No. 1006 Holder Serial No. 16135 Motor driven with V. Belt.

1-Bench Vice Swivel Type 6" steel jaw.

1-Steel Work bench 3' wide by 12' long.

1-Steel Work bench 1½' wide by 6' long.

1-Drill Press Registered 19 No. B. 92 C. (Smith Booth Usher Co.).

1-Two wheel Emery grinder (Hisey) driven by 1 3½ H.P. Elec. Motor Serial No. 68926 Type 6 L.A. Model 27.

1-Blacksmiths Welding Hammer (Hazel Eng. & Mach. Co. Size 3B No. 1341) Electric Air Driven.

1-Hydraulic Gear Press (No Name) Value about $50.00.

1-Williams Threading Machine, Elec. driven (Harron Richard & Mc.Cone.).

1-Wheel Press Allen Bradley Type J. 1552.

1-Power Hack Saw Powered with 1 H.P. Quality Motor (B line).

1-Wrist Pin Grinder (Sawyer-Weber) Electric 1 H.P. Motor & 1/10/H. P. Turking Motor.

1-Steel planer (Stockbridge Mach. Co.) Motor belt driven Reg. No. R. 3 4 'S.B. Usher Co.).

1-Standard drill press (Reed Prentice Co. N.Y.) 4' Swinging Arm. Powered by 1 7½ H.P. U.S. Elec Motor.

1070

Main Repair Shop.

1-Portable Electric lighting System Complete (Fairbanks Morse) 115 Volt 1500 Watt Style H. Powered with 1 7½ H.P. Electric Motor. 3 Phase 60 Cy. 440 Volt 1800 R.P.M.

1-American Hoist and Derricle Co. Cable drum Hoist Powered by 1 100 H.P. Induction Motor No. 12B. 924.

1-General Electric Hoist driven by 50 H.P. Elec. Motor (old)

1-5 H.P. Horizontal Gas Engine (No Name) old.

1-25 H.P. Cable Hoist Powered by 4 Cyl. Buda Gas Eng. Mounted on steel eye beam skids.

1-Portable Ascetaline Welding Outfit with hose & torch, on hand push truck.

Road Graders.

1-Power Road Grader (G alion E.Z. lift) with 10 foot blade P 319 powered with Mc.Cormick Deering Gas Eng. Industrial Tractor. Model 20 (International Harvester Co.).

1-Portable Steam Upright Boiler for steam Cleaning trucks, engine & equipment.

1-Road Rooter (Earthmover equipment) with hydraulic lift.

1-Road Rooter mounted on 4 foot wheels 5" tires.

Truck Bodies.

15-Truck bodies (sheet steel paneled dump) about 6'x12'x2' 5 cu. Yd. (Used).

8-Truck bodies (sheet steel paneled dump) about 6½'x13'x3' 9 Cu. Yd. (Used).

2-Truck bodies (Steel Ribbed truck bodies) about 8'x12'x2' 7 Cu.Yd. (New).

3-Truck bodies (Steel Concrete bodies Tops beveled in) 3 Cu.Yd. (Used).

Steel Rails--Ties.

1320' of 30# steel rails-30' lengths (old).

1590' of 30# " " " " "

Steel Rails--Ties.

1200' of 30# steel rails-30' lengths (old).

2070' of 6"x6" O.P. R.R. Ties 460 Pieces 4½' long.

Steel Pipe--And Valves--And Bends.

1240 feet (62 Joints of 20' Length) of 15" I D. Slip Joint Casing (W.P. & Steel Co.) Del. 10/18/32.

65'	feet	8"	flanged	steel	pipe.	
130'	"	6"	"	"	"	4-30' Lengths 1-10' Length.
490'	"	"	"	"	"	6' to 8' Long Flanged.
120'	"	"	"	"	"	20-6' Lengths all flanged & 15° bend
55'	"	"	"	"	"	11-4' to 6' lengths flanged 1 end.
5300	"	4"	Wrought	Iron	Pipe	(Screw)
2400	"	3"	"	"	"	"
9420	"	2"	"	"	"	"

Glazed Terra Cotti Soil Pipe.

100'-4" glazed Terracotti Soil Pipe. (50-2' lengths).
42'-4" " " " " (28-1½' lengths). 90° bends.

Valves & Fittings.

2-4" Walworth Valve (125).
1-3" Union.
1-3" to 2" Reducer.
1-3" Air Valve.
1-3" 45° bends.
2-2" Gate Valves.
1-8" Gate Valve (Crane).
1-3" T
2-2" T's.
3-2" 90° Bends.
1-2" to 3/4" reducer.

Corrugated Galvanized Culvert Pipe.

2100 feet -24" Corrugated Culvert Pipe.
30 feet -36" " " "
36 feet -30" " " "
124 feet-12" " " "

Grouting Equipment.

6' - 6" Rubber Discharge Flanged.

6' - 6" " " "

Steel Tunnel Forms.

7-Tunnel Segment forms (steel) Size 10' wide x 25' long. No. 2303.

14-Tunnel Segment forms (steel) Size 10' wide x 185' long.

1-Pioneer Portable Rock Crusher and Sand Washing plant Complete with steel Bins.

1-Le Roi Gas Engine 160 H.P.

1-Best 60 H.P. Gas Engine.

1-Buda 35 H.P. Gas Engine.

1-Buda 35 H.P. Gas Engine.

2-Holt 75 H.P. Gas Engine. (Very old)

(Estimated Not Measured).

1600' of New Round drill steel 1¼"
7300' of Sharpened drill steel 1¼" Round and Hex.
400' " " " " 1 " " being used at S & W. Tunnel Portale.
100' of Sharpened drill steel 1" " " " in Core Trench.
300' of " " " 1¼ " Steel in Quarry.

New Flat Steel and Angle Iron.

10,000# of flat steel and angles, other shapes for shop use.

Air Blower.

1-8" Air blower belt driven on 6" x 6" Skids 10' long.

Pulleys.

1-Extra 14" Dia. Cast pulley 12" wide 4" Keyed Hole.

1-Extra 28" Dia. Split Steel pulley 3" wide 4" Hub shaft opening.

Roebling Steel Cable.

850'-2" Roebling Steel Cable.

Grouting Equipment.

1-No. 500 Rix Grout Pressure Tank.

1-Old Cement gun Charging drum (about 2 sack copy).

1-8" 45° Bend.

6'-6" 15° Bend.

140'-6" Steel pipe flanged both ends 10-14' lengths.

10' - 8" Steel pipe 45° Bend flanged.

20' - 8" Rubber intake Hose and Strainer Flanged.

10' - 6" " Discharge Hose Flanged (Pioneer Brand).

Miscellaneous Equipment.

1-One ton Hoisting Block.

2-Large 25 ton Ratchet Jacks.

1-Prentice Swivel Bench Vice No. 183 7" Steel Jaws Bench tools about $20.00.

5-Front Springs Sterling.

3-Rear Springs Sterling.

1-3/4 Cu. Yd. bottom dump (Single) Concrete delivery bucket.

1-2 Cu. Yd. (About) Bucket #477 C. 68.

1-2 Cu. Yd. (About) Bucket #477 C. 611.

1 General Electric Hoist Driven by 50 H.P. Electric Motor (old).

1-Electric Hoist (American Hoist & Derrick Co.) (Sundh-Elec. Co.) Mounted on timber skids. 120 feet (6-20' lengths) of Ensley 20" x 20" Lattice braced Steel tower.

1-Large Ensley Concrete hopper.

1-Small Ensley Concrete Hopper.

100 feet Ensley 16" Steel Concrete Chate.

36 feet " 12" " " "

1-2000 gal Elliptical Gasoline truck tank 4' x 8' x 10' bulged ends (No truck).

2-Track 2 wheel trucks mounted with 1 Cu. Yd. steel skip each.

1-18' x 10' Eye beam (New).

2-40' Northwest lattice braced steel booms.

1-32 & Length of Double Eye beam Mast Steel 12" x 12" Sq.

1 pair Cog driven Car Wheels.

1 set of track trucks (4 wheels) No body.

1 Blasting Battery Hercules.

#2 1-4 Cyl. (C.L. Best Gas Traction Eng. Co.) Gas Eng. Mounted on 12" steel frame. (old).