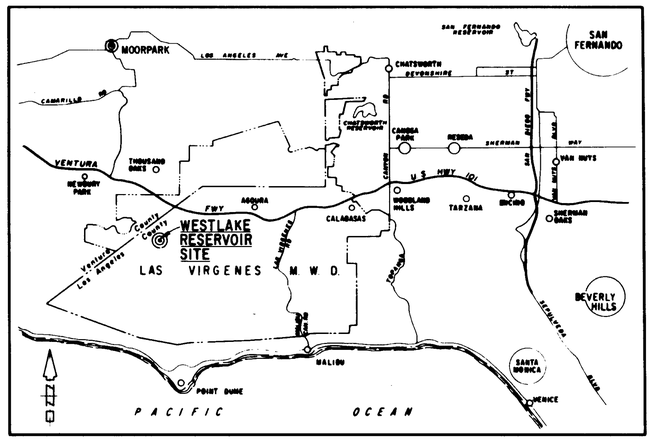
LAS VIRGENES MUNICIPAL WATER DISTRICT

LOS ANGELES COUNTY, CALIFORNIA

CONSTRUCTION PLANS FOR

WESTLAKE RESERVOIR

DAM AND APPURTENANCES



VICINITY MAP

SCALE 0 1 2 3 4 5 IN MILES

PLANS APPROVED BY:

Leslie A Clayton

LESLIE A. CLAYTON - R.C.E. 9986
PROJECT MANAGER

PLANS PREPARED BY:

BOYLE ENGINEERING

SANTA ANA
BAKERSFIELD
SAN DIEGO
VENTURA

Consulting Engineers

BOARD OF DIRECTORS
LAS VIRGENES MUNICIPAL WATER DISTRICT

MACNEIL STELLE - PRESIDENT
WILLIAM M. BRAY — RALPH VENUS
EARLE BROOKINS — GEORGE R. LONG
H. W. STOKES - GENERAL MANAGER/CHIEF ENGINEER

Approved by the Board of Directors
on this 9th day of November 1970.

By: M M Stelle
MACNEIL STELLE - PRESIDENT

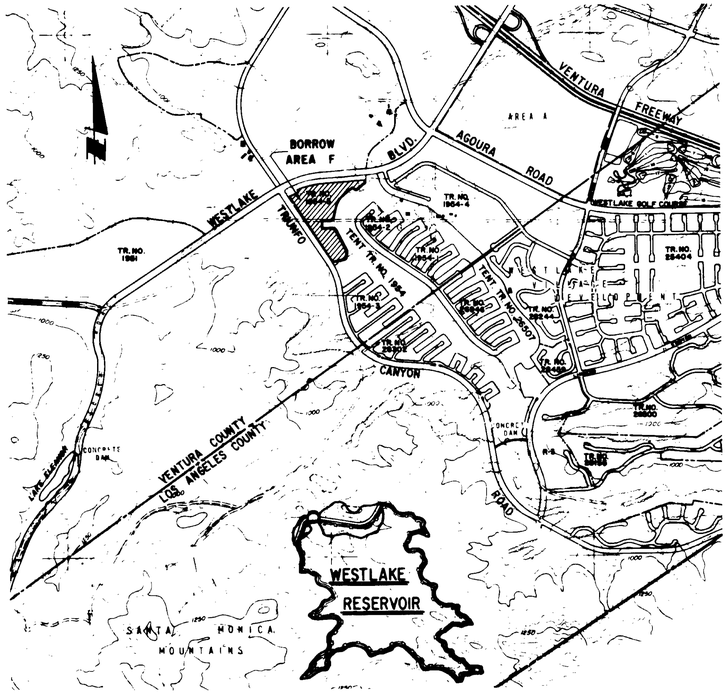
By: William M Bray
WILLIAM M. BRAY - SECRETARY

By: H W Stokes
H. W. STOKES - GENERAL MANAGER/CHIEF ENGINEER

05249

AS CONSTRUCTED
DATE 4/5/73 DFT H.H.P. CKD DFM

84-2577-00
SHEET 1 OF 35 SHEETS



SITE MAP

DRAWING LIST

DRWG. NO.	TITLE
	GENERAL
1	Title Sheet
2	Index Maps, Drawing List
3	Reservoir Plan
3A	Monitoring Monuments Plan
4	Horizontal Control Lines
	SUBSURFACE EXPLORATION
5	Location of Exploration
6	Geology, Logs of Exploration - Sheet 1 of 5
7	Geology, Logs of Exploration - Sheet 2 of 5
8	Geology, Logs of Exploration - Sheet 3 of 5
9	Geology, Logs of Exploration - Sheet 4 of 5
10	Geology, Logs of Exploration - Sheet 5 of 5
11	Borrow Areas for Riprap & Zones 4 & 5
12	Borrow Areas, Logs of Exploration - Sheet 1 of 2
13	Borrow Areas, Logs of Exploration - Sheet 2 of 2
14	Zone 1 Borrow Area, Plan and Logs of Exploration
15	Zone 1 Borrow Area, Logs of Exploration - Sheet 1 of 2
16	Zone 1 Borrow Area, Logs of Exploration - Sheet 2 of 2
	MAIN EMBANKMENT
17	General Layout
17A	Excavated Foundation - Geologic Map
18	Sections - Sheet 1 of 2
19	Sections - Sheet 2 of 2
20	Longitudinal Profiles Index - Grout Curtain Summary
20A	Grout Hole Locations - Sheet 1 of 2
20B	Grout Hole Locations - Sheet 2 of 2
20C	Grout Curtain Summary - Sheet 1 of 9
20D	Grout Curtain Summary - Sheet 2 of 9
20E	Grout Curtain Summary - Sheet 3 of 9
20F	Grout Curtain Summary - Sheet 4 of 9
20G	Grout Curtain Summary - Sheet 5 of 9
20H	Grout Curtain Summary - Sheet 6 of 9
20I	Grout Curtain Summary - Sheet 7 of 9
20J	Grout Curtain Summary - Sheet 8 of 9
20K	Grout Curtain Summary - Sheet 9 of 9
21	Details - Sheet 1 of 2
22	Details - Sheet 2 of 2

DRWG. NO.	TITLE
	WEST EMBANKMENT
23	General Layout
23A	Excavated Foundation - Geologic Map
24	Sections
	INTAKE-OUTLET CONDUIT
25	Plan and Profile - Sheet 1 of 2
26	Plan and Profile - Sheet 2 of 2
26A	Reinforcing Details
27	Details - Sheet 1 of 2
28	Details - Sheet 2 of 2
29	Log Boom
	SPILLWAY
30	General Layout
31	Excavation
32	Concrete Outlines
33	Reinforcing - Sheet 1 of 2
34	Reinforcing - Sheet 2 of 2
35	Trash Barrier Details

VICINITY MAP

05250

AS CONSTRUCTED
DATE 4/5/73 DFT H.H.R. CKD DFM.

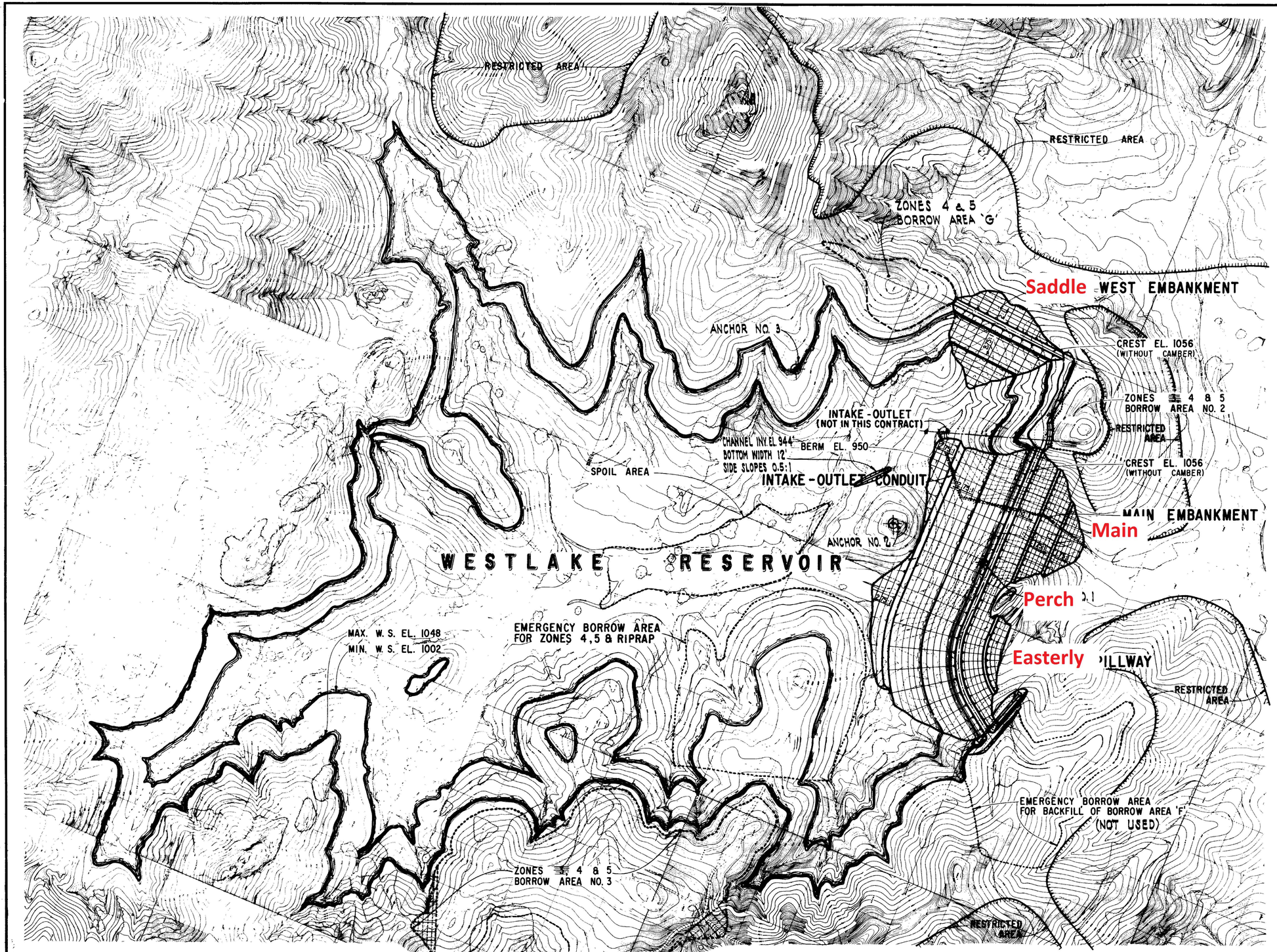
NO.	DATE	REVISIONS	BY	CH'K	JOB ENG.	PROJ. ENG.	MGR.
△		ISSUED FOR CONSTRUCTION	T.E.N.		DFM		

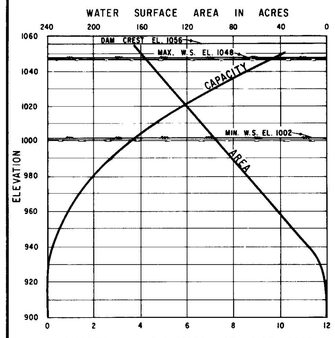
LAS VIRGENES MUNICIPAL WATER DISTRICT

BOYLE ENGINEERING
W. A. WAHLER & ASSOCIATES

WESTLAKE RESERVOIR
INDEX MAPS
DRAWING LIST

DESIGNED A.U.
DATE: 11 - 70
JOB ENG. DFM
PROJ. ENG.
DRAWN A.U.
CHECKED DFM
SCALE AS SHOWN
L.A. Clayton
R. C. E. 9986
DRAWING NUMBER 2
REV.





RESERVOIR AREA - CAPACITY CURVES

NOTES

1. Contractor shall not operate equipment of any kind within the designated restricted areas, or otherwise disturb the natural features, including trees, brush, ground cover and rock formations.

AS CONSTRUCTED
DATE 4/5/73 DFT H.H.R. CKD D.F.M.

100' 0 100' 200' 300' 400'
1" = 200'

05251

NO.	DATE	REVISIONS	BY	CHK	JOB ENG.	PROJ. ENG.	MGR.
1	11/70	ISSUED FOR CONSTRUCTION	T.R.N.	D.F.M.	D.F.M.	G.M.	Inc.

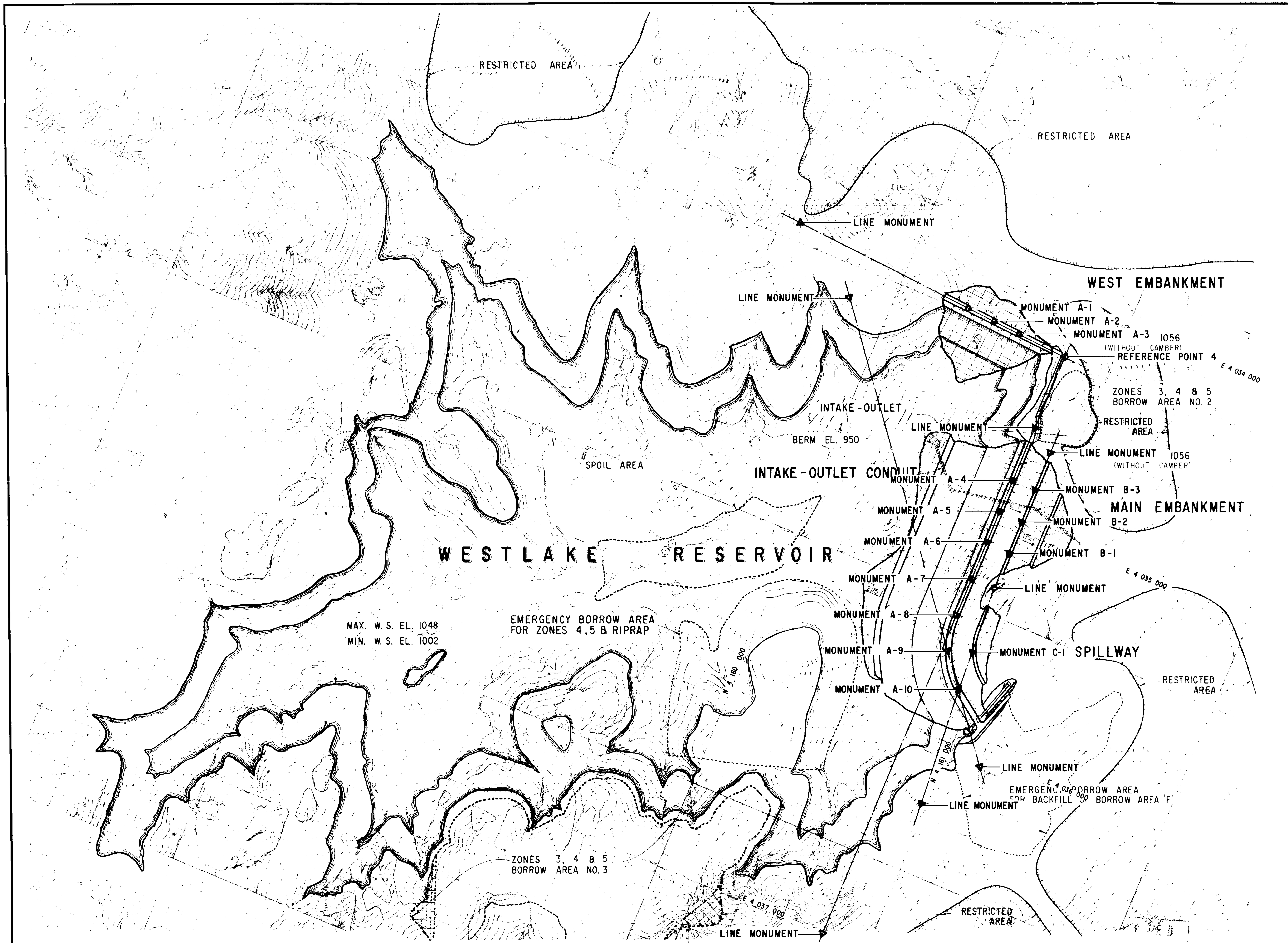
LAS VIRGENES MUNICIPAL WATER DISTRICT

BOYLE ENGINEERING
W. A. WAHLER & ASSOCIATES

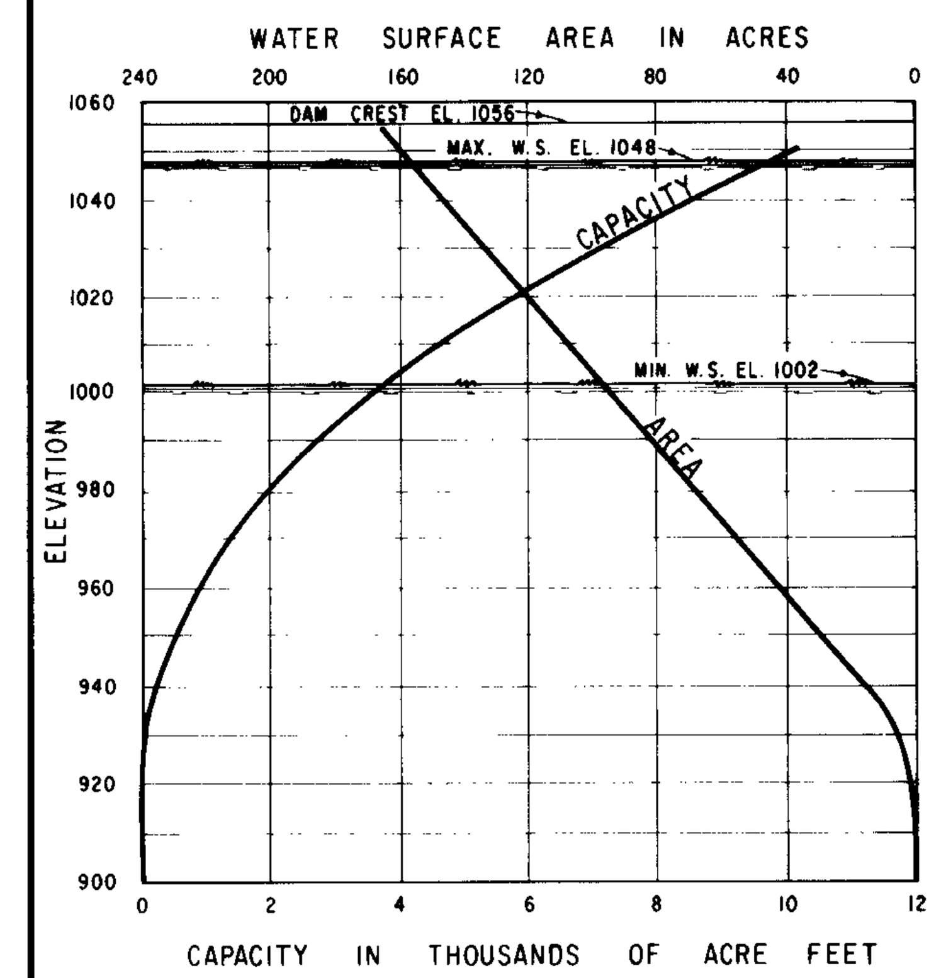
WESTLAKE RESERVOIR

RESERVOIR PLAN

DESIGNED	DATE: 11-70	JOB ENG. D.F.M.	PROJ. ENG. G.M.	
DRAWN H.H.R.			DRAWING NUMBER	REV.
CHECKED D.F.M.	R.C.E. 9984		3	
SCALE AS SHOWN				



RESTRICTED AREA
RESTRICTED AREA
LINE MONUMENT
WEST EMBANKMENT
LINE MONUMENT
MONUMENT A-1
MONUMENT A-2
MONUMENT A-3
1056 (WITHOUT CAMBER)
REFERENCE POINT 4
E 4 034 000
ZONES 3, 4 & 5 BORROW AREA NO. 2
INTAKE-OUTLET
LINE MONUMENT
RESTRICTED AREA
BERM EL. 950
LINE MONUMENT
1056 (WITHOUT CAMBER)
SPOIL AREA
INTAKE-OUTLET CONDUIT
MONUMENT A-4
MONUMENT B-3
MONUMENT A-5
MAIN EMBANKMENT
MONUMENT B-2
MONUMENT A-6
MONUMENT B-1
WESTLAKE RESERVOIR
MONUMENT A-7
LINE MONUMENT
E 4 035 000
MONUMENT A-8
MAX. W. S. EL. 1048
MIN. W. S. EL. 1002
EMERGENCY BORROW AREA FOR ZONES 4,5 & RIPRAP
MONUMENT A-9
MONUMENT C-1
SPILLWAY
N 4 160 000
RESTRICTED AREA
MONUMENT A-10
N 4 161 000
LINE MONUMENT
EMERGENCY BORROW AREA FOR BACKFILL OR BORROW AREA 'F'
E 4 036 000
LINE MONUMENT
ZONES 3, 4 & 5 BORROW AREA NO. 3
E 4 037 000
RESTRICTED AREA
LINE MONUMENT



RESERVOIR AREA - CAPACITY CURVES

NOTES

AS CONSTRUCTED
DATE 12-13-73 DFT RRR and DFM

1" = 200'

05252

NO.	DATE	REVISIONS	BY	CHK	JOB ENG.	PROJ. ENG.	MGR.
△	12/1/70	ISSUED FOR CONSTRUCTION	T.E.N.	R.E.E.	DFM		

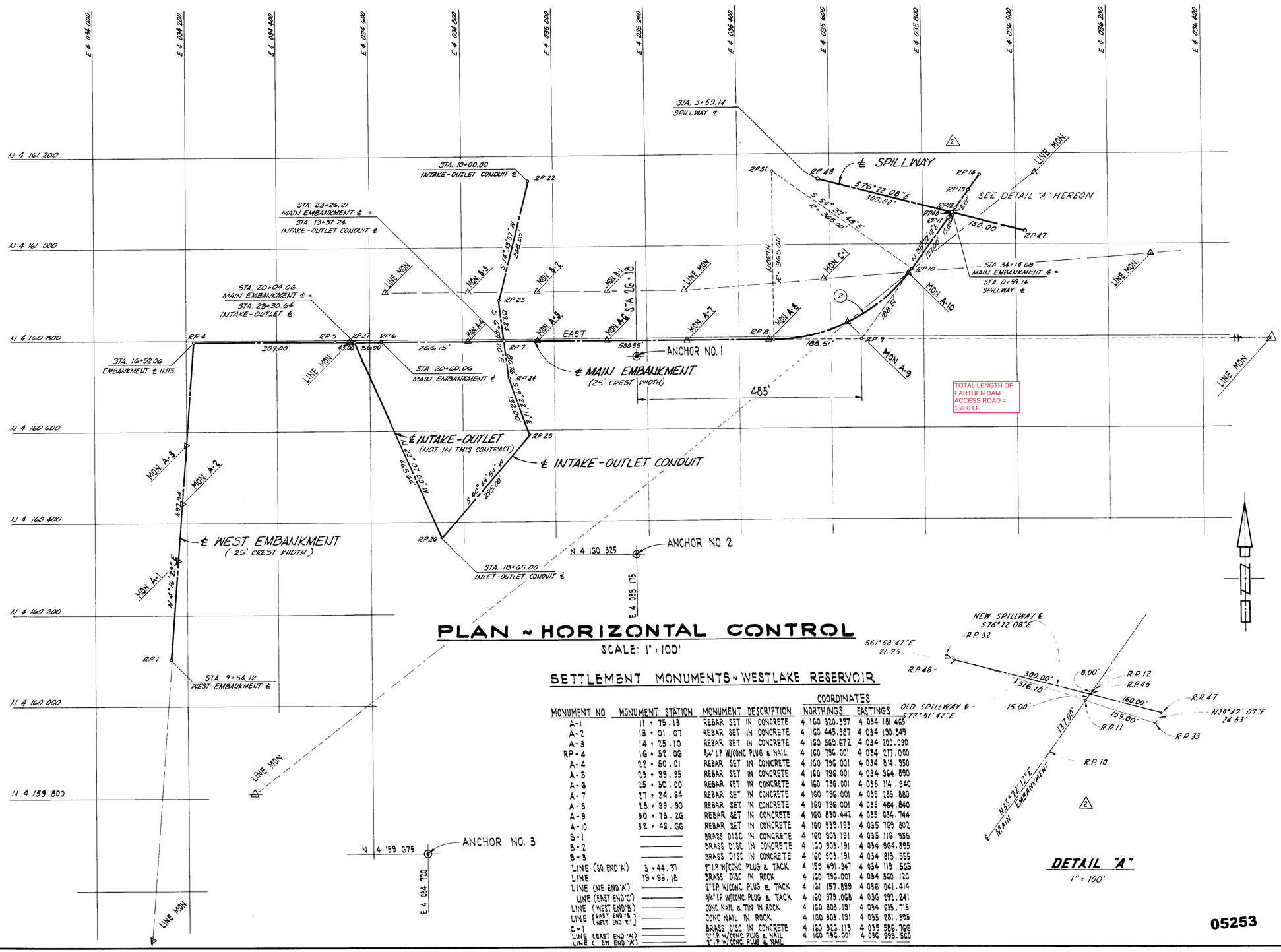
LAS VIRGENES MUNICIPAL WATER DISTRICT

BOYLE ENGINEERING
W. A. WAHLER & ASSOCIATES

WESTLAKE RESERVOIR

MONITORING MONUMENTS PLAN

DESIGNED	DATE: 11-70	JOB ENG. DFM	PROJ. ENG.
DRAWN			DRAWING NUMBER 3A
CHECKED DFM	R.C.E. 9984		REV.
SCALE AS SHOWN			



PLAN ~ HORIZONTAL CONTROL

SCALE: 1" = 100'

SETTLEMENT MONUMENTS ~ WESTLAKE RESERVOIR

MONUMENT NO.	MONUMENT STATION	MONUMENT DESCRIPTION	COORDINATES NORTHINGS	COORDINATES EASTINGS
A-1	11 + 75.13	REBAR SET IN CONCRETE	4 160 320.397	4 034 181.465
A-2	13 + 01.07	REBAR SET IN CONCRETE	4 160 445.987	4 034 190.849
A-3	14 + 25.10	REBAR SET IN CONCRETE	4 160 569.672	4 034 200.090
RP-4	16 + 52.06	3/4" I.P. W/CONC. PLUG & NAIL	4 160 796.001	4 034 217.000
A-4	22 + 50.01	REBAR SET IN CONCRETE	4 160 796.001	4 034 814.350
A-5	23 + 99.95	REBAR SET IN CONCRETE	4 160 796.001	4 034 964.890
A-6	25 + 50.00	REBAR SET IN CONCRETE	4 160 796.001	4 035 114.940
A-7	27 + 24.94	REBAR SET IN CONCRETE	4 160 796.001	4 035 289.880
A-8	28 + 99.90	REBAR SET IN CONCRETE	4 160 796.001	4 035 464.840
A-9	30 + 73.26	REBAR SET IN CONCRETE	4 160 830.442	4 035 634.744
A-10	32 + 46.66	REBAR SET IN CONCRETE	4 160 939.193	4 035 769.802
B-1	———	BRASS DISC IN CONCRETE	4 160 903.191	4 035 119.955
B-2	———	BRASS DISC IN CONCRETE	4 160 903.191	4 034 964.895
B-3	———	BRASS DISC IN CONCRETE	4 160 903.191	4 034 815.555
LINE (SO. END 'A')	3 + 44.37	2" I.P. W/CONC. PLUG & TACK	4 159 491.347	4 034 119.505
LINE	19 + 95.15	BRASS DISC IN ROCK	4 160 796.001	4 034 560.120
LINE (NE END 'A')	———	2" I.P. W/CONC. PLUG & TACK	4 161 157.899	4 036 041.414
LINE (EAST END 'C')	———	3/4" I.P. W/CONC. PLUG & TACK	4 160 979.068	4 036 292.241
LINE (WEST END 'B')	———	CONC. NAIL & TIN IN ROCK	4 160 903.191	4 034 635.715
LINE (EAST END 'B')	———	CONC. NAIL IN ROCK	4 160 903.191	4 035 281.395
C-1	———	BRASS DISC IN CONCRETE	4 160 926.113	4 035 586.766
LINE (EAST END 'A')	———	2" I.P. W/CONC. PLUG & NAIL	4 160 796.001	4 036 999.560
LINE (SW END 'A')	———	2" I.P. W/CONC. PLUG & NAIL		

DETAIL "A"

1" = 100'

05253

TABLE OF REFERENCE POINTS

R.P. NO.	COORDINATES NORTHINGS	COORDINATES EASTINGS
1	4 160 100.000	4 034 165.000
2	4 160 270.396	4 034 183.782
3	4 160 478.163	4 034 225.937
4	4 160 796.001	4 034 217.000
5	4 160 796.001	4 034 526.000
6	4 160 796.001	4 034 625.000
7	4 160 796.001	4 034 891.149
8	4 160 796.001	4 035 479.998
9	4 160 796.001	4 035 668.510
10	4 160 948.720	4 035 777.631
11	4 161 081.434	4 035 856.934
12	4 161 080.189	4 035 870.248
13	4 161 119.214	4 035 897.951
14	4 161 153.576	4 035 922.345
15	4 160 281.099	4 034 101.459
16	4 160 253.693	4 034 266.185
17	4 160 218.895	4 034 457.610
18	4 160 461.460	4 034 308.160
19	4 160 386.893	4 034 675.771
20	4 160 769.206	4 034 525.000
21	4 160 506.001	4 034 825.000
22	4 161 144.000	4 034 948.000
23	4 160 884.614	4 034 880.600
24	4 160 715.806	4 034 900.696
25	4 160 591.217	4 034 944.475
26	4 160 367.190	4 034 751.918
27	4 160 796.001	4 034 569.000
28	4 160 522.009	4 035 894.991
29	4 160 958.435	4 036 182.641
30	4 161 000.001	4 036 220.994
31	4 161 161.001	4 035 479.998
32	4 161 154.582	4 035 554.870
33	4 161 014.580	4 036 000.874
34	4 161 058.462	4 035 900.827
35	4 161 082.981	4 035 819.218
36	4 161 143.413	4 035 899.248
37	4 161 022.245	4 035 881.629
38	4 161 065.538	4 036 049.167
39	4 161 076.548	4 036 066.341
40	4 161 120.718	4 036 135.238
41	4 161 036.559	4 036 091.875
42	4 161 038.982	4 036 139.413
43	4 161 043.701	4 036 231.793
44	4 160 999.166	4 036 161.755
45	4 160 967.282	4 036 179.674
46	4 161 073.665	4 035 865.617
47	4 161 035.958	4 036 021.110
48	4 161 144.366	4 035 574.067

℄ CURVE DATA

CURVE NUMBER ②

Δ = 54° 37' 48"
R = 365.000'
T = 188.512'
L = 348.018'

AS CONSTRUCTED
DATE 4/5/73 DFT [illegible] CKD D.F.M.

1" = 100'

NO.	DATE	REVISIONS	BY	CH'K	JOB ENG.	PROJ. ENG.	MGR.
2	3/14/73	REVISE SPILLWAY ALIGNMENT	T.E.N.	R.L.E.	R.C.E.		
1	12-1-72	ISSUED FOR CONSTRUCTION	R.V.	R.L.E.	D.F.M.		

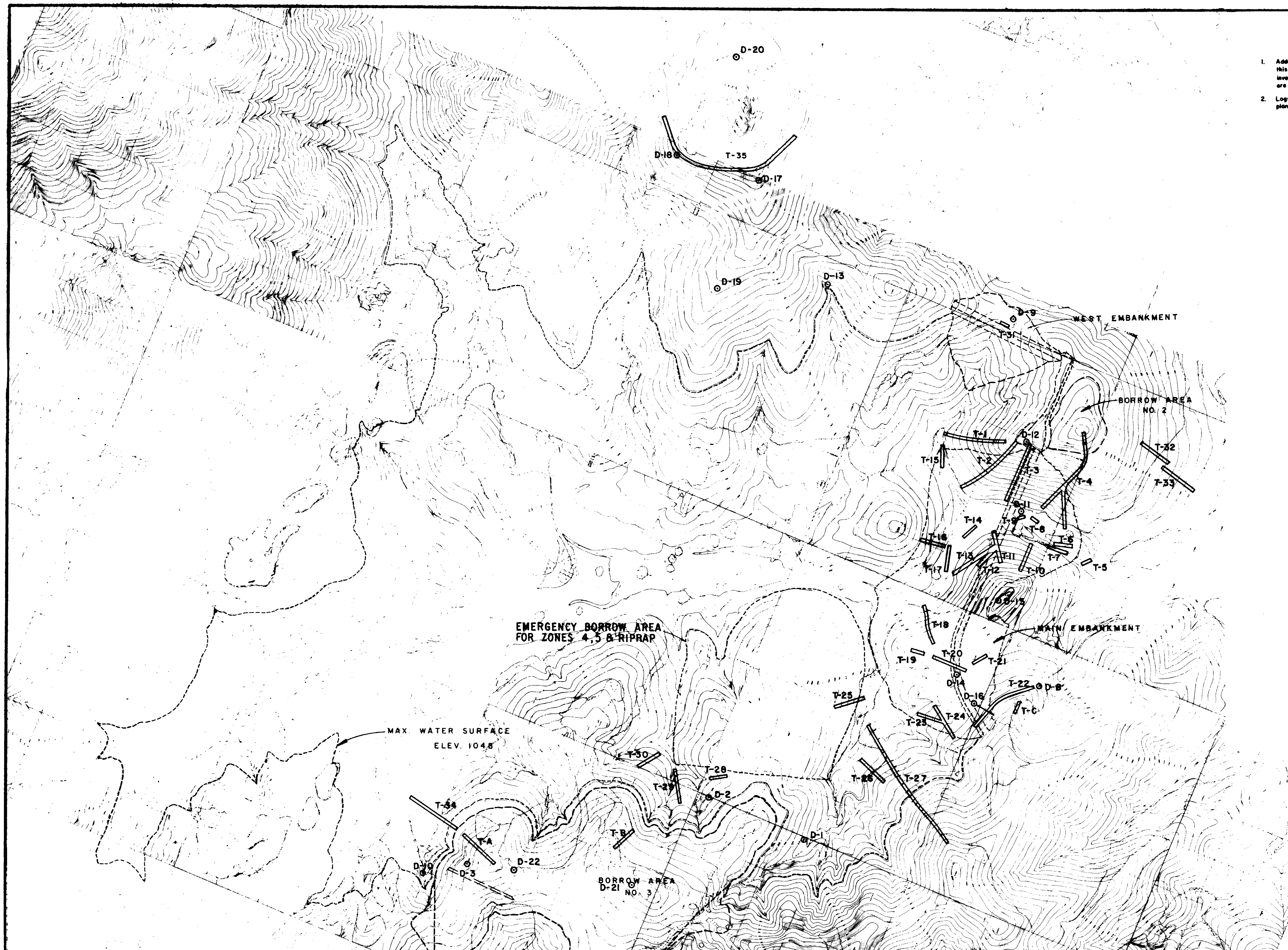
LAS VIRGENES MUNICIPAL WATER DISTRICT

BOYLE ENGINEERING
W. A. WAHLER & ASSOCIATES

WESTLAKE RESERVOIR

HORIZONTAL CONTROL LINES

DESIGNED	DATE: 11-70	JOB ENG. D.F.M.	PROJ. ENG.
DRAWN			DRAWING NUMBER 4
CHECKED D.F.M.	R.C.E.		REV.
SCALE AS SHOWN			



NOTES

1. Additional exploratory borings and trenches, other than those shown on this drawing, have been made in the vicinity in connection with earlier investigations for a different site. Logs of such borings and trenches are not included in these plans and specifications.
2. Logs of trenches shown on this drawing are not included in these plans and specifications.

KEY

- DIAMOND CORE BORING
- SLANTED DIAMOND CORE BORING
- EXPLORATORY DOZER TRENCH

SCALE

200 0 200 FEET

REFERENCE DRAWINGS

6 GEOLOGY, LOGS OF EXPLORATION - SHEET 1 OF 5
7 GEOLOGY, LOGS OF EXPLORATION - SHEET 2 OF 5
8 GEOLOGY, LOGS OF EXPLORATION - SHEET 3 OF 5
9 GEOLOGY, LOGS OF EXPLORATION - SHEET 4 OF 5
10 GEOLOGY, LOGS OF EXPLORATION - SHEET 5 OF 5
11 BORROW AREAS FOR RIPRAP AND ZONES 3, 4 & 5
12 ZONE 1 BORROW AREAS, LOGS OF EXPLORATION - SHEET 1 OF 2
13 ZONE 1 BORROW AREAS, LOGS OF EXPLORATION - SHEET 2 OF 2
14 ZONE 1 BORROW AREA "F", PLAN AND LOGS OF EXPLORATION
15 ZONE 1 BORROW AREA, LOGS OF EXPLORATION - SHEET 1 OF 2
16 ZONE 1 BORROW AREA, LOGS OF EXPLORATION - SHEET 2 OF 2

05254

NO.	DATE	REVISIONS	BY	CHK	JOB ENG.	PROJ. ENG.	MGR.
1	12/17/70	ISSUED FOR CONSTRUCTION	T.E.N.	[illegible]	D.J.M.	[illegible]	[illegible]

LAS VIRGENES MUNICIPAL WATER DISTRICT

BOYLE ENGINEERING
W. A. WAHLER & ASSOCIATES

WESTLAKE RESERVOIR

LOCATION OF EXPLORATION

DESIGNED D.H | DATE: 11-70 | JOB ENG. C.W.P. | PROJ. ENG. [signature]

DRAWN B.S.

CHECKED C.W.P.

SCALE AS SHOWN

[signature] R.C.E.

DRAWING NUMBER 5

REV.

HOLE NO. D-1

HOLE LOCATION UPPER EAST FORK	HOLE ELEVATION 1020	ANGLE VERTICAL BEARING ---	
DRILL RIG JOY	CORE SIZE NX (2")	LOGGED BY RB/DH	DATE DRILLED 2/9/67 to 2/15/67

COMMENTS	DEPTH	DESCRIPTION
Core recovered as broken fragments 1"-3" size.	0	0-11.0 BASALT FLOW BRECCIA; fragments of basalt in a matrix of greenish brown crystalline olivine basalt porphyry.
Core recovered in 4"-1' lengths.	5	
Core recovered in 6"-8" lengths.	11	11-23 BASALT FLOW ROCK, with a few included fragments of basalt in a matrix, as above.
	23	23-40 OLIVINE BASALT PORPHYRY FLOW ROCK; 1-2 mm size olivine phenocrysts scattered through a matrix of gray very fine-grained crystalline basalt. Rock is massive but is cut by an irregular network of tight chlorite-lined fractures. Calcite fills some irregular fractures and fresh pyrite is present along some fracture surfaces.
Difficult drilling in fractured rock.	35	
	40	40-99.2 BASALT FLOW BRECCIA; same as rock in 0-11' interval.
	50.4	(50.4) Fractured zone, partly filled by calcite.
	55	(55.0) Fracture.
	62	(62.0) Gash fracture.
	68	(68.0) Gash fracture.
	70	(70-72) Clay-chlorite-healed breccia zone.
	72	(72-74) Fractured zone.
	99.2	BOTTOM OF HOLE = 99.2 FEET

HOLE NO. D-1

HOLE NO. D-2

HOLE LOCATION UPPER EAST FORK	HOLE ELEVATION 1050	ANGLE VERTICAL BEARING ---	
DRILL RIG JOY	CORE SIZE NX	LOGGED BY RB/DH	DATE DRILLED 2/16/67 to 2/21/67

COMMENTS	DEPTH	DESCRIPTION
0-4.5 Drilled with roller bit.	0	0-100.3 OLIVINE BASALT PORPHYRY FLOW ROCK; 1-2 mm size olivine phenocrysts scattered through a matrix of gray very fine-grained crystalline basalt.
	5	(5.0-7.0) Parallel fractures, dipping 15-20°
	8	(8-23) Rock cut by clean, individual fractures, dipping 45-60°, at 6"-18" intervals.
	20	(20) Fracture.
	23	(23-27) Rock crushed and partially altered to clay; cut by fractures at 2"-1' intervals.
	27	(27-100.3) Rock cut by a network of irregular intersecting closed chlorite-lined fractures.
	33	(33) Fracture.
	37	(37-38.5) Rock closely fractured.
	42	(42-43) Fracture Zone.
	56	(56-56.9) Fracture Zone.
	64.5	(64.5-65.6) Fracture Zone.
	70	(70-70.4) Fracture Zone.
	80	(80-80.5) Fracture Zone
	82	(82-83.0) Fracture Zone
	90.4	(90.4-91) Fracture Zone.
	100.3	BOTTOM OF HOLE = 100.3 FEET

HOLE NO. D- 2

HOLE NO. D-3

HOLE LOCATION UPPER EAST FORK	HOLE ELEVATION 990	ANGLE VERTICAL BEARING ---	
DRILL RIG JOY	CORE SIZE NX	LOGGED BY RB/DH	DATE DRILLED 2/21/67 to 2/27/67

COMMENTS	DEPTH	DESCRIPTION
Hole drilled with roller bit to 10' depth.	0	0-3 DOZED FILL; rocky clayey sand.
	3	3-7 ALLUVIAL AND SLOPEWASH SOIL; rocky clayey sand.
Core recovered in 6"-5' lengths; rock very sound.	7	7-98 BASALT FLOW BRECCIA; fragments of basalt and other volcanic rock types in a matrix of light gray dense crystalline olivine porphyry basalt. The proportion of the rock consisting of included fragments varies from 5% to 30-40%. Fragments range from 1/4" to 1' in size.
	58.5	(58.5) Calcite veinlet.
	77	(77-80) Possible flow layering shown by oxidized zones of fine-grained basalt in medium-grained crystalline basalt, dipping 10-15°.
	90.5	(90.5) Calcite veinlet.
	98	98-100 OLIVINE BASALT PORPHYRY FLOW ROCK.
	100	BOTTOM OF HOLE = 100.0 FEET

HOLE NO. D-3

NOTES

1. The subsurface information shown in the hole logs presented on this drawing indicate conditions found only on the date and at the location of the hole.
   Users of this information are cautioned that the Engineer and W.A. Wahler and Associates in no way warrant that that such information is representative of conditions at any other location, or at any other time. Strata, lithology, and other conditions may change between holes due to dipping of strata, folds and / or faults or other causes. Groundwater levels are subject to change with time, depending on precipitation and surface and subsurface runoff, etc.
2. The subsurface exploration program was carried out to provide a basis for the design of the works presented in these plans and specifications. Reasonable continuity between points of known data was assumed for design purposes. If conditions differing substantially from those shown are encountered, the Engineer shall be notified to permit modified recommendations and / or designs to be made before work progress precludes such modifications.
3. Only logs of borings shown on drawing number 5 are included in these plans.

05255

NO.	DATE	REVISIONS	BY	CH'K	JOB ENG.	PROJ. ENG.	MGR.
1	12/17/70	ISSUED FOR CONSTRUCTION	T.E.N.	[illegible]	D.T.W.	[illegible]	[illegible]

LAS VIRGENES MUNICIPAL WATER DISTRICT

BOYLE ENGINEERING
W. A. WAHLER & ASSOCIATES

WESTLAKE RESERVOIR
GEOLOGY
LOGS OF EXPLORATION
SHEET 1 OF 5

DESIGNED D.H.	DATE: 11-70	JOB ENG. C.W.P.	PROJ. ENG. [illegible]
DRAWN B.S	[signature] R.C.E. [illegible]	DRAWING NUMBER 6	REV.
CHECKED C.W.P.			
SCALE AS SHOWN			

HOLE LOCATION NORTH RIM RIDGE | HOLE ELEVATION 1030 | ANGLE VERTICAL | BEARING ---

DRILL RIG CHICAGO PNEUMATIC 8 | CORE SIZE NX | LOGGED BY LC/DH | DATE DRILLED 8/10-24/67

COMMENTS	DESCRIPTION
0-5° Core drilled to 3" diameter, recovered in 2-10 inch lengths	0-52.0 LAPILLI AND LITHIC TUFF BRECCIA; Grey-white color, clasts of hard grey-brown, fine-grained volcanic rock to 2" size, in a matrix of dense, firmly cemented, very fine-grained tuff.
	(5.0-12.5) Massive, fine-grained tuff; very few clasts.
	(8.5-9.5) Closely fractured zone.
	(16.0-16.5) Closely fractured zone.
	(31.0-32.0) Closely fractured zone; core in 1/4" - 1" size fragments.
	(32.0-51.8) Lithic tuff breccia - 1/2 to 1-1/2" size clasts in a matrix of fine to medium grained lithic tuff.
	(48.0) Color changes from light grey to grey tan; matrix becomes medium-grained lithic tuff.
	(51.8) Fault gouge, sheared lithic tuff.
	(52.0) Flat, polished shear plane.
Basalt core broken to 1/4" to 1" size fragments.	52.0-90.5 BASALT; Greenish gray, medium to coarse grained, crystalline, with inclusions of dark grey basalt. Matrix basalt is altered and crumbly.
	(61.5) Shear plane, vertical.
	(63.5) Shear plane, dipping 70°
	BOTTOM OF HOLE = 97.0 FEET

HOLE NO. D-8

HOLE LOCATION HILL 1116 SADDLE | HOLE ELEVATION 1019 | ANGLE VERTICAL | BEARING ---

DRILL RIG CHICAGO PNEUMATIC 8 | CORE SIZE NX | LOGGED BY LC/DH | DATE DRILLED 8/25-9/5/67

COMMENTS	DESCRIPTION
Core recovered in 1 to 6" lengths.	0-34.5 BASALT FLOW BRECCIA; Inclusion fragments of grey-brown and dark grey massive and vesicular basalt in a matrix of mottled grey, greenish grey, and dark grey, medium-grained crystalline basalt. Rock is moderately weathered.
	35.4-55.5 BASALT PORPHYRY FLOW ROCK; Light to dark grey, massive, fine-grained crystalline basalt, with 1 to 2 mm size phenocrysts of a greenish, cleavable mineral, probably a pyroxene. Rock is pervasively fractured, with clay and chlorite lining on fracture surfaces. Fractures tend to open when core is exposed.
	(47.4) Flat shear plane, dipping 70°, with slickensiding across surface dipping 10°.
	(48.8) 1/8" thick fault gouge, dipping 60°.
Core mostly recovered as blocky. 1/16 to 1/8-inch fragments.	55.0-66.5 BASALT FLOW ROCK; Dark greyish-green, altered and partially decomposed to clayey material, pervasively fractured where recovered intact.
Core recovered in 6 inch to 2 foot lengths	66.5-90.5 BASALT FLOW ROCK; Some breccia inclusions, dark red (primary oxidized zone) down to 70' depth.
	Light greenish grey below 70', massive, medium-grained, crystalline. Mostly sound rock.
	BOTTOM OF HOLE = 90.5 FEET

HOLE NO. D- 9

HOLE LOCATION EAST RIM RIDGE | HOLE ELEVATION 1040 | ANGLE VERTICAL | BEARING ---

DRILL RIG CHICAGO PNEUMATIC 8 | CORE SIZE NX | LOGGED BY LC/DH | DATE DRILLED 9/6-12/67

COMMENTS	DESCRIPTION
0-10° Hole drilled with roller bit; hole cased.	0-8.0 DOZED ROAD FILL AND TOPSOIL
Core recovered in 2 inch to 2 foot sections; most breaks caused by drilling.	8.0-90.0 LAPILLI TUFF BRECCIA; Light grey; angular to sub-rounded clasts of various volcanic rock types, predominantly of 1/4 to 1" size, in a firmly indurated matrix of fine-grained vitric and crystal tuff.
	(17.9) Fracture dipping 70-80°.
	(20.0) Irregular fracture dipping 70°.
	(33.0) Parallel fractures, slickensided, dipping 80°.
Core recovered in 1 to 6 inch sections, and fragments of sections. Most breaks caused by drilling	(53.0) Matrix becomes more clayey and clay seams or lenses present in rock.
	(58.5) Fracture
	(60.5) Fracture
Below 53 feet, much clay, derived from seams and from drilling, coating core.	
	BOTTOM OF HOLE = 90.0 FEET

HOLE NO. D-10

NOTES

1. Notes 1, 2 and 3 on drawing number 6 apply to this drawing.

05256

NO.	DATE	REVISIONS	BY	CHK	JOB ENG.	PROJ. ENG.	MGR.
1	12/11/70	ISSUED FOR CONSTRUCTION	T.E.H.	R.E.C.	C.W.P.		J.C.

LAS VIRGENES MUNICIPAL WATER DISTRICT

BOYLE ENGINEERING
W. A. WAHLER & ASSOCIATES

WESTLAKE RESERVOIR

GEOLOGY

LOGS OF EXPLORATION
SHEET 2 OF 5

DESIGNED D.H.	DATE: 11-70	JOB ENG. C.W.P.	PROJ. ENG.
DRAWN B.S			DRAWING NUMBER 7
CHECKED C.W.P.	R. C. E.		REV.
SCALE AS SHOWN			

HOLE D-11

HOLE LOCATION Main Dam Foundation Area	HOLE ELEVATION 900 ±	ANGLE 50°	BEARING Due E
DRILL RIG Chicago Pneumatic 8	CORE SIZE NX	LOGGED BY LGC DHH	DATE DRILLED 10/5-13/67

COMMENTS

Cored with 2 7/8 inch O.D. Diamond bit.

Water Test #1 10'-20' No loss
Water Test #2 10'-20' Loss due to jacking
Water Test #3 10'-20'. Loss due to rock heaving.

Water Test #4 20'-35' No loss
Water Test #5 same interval as #4. Higher pressure, no loss
Water Test #6 same interval as #5. Higher pressure, no loss
Water Test #7, 8, 9, unable to seat packer.
Water Test #10 35'-65' No loss
Water Test #11 same interval as #10, higher pressure, no loss.
Water Test #12 same interval as #11, higher pressure, no loss.
Water Test #13 50'-65' No loss
Water Test #14 same interval as #13, higher pressure, no loss.
Water Test #15, same interval as #14, higher pressure, no loss.

Set casing to 70 feet.

Water Test #16 75'-90' No loss
Water Test #17 same interval as #16, higher pressure, no loss.
Water Test #18 same interval as #17, higher pressure, no loss.

Water Test #19 90'-110' Loss approximately 2gpm.
Water Test #20 same interval as #19, higher pressure, loss approximately 4.5gpm. Fractures slightly jacked.
Water Test #21 same interval as #20, higher pressure, loss (Cont.)

DESCRIPTION

0.0'-3.0' Dozed fill - no core.

3.0'-19.0' BASALT: Brown and green to dark gray, fine to medium-grained crystalline flow rock. Physical Condition: Moderately friable to moderately hard, massive with thin clay-chlorite lined fractures at 10.5 feet, 60 degrees and 75 degrees to core axis.

19.0'-43.5' BASALT FLOW BRECCIA: Light gray, medium-grained, crystalline basalt matrix. Zones of dark gray, fine to coarse-grained flow rock at 20'-23', 25'-28', and 35'-38'. Quartz lens at 26.5'. Calcite lens 60 degrees to core axis at 36.5'.

43.5'-45.0' BASALT: Brown to gray, microcrystalline with plagioclase phenocrysts. Physical Condition: Intensely fractured in angular, sharp ¼" to 1" fragments.

45.0'-57.5' BASALT PORPHYRY: Dark gray, microcrystalline, 1-2mm elongate white plagioclase phenocrysts in dark gray, hard, aphanitic groundmass. Physical Condition: Closely fractured with calcite veins in some fractures. 51.5'-52.5' Breccia gouge zone, green to brown-maroon clay matrix.

57.5'-61.5' BASALT: Medium - grained flow rock, irregular calcite lensing and impregnation. 61.0'-61.5' Breccia gouge zone, brown to maroon clay matrix.

61.5'-68.0' BASALT: Brown to gray, microcrystalline. Physical Condition: Intensely fractured in angular, sharp ¼" to 1" fragments. 64'-65' Breccia zone.

68.0'-73.0' BASALT: Fine to medium-grained flow rock, massive.

73.0'-85.0' BASALT FLOW BRECCIA: Grading in places to flow rock. Gray, medium-grained, crystalline, massive. 77.7'-79.9' Basalt porphyry, dark gray, aphanitic, 2-4mm white phenocrysts, ¼" to 4" fine to coarse-grained dark inclusions. Physical Condition: Moderate fracturing at 60°-70° to core axis, little weathering.

85.0'-91.7' BASALT PORPHYRY: Fine to medium-grained with 1mm light gray plagioclase phenocrysts. 88.2' broken zone with irregular fractures at 45 degrees and 60 degrees to core axis.

91.7'-95.0' BASALT PORPHYRY: Dark gray, aphanitic flow rock with 2-3mm white, tabular, plagioclase phenocrysts.

95.0'-103.5' BASALT PORPHYRY: Fine to medium-grained flow rock with 1mm light gray plagioclase phenocrysts. Dark inclusion at 103.5 feet. Physical Condition: Closely fractured, moderately weathered.

HOLE D-11 (continued)

HOLE LOCATION Main Dam Foundation Area	HOLE ELEVATION 900 ±	ANGLE 50°	BEARING Due E
DRILL RIG Chicago Pneumatic 8	CORE SIZE NX	LOGGED BY LGC DHH	DATE DRILLED 10/5-13/67

COMMENTS

approximately 4.5 gpm, additional jacking.

Water Test #22 110'-130' Loss approximately 1 gpm, some jacking.

Water Test #23 same interval as #22, higher pressure, loss approximately 3.5 gpm, additional jacking.

Water Test #24 same interval as #23, higher pressure, loss approximately 4.5 gpm, significant additional jacking.

Water Test #25 110'-147' Loss approximately 2 gpm. Fractures slightly jacked.
Water Test #26 same interval as #25, higher pressure, loss approximately 9 gpm, some additional jacking.
Water Test #27 same interval as #26, higher pressure, loss approximately 9 gpm, continuous jacking.

DESCRIPTION

103.5'-108.0' BASALT PORPHYRY: Dark gray, aphanitic flow rock with 2.3mm white, tabular, plagioclase phenocrysts. Physical Condition: Moderate, incipient fractures, little weathering.

108.0'-131.0' BASALT: Coarse-grained, crystalline flow rock, massive. Physical Condition: Deeply weathered to green and maroon chlorite and clay minerals, low hardness, moderately to intensely fractured. Crushed from 125.0 feet to 130.0 feet.

131.0'-147.0' BASALT: Light gray, fine to medium-grained, crystalline, flow rock. Physical Condition: Closely fractured at 30 and 45 degrees to core axis. Little weathering.

146.7'-147.0' Breccia gouge zone, 1/8" to ¼" angular fragments in gray clay.

BOTTOM OF HOLE = 147.0 FEET

HOLE NO. D-11

HOLE D-12

HOLE LOCATION Dam Left Abutment	HOLE ELEVATION 1053	ANGLE Vert.	BEARING
DRILL RIG Cannon Drilling Co. Joy B-12 Rig	CORE SIZE NX	LOGGED BY RCH	DATE DRILLED 10/10-18/68

COMMENTS

Cored with 2 7/8" O.D. diamond bit.

Water Test #1 11.5'-23.4'.

Water Test #2 21.2'-33.1'. Similar loss in both tests, possible leak in fractures at 21.5'.

Water Test #3 31.3'-43.2'. No loss

Water Test #4 41.5'-53.4'. No loss

Water Test #5 51.5'-63.4'. No loss

Water Test #6 61.5'-73.4'. No loss

Water Test #7 71.5'-83.4'. Loss approximately 9 GPM.
Water Test # 7a 72.7'-84.6'. Loss approximately 13 GPM. Leakage probably in several fractures between 71.5' and 84.6'. Cemented hole to 84.6' and continued coring.
Water Test #8 82.1'-94.0'. No loss

DESCRIPTION

0.0'-43.4' BASALT PORPHYRY: Fine-grained to microcrystalline matrix, phenocrysts mainly pyroxene and plagioclase, dense, massive. Closely to little fractured; very thin clay coatings on some fractures; calcite coatings on most; hard; strong; deeply weathered to 22 feet, moderately weathered below 22 feet.

43.4'-111.3' BASALT FLOW BRECCIA: Fine-grained porphyritic basalt with slightly coarser-grained porphyritic inclusions; inclusions are angular to rounded, sand to cobble size with corroded and remelted boundarys, phenocrysts mainly pyroxene, olivene and plagioclase.

Closely to little fractured; no clay coatings; scattered calcite veinlets and vug fillings; moderately hard, weak to moderately strong; moderately to little weathered.

94.0'-96.0' Abundant calcite veins and calcite sealed fractures.

HOLE D-12 (continued)

HOLE LOCATION Dam Left Abutment	HOLE ELEVATION 1053	ANGLE Vert.	BEARING
DRILL RIG Cannon Drilling Co. Joy B-12 Rig	CORE SIZE NX	LOGGED BY RCH	DATE DRILLED 10/10-18/68

COMMENTS

Water Test #9 92.1'-104.0'. Loss approximately 5 GPM, from fracture at 103.8'.

Water Test #10 101.3'-113.2'. Loss approximately 10 GPM. Probably loss from fractures at 103.8' and 108'.

Water Test #11 111.1'-123.0'. No loss

Water Test #12 same interval as #11, higher pressure, no loss.

Water Test #13 92.1'-123.0'. Retest of #9 and #10 intervals. Loss approximately 15 GPM.

Water Test #14 120.2'-132.1'. No loss
Water Test #15 100.2'-132.1'. Retest of 32' interval, Loss approximately 15 GPM.
Water Test #16 130.2'-142.1'. No loss
Water Test #17 130.2'-142.1' No loss, same interval higher pressure

Water Test #18 140.2 Terminated hole at 152.1 feet.

DESCRIPTION

43.4'-111.3' BASALT FLOW BRECCIA (cont.)

105.5'-106.6' Vesicular basalt, most vugs filled with calcite.

111.3'-142.0' BASALT PORPHYRY: Similar to above porphyry; phenocrysts finer grained, contacts are gradational top and bottom, no sharp boundaries. Closely to little fractured; calcite coatings on most fractures, probably tight in place; hard, strong, moderately weathered.

142'-152.1' BASALT FLOW BRECCIA: Same as above, little fractured, hard, strong, little weathered.

BOTTOM OF HOLE = 152.1 FEET

HOLE NO. D-12

NOTES

1. Notes 1,2 and 3 on drawing number 6 apply to this drawing.

05257

NO.	DATE	REVISIONS	BY	CHK	JOB ENG.	PROJ. ENG.	MGR.
△	11/…	ISSUED FOR CONSTRUCTION	T.E.M.				

LAS VIRGENES MUNICIPAL WATER DISTRICT

BOYLE ENGINEERING
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WESTLAKE RESERVOIR
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LOGS OF EXPLORATION
SHEET 3 OF 5

DESIGNED D.H.	DATE: 11-70	JOB ENG. C.W.P.	PROJ. ENG.
DRAWN B.S.		DRAWING NUMBER 8	REV.
CHECKED C.W.P.	R.C.E.		
SCALE AS SHOWN			

HOLE LOCATION: Draw below Saddle 1102, South of West Embankment | HOLE ELEVATION: 1052 | ANGLE: Vert. | BEARING:
DRILL RIG: Cannon Drilling Co. Joy B-12 Rig | CORE SIZE: NX | LOGGED BY: RCH | DATE DRILLED: 10/21-25/68

COMMENTS	DESCRIPTION
Cored with 2 7/8" O.D. diamond bit, surface casing to 5.0 feet.	0'-90.1' BASALT PORPHYRY FLOW BRECCIA: Fine-grained porphyritic basalt containing angular, rounded and streaked out inclusions of slighely coarser grained basalt porphyry; phenocrysts in both matrix and inclusions are predominantly pyroxene and plagioclase laths; borders of many inclusions are corroded and partially remelted; contains scattered small veinlets of calcite. Closely to little fractured; clay fillings on fractures in deeply weathered zone, no fillings below deeply weathered zone, hard and moderately strong; deeply weathered to 16 feet, moderately weathered 16 feet to 70 feet, little weathered below 70 feet.
Water Test #1 8.4'-15.3'. Loss approximately 7 to 8 GPM, probably from fractures at 9.7' and 14.5'. Cased hole to 15 feet, drilling water muddy.	
Water Test #2 18.1'-25.0'. No loss	
Water Test #3 22.5'-34.4'. No loss	
Water Test #4 31.5'-43.4'. No loss	
Water Test #5 40.5'-52.4'. 0.1 GPM loss, possibly leak in fittings. Difficult drilling	
Water Test #6 48.5'-60.4'. No loss Difficult drilling 60'-63', rig chattering, water loss at 62'. At 63', hole appears to be producing water at rate of 2 GPM.	
Water Test #7 58.5'-70.4'. Loss approximately 18 GPM with small amount leaking around packer.	
Water Test #8 58.5'-70.4'. Retest, loss 19 to 20 GPM, some leaking past packer.	
Water Test #9 68.1'-80.0'. Loss about 18 to 20 GPM some leaking past packer. Water probably leaking between 60' and 70'.	
Water Test #10 78.2'-90.1'. No loss	
Terminated hole at 90.1 feet.	BOTTOM OF HOLE = 90.1 FEET

HOLE NO. D-13

HOLE LOCATION: Dam Right Abutment, Saddle | HOLE ELEVATION: 982 | ANGLE: Vert. | BEARING:
DRILL RIG: Cannon Drilling Co. Joy B-12 Rig | CORE SIZE: NX | LOGGED BY: DHH | DATE DRILLED: 10/28-31/68

COMMENTS	DESCRIPTION
Roller rock bit to 5.0' Set surface casing to 5.0 feet. Cored with 3¾" O.D. diamond bit. Lost circulation at 9.0 feet.	5.0'-51.6' BASALT FLOW BRECCIA: Basalt clasts 1/8" to 2" size in matrix of medium grained crystalline basalt. Closely to moderately fractured, minimum 0.1 foot, maximum 0.7 foot, moderately weathered.
	10.0'-12.0' Soft, disintigrated zone, intensely fractured.
Water Test #1 7.6'-14.5'. Loss about 4 GPM. Attempted Water Test #2 packer would not pass 10 feet, set casing to 15 feet	13.2'-51.6' Clasts of grey fine grained to medium grained basalt in dark gray, medium grained, massive, uniform crystalline basalt, many fractures cutting this interval are confined to the larger fine grained basalt clasts and to zones where rock grades to fine grained basalt. Closely to little fractured, minimum 0.1 foot, maximum 3.0 feet, most breaks slightly rough and clean, probably closed at depth; hard; little weathered.
Water Test #2 18.5'-25.4'. No loss	25.3'-26.0' Moderately soft zone, affected by partial granular disintigration.
No circulation loss while coring.	
Water Test #3 23.1'-35.0'. No loss	37.0'-38.0' Rock grades to fine grained light gray then back to medium grained, dark gray basalt.
Water Test #4 32.3'-44.2'. No loss	42.0'and 46.0' Olivene basalt porphyry flow rock inclusions in medium grained basalt, fairly sharp contacts, slightly resorbed.
Water Test #5 43.3'-55.2'. No loss	51.6'-70.2' OLIVENE BASALT PORPHYRY FLOW ROCK: Light gray with light reddish alteration streaks; fine-grained groundmass with abundant, evenly disseminated, 1 to 2 mm size weathered olivene phenocryats; laced with irregular closed chlorite filled fractures, more planar fractures lined with plates of shear polished chlorite. Closely fractured, mostly 0.1 foot to 0.5 foot, some intervals intensely fractured; hard, strong, little weathered.
Water Test #6 53.3'-65.2'. No loss	
Water Test #6a 63.1'-75.0'. No loss	70.2'-90.2' BASALT FLOW BRECCIA AND FLOW ROCK: Medium dark gray; massive with scattered inclusions of subangular to angular basalt clasts. Moderately fractured to massive; hard; strong.
Water Test #7 73.1'-85.0'. No loss	75.6'-76.1' Inclusions of gray basalt porphyry, slightly resorbed gradational contacts.
Water Test #8 78.3'-90.2'. No loss	
Terminated hole at 90.2 feet.	BOTTOM OF HOLE = 90.2 FEET

HOLE NO. D-14

HOLE LOCATION: Dam Right Abutment, Hill 1041 | HOLE ELEVATION: 1037 | ANGLE: Vert. | BEARING:
DRILL RIG: Cannon Drilling Co. Joy B-12 Rig | CORE SIZE: NX | LOGGED BY: RCH | DATE DRILLED: 11/4-8/68

COMMENTS	DESCRIPTION
Cored with 3¾ inch O.D. diamond bit. Set casing to 5.0 feet	0'-78.0' BASALT PORPHYRY FLOW ROCK: Massive, fine-grained rock with scattered phenocrysts of light green weathered olivene in a dense crystalline groundmass aggregate of plagioclase and dark minerals. Rock is brownish tan on surface of core, purplish gray-brown on freshly broken surfaces. Aspect of pitted surface mostly results from weathering out of olivene phenocrysts, core breaks on intersecting 45 degrees to 60 degrees dipping fractures. Generally moderately fractured to massive; moderately hard; deeply to moderately weathered.
Water Test #1 8.2'-15.1'. No Loss	0.0'-4.0' Core in ½ inch to 2 inches fragments, rounded by drilling action.
	4.0'-5.0' Closely fractured.
	5.0'-7.0' Closely to moderately fractured, intersecting 60 degrees dipping fractures with clay coatings and iron oxide stains.
Water Test #2 13.5'-25.4'. No loss	12.5'-15.5' Zone of close spaced, sheeted and intersecting fractures, clay and chlorite coated surfaces.
	20.5'-21.5' Irregular, rough surfaced fractures.
Water Test #3 23.1'-35.0'. No loss	
	40.0'-41.2' & 45.4'-47.5' Zone of irregular, closed, chlorite-filled fractures in gray basalt porphyry.
Driller reports mud on bit at 45.4 feet. Water Test #4 33.5'-45.4'. No loss	
Water Test #5 42.7'-54.6'. No.loss	61.5'-63.0' Interval of flow breccia, light gray basalt porphyry angular fragments in dark brown-gray medium grained basalt matrix.
Hole caved from undetermined depth after run to 60.4', 5' of cave retrieved in next run.	
Water Test #6 53.5'-65.4'. No loss	Most fracture breaks very narrow with only staining of Fe_2O_3 on surfaces.
Core blocking and grinding at 75 feet due to blocky nature of rock. Water Test #7 63.5'-75.4'. No loss	78.0'-102.7' BASALT FLOW BRECCIA: Reddish brown (dark brick red) color with varying concentrations of basalt clast inclusions, in a matrix of fine to medium-grained crystalline basalt. Rock is hard, cannot be scratched deeply with knife.
Water Test #8 73.2'-85.1'. Loss approximately 2 GPM, Core looks tight, drills smooth and fast, possible leak at 75' or contact?	Contact Zone Angular fragments of fine-grained gray basalt porphyry in matrix of reddish medium grained basalt, (78'-79'). Massive; hard.
Water Test #9 83.3'-95.2'. No loss	

HOLE LOCATION: Dam Right Abutment, Hill 1041 | HOLE ELEVATION: 1037 | ANGLE: Vert. | BEARING:
DRILL RIG: Cannon Drilling Co. Joy B-12 Rig | CORE SIZE: NX | LOGGED BY: RCH | DATE DRILLED: 11/4-8/68

COMMENTS	DESCRIPTION
	102.7'-108.7' BASALT PORPHYRY FLOW ROCK: Gray, massive, as in 0'-78' interval. Contact zone, fragments of gray basalt porphyry in reddish medium-grained basalt. Rock cut by many planar and irregular closed, chlorite-filled fractures.
Water Test #10 93.2'-105.1'. Loss 10-11 GPM, probably in fractures near contact, pressure buildup in formation with backsurge after releasing packer.	108.7'-129.0' BASALT FLOW BRECCIA: Reddish brown massive, medium-grained, with clasts of darker brown but generally similar basalt as inclusions, same as rock above 102.7 feet. Contact; gray basalt porphyry in direct contact with reddish medium-grained basalt. Contact surface irregular, but appears normal to core axis.
Water Test #11 103.1'-115.0'. Loss 2-3 GPM, probably from 115.0 feet.	
Water Test #12 113.5'-125.4'. Loss approximately 19 GPM, probably from several fractures, used 450 gallons of water coring this interval.	129.0'-134.4' BASALT PORPHYRY FLOW ROCK: As before. Contact; angular fragments of gray basalt porphyry in reddish medium-grained basalt.
Water Test #13 123.5'-135.4'. Loss approximately 3 GPM, from fractures near contact (?), used 600 gallons coring this interval.	134.4'-155.4' BASALT FLOW BRECCIA: Reddish brown, as before. Contact at drilling break, not recovered.
Water Test #14 133.4'-145.3'. Loss approximately 5-6 GPM, probably from fractures at 134' & 141'	
Water Test #15 143.5'-155.4'. No loss Terminated hole at 155.4 feet.	BOTTOM OF HOLE = 155.4 FEET

HOLE NO. D-15

NOTES
1. Notes 1,2 and 3 on drawing number 6 apply to this drawing.

NO.	DATE	REVISIONS	BY	CHK	JOB ENG.	PROJ. ENG.	MGR.
1	11/4/70	ISSUED FOR CONSTRUCTION	T.E.M.	A.R.E.	C.T.M.		

LAS VIRGENES MUNICIPAL WATER DISTRICT

BOYLE ENGINEERING
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WESTLAKE RESERVOIR
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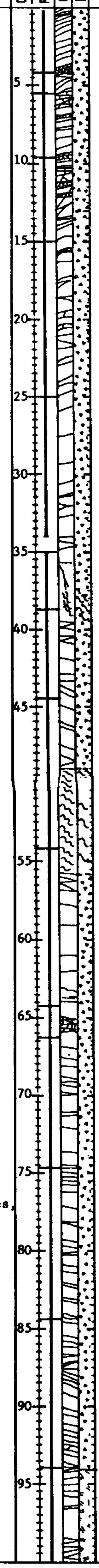
LOGS OF EXPLORATION
SHEET 4 OF 5

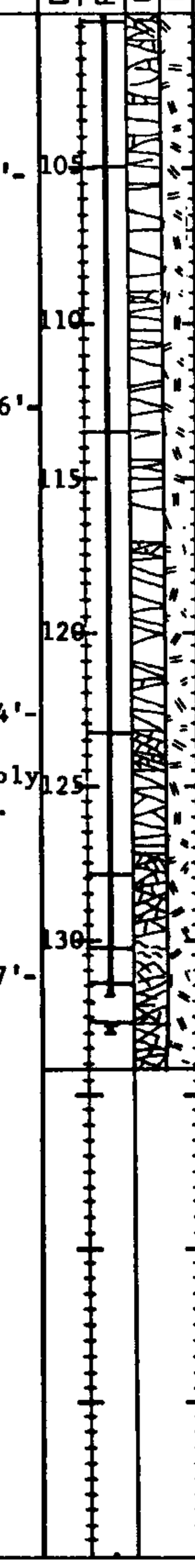
DESIGNED D.H.	DATE: 11-70	JOB ENG. C.W.P	PROJ. ENG.
DRAWN B.S.			DRAWING NUMBER 9
CHECKED C.W.P	R.C.E. 9964		REV.
SCALE AS SHOWN			

05258

HOLE LOCATION Dam Right Abutment	HOLE ELEVATION 1008	ANGLE 45° BEARING N08E
DRILL RIG Cannon Drilling Co. Joy B-12 Rig	CORE SIZE NX / LOGGED BY RCH	DATE DRILLED 11/16-20/68

COMMENTS	DEPTH / RECOVERY / CONDITION / LITHOLOGY	DESCRIPTION
Cored with 3½" O.D. diamond bit, set casing to 5.0 feet.		0'-13.0' **BASALT PORPHYRY BRECCIA:** Pale purple, fragments of porphyritic basalt in autobrecciated matrix; phenocrysts are mainly white plagioclase laths. Closely to moderately fractured; no clay fillings in fractures, oxide staining on some; hard; moderately strong; moderately weathered.
Water Test #1 8.1'-15.0'. Water loss 7-8 GPM many fractures.		13.0'-49.0' **BASALT FLOW BRECCIA:** Angular fragments in microcrystalline matrix; fragments are sand to cobble size, closely packed to scattered. Moderately fractured; no clay fillings; hard; strong; little weathered.
High drill water loss while coring.		
Water Test #2 13.1'-25.0'. Water loss 2-3 GPM numerous fractures.		
Water Test #3 23.1'-35.0'. No loss		37.0'-39.0' Thin shear fracture, slickensided gouge ½ to 1 inch thick, oriented about 3 degrees to core axis.
Water Test #4 32.5'-44.4'. No loss		49.0'-55.6' **SHEAR ZONE:** Slickensided gouge and fragmented basalt; most shear planes within zone are 30 degrees to 50 degrees to core axis, slickensides are variously oriented.
Water Test #5 42.5'-54.4'. No loss		55.6'-94.0' **BASALT FLOW BRECCIA:** Angular fragments of basalt in fine-grained crystalline matrix; fragments generally sand to gravel size and range from closely packed to scattered in matrix. Closely to little fractured; no clay fillings in fractures, slickensides on some; moderately hard; moderately strong; moderately weathered.
Water Test #6 52.3'-64.2'. No loss		
Water Test #7 62.7'-74.6'. No loss		
Erratic drilling rates, slow to fast.		
Water Test #8 72.5'-84.4'. No loss		
600 gallons of water used in coring 64 to 93 feet.		
Water Test #9 82.0'-93.9'. No loss		94.0'-134.1' **INTERBEDDED BASALT and TUFF BRECCIA:** Porphyritic basalt with phenocrysts of olivene and pyroxene (?) altered to chlorite in dense microcrystalline matrix; tuff breccia consists of various textured basalt clasts, gravel to cobble size, angular; in fine-grained tuff matrix.

HOLE LOCATION Dam Right Abutment	HOLE ELEVATION 1008	ANGLE 45° BEARING N08E
DRILL RIG Cannon Drilling Co. Joy B-12 Rig	CORE SIZE NX / LOGGED BY RCH	DATE DRILLED 11/16-20/68

COMMENTS	DEPTH / RECOVERY / CONDITION / LITHOLOGY	DESCRIPTION
		94.0'-134.1' **INTERBEDDED BASALT and TUFF BRECCIA** (Cont.) Closely to little fractured, very thin clay coatings with slickensides on some fractures, calcite coatings on some with scattered calcite veinlets; basalt is hard and strong; tuff matrix is moderately hard and weak; little weathered.
Water Test #10 93.1'-105.0'. Loss 0.3-0.4 GPM.		
Slow drilling.		
Water Test #11 101.6'-113.5'. Loss 0.5-0.7 GPM.		
Water Test #12 111.4'-123.3'. Loss 2.8 GPM, probably in fracture at 117'.		123.0'-134.1' Basalt is moderately weathered, intensely to closely fractured with abundant thin shear planes, clay fillings in fractures are more numerous.
Water Test #13 120.7'-132.6'. Loss 0.4-0.6 GPM, numerous fractures.		
Terminated hole at 134.1 feet		BOTTOM OF HOLE = 134.1 FEET

HOLE NO. D-16

NOTES

1. Notes 1,2 and 3 on drawing number 6 apply to this drawing.

05259

NO.	DATE	REVISIONS	BY	CHK	JOB ENG.	PROJ. ENG.	MGR.
1	12/17/70	ISSUED FOR CONSTRUCTION	F.E.K.	R.E.E.	D.H.M.	[signature]	[signature]

LAS VIRGENES MUNICIPAL WATER DISTRICT

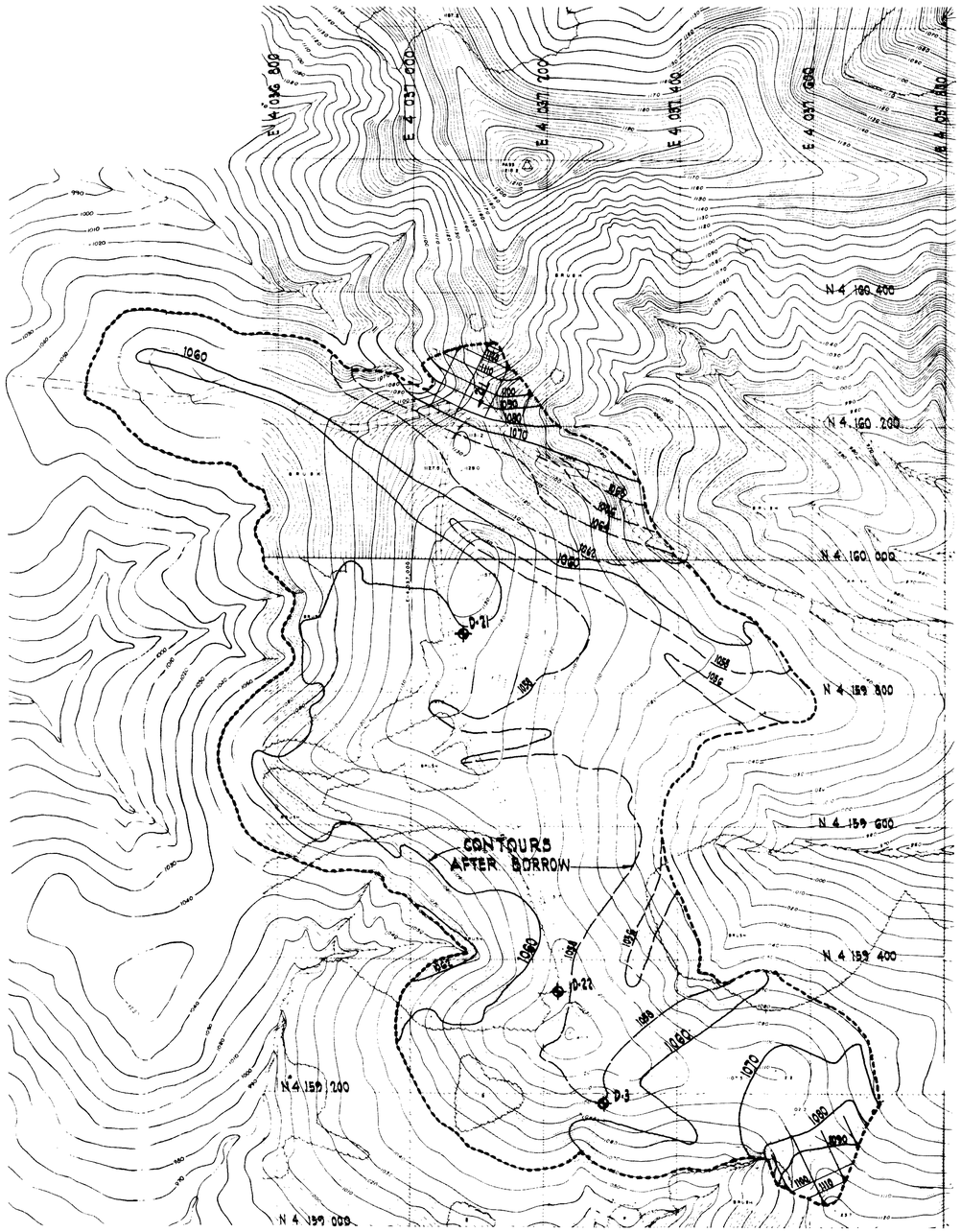
BOYLE ENGINEERING
W. A. WAHLER & ASSOCIATES

WESTLAKE RESERVOIR
GEOLOGY
LOGS OF EXPLORATION
SHEET 5 OF 5

DESIGNED D.H	DATE: 11-70	JOB ENG. C.W.P	PROJ. ENG. [signature]
DRAWN B.S.	[signature] R.C.E. 9986	DRAWING NUMBER 10	REV.
CHECKED C.W.P			
SCALE AS SHOWN			

NOTES

1. Maximum overbreak beyond the grades shown shall be 12 inches & maximum projection above the grades shown shall be 12 inches.
2. The overbreak beyond the limits indicated above shall be backfilled with Zone 4 material to the grades shown on the Dwg.



BORROW AREA NO. 3

ZONES ~~3,~~ 4 & 5

SCALE: 1" = 100'

AS CONSTRUCTED
DATE 4/5/73 BY H.H.R. DFM.

100' 0 100' 200'
1" = 100'

05260

1	12/17/70	ISSUED FOR CONSTRUCTION	T.E.N.	A.L.S.	DFM.	JN	Lw
NO.	DATE	REVISIONS	BY	CH'K	JOB ENG.	PROJ. ENG.	MGR.

LAS VIRGENES MUNICIPAL WATER DISTRICT

BOYLE ENGINEERING
W. A. WAHLER & ASSOCIATES

WESTLAKE RESERVOIR
BORROW AREAS
FOR RIPRAP AND ZONES ~~3,~~ 4 & 5

DESIGNED C.L.B.	DATE: 11-70	JOB ENG. C.W.P.	PROJ. ENG. JN
DRAWN H.R.	L. A. Clayton R.C.E. 8086	DRAWING NUMBER	REV.
CHECKED C.W.P.		11	
SCALE AS SHOWN			

HOLE LOCATION BORROW AREA 1 | HOLE ELEVATION 1240' (TOPO) | ANGLE 90° | BEARING

DRILL RIG JOY 12B--Fred Cannon Co. | CORE SIZE Nx | LOGGED BY RET | DATE DRILLED 1/19-21/70

COMMENTS

DESCRIPTION

0.0-60.0 BASALT FLOW BRECCIA; angular to sub-angular fragments of BASALT and olivine BASALT in a matrix of fine-grained BASALT. Matrix is generally darker, finer-grained, and less altered than the breccia fragments. Rock is purplish brown to gray on fresh surfaces, tan to greenish brown where weathered. Moderately to closely fractured; fractures dip 30° or less, and nearly vertical. Moderately hard and strong, moderately to severely weathered.

(0.0-4.0) Massive BASALT flow unit, purplish gray, moderately hard and strong, fracture spacing 0.1 to 0.6 foot, crush zone at 2.1-2.5 feet.
(4.0-37.5) BASALT flow breccia, mottled green and purplish brown. Moderately hard and strong, moderately weathered (locally severely weathered). Fracture spacing 0.1 to 1.2 feet, averages 0.3 foot. Most fractures have patchy oxide coatings; a few have mud-like fillings to 1/16 inch thick.
(7.0-7.1) Crush zone
(13.2-13.5) Crush zone.
(26.3) Calcite vein 1/8-inch thick.
(37.5-60.0) BASALT flow breccia, purplish gray and greenish gray. Moderately hard and strong, moderately weathered. Fracture spacing 0.1 to 2.0 feet; average fracture spacing 0.5 foot. Fractures generally uncoated; a few have patchy oxide coatings.
(46.0-47.2) Altered zone, brown, weak.

(55.2) Thin crush zone, nearly horizontal.

BOTTOM OF HOLE = 60.0 FEET

NOTES: 1. Collar is about 2 feet below original ground.
2. Average rock hardness 3.5-4.5 on Mho's scale, 1-28-70.
3. Water level 35.9 feet.
4. Fluid take during drilling was very low--250 gallons used for entire hole.

BOX 1 of 4: 0.0-17.6
2 of 4: 17.6-36.1
3 of 4: 36.1-55.3
4 of 4: 55.3-60.0

HOLE NO. D-17

HOLE LOCATION BORROW AREA 1 | HOLE ELEVATION 1222' (TOPO) | ANGLE 90° | BEARING

DRILL RIG JOY 12B--Fred Cannon Co. | CORE SIZE Nx | LOGGED BY RET | DATE DRILLED 1/22-26/70

COMMENTS

DESCRIPTION

0.0-15.1 BASALT; hard, fresh, fine-grained BASALT with about 1% scattered, altered olivine phenocrysts up to 1/8-inch diameter. Rock is blue-gray on cored surface, black on freshly broken surface. Fracture spacing 0.1 foot to 0.6 foot, averages 0.4 foot. Most fractures have extensive oxide and mud-like coatings; a few have crushed rock fillings up to 1/10-inch thick. Fractures dip 0°-20°, 45°, and nearly vertically in core. Slickensides present on some fracture coatings. Massive--no flow structure apparent.

(10.0) specific gravity = 2.61

15.1-70.0 BASALT FLOW BRECCIA; angular to sub-angular fragments of BASALT and olivine BASALT in a matrix of fine- to medium-grained BASALT. Matrix material (about 60% of total volume) is purplish gray, medium hard, and moderately weathered. Breccia fragments are fine to coarse grained, gray and greenish-gray, basaltic rock, medium hard and moderately weathered, but locally are altered and distinctly weaker then the matrix.

Fractures dip at 0°-20° and 45°-60°; a few are nearly vertical. Fractures pass through matrix and included fragments directly; no preference shown towards breaking around inclusions. Fracture spacing 0.1 to 1.9 feet, average spacing about 0.8 foot.
(15.1-19.1) Most fractures have thin sand, clay, or oxide coatings.
(19.1-49.0) Fractures clean or have patchy mud or caliche coatings.
(19.5-19.8) Crush zone, dips 60°.
(36.8-37.2) Crush zone.
(37.5) 1/4" Calcite vein.
(41.5-41.9) Crush zone.

(49.0-70.0) Fractures generally clean; some have thin clay coatings or fillings to 1/10-inch thick, and show slickensides.
(58.5) Trace of iron sulfice (Pyrite?)
(58.7) Flow structure, dips 30°.
(63.0) Thin crush zone.
(65.4-65.8) Alteration and crush zone.
(59.0) Specific gravity =2.35

BOTTOM OF HOLE - 70.0 FEET

NOTES: 1. Hole caved at 2 feet, 1/28/70.
2. Collar is approximately 8 feet below original ground.
3. Average rock hardness 3.5-4.5 on Mho's scale.
4. Rock is of light heft throughout.
5. 500 gallons of drilling water used for entire hole.
6. Boundaries between FLOW BRECCIA units are indistinct, but individual flows appear to range from 5 to 25 feet thick.

BOX 1 of 4: 0.0-19.1
2 of 4: 19.1-37.4
3 of 4: 37.4-54.4
4 of 4: 54.4-70.0

HOLE NO. D-18

HOLE LOCATION BORROW AREA 1 | HOLE ELEVATION 1144' (TOPO) | ANGLE 90° | BEARING

DRILL RIG JOY 12B--Fred Cannon Co. | CORE SIZE Nx | LOGGED BY RET | DATE DRILLED 1/24-26/70

COMMENTS

DESCRIPTION

0.0-50.0 BASALT FLOW BRECCIA; angular to subangular fragments of BASALT and ANDESITE in a matrix of fine-grained BASALT. Matrix material is about 2/3 of total volume. Included fragments vary in size from 1/4-inch to about 1 foot in diameter apparent in the core. Bedding or flow structure lacking.

(0.0-13.6) Tan, moderately to severely weathered, many inclusions altered, core has a pock-marked appearance due to voids where olivine crystals have weathered away. Fracture spacing 0.1 to 0.6 foot, fractures have mud and oxide coatings. 1/2-inch crush zone at 4 feet. Closely fractured at about 13 feet.
(13.6-50.0) Blue-gray matrix with greenish inclusions. Moderately weathered, moderately hard and strong. Fracture spacing 0.1 to 3.0 feet, average 0.8 foot. Most fractures are clean; some have patch clay and/or oxide coatings. Most fractures are either nearly horizontal or nearly vertical.
(34.8-50.0) Rock appears to be slightly altered, but is moderately hard and strong.
(35.8) 2" alteration and crush zone.
(38.6) 1" crush zone, horizontal.
(40.2) 1" crush zone, horizontal.
(49.0) Thin shear zone, dips 45°.

NOTES: 1. Fluid level 1/31/70: 27.5 feet.
2. Hole took about 500 gallons of water per day. Most of the water seemed to go into fractures at 13 feet and 35 feet.
3. Collar is approximately 1 foot below original ground.

BOTTOM OF HOLE = 50.0 FEET

HOLE NO. D-19

NOTES

1. Notes 1,2 and 3 of drawings number 8 apply to this drawing.

05261

NO.	DATE	REVISIONS	BY	CHK.	JOB ENG.	PROJ. ENG.	MGR.
△	4/11/70	ISSUED FOR CONSTRUCTION	F.K.	M.B.S.	R.C.W.		

LAS VIRGENES MUNICIPAL WATER DISTRICT

BOYLE ENGINEERING
W. A. WAHLER & ASSOCIATES

WESTLAKE RESERVOIR

BORROW AREAS

LOGS OF EXPLORATION - SHEET 1 OF 2

DESIGNED F.K	DATE: 11-70	JOB ENG. C.W.P	PROJ. ENG.
DRAWN B.S.			DRAWING NUMBER 12 / REV.
CHECKED C.W.P	R. C. E. 9969		
SCALE AS SHOWN			

HOLE NO. D-20

HOLE LOCATION BORROW AREA No. 1	HOLE ELEVATION 1313' (TOPO)	ANGLE 90°	BEARING
DRILL RIG Joy 12B-Fred Cannon Co.	CORE SIZE Nx	LOGGED BY RET	DATE DRILLED 1/27-2/2/70

COMMENTS | DEPTH | RECOVERY | LOG | DESCRIPTION

0.0-80.0 BASALT FLOW AND FLOW BRECCIA; fine to coarse-grained with about 5% scattered, olivine crystals to 1/8-inch diameter. The olivine is altered throughout the hole, and locally was washed away by the drilling. The matrix of the flow breccia is as described above; about 2/3 of the flow breccia is angular to sub-rounded fragments of basaltic rock up to 1 foot long in the core. Fractures throughout dip nearly horizontally, nearly vertically, and at 25°-30° (parallel to bedding or flow structure). Individual flow units are about 2 to 15 ft. thick; boundaries are vague.

(0.0-2.0?) BASALT FLOW (?), severely weathered, weak to moderately hard, maximum core length recovered 0.3 ft.
(2.0(?)-6.4) SANDSTONE, fine to medium-grained, thin-bedded, weak, bedding chips 25°. Fracture spacing 0.2 ft., fractures coated with oxides.
(6.4-16.0) BASALT FLOW ROCK, highly altered, greenish-gray, weak to moderately hard and strong. Fracture spacing 0.1 to 0.4 ft., averages 0.2 ft. Fractures coated with clay or alteration products.
(16.0-21.0) BASALT FLOW ROCK, moderately weathered, moderately hard and strong, locally altered and weak. 1/2-inch chalcedony vein @ 16.5-18.5.
(21.0-47.0) BASALT FLOW BRECCIA, generally slightly to moderately weathered.

(21.0-47.0) BASALT FLOW BRECCIA--Cont., moderately hard and strong. Fracture spacing 0.1 to 2.3 ft., averages 0.5 ft. Most fractures have patch clay or oxide coatings.
(47.0-65.5) BASALT FLOW ROCK, slightly to moderately weathered, moderately hard and strong, gray to reddish gray. Fracture spacing 0.2 to 2.3 ft., averages 1 foot. Fractures clean or have patchy clay coatings. Contains a few scattered inclusions.
(65.5-80.0) BASALT FLOW BRECCIA, slightly to moderately weathered, moderately hard and strong. Fracture spacing 0.1 to 2.3 ft., averages 0.8 ft. Most fractures have patchy clay coatings.

BOTTOM OF HOLE = 80.0 FEET

NOTES: 1. Fluid level 2/2/70: 13.8 feet.
2. Elevations are unsurveyed.
3. Fluid take was low during drilling.
4. Collar is approximately 3 feet below original ground.

HOLE NO. D-20

HOLE NO. D-21

HOLE LOCATION BORROW AREA No. 3	HOLE ELEVATION 1145 (TOPO)	ANGLE 90°	BEARING
DRILL RIG Joy 12B--Fred Cannon Co.	CORE SIZE NX	LOGGED BY RET	DATE DRILLED 2/4-6/70

COMMENTS | DEPTH | RECOVERY | LOG | DESCRIPTION

0-2.0 SOIL; Silty SAND

2.0-55.0 BASALT FLOW BRECCIA; Angular to sub-rounded fragments of BASALT and ANDESITE in a matrix of fine-to coarse-grained BASALT. Included fragments (1/16-inch to 1 foot diameter) make up about 75% of the rock; the matrix is about 25% of the rock, color greenish to purplish gray. Moderately to closely fractured, fractures dip 30° and nearly horizontal.

(2.0-16.0) BASALT FLOW BRECCIA, severely to moderately weathered, weak to moderately hard and strong. Fracture spacing 0.05 to 0.8ft. Fractures generally have thin or clay fillings. May include some sedimentary breccia.
(16.0-55.0) BASALT FLOW BRECCIA, moderately to slightly weathered, moderately hard and strong. Fracture spacing 0.1 to 2.5 ft., averages about 1 ft. Fracture surfaces clean or have thin to patchy clay coatings.

Comments: Cemented interval 20.0-23.0 to stop water loss at 22.6 ft.

BOTTOM OF HOLE = 55.0 FEET

NOTES: 1. Water level 2/10/70: 7 feet.
2. Collar and original ground elevations are the same.

HOLE NO. D-21

HOLE NO. D-22

HOLE LOCATION BORROW AREA No. 3	HOLE ELEVATION 1125 (TOPO)	ANGLE 90°	BEARING
DRILL RIG Joy 12B--Fred Cannon Co.	CORE SIZE NX	LOGGED BY RET	DATE DRILLED 2/8-10/70

COMMENTS | DEPTH | RECOVERY | LOG | DESCRIPTION

0.0-27.8 BASALT FLOW ROCK; generally fine-grained with about 2% disseminated phenocrysts of altered olivine. Moderately hard and strong, to hard and locally brittle. Fracture spacing 0.6 to 0.05 ft., averages 0.3ft. Fractures dip 15°, 60°, and nearly vertical. Fractures have clay or oxide coatings, many show slickensides. Flow structure vague, apparently parallels fractures dipping @ 15°.

(0.0-5.0) Moderately weathered, medium-grained.
(5.0-27.8) Moderately to slightly weathered; hard and strong.

27.8-39.5 BASALT FLOW BRECCIA; angular to sub-rounded fragments of BASALT and olivine BASALT in a matrix of fine-to medium-grained BASALT. Green where altered, dark gray where fresh or moderately weathered. Fracture spacing 0.3 to 1.0 ft., averages about 0.6 ft. Most fractures have patchy to extensive thin clay coatings which show slickensides.

39.5-45.0 BASALT FLOW ROCK; Similar to interval 0.0-27.8. Severely to moderately weathered, moderately hard and strong. Fracture spacing 0.05 to 0.5 ft. Fractures dip 25° and 70-90°. Most fractures have clay fillings up to 1/10-inch thick and show oblique-slip slickensides.

BOTTOM OF HOLE = 45.0 FEET
NOTES: 1. Water level 2/11/70: 5 feet
2. original ground elevation 1130 (TOPO)

HOLE NO. D-22

NOTES

1. Notes 1, 2 and 3 of drawings number 6 apply to this drawing.

05262

NO.	DATE	REVISIONS	BY	CH'K	JOB ENG.	PROJ. ENG.	MGR.
1	12/11/70	ISSUED FOR CONSTRUCTION	T.E.N.	R.R.S.	[illegible]	[illegible]	[illegible]

LAS VIRGENES MUNICIPAL WATER DISTRICT

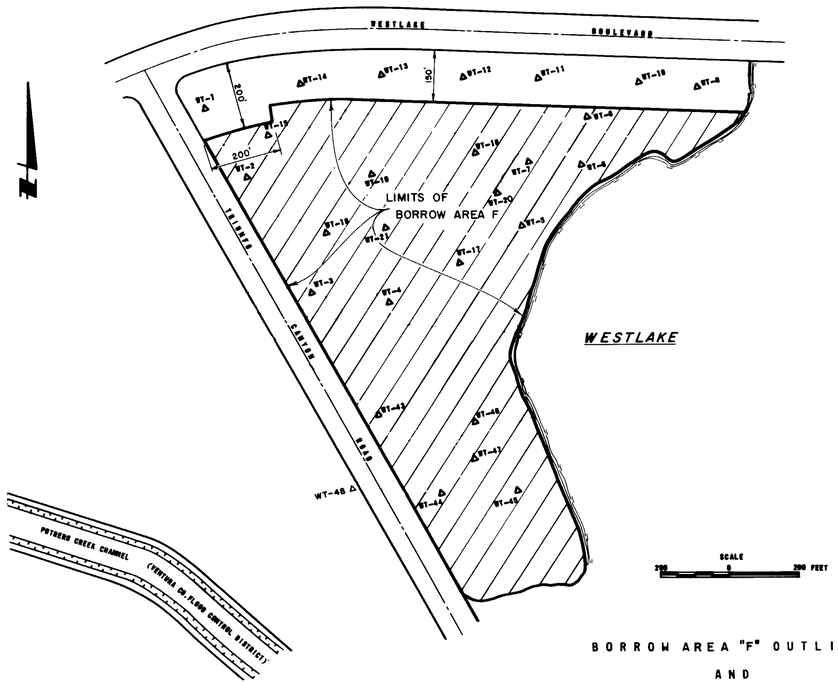
BOYLE ENGINEERING
W. A. WAHLER & ASSOCIATES

WESTLAKE RESERVOIR

BORROW AREAS

LOGS OF EXPLORATION - SHEET 2 OF 2

DESIGNED F. K.	DATE: 11-70	JOB ENG. C.W.P	PROJ. ENG. [signature]
DRAWN B.S.	L. A. Clayton R. C. E. 9986	DRAWING NUMBER 13	REV.
CHECKED C.W.P			
SCALE AS SHOWN			

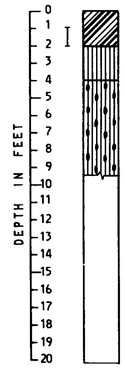


BORROW AREA "F" OUTLINE

AND

TRENCH LOCATION MAP

TRENCH WT-1

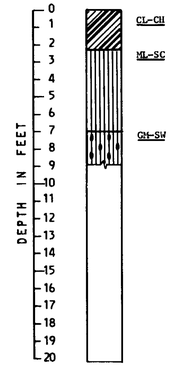


CL-CH;
Dark brown, porous, rootlets, shrinkage cracks.

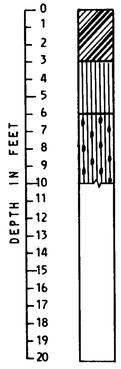
ML-SC;
Brown, scattered gravel, porous, occasional rootlets.

GW-SW;
Light brown to gray, in 2-4" thick, nearly horizontal beds.

TRENCH WT-2



TRENCH WT-3

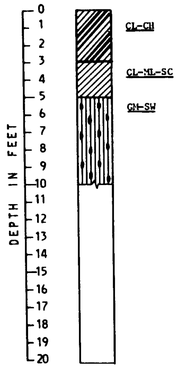


CL-CH;
Dark brown, moist, scattered gravel.

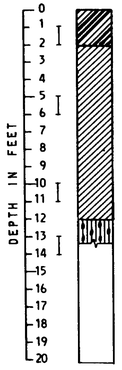
ML-SC;
Scattered gravel

GW-SW

TRENCH WT-4



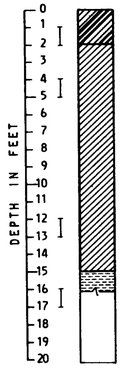
TRENCH WT-5



CL-CH;
Dark brown.

CL-ML-SC;
Brown, scattered gravel.

TRENCH WT-6

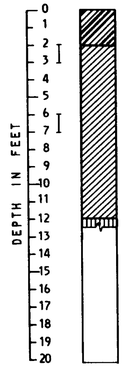


CL-CH;
Scattered sand.

CL-ML;
Scattered sand.

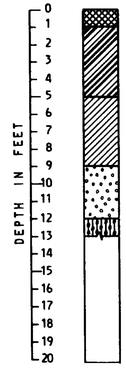
BEDROCK;
MODELO SHALE, white cream and gray, soft moist.

TRENCH WT-7



ML-SC;
Becomes very sandy.

TRENCH WT-8



FILL;
Clay

CH-CL;
Dark brown.

CL;
Brown.

SW;
Reddish brown.

CH;
Brown.

NOTES

1. The subsurface information shown in the trench logs presented on this drawing indicate conditions found only at the date and location of the trench. Users of this information are cautioned that the Engineer and W.A. Wahler and Associates in no way warrant that such information is representative of conditions at any other location, or at any other time. Strata, lithology and other conditions may change between trenches due to lensing or discontinuity of formation or due to dipping of strata or other causes. Groundwater levels are subject to change with time, depending on precipatation and subsurface runoff, etc.
2. The subsurface exploration program was carried out to provide a basis for the design of the works presented in these plans. Reasonable continuity between points of known data was assumed for design purposes. If conditions differing substantially from those shown are encountered, the Engineer shall be notified to permit modified recommendations and/or design to be made.
3. Additional trenches, other than those shown on Trench Location Map, have been excavated in the vicinity. These additional trenches were outside the limits of Borrow Area F, and are therefore not shown. Only the logs of trenches shown on the Trench Location Map are included in these plans.
4. Soil classifications shown on logs are field classifications based on Unified Soils Classification System.
5. Where soil is gradational between clay, silt, sand, and/or gravel, log representation has been patterned with symbol for predominant soil type.
6. See Drawing number 16 for key to soil classification patterning in the trench logs.
7. Trenches were made in November 1968.

05263

NO.	DATE	REVISIONS	BY	CHK	JOB ENG.	PROJ. ENG.	MGR.
1	12/1/70	ISSUED FOR CONSTRUCTION	T.E.H.	A.F.F.	D.T.W.		

LAS VIRGENES MUNICIPAL WATER DISTRICT

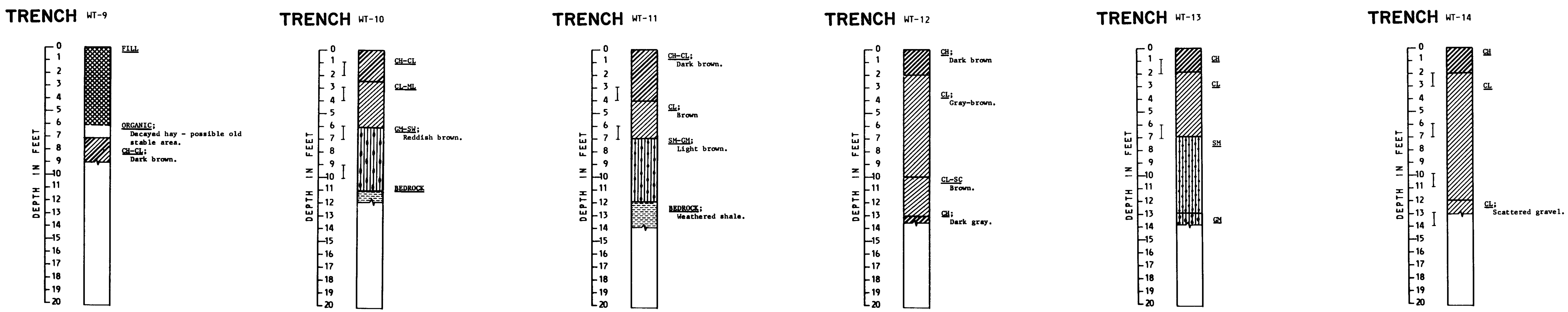
BOYLE ENGINEERING
W. A. WAHLER & ASSOCIATES

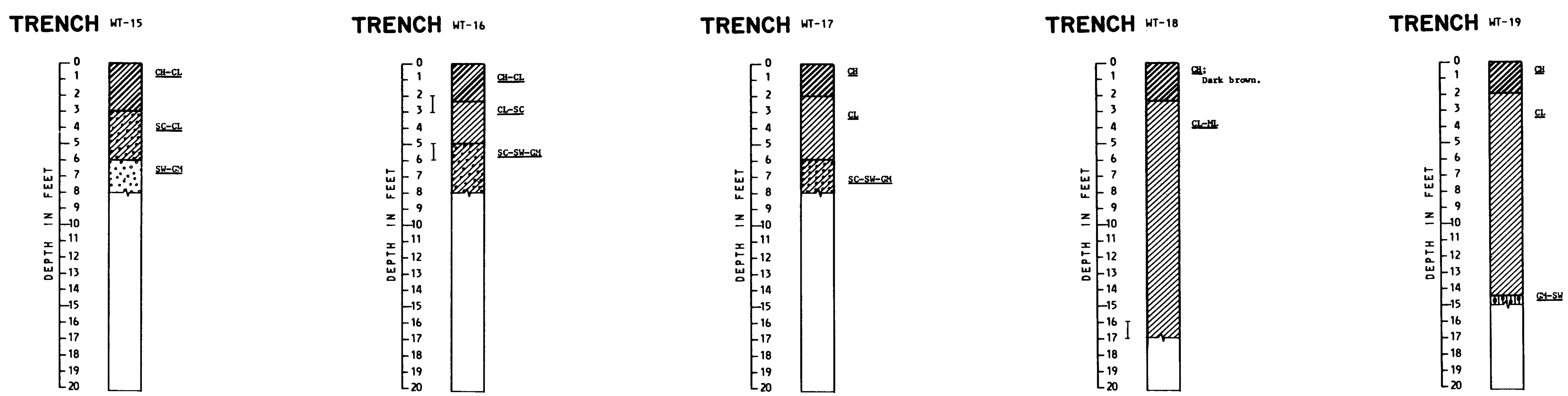
WESTLAKE RESERVOIR

ZONE 1 - BORROW AREA "F"

PLAN AND LOGS OF EXPLORATION

DESIGNED D. H.	DATE: 11-70	JOB ENG. C.W.P.	PROJ. ENG.
DRAWN B.S.			DRAWING NUMBER 14
CHECKED C.W.P.	R. C. E.		REV.
SCALE AS SHOWN			





NOTES

1. Notes 1 through 6 on Drawing number 14 apply to this drawing.
2. See Drawing number 14 for borrow area outline and trench location map.

05264

NO.	DATE	REVISIONS	BY	CHK	JOB ENG.	PROJ. ENG.	MGR.
△	11/-/70	ISSUED FOR CONSTRUCTION	T.E.N.	R.R.R.	C.W.P.	[illegible]	[illegible]

LAS VIRGENES MUNICIPAL WATER DISTRICT

BOYLE ENGINEERING
W. A. WAHLER & ASSOCIATES

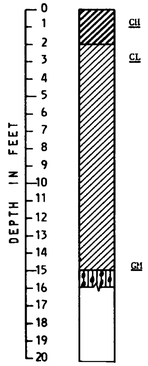
WESTLAKE RESERVOIR

ZONE I - BORROW AREA

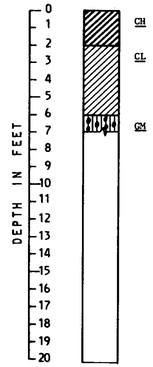
LOGS OF EXPLORATION - SHEET 1 OF 2

DESIGNED D.H.	DATE: 11-70	JOB ENG. C.W.P.	PROJ. ENG. [signature]
DRAWN B.S.	[signature]	DRAWING NUMBER 15	REV.
CHECKED C.W.P.	R.C.E. [illegible]		
SCALE AS SHOWN			

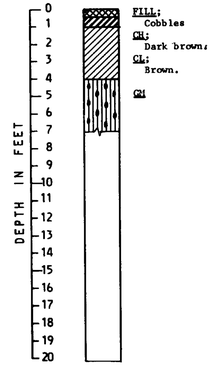
TRENCH WT-20



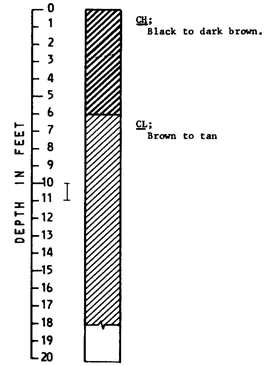
TRENCH WT-21



TRENCH WT-43



TRENCH WT-44

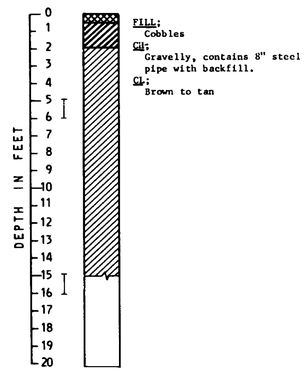


KEY TO FIELD CLASSIFICATION OF SOIL TYPE

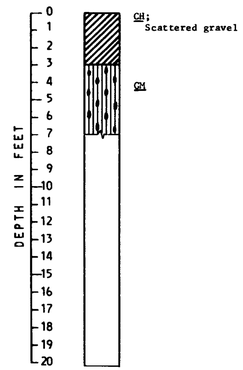
MAJOR DIVISIONS		LETTER	SYMBOL	DESCRIPTION
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW		Well-graded gravel-sand mixtures, little or no fines.
		GP		Poorly-graded gravels or gravel-sand-silt mixtures.
		GM		Silty gravels, gravel-sand-silt mixtures.
		GC		Clayey gravels, gravel-sand-clay mixtures.
	SAND AND SANDY SOILS	SW		Well-graded sand, little or no fines.
		SM		Silty sands, sand-silt mixtures.
		SC		Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS	SILTS AND CLAYS LL < 50	ML		Inorganic silts and very fine sands, silty to clayey fine sands or clayey silts with slight plasticity.
		CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
	CLAYS WHERE LL ≯ 50	CL-CH CH-CL		Inorganic clays and silty clays of medium to high plasticity
	SILTS AND CLAYS LL > 50	MH		Inorganic silts, micaceous or diatomaceous, fine sandy or silty soils, elastic silts.
		CH		Inorganic clays of high plasticity, fat clays.
BEDROCK				Modelo Formation shale, siltstone, and minor diatomite.
FILL				Artificial fill, gravelly soil and debris.

I DISTURBED SAMPLE

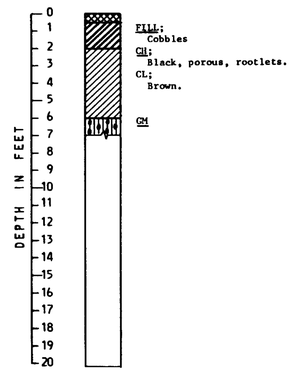
TRENCH WT-45



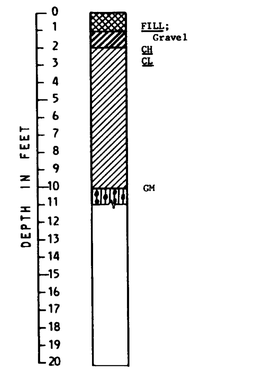
TRENCH WT-46



TRENCH WT-47



TRENCH WT-48



NOTES

1. Notes 1 through 6 on Drawing number 14 apply to this drawing.
2. See Drawing number 14 for borrow area outline and trench location map.

05265

NO.	DATE	REVISIONS	BY	CHK	JOB ENG.	PROJ. ENG.	MGR.
△	6/11/71	ISSUED FOR CONSTRUCTION	T.E.M.A.R.E.				

LAS VIRGENES MUNICIPAL WATER DISTRICT

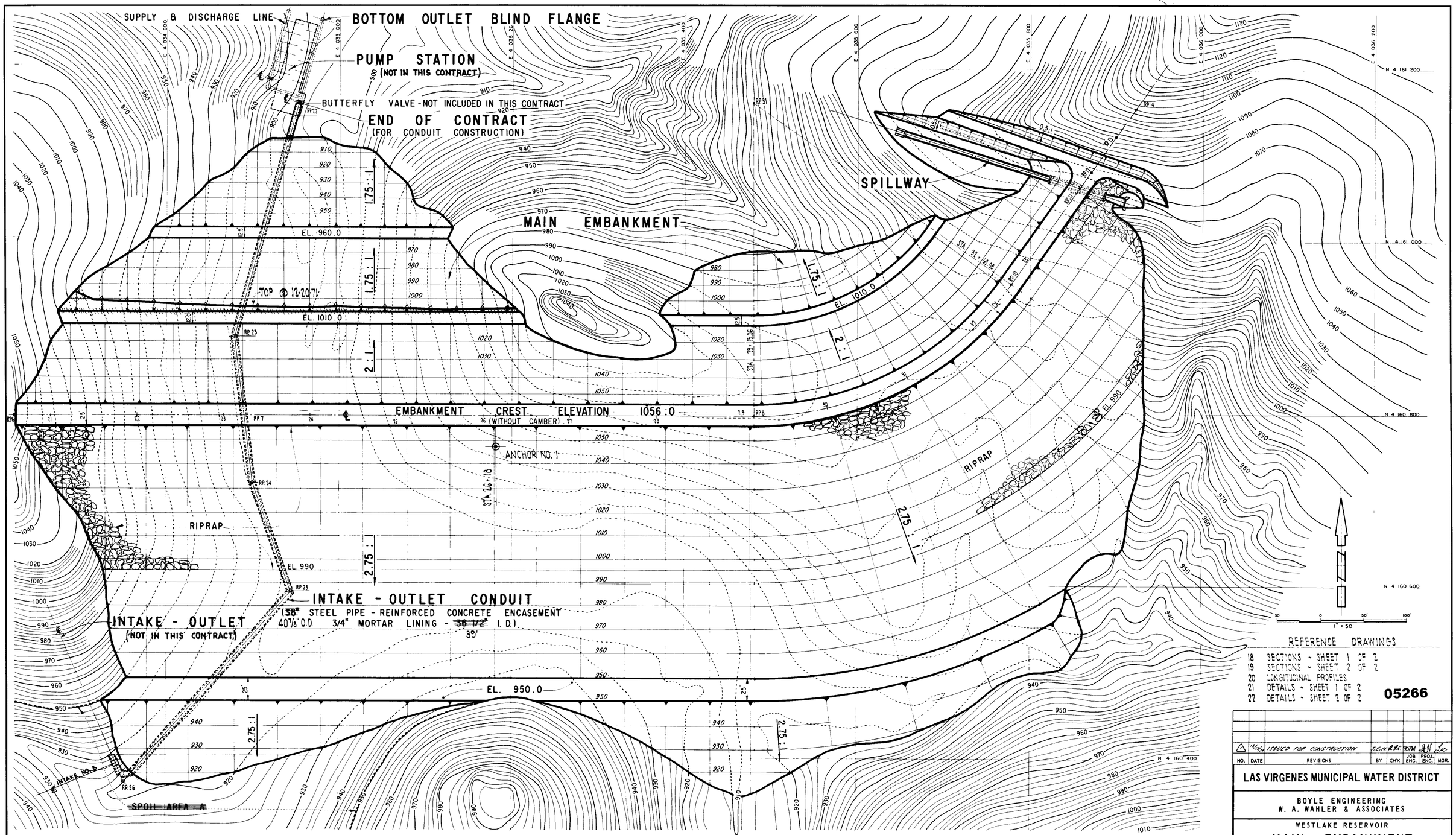
BOYLE ENGINEERING
W. A. WAHLER & ASSOCIATES

WESTLAKE RESERVOIR

ZONE I - BORROW AREA

LOGS OF EXPLORATION - SHEET 2 OF 2

DESIGNED D.H.	DATE: 11-70	JOB ENG. C.W.P.	PROJ. ENG.	
DRAWN B.S.			DRAWING NUMBER	REV.
CHECKED C.W.P.	R. C. E. 9966		16	
SCALE AS SHOWN				



PLAN

SCALE: 1" = 50'

AS CONSTRUCTED
DATE 4/5/73 DFT H.W.R. CKD DFM

REFERENCE DRAWINGS

18	SECTIONS - SHEET 1 OF 2
19	SECTIONS - SHEET 2 OF 2
20	LONGITUDINAL PROFILES
21	DETAILS - SHEET 1 OF 2
22	DETAILS - SHEET 2 OF 2

05266

NO.	DATE	REVISIONS	BY	CH'K	JOB ENG.	PROJ. ENG.	MGR.
1	4/5/73	ISSUED FOR CONSTRUCTION	T.E.M.	R.E.M.	DFM		

LAS VIRGENES MUNICIPAL WATER DISTRICT

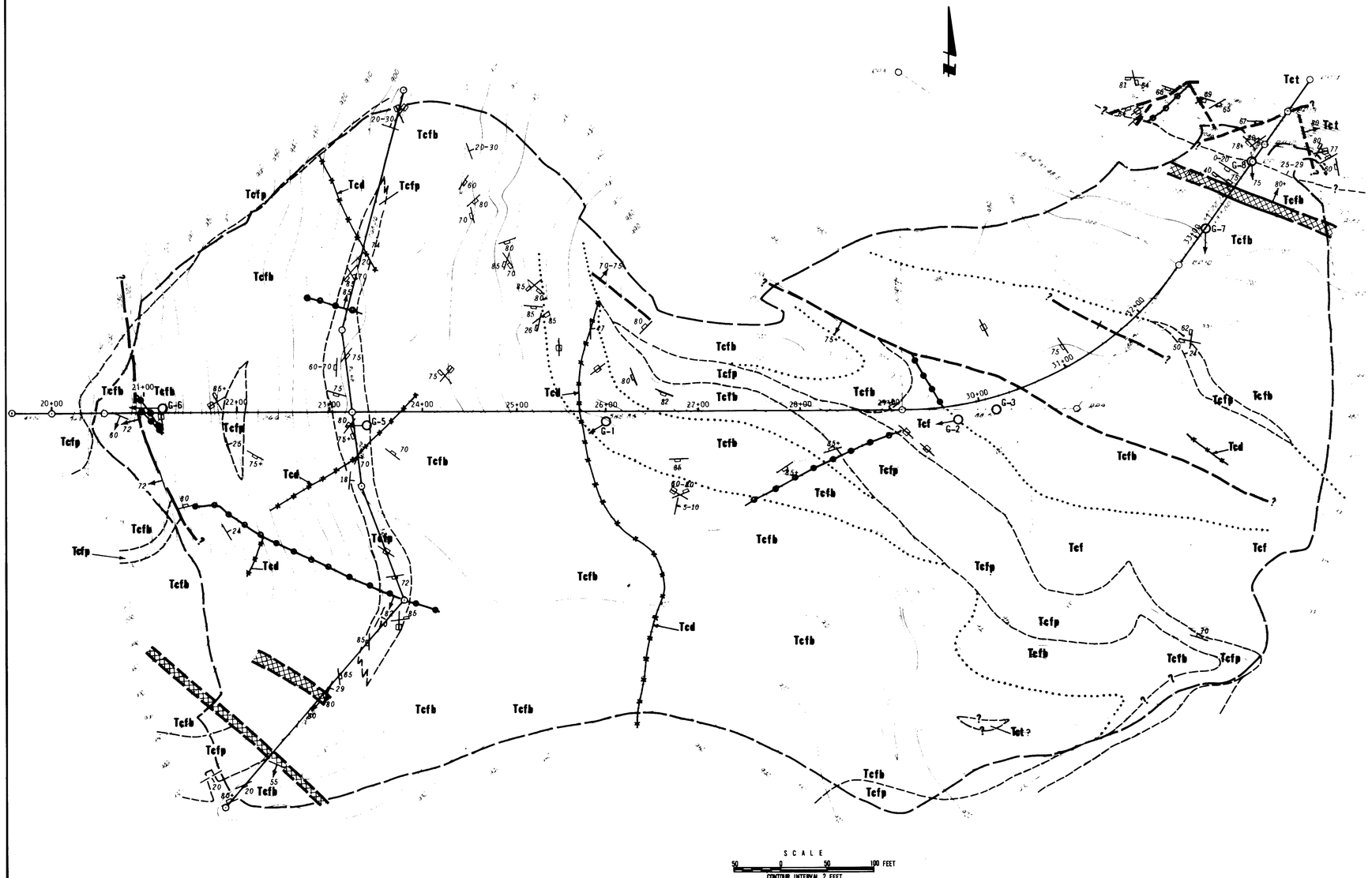
BOYLE ENGINEERING
W. A. WAHLER & ASSOCIATES

WESTLAKE RESERVOIR

MAIN EMBANKMENT

GENERAL LAYOUT

DESIGNED F.W.G.	DATE: 11-70	JOB ENG. C.W.P.	PROJ. ENG.
DRAWN Y.R.			DRAWING NUMBER 17
CHECKED C.W.P.	R. C. E. 9986		REV.
SCALE AS SHOWN			



K E Y

TERTIARY ROCK UNITS

CONEJO VOLCANICS MEMBER OF TOPANGA FORMATION

- Tcd — INTRUSIVE IGNEOUS ROCKS: DIKES OF BASALTIC OR ANDESITIC COMPOSITION
- Tct — TUFF BRECCIA
- Tcf — BASALT FLOW AND FLOW BRECCIA ROCK: UNDIFFERENTIATED
- Tcfp — BASALT PORPHYRY
- Tcfb — FLOW BRECCIA, MASSIVE: INCLUDES CLASTS OF BASALTIC ROCK IN BASALTIC MATRIX, IN MANY CASES AUTOBRECCIATED.

SYMBOLS

- CONTACT BETWEEN UNITS OF DIFFERENT LITHOLOGY, APPROXIMATELY LOCATED, SHOWING ATTITUDE; QUESTIONED WHERE CONJECTURAL.
- CONTACT BETWEEN FLOWS OF SIMILAR LITHOLOGY, APPROXIMATELY LOCATED
- FAULT, APPROXIMATE LOCATION, SHOWING ATTITUDE; QUESTIONED WHERE EXTENSION IS DOUBTFUL.
- FAULT ZONE, WIDTH TO SCALE, SHOWING ATTITUDE; DASHED WHERE APPROXIMATELY LOCATED.
- ALTERATION ZONE, STEEPLY DIPPING; POSSIBLE FAULT
- ATTITUDE OF CONTACT OR FLOW STRUCTURE
- APPROXIMATE OR GENERALIZED ATTITUDE OF FLOW STRUCTURE
- STRIKE OF VERTICAL FAULT
- ATTITUDE OF JOINT
- ATTITUDES OF INTERSECTING JOINTS
- STRIKE OF VERTICAL JOINT
- JOINT SET WITH SAME STRIKE AND DIFFERENT DIPS
- G-3 — DIAMOND CORE HOLE (VERTICAL)
- G-7 — DIAMOND CORE HOLE (INCLINED)
- OUTLINE OF DAM AND RESERVOIR

NOTE: A PLUS SIGN BY THE AMOUNT OF DIP, E.G. 70°+, MEANS THE DIP VARIES FROM THE INDICATED AMOUNT UP TO VERTICAL OVER SHORT DISTANCES.

05267

AS CONSTRUCTED
DATE 12-13-73 DFT H.H.R.

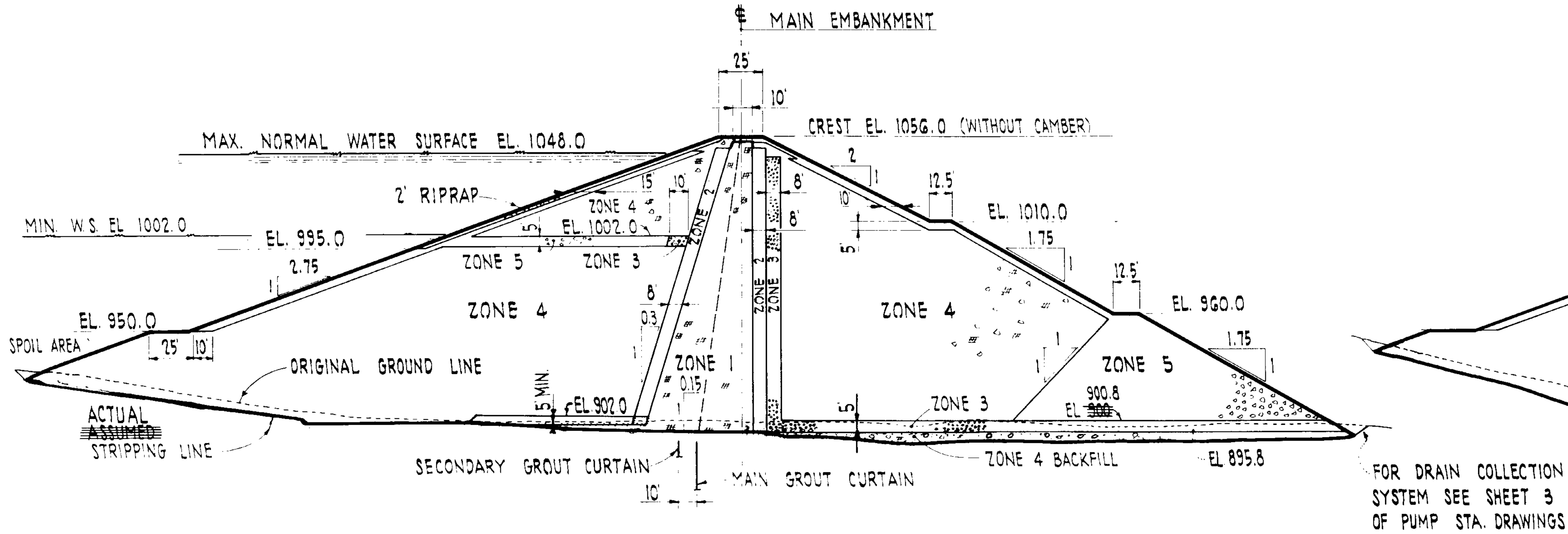
NO.	DATE	REVISIONS	BY	CHK.	JOB ENG.	PROJ. ENG.	MGR.

LAS VIRGENES MUNICIPAL WATER DISTRICT

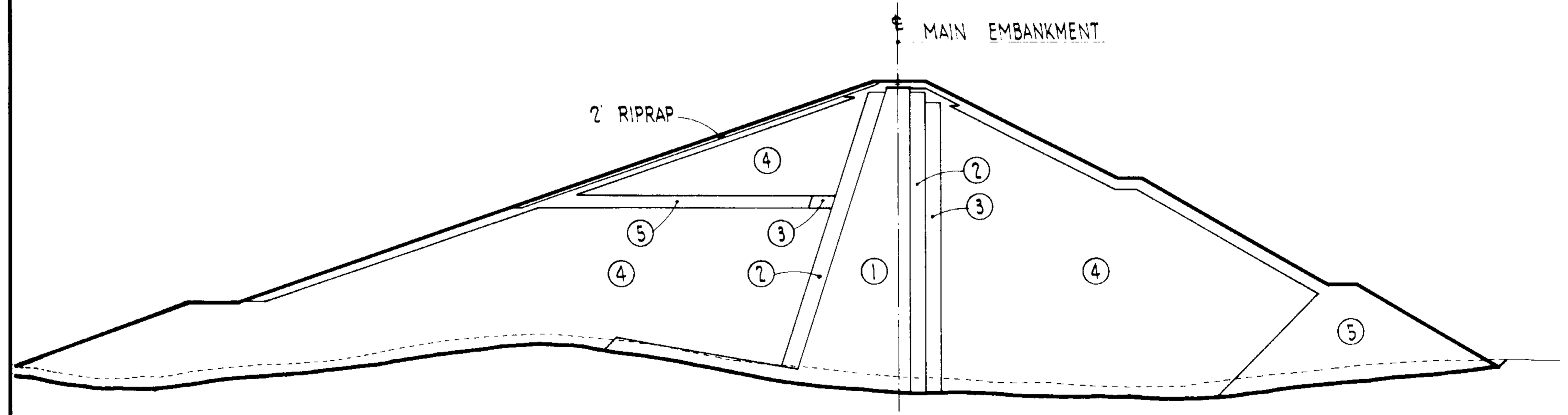
BOYLE ENGINEERING
W. A. WAHLER & ASSOCIATES

WESTLAKE RESERVOIR
EXCAVATED FOUNDATION
GEOLOGIC MAP
MAIN EMBANKMENT

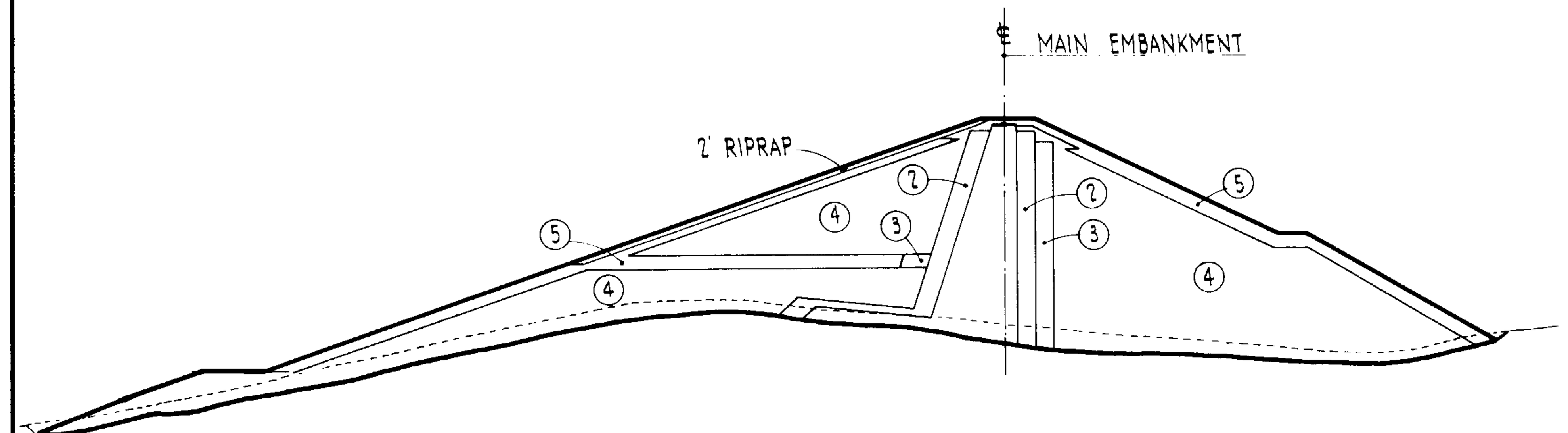
DESIGNED R.C.E.	DATE: 6/72	PROJ. ENG.	
DRAWN JBD		DRAWING NUMBER	REV.
CHECKED R.C.E.	R. C. E. 6984	17-A	
SCALE AS SHOWN			



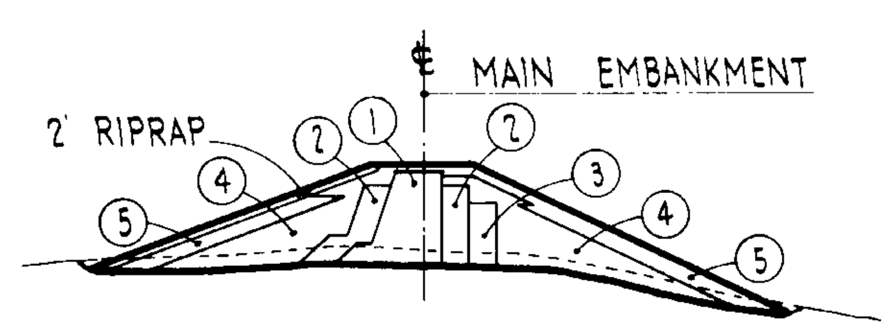
SECTION AT STA. 24+00



SECTION AT STA. 23+00

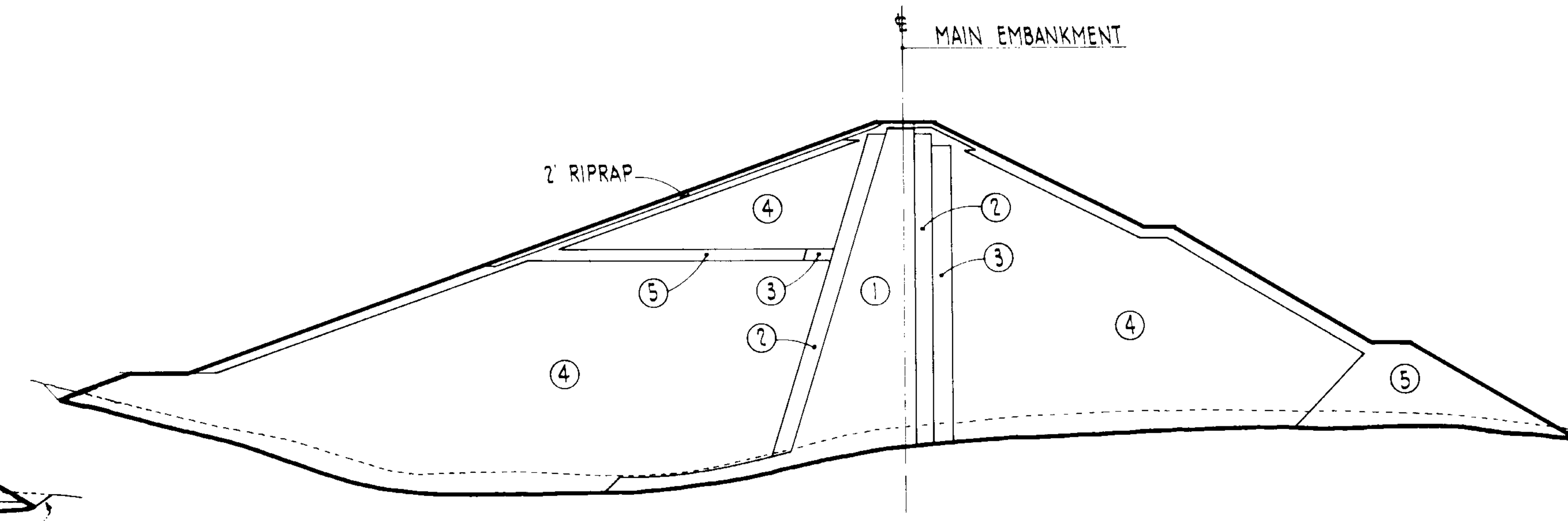


SECTION AT STA. 22+00

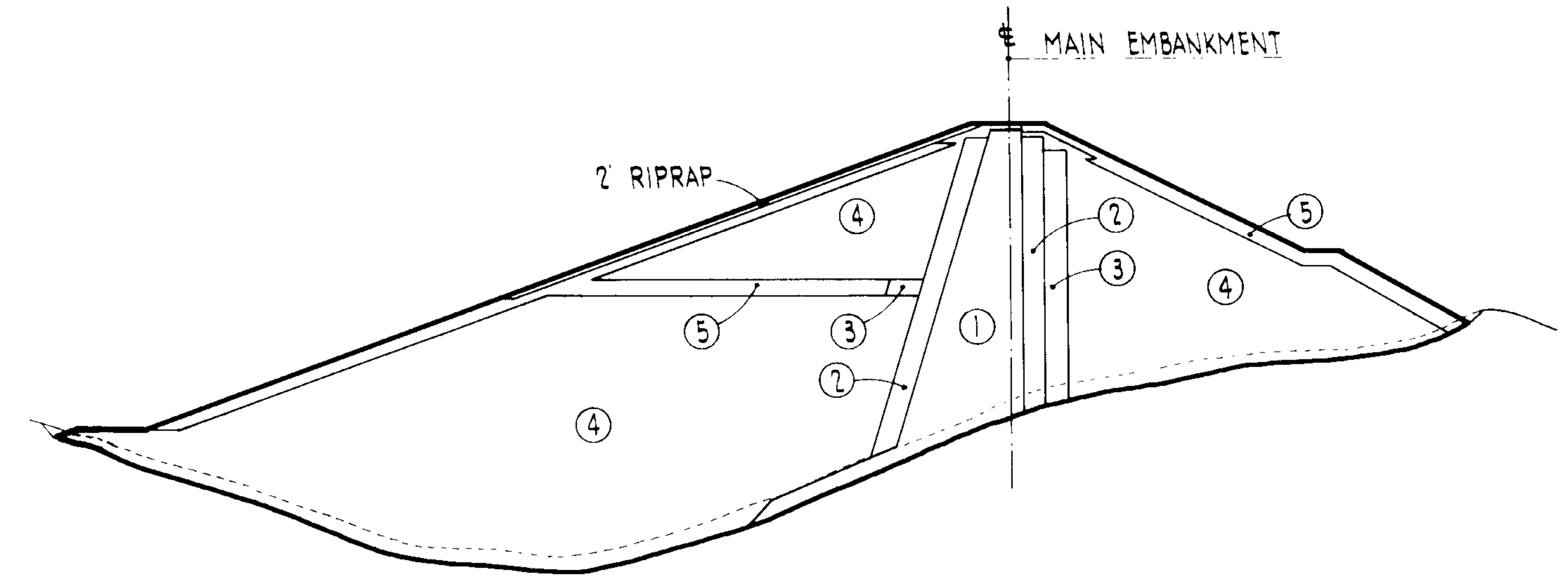


SECTION AT STA. 21+00

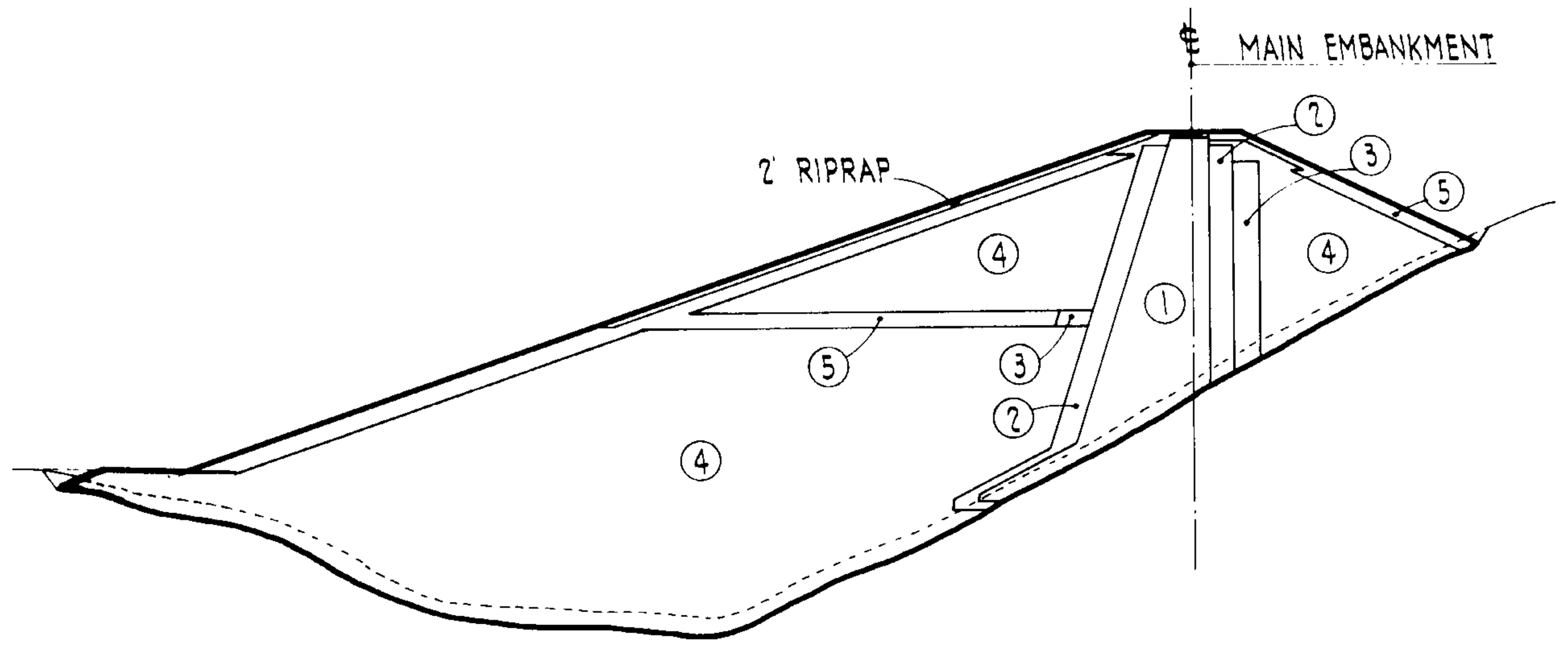
SCALE: 1" = 50'



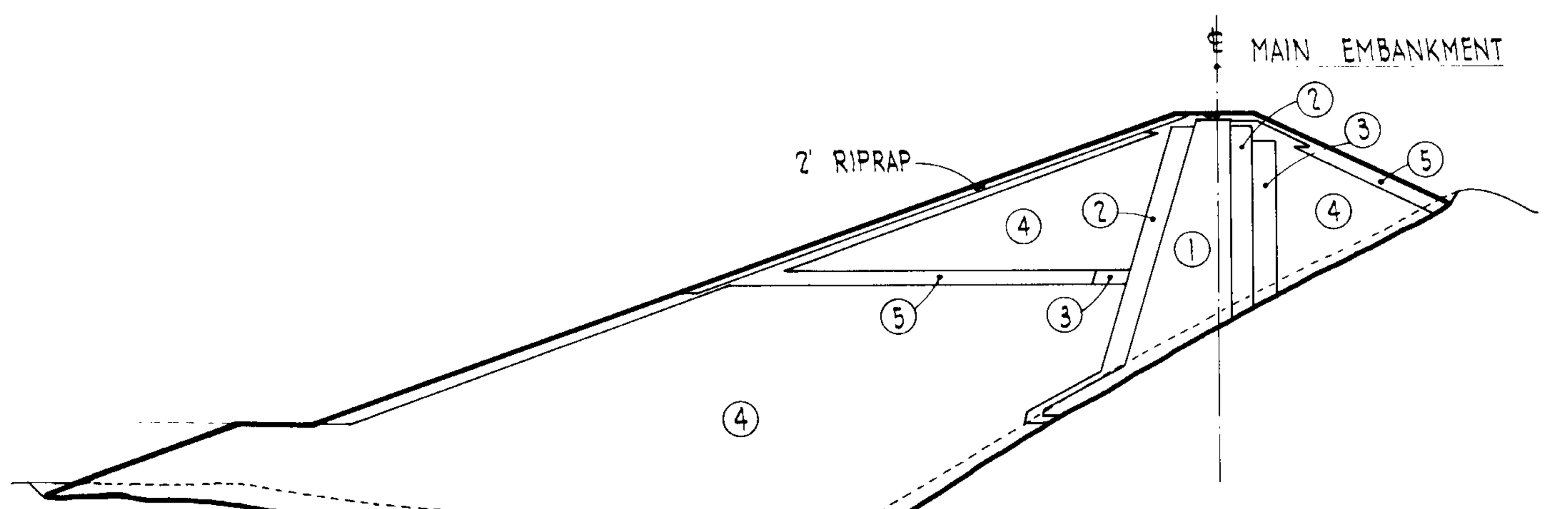
SECTION AT STA. 25+00



SECTION AT STA. 26+00



SECTION AT STA. 27+00



SECTION AT STA. 28+00

SCALE: 1" = 50'

NOTES

1. Main and secondary grout curtains are shown only on Sections at Sta. 24+00. Criteria for grout curtain locations over remainder of dam alignment are as shown on that section.

05268

REFERENCE DRAWINGS

FOR REFERENCE DRAWINGS SEE DRAWING NO. 17

4/5/73 H.H.R. D.F.M.

1" = 50'

NO.	DATE	REVISIONS	BY	CH'K	JOB ENG.	PROJ. ENG.	MGR.
△		ISSUED FOR CONSTRUCTION	T.E.M.				

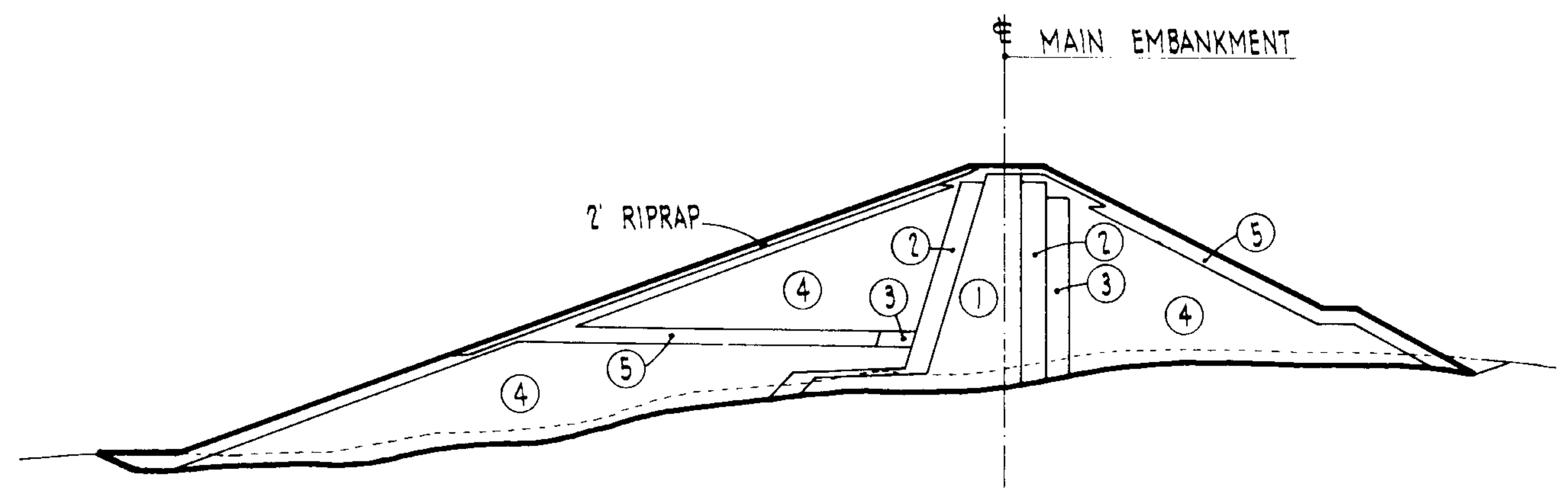
LAS VIRGENES MUNICIPAL WATER DISTRICT

BOYLE ENGINEERING
W. A. WAHLER & ASSOCIATES

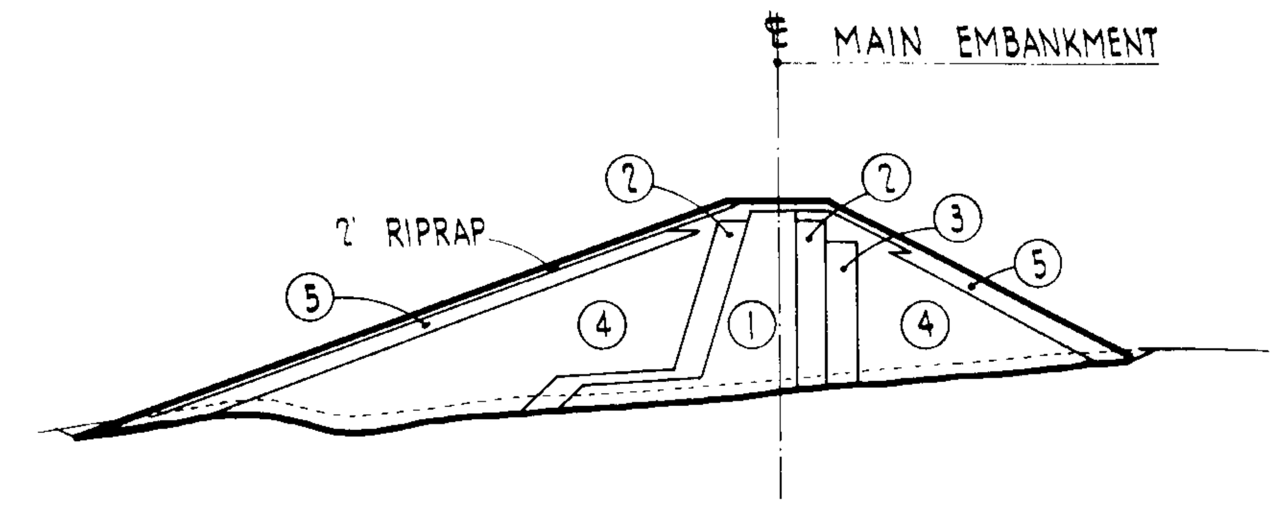
WESTLAKE RESERVOIR

MAIN EMBANKMENT
SECTIONS - SHEET 1 OF 2

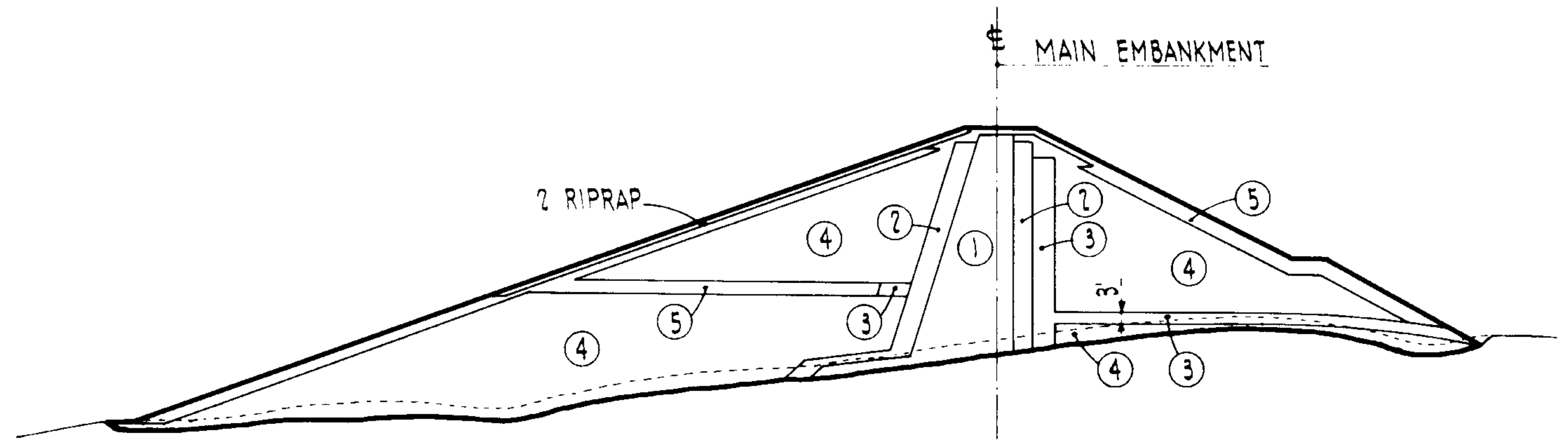
DESIGNED F.W.G. DATE: 11-70 JOB ENG. C.W.P. PROJ. ENG.
DRAWN H.R.
CHECKED C.W.P.
SCALE AS SHOWN
R.C.E. 9986
DRAWING NUMBER 18
REV.



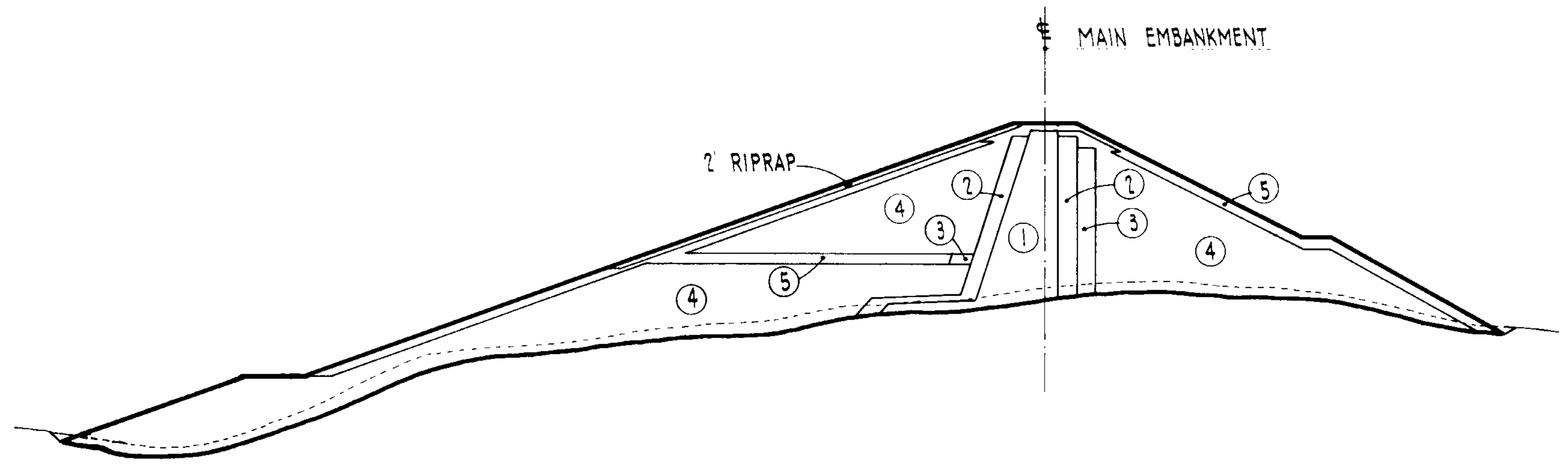
SECTION AT STA. 32+00



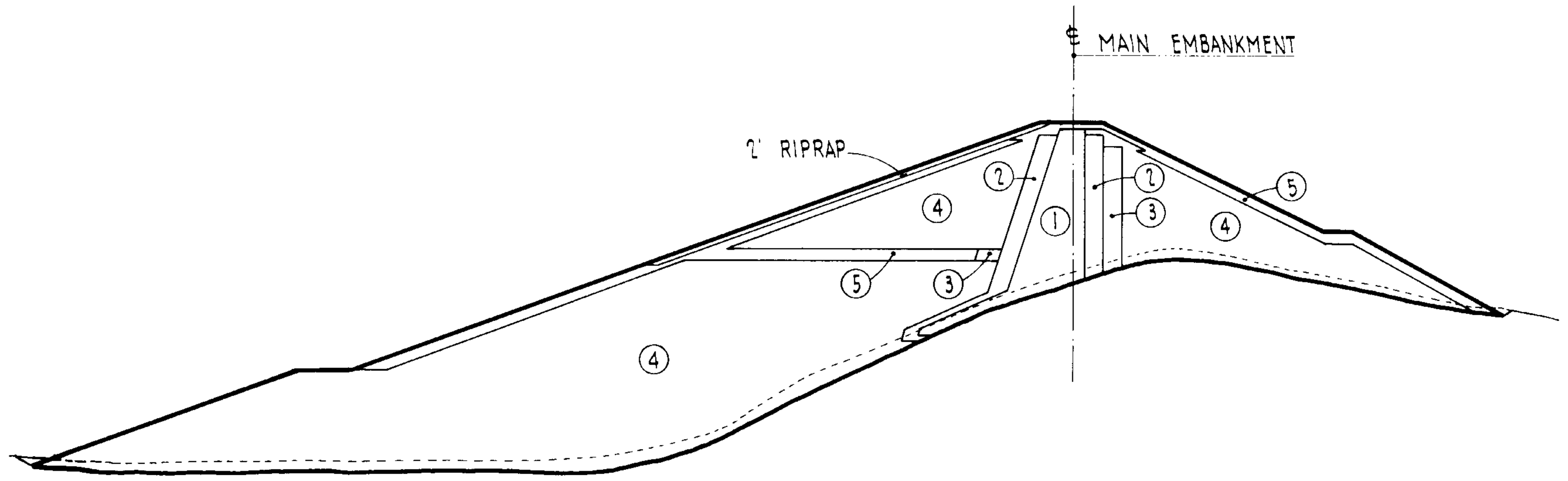
SECTION AT STA. 33+00



SECTION AT STA. 31+00



SECTION AT STA. 30+00



SECTION AT STA. 29+00

SCALE: 1" = 50'

NOTES

1 See note 1 on drawing number 18 for detail.

2 Vertical control of the 3 foot thick section of Zone 3 material, shown by section at station 31+00, will be determined in the field. The bottom of the 3 foot thick Zone 3 section shall not be more than 2 feet above the crest of the ridge after the stripping.

05269

REFERENCE DRAWINGS

FOR REFERENCE DRAWINGS SEE DRAWING NO. 17

AS CONSTRUCTED
DATE 4/5/73 DFT H.H.R. CKD DFM

50' 0 50' 100'
1" = 50'

NO.	DATE	REVISIONS	BY	CH'K	JOB ENG.	PROJ. ENG.	MGR.
1	12/11/70	ISSUED FOR CONSTRUCTION	T.E.N.	R.L.E.	DFM	[illegible]	[illegible]

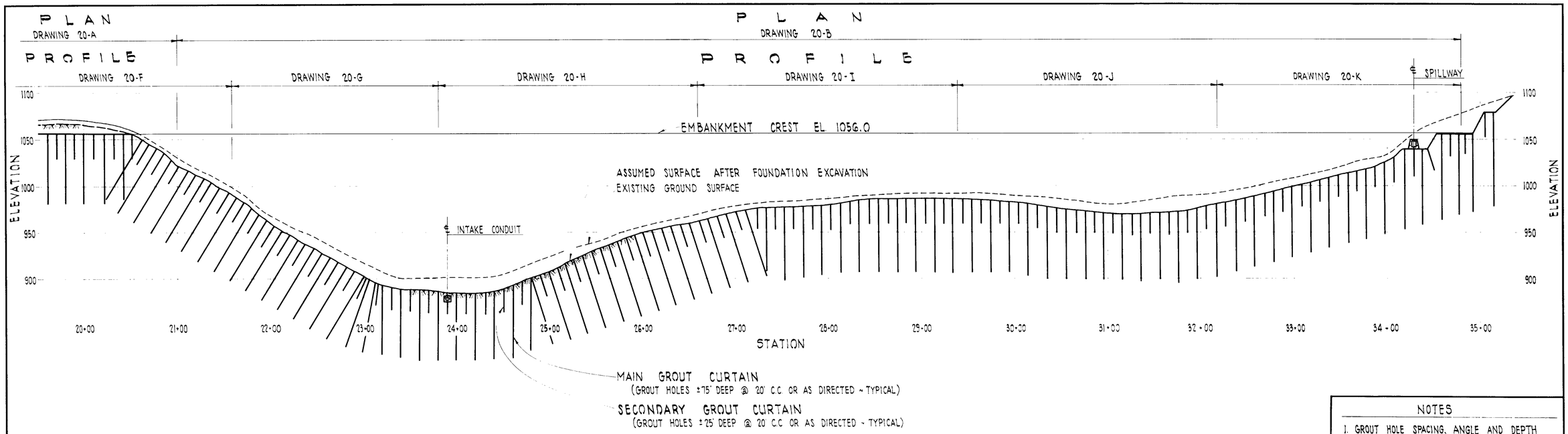
LAS VIRGENES MUNICIPAL WATER DISTRICT

BOYLE ENGINEERING
W. A. WAHLER & ASSOCIATES

WESTLAKE RESERVOIR

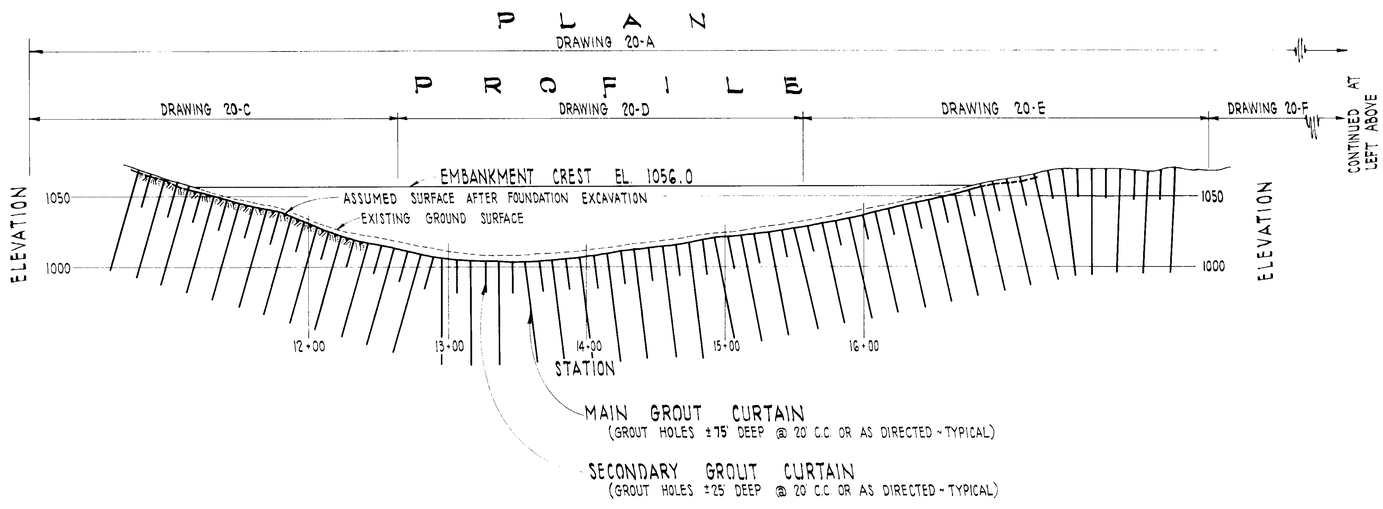
MAIN EMBANKMENT
SECTIONS - SHEET 2 OF 2

DESIGNED F.W.G.	DATE: 11-70	JOB ENG. C.W.P.	PROJ. ENG. [signature]
DRAWN H.H.	L. A. Clayton R.C.E. 9986		DRAWING NUMBER 19
CHECKED C.W.P.			REV.
SCALE AS SHOWN			



MAIN EMBANKMENT - LONGITUDINAL PROFILE

SCALE: 1" = 50'



WEST EMBANKMENT - LONGITUDINAL PROFILE

SCALE: 1" = 50'

INDEX ~ GROUT CURTAIN SUMMARY

NOTES

1. GROUT HOLE SPACING, ANGLE AND DEPTH SHOWN ON THIS SHEET FOR BIDDING PURPOSES ONLY. SEE DRAWINGS INDICATED ON THIS INDEX FOR 'AS CONSTRUCTED' DATA.

05270

REFERENCE DRAWINGS

FOR REFERENCE DRAWINGS SEE DRAWING NO. 17 AND DRAWING NO. 73

AS CONSTRUCTED
DATE 4/5/73 DFT KK CKD DFM

50' 0 50' 100'
1" = 50'

NO.	DATE	REVISIONS	BY	CHK	JOB ENG.	PROJ. ENG.	MGR.
△	12/11/72	ISSUED FOR CONSTRUCTION	REMARE	DFM			

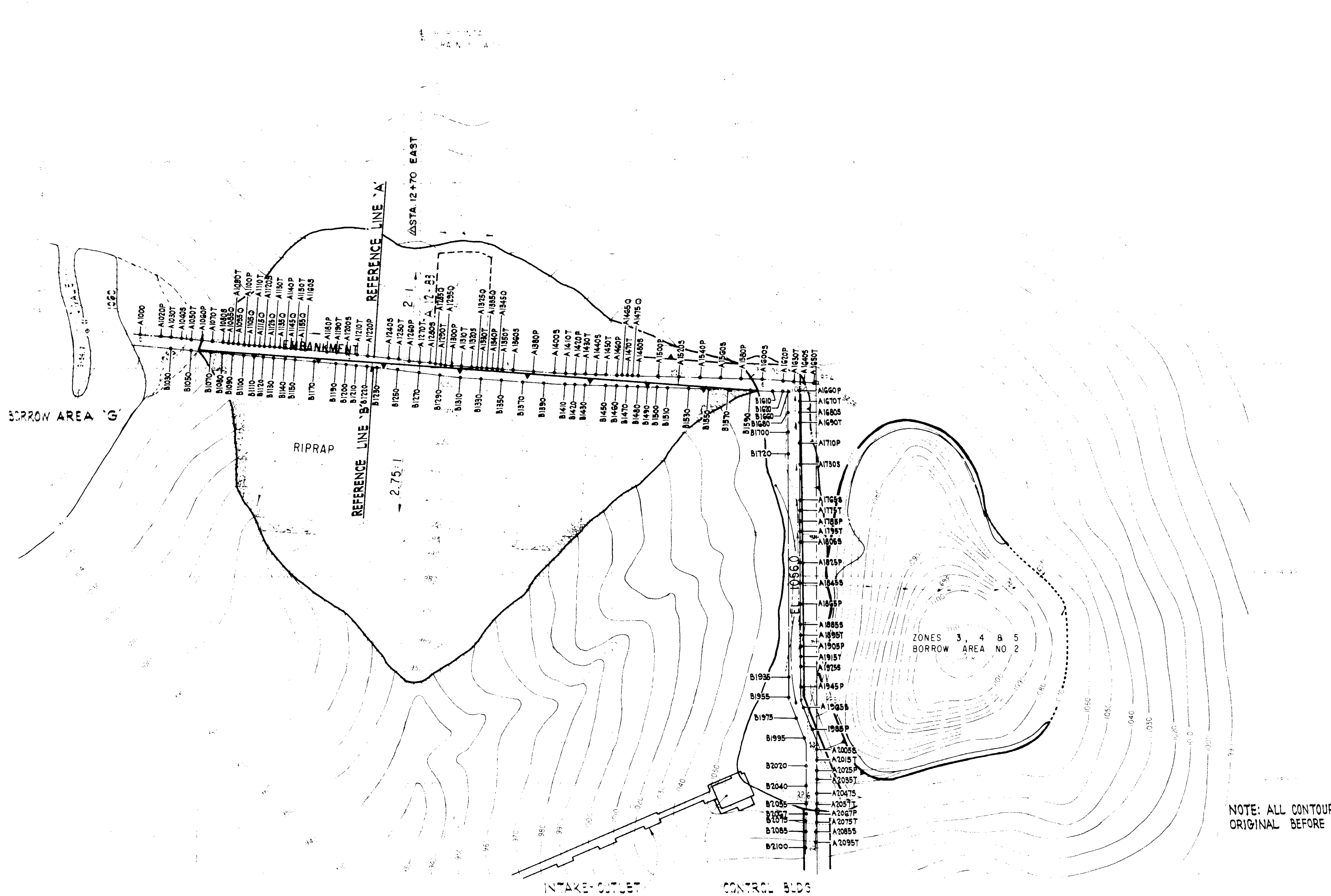
LAS VIRGENES MUNICIPAL WATER DISTRICT

BOYLE ENGINEERING
W. A. WAHLER & ASSOCIATES

WESTLAKE RESERVOIR

MAIN & WEST EMBANKMENTS
LONGITUDINAL PROFILES

DESIGNED F.W.G.	DATE: 11-70	JOB ENG. C.W.P.	PROJ. ENG.
DRAWN KK			DRAWING NUMBER 20
CHECKED C.W.P.			REV.
SCALE AS SHOWN	R. C. E. 9996		



NOTE: ALL CONTOURS INDICATED ARE ORIGINAL BEFORE STRIPPING.

SEE SHEET 20-B FOR CONTINUATION OF GROUT HOLE LOCATIONS.

PLAN

SCALE 1" = 50'

NOTES

- INDICATES GROUT HOLE LOCATION UP TO 25' IN DEPTH.
- INDICATES GROUT HOLE LOCATION OVER 25' IN DEPTH.

AS CONSTRUCTED

DATE 4/5/73 DFT R.H.R. CKD D.F.M.

REFERENCE DRAWINGS

20 LONGITUDINAL PROFILES
24 SECTIONS

05271

50' 0 50' 100'

1" = 50'

NO.	DATE	REVISIONS	BY	CH'K	JOB ENG.	PROJ. MGR.
△	11/1/70	Issued For Construction	T.E.N.	R.R.B.	D.F.M.	J.H.

LAS VIRGENES MUNICIPAL WATER DISTRICT

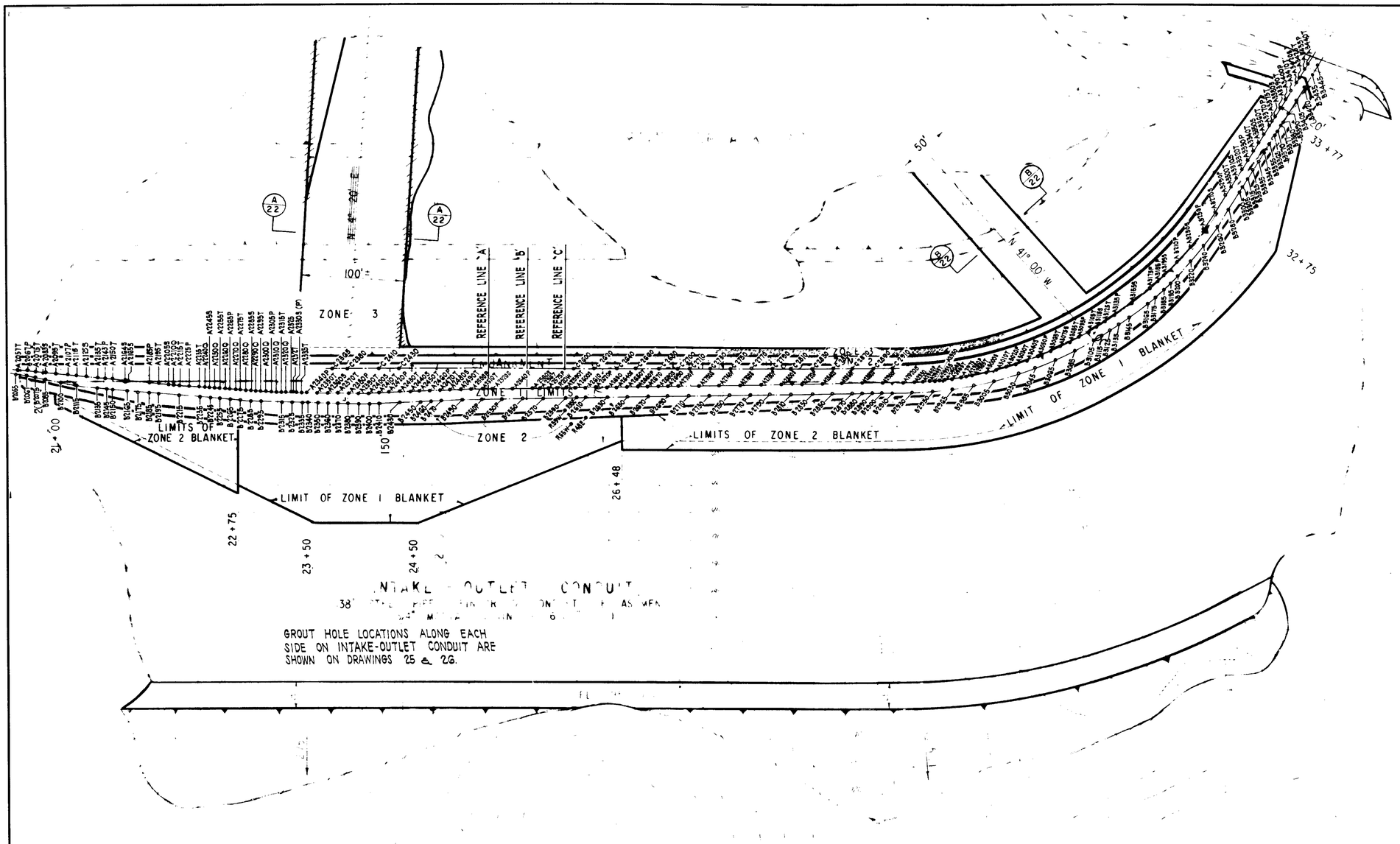
BOYLE ENGINEERING
W. A. WAHLER & ASSOCIATES

WESTLAKE RESERVOIR

WEST EMBANKMENT

GROUT HOLE LOCATIONS - SHEET 1 OF 2

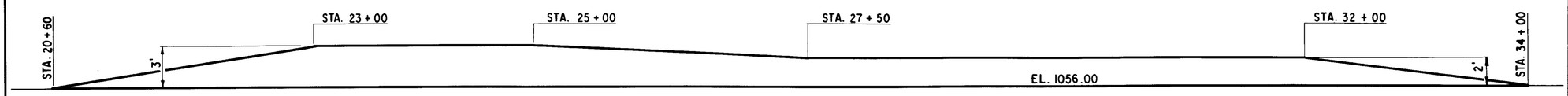
DESIGNED F.W.G.	DATE: 11-70	JOB ENG. C.W.P.	PROJ. ENG.
DRAWN T.E.N.		DRAWING NUMBER	REV.
CHECKED C.W.P.	L. A. Clayton R.C.E. 9986	20-A	
SCALE AS SHOWN			



PLAN ~ AT FOUNDATION ~ CONTACT

SCALE: 1" = 50'

NOTE: ALL CONTOURS INDICATED ARE ORIGINAL BEFORE STRIPPING.



CAMBER DIAGRAM

HORIZ. SCALE: 1" = 20'
VERT. SCALE: 1" = 4'

AS CONSTRUCTED
DATE 4/15/13 DFT [illegible] CAD DFM

REFERENCE DRAWINGS

FOR REFERENCE DRAWINGS SEE DRAWING NO. 17

05272

50' 0 50' 100'
1" = 50'

NO.	DATE	REVISIONS	BY	CHK	JOB ENG.	PROJ ENG.	MGR.
1	4/11/13	ISSUED FOR CONSTRUCTION	TEA	RLE	CTM		

LAS VIRGENES MUNICIPAL WATER DISTRICT

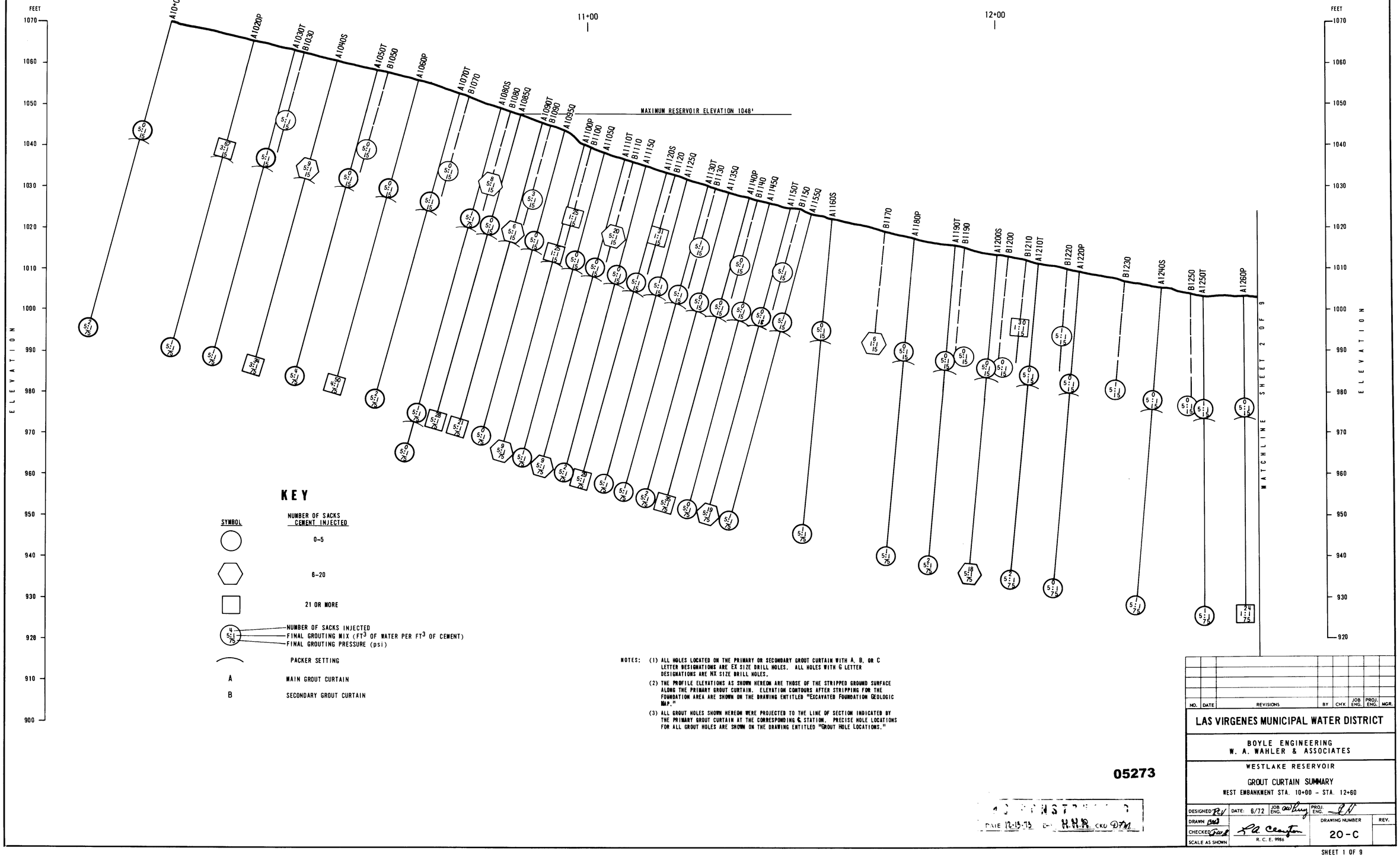
BOYLE ENGINEERING
W. A. WAHLER & ASSOCIATES

WESTLAKE RESERVOIR

MAIN EMBANKMENT

GROUT HOLE LOCATIONS - SHEET 2 OF 2

DESIGNED F.W.G.	DATE: 11-70	JOB ENG. C.W.P.	PROJ. ENG.
DRAWN [illegible]			DRAWING NUMBER 20-B
CHECKED C.W.P.	R. C. E. 9986		REV.
SCALE AS SHOWN			



KEY

SYMBOL	NUMBER OF SACKS CEMENT INJECTED
○	0–5
⬡	6–20
□	21 OR MORE
4 / 5:1 / 75	NUMBER OF SACKS INJECTED FINAL GROUTING MIX (FT³ OF WATER PER FT³ OF CEMENT) FINAL GROUTING PRESSURE (psi)
⌒	PACKER SETTING
A	MAIN GROUT CURTAIN
B	SECONDARY GROUT CURTAIN

NOTES:
(1) ALL HOLES LOCATED ON THE PRIMARY OR SECONDARY GROUT CURTAIN WITH A, B, OR C LETTER DESIGNATIONS ARE EX SIZE DRILL HOLES. ALL HOLES WITH G LETTER DESIGNATIONS ARE NX SIZE DRILL HOLES.
(2) THE PROFILE ELEVATIONS AS SHOWN HEREON ARE THOSE OF THE STRIPPED GROUND SURFACE ALONG THE PRIMARY GROUT CURTAIN. ELEVATION CONTOURS AFTER STRIPPING FOR THE FOUNDATION AREA ARE SHOWN ON THE DRAWING ENTITLED "EXCAVATED FOUNDATION GEOLOGIC MAP."
(3) ALL GROUT HOLES SHOWN HEREON WERE PROJECTED TO THE LINE OF SECTION INDICATED BY THE PRIMARY GROUT CURTAIN AT THE CORRESPONDING ℄ STATION. PRECISE HOLE LOCATIONS FOR ALL GROUT HOLES ARE SHOWN ON THE DRAWING ENTITLED "GROUT HOLE LOCATIONS."

05273

DATE 12-15-75 BY H.H.R. CKD D.F.M.

NO.	DATE	REVISIONS	BY	CHK	JOB ENG.	PROJ. ENG.	MGR.

LAS VIRGENES MUNICIPAL WATER DISTRICT

BOYLE ENGINEERING
W. A. WAHLER & ASSOCIATES

WESTLAKE RESERVOIR

GROUT CURTAIN SUMMARY
WEST EMBANKMENT STA. 10+00 – STA. 12+60

DESIGNED RV	DATE: 6/72	JOB ENG.	PROJ. ENG.
DRAWN BMB			
CHECKED	R. A. Creighton R. C. E. 9986	DRAWING NUMBER 20-C	REV.
SCALE AS SHOWN			

SHEET 1 OF 9

NOTES:

(1) ALL HOLES LOCATED ON THE PRIMARY OR SECONDARY GROUT CURTAIN WITH A, B, OR C LETTER DESIGNATIONS ARE EX SIZE DRILL HOLES. ALL HOLES WITH G LETTER DESIGNATIONS ARE NX SIZE DRILL HOLES.

(2) THE PROFILE ELEVATIONS AS SHOWN HEREON ARE THOSE OF THE STRIPPED GROUND SURFACE ALONG THE PRIMARY GROUT CURTAIN. ELEVATION CONTOURS AFTER STRIPPING FOR THE FOUNDATION AREA ARE SHOWN ON THE DRAWING ENTITLED "EXCAVATED FOUNDATION GEOLOGIC MAP."

(3) ALL GROUT HOLES SHOWN HEREON WERE PROJECTED TO THE LINE OF SECTION INDICATED BY THE PRIMARY GROUT CURTAIN AT THE CORRESPONDING ℄ STATION. PRECISE HOLE LOCATIONS FOR ALL GROUT HOLES ARE SHOWN ON THE DRAWING ENTITLED "GROUT HOLE LOCATIONS."

AS CONSTRUCTED
DATE 12-13-73 DFT H.H.R. CKD DFM

NO.	DATE	REVISIONS	BY	CH'K	JOB ENG.	PROJ. ENG.	MGR.

LAS VIRGENES MUNICIPAL WATER DISTRICT

BOYLE ENGINEERING
W. A. WAHLER & ASSOCIATES

WESTLAKE RESERVOIR

GROUT CURTAIN SUMMARY

WEST EMBANKMENT STA. 12+70 - STA. 15+50

DESIGNED R.L.V. DATE: 6/72 JOB ENG. C.W. Perry PROJ. ENG.
DRAWN B.S.B.
CHECKED J.A.G. L. A. Clayton R. C. E. 9980
SCALE AS SHOWN
DRAWING NUMBER 20-D REV.

SHEET 2 OF 9

05275

KEY

SYMBOL	NUMBER OF SACKS OF CEMENT INJECTED
◯	0–5
⬡	6–20
□	21 OR MORE

- NUMBER OF SACKS INJECTED
- FINAL GROUTING MIX (FT³ OF WATER PER FT³ OF CEMENT)
- FINAL GROUTING PRESSURE (psi)
- ⌒ PACKER SETTING
- A MAIN GROUT CURTAIN
- B SECONDARY GROUT CURTAIN

NOTES:

(1) ALL HOLES LOCATED ON THE PRIMARY OR SECONDARY GROUT CURTAIN WITH A, B, OR C LETTER DESIGNATIONS ARE EX SIZE DRILL HOLES. ALL HOLES WITH G LETTER DESIGNATIONS ARE NX SIZE DRILL HOLES.

(2) THE PROFILE ELEVATIONS AS SHOWN HEREON ARE THOSE OF THE STRIPPED GROUND SURFACE ALONG THE PRIMARY GROUT CURTAIN. ELEVATION CONTOURS AFTER STRIPPING FOR THE FOUNDATION AREA ARE SHOWN ON THE DRAWING ENTITLED "EXCAVATED FOUNDATION GEOLOGIC MAP."

(3) ALL GROUT HOLES SHOWN HEREON WERE PROJECTED TO THE LINE OF SECTION INDICATED BY THE PRIMARY GROUT CURTAIN AT THE CORRESPONDING ℄ STATION. PRECISE HOLE LOCATIONS FOR ALL GROUT HOLES ARE SHOWN ON THE DRAWING ENTITLED "GROUT HOLE LOCATIONS."

AS CONSTRUCTED
DATE 12-13-73 DFT H.H.A. CKD D.T.M.

NO.	DATE	REVISIONS	BY	CH'K	JOB ENG.	PROJ. ENG.	MGR.

LAS VIRGENES MUNICIPAL WATER DISTRICT

BOYLE ENGINEERING
W. A. WAHLER & ASSOCIATES

WESTLAKE RESERVOIR
GROUT CURTAIN SUMMARY
RESERVOIR RIM STA. 15+60 – STA. 18+45.

DESIGNED R.L.V. | DATE: 6/72 | JOB ENG. C.W. Perry | PROJ. ENG.
DRAWN | CHECKED | SCALE AS SHOWN
L. A. Clayton, R.C.E.
DRAWING NUMBER 20-E | REV.

SHEET 3 OF 9

19+00

20+00

21+00

FEET

ELEVATION

1070
1060
1050
1040
1030
1020
1010
1000
990
980
970
960
950
940
930
920

MATCHLINE SHEET 3 OF 9

A1865P
A1885S
A1895T
A1905P
A1915T
A1925S
B1935
A1945P
B1955
A1965S
B1975
A1985P
B1995
A2005S
A2015T
B2020
A2025P
A2035T
B2040
A2047S
B2055
A2057T
B2067
A2071P
B2075
A2075T
B2085
A2085S
A2095T
B2100
A2107P
G-6 STA. 21+10
B2115
A2115T
A2123S
B2135
A2135T
A2143P
B2145
B2150
A2150T

MATCHLINE SHEET 5 OF 9

FEET

ELEVATION

1070
1060
1050
1040
1030
1020
1010
1000
990
980
970
960
950

KEY

SYMBOL	NUMBER OF SACKS OF CEMENT INJECTED
○	0–5
⬡	6–20
□	21 OR MORE

- 4 / 5:1 / 75 — NUMBER OF SACKS INJECTED / FINAL GROUTING MIX (FT^3 OF WATER PER FT^3 OF CEMENT) / FINAL GROUTING PRESSURE (psi)
- PACKER SETTING
- A — MAIN GROUT CURTAIN
- B — SECONDARY GROUT CURTAIN

NOTES:
(1) ALL HOLES LOCATED ON THE PRIMARY OR SECONDARY GROUT CURTAIN WITH A, B, OR C LETTER DESIGNATIONS ARE EX SIZE DRILL HOLES. ALL HOLES WITH G LETTER DESIGNATIONS ARE MX SIZE DRILL HOLES.
(2) THE PROFILE ELEVATIONS AS SHOWN HEREON ARE THOSE OF THE STRIPPED GROUND SURFACE ALONG THE PRIMARY GROUT CURTAIN. ELEVATION CONTOURS AFTER STRIPPING FOR THE FOUNDATION AREA ARE SHOWN ON THE DRAWING ENTITLED "EXCAVATED FOUNDATION GEOLOGIC MAP."
(3) ALL GROUT HOLES SHOWN HEREON WERE PROJECTED TO THE LINE OF SECTION INDICATED BY THE PRIMARY GROUT CURTAIN AT THE CORRESPONDING ℄ STATION. PRECISE HOLE LOCATIONS FOR ALL GROUT HOLES ARE SHOWN ON THE DRAWING ENTITLED "GROUT HOLE LOCATIONS."

AS CONSTRUCTED
DATE 12-19-73 DFT H.H.B.

05276

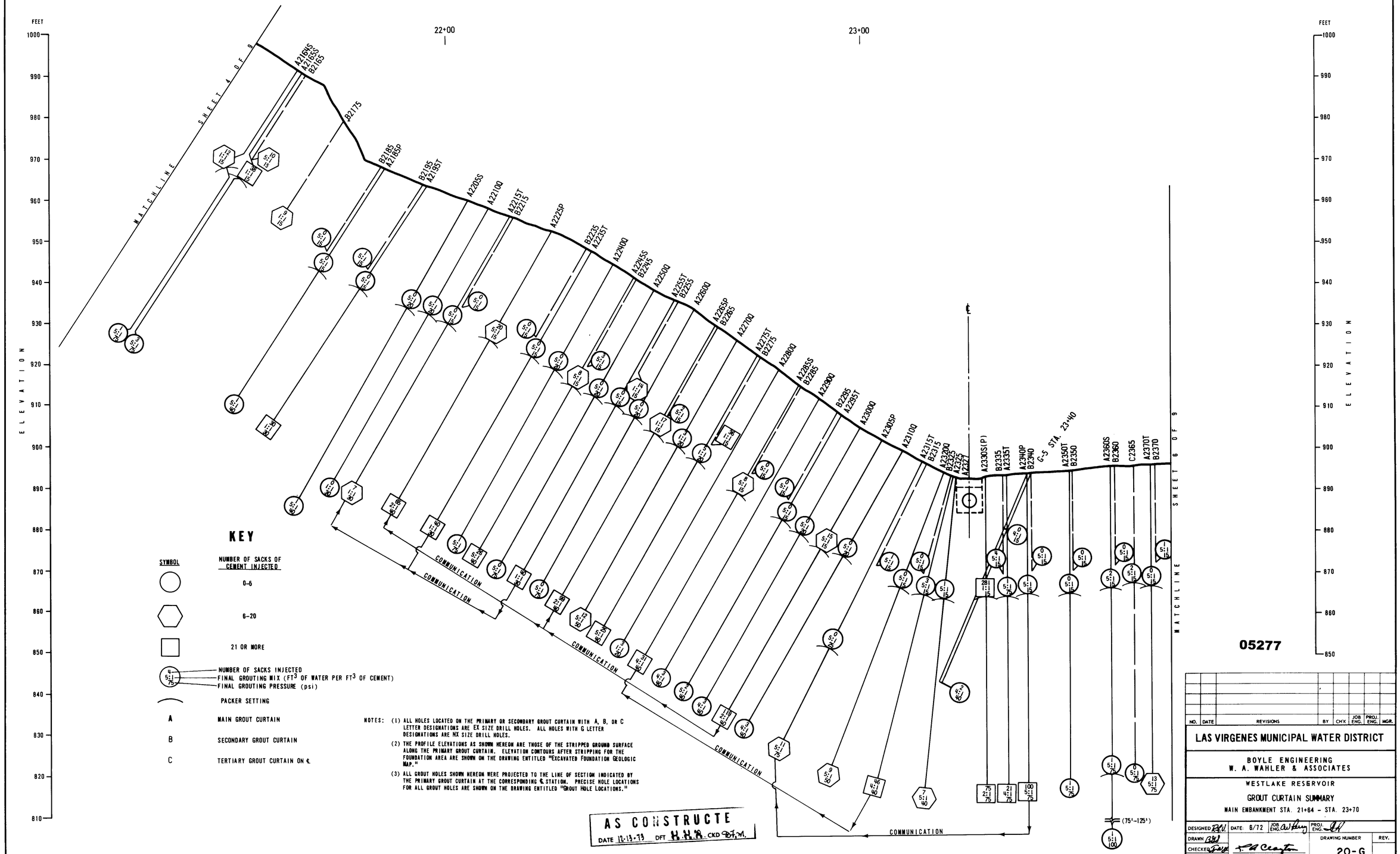
LAS VIRGENES MUNICIPAL WATER DISTRICT

BOYLE ENGINEERING
W. A. WAHLER & ASSOCIATES

WESTLAKE RESERVOIR

GROUT CURTAIN SUMMARY
MAIN EMBANKMENT STA. 18+65 – STA. 21+50

DESIGNED RCW	DATE: 6/72	JOB ENG.	PROJ. ENG.	
DRAWN BAH			DRAWING NUMBER	REV.
CHECKED	R. C. E. 9986		20-F	
SCALE AS SHOWN				



KEY

SYMBOL	NUMBER OF SACKS OF CEMENT INJECTED
○	0-6
⬡	6-20
□	21 OR MORE

NUMBER OF SACKS INJECTED
FINAL GROUTING MIX (FT^3 OF WATER PER FT^3 OF CEMENT)
FINAL GROUTING PRESSURE (psi)

PACKER SETTING

A — MAIN GROUT CURTAIN

B — SECONDARY GROUT CURTAIN

C — TERTIARY GROUT CURTAIN ON ℄

NOTES:
(1) ALL HOLES LOCATED ON THE PRIMARY OR SECONDARY GROUT CURTAIN WITH A, B, OR C LETTER DESIGNATIONS ARE EX SIZE DRILL HOLES. ALL HOLES WITH G LETTER DESIGNATIONS ARE NX SIZE DRILL HOLES.
(2) THE PROFILE ELEVATIONS AS SHOWN HEREON ARE THOSE OF THE STRIPPED GROUND SURFACE ALONG THE PRIMARY GROUT CURTAIN. ELEVATION CONTOURS AFTER STRIPPING FOR THE FOUNDATION AREA ARE SHOWN ON THE DRAWING ENTITLED "EXCAVATED FOUNDATION GEOLOGIC MAP."
(3) ALL GROUT HOLES SHOWN HEREON WERE PROJECTED TO THE LINE OF SECTION INDICATED BY THE PRIMARY GROUT CURTAIN AT THE CORRESPONDING ℄ STATION. PRECISE HOLE LOCATIONS FOR ALL GROUT HOLES ARE SHOWN ON THE DRAWING ENTITLED "GROUT HOLE LOCATIONS."

AS CONSTRUCTE
DATE 12-13-73 DFT H.H.A. CKD B.F.M.

05277

NO.	DATE	REVISIONS	BY	CH'K	JOB ENG.	PROJ. ENG.	MGR.

LAS VIRGENES MUNICIPAL WATER DISTRICT

BOYLE ENGINEERING
W. A. WAHLER & ASSOCIATES

WESTLAKE RESERVOIR

GROUT CURTAIN SUMMARY

MAIN EMBANKMENT STA. 21+64 – STA. 23+70

DESIGNED	DATE: 6/72	JOB ENG.	PROJ. ENG.	DRAWING NUMBER	REV.
DRAWN				20-G	
CHECKED	R. C. E. 9986				
SCALE AS SHOWN					

05278

NOTES:

(1) ALL HOLES LOCATED ON THE PRIMARY OR SECONDARY GROUT CURTAIN WITH A, B, OR C LETTER DESIGNATIONS ARE EX SIZE DRILL HOLES. ALL HOLES WITH G LETTER DESIGNATIONS ARE NX SIZE DRILL HOLES.

(2) THE PROFILE ELEVATIONS AS SHOWN HEREON ARE THOSE OF THE STRIPPED GROUND SURFACE ALONG THE PRIMARY GROUT CURTAIN. ELEVATION CONTOURS AFTER STRIPPING FOR THE FOUNDATION AREA ARE SHOWN ON THE DRAWING ENTITLED "EXCAVATED FOUNDATION GEOLOGIC MAP."

(3) ALL GROUT HOLES SHOWN HEREON WERE PROJECTED TO THE LINE OF SECTION INDICATED BY THE PRIMARY GROUT CURTAIN AT THE CORRESPONDING ℄ STATION. PRECISE HOLE LOCATIONS FOR ALL GROUT HOLES ARE SHOWN ON THE DRAWING ENTITLED "GROUT HOLE LOCATIONS."

(4) GROUT HOLES INDICATED AS 2582R20W WERE PROJECTED TO THE PROFILE OF THE PRIMARY GROUT CURTAIN; HOWEVER, THE ACTUAL NIPPLE ELEVATION OF THE GROUT HOLE IS SHOWN AT THE TOP OF THE STICK LOG. THE HOLE DESIGNATION INDICATES THE STATION LOCATION OF THE NIPPLE, WHETHER THE HOLE IS RIGHT (R) OR LEFT (L) OF THE PRIMARY GROUT CURTAIN LOOKING UPSTATION, THE DISTANCE OF THE GROUT HOLE FROM THE PRIMARY CURTAIN, AND WHETHER THE HOLE WAS EAST (E) OR WEST (W) OF THE SURFACE EXPOSURE OF AN INTRUSIVE, ANDESITIC DIKE WHICH CROSSED THE PRIMARY GROUT CURTAIN LINE AT ABOUT STA 25+75.

AS CONSTRUCTED
DATE 12-13-73 DFT H.H.R. CKD D.F.M.

NO.	DATE	REVISIONS	BY	CH'K	JOB ENG.	PROJ. ENG.	MGR.

LAS VIRGENES MUNICIPAL WATER DISTRICT

BOYLE ENGINEERING
W. A. WAHLER & ASSOCIATES

WESTLAKE RESERVOIR
GROUT CURTAIN SUMMARY
MAIN EMBANKMENT STA. 23+80 – STA. 26+50

DESIGNED R.L.V. DATE: 6/72 JOB ENG. C.W. Perry PROJ. ENG.
DRAWN B.W.S.
CHECKED F.W.S.
SCALE AS SHOWN
R. A. Crayton R. C. E. 9986
DRAWING NUMBER 20-H
REV.

KEY

SYMBOL	NUMBER OF SACKS OF CEMENT INJECTED
○	0–5
⬡	6–20
□	21 OR MORE

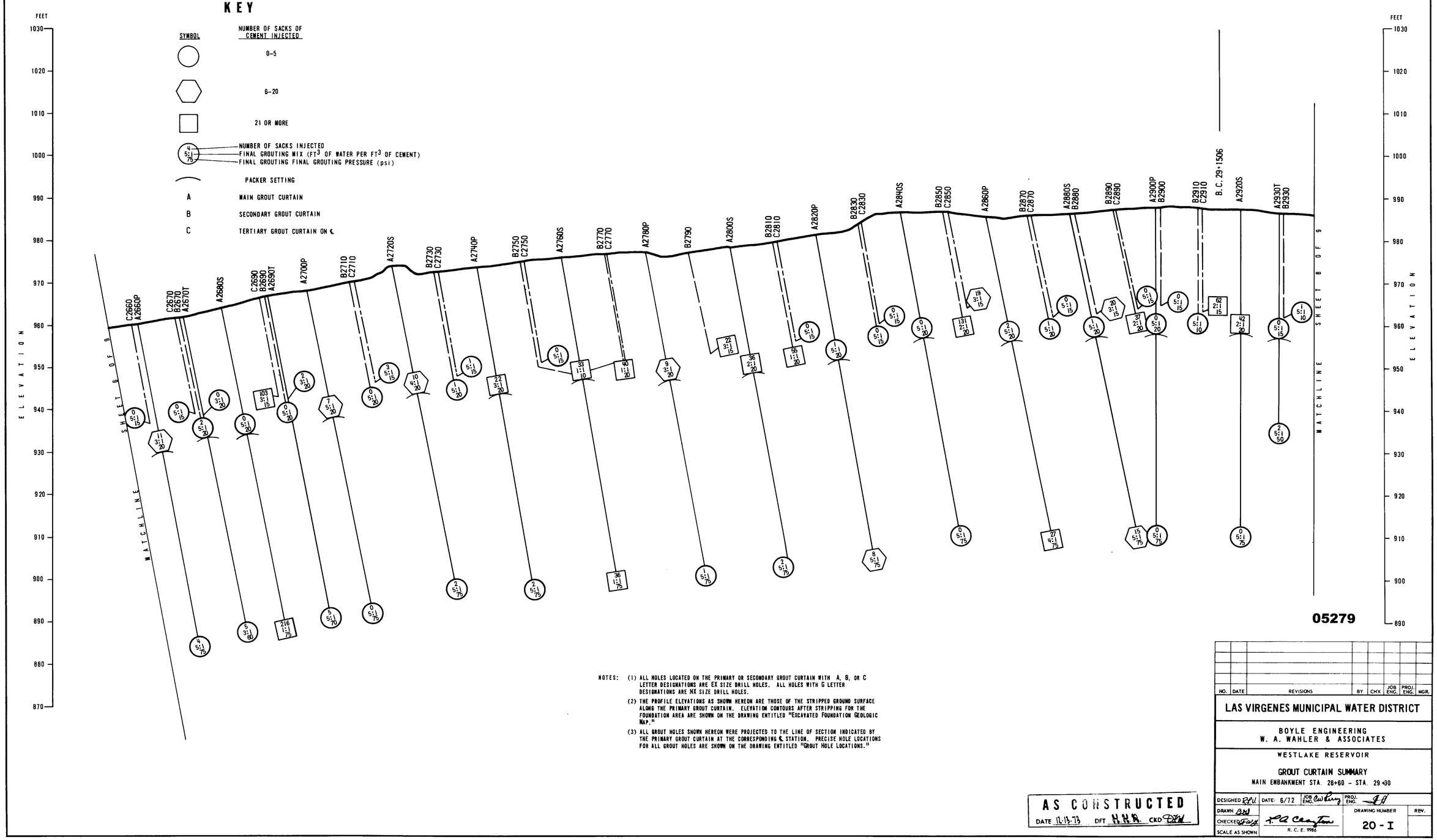
NUMBER OF SACKS INJECTED / FINAL GROUTING MIX (FT^3 OF WATER PER FT^3 OF CEMENT) / FINAL GROUTING FINAL GROUTING PRESSURE (psi)

PACKER SETTING

A — MAIN GROUT CURTAIN

B — SECONDARY GROUT CURTAIN

C — TERTIARY GROUT CURTAIN ON ℄



NOTES:

(1) ALL HOLES LOCATED ON THE PRIMARY OR SECONDARY GROUT CURTAIN WITH A, B, OR C LETTER DESIGNATIONS ARE EX SIZE DRILL HOLES. ALL HOLES WITH G LETTER DESIGNATIONS ARE NX SIZE DRILL HOLES.

(2) THE PROFILE ELEVATIONS AS SHOWN HEREON ARE THOSE OF THE STRIPPED GROUND SURFACE ALONG THE PRIMARY GROUT CURTAIN. ELEVATION CONTOURS AFTER STRIPPING FOR THE FOUNDATION AREA ARE SHOWN ON THE DRAWING ENTITLED "EXCAVATED FOUNDATION GEOLOGIC MAP."

(3) ALL GROUT HOLES SHOWN HEREON WERE PROJECTED TO THE LINE OF SECTION INDICATED BY THE PRIMARY GROUT CURTAIN AT THE CORRESPONDING ℄ STATION. PRECISE HOLE LOCATIONS FOR ALL GROUT HOLES ARE SHOWN ON THE DRAWING ENTITLED "GROUT HOLE LOCATIONS."

AS CONSTRUCTED
DATE 12-13-73 DFT H.H.B. CKD DFM

NO.	DATE	REVISIONS	BY	CH'K	JOB ENG.	PROJ. ENG.	MGR.

LAS VIRGENES MUNICIPAL WATER DISTRICT

BOYLE ENGINEERING
W. A. WAHLER & ASSOCIATES

WESTLAKE RESERVOIR

GROUT CURTAIN SUMMARY
MAIN EMBANKMENT STA. 26+60 – STA. 29+30

DESIGNED RDU	DATE: 6/72	JOB ENG.	PROJ. ENG.
DRAWN BJH			
CHECKED	R. C. E. 9986	DRAWING NUMBER 20 - I	REV.
SCALE AS SHOWN			

SHEET 7 OF 9

KEY

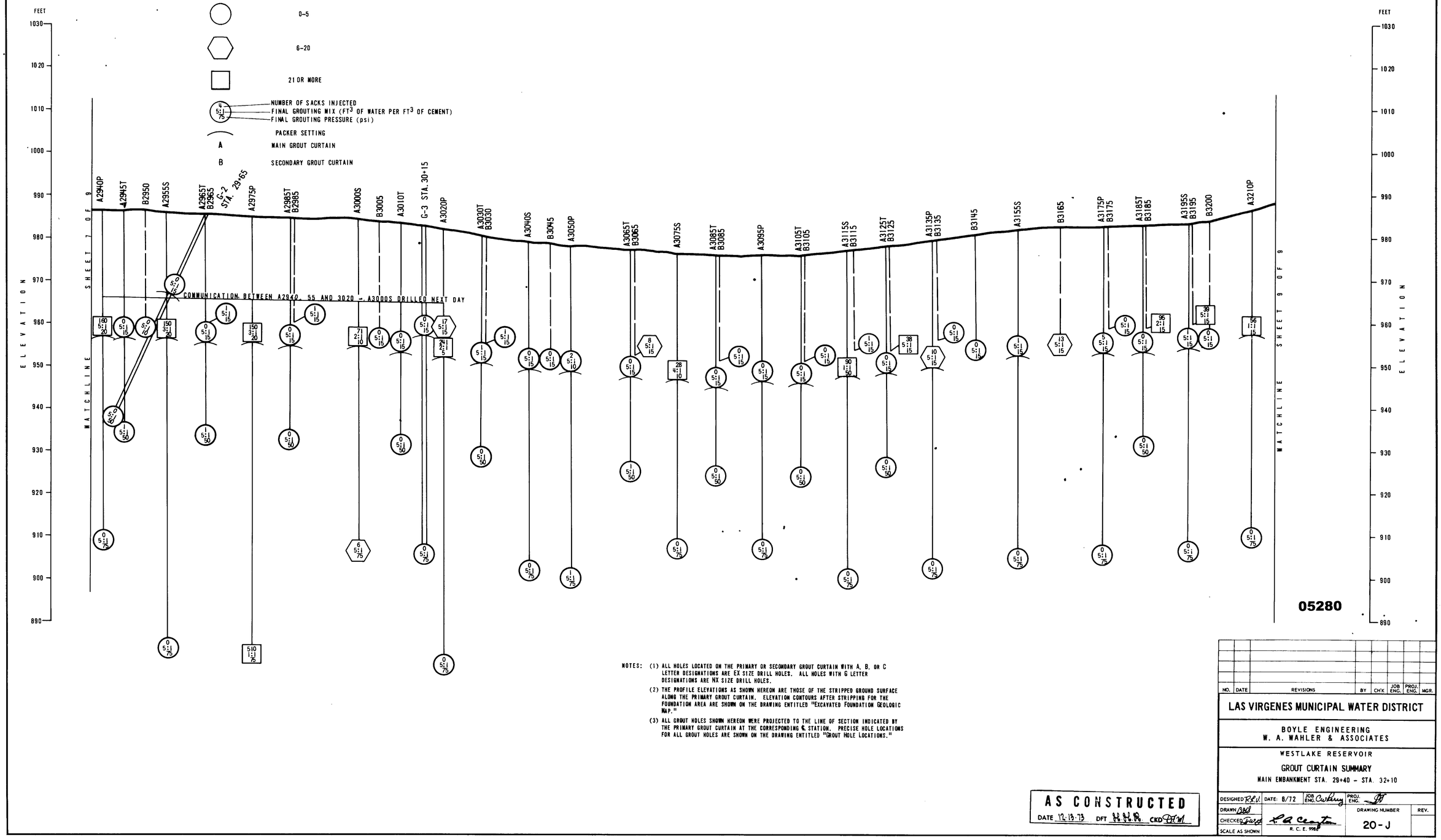
SYMBOL	NUMBER OF SACKS OF CEMENT INJECTED
○	0–5
⬡	6–20
□	21 OR MORE

4 / 5:1 / 75 — NUMBER OF SACKS INJECTED; FINAL GROUTING MIX (FT^3 OF WATER PER FT^3 OF CEMENT); FINAL GROUTING PRESSURE (psi)

PACKER SETTING

A — MAIN GROUT CURTAIN

B — SECONDARY GROUT CURTAIN



NOTES:

(1) ALL HOLES LOCATED ON THE PRIMARY OR SECONDARY GROUT CURTAIN WITH A, B, OR C LETTER DESIGNATIONS ARE EX SIZE DRILL HOLES. ALL HOLES WITH G LETTER DESIGNATIONS ARE NX SIZE DRILL HOLES.

(2) THE PROFILE ELEVATIONS AS SHOWN HEREON ARE THOSE OF THE STRIPPED GROUND SURFACE ALONG THE PRIMARY GROUT CURTAIN. ELEVATION CONTOURS AFTER STRIPPING FOR THE FOUNDATION AREA ARE SHOWN ON THE DRAWING ENTITLED "EXCAVATED FOUNDATION GEOLOGIC MAP."

(3) ALL GROUT HOLES SHOWN HEREON WERE PROJECTED TO THE LINE OF SECTION INDICATED BY THE PRIMARY GROUT CURTAIN AT THE CORRESPONDING ℄ STATION. PRECISE HOLE LOCATIONS FOR ALL GROUT HOLES ARE SHOWN ON THE DRAWING ENTITLED "GROUT HOLE LOCATIONS."

AS CONSTRUCTED
DATE 12-13-73 DFT [illegible] CKD [illegible]

NO.	DATE	REVISIONS	BY	CH'K	JOB ENG.	PROJ. ENG.	MGR.

LAS VIRGENES MUNICIPAL WATER DISTRICT

BOYLE ENGINEERING
W. A. WAHLER & ASSOCIATES

WESTLAKE RESERVOIR

GROUT CURTAIN SUMMARY

MAIN EMBANKMENT STA. 29+40 – STA. 32+10

DESIGNED R.R.V.	DATE: 8/72	JOB ENG. Ackley	PROJ. ENG. [illegible]	
DRAWN [illegible]		DRAWING NUMBER		REV.
CHECKED [illegible]		R. C. E. 9980	20-J	
SCALE AS SHOWN				

05280

KEY

SYMBOL	NUMBER OF SACKS OF CEMENT INJECTED
○	0–5
⬡	6–20
□	21 OR MORE

- NUMBER OF SACKS INJECTED
- FINAL GROUTING MIX (FT³ OF WATER PER FT³ OF CEMENT)
- FINAL GROUTING PRESSURE (psi)

PACKER SETTING

A — MAIN GROUT CURTAIN

B — SECONDARY GROUT CURTAIN

33+00

34+00

FEET

ELEVATION

1080 1070 1060 1050 1040 1030 1020 1010 1000 990 980 970 960 950 940 930 920 910 900

SHEET 8 OF 9

MATCHLINE

MAXIMUM RESERVOIR ELEVATION 1048'

B3220 A3230S B3240 A3250P B3260 32+63.08 E.C. A3270S A3280T B3280 A3290P A3300T B3300 B3305 A3310S G-7 STA. 33+10 B3315 A3320T B3325 A3330P B3335 A3340T B3345 A3350S B3355 A3360T B3365 A3370P B3370 A3375T B3377 B3380 A3380S A3390T B3390 A3400P B3405 G-8 STA. 34+05 A3410T A3420S B3420 A3425T A3435P B3435 A3440T B3445

NOTES:

(1) ALL HOLES LOCATED ON THE PRIMARY OR SECONDARY GROUT CURTAIN WITH A, B, OR C LETTER DESIGNATIONS ARE EX SIZE DRILL HOLES. ALL HOLES WITH G LETTER DESIGNATIONS ARE NX SIZE DRILL HOLES.

(2) THE PROFILE ELEVATIONS AS SHOWN HEREON ARE THOSE OF THE STRIPPED GROUND SURFACE ALONG THE PRIMARY GROUT CURTAIN. ELEVATION CONTOURS AFTER STRIPPING FOR THE FOUNDATION AREA ARE SHOWN ON THE DRAWING ENTITLED "EXCAVATED FOUNDATION GEOLOGIC MAP."

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AS CONSTRUCTED
DATE 12-13-73 DFT H.H.R. CKD DFM

05281

NO.	DATE	REVISIONS	BY	CHK	JOB ENG.	PROJ. ENG.	MGR.

LAS VIRGENES MUNICIPAL WATER DISTRICT

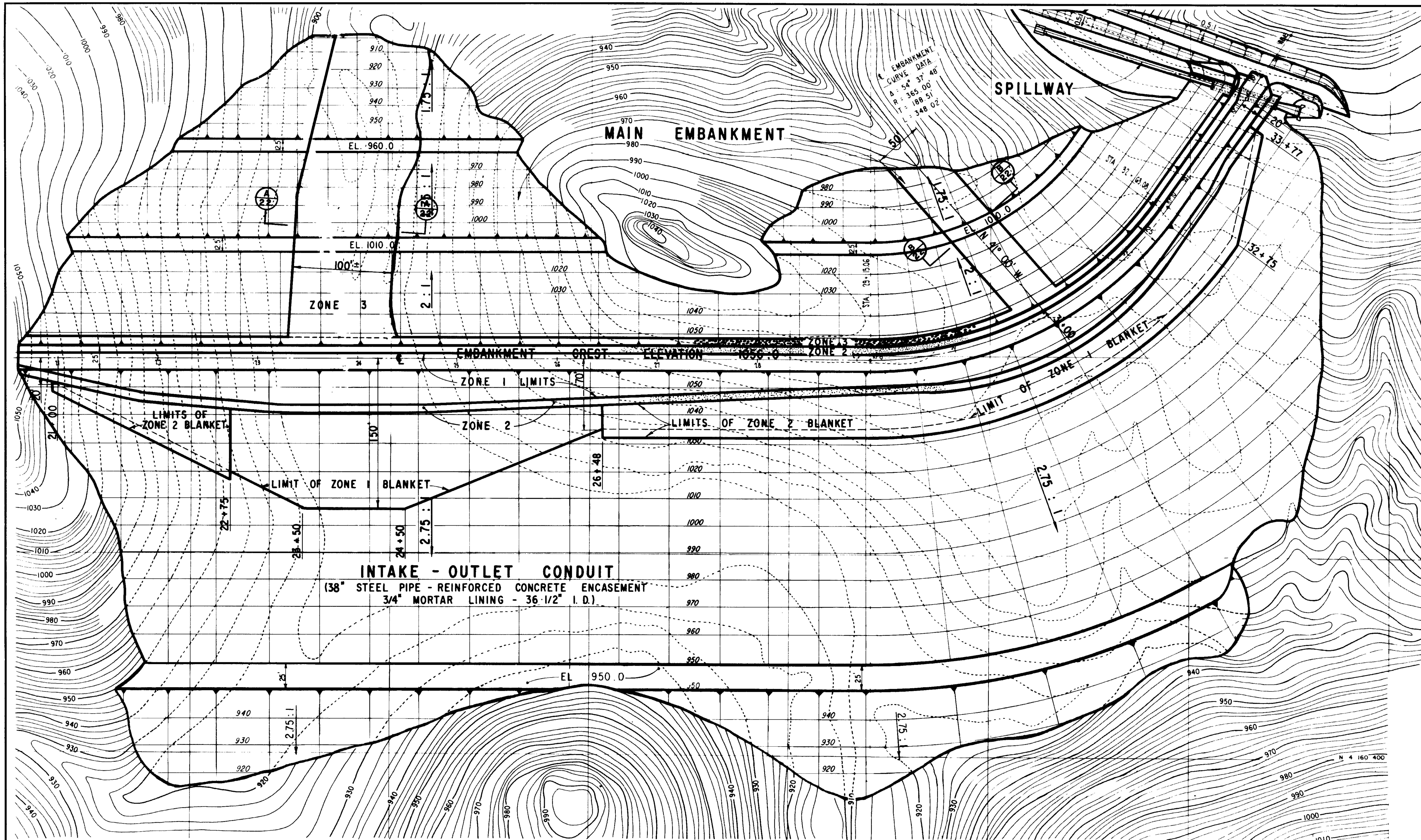
BOYLE ENGINEERING
W. A. WAHLER & ASSOCIATES

WESTLAKE RESERVOIR

GROUT CURTAIN SUMMARY

MAIN EMBANKMENT STA. 32+20 – STA 34+45

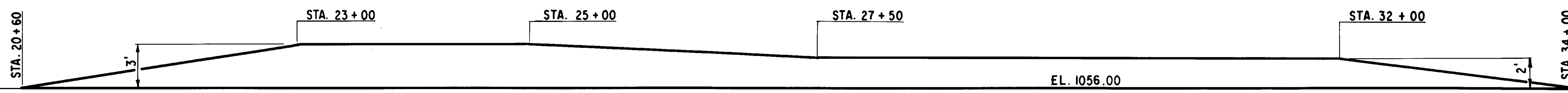
DESIGNED RJV	DATE: 6/72	JOB ENG.	PROJ. ENG.	
DRAWN BJS			DRAWING NUMBER	REV.
CHECKED		R. C. E. 9986	20-K	
SCALE AS SHOWN				



PLAN ~ AT FOUNDATION CONTACT

SCALE: 1" = 50'

NOTE: ALL CONTOURS INDICATED ARE ORIGINAL BEFORE STRIPPING.



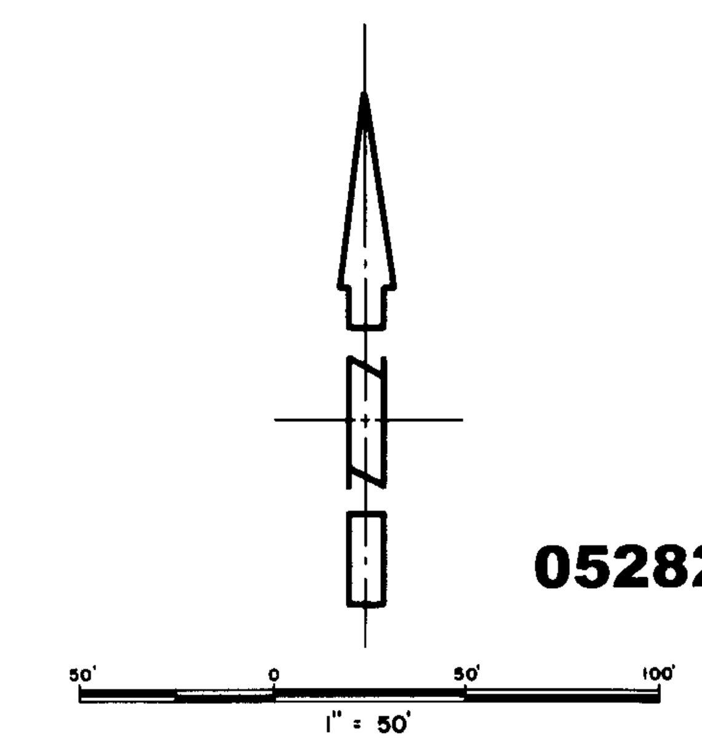
CAMBER DIAGRAM

HORIZ. SCALE: 1" = 20'
VERT. SCALE: 1" = 4'

AS CONSTRUCTED
DATE 4/5/73 DFT H.K.R. CKD D.F.M.

REFERENCE DRAWINGS

FOR REFERENCE DRAWINGS SEE DRAWING NO. 17



05282

NO.	DATE	REVISIONS	BY	CHK	JOB ENG.	PROJ. ENG.	MGR.
1	12/11/70	ISSUED FOR CONSTRUCTION	T.E.M.				

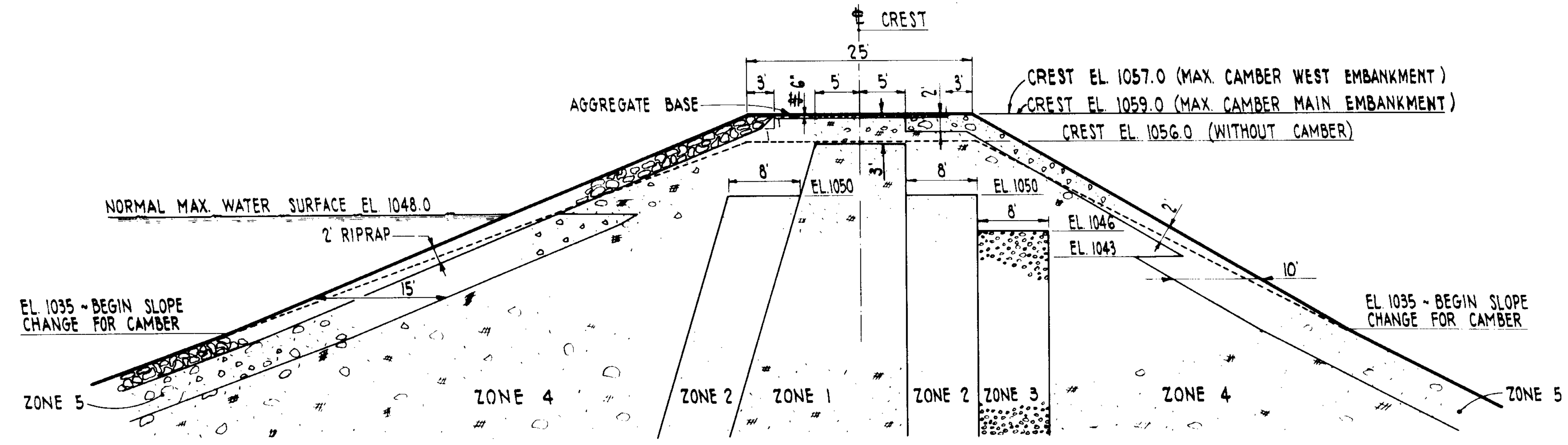
LAS VIRGENES MUNICIPAL WATER DISTRICT

BOYLE ENGINEERING
W. A. WAHLER & ASSOCIATES

WESTLAKE RESERVOIR

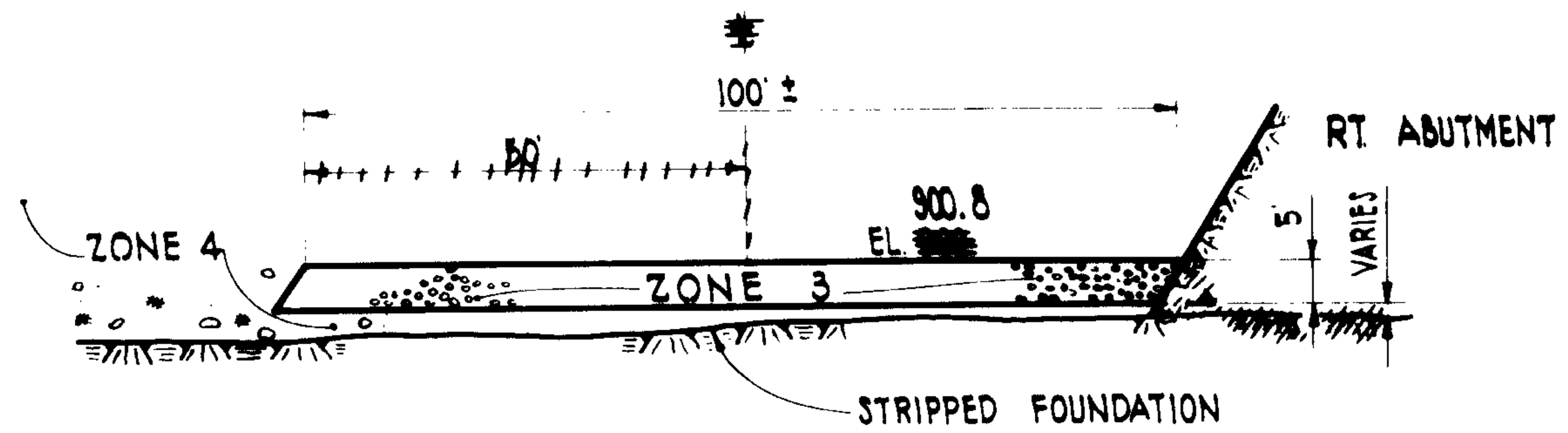
MAIN EMBANKMENT
DETAILS - SHEET 1 OF 2

DESIGNED F.W.G. DATE: 11-70 JOB ENG. C.W.P.
DRAWN H.R.
CHECKED C.W.P.
SCALE AS SHOWN
R.C.E. 9986
DRAWING NUMBER 21
REV.



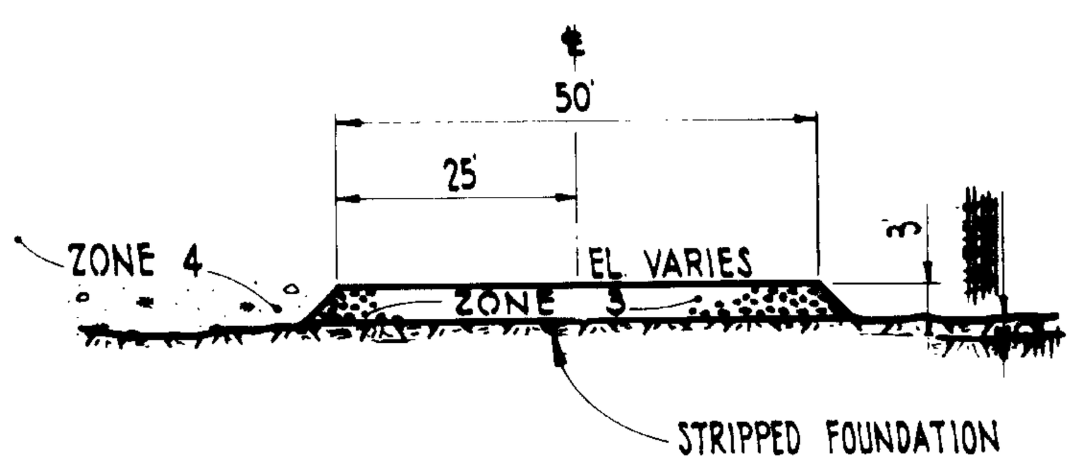
WEST & MAIN EMBANKMENT CREST DETAIL

SCALE: 1" = 10'



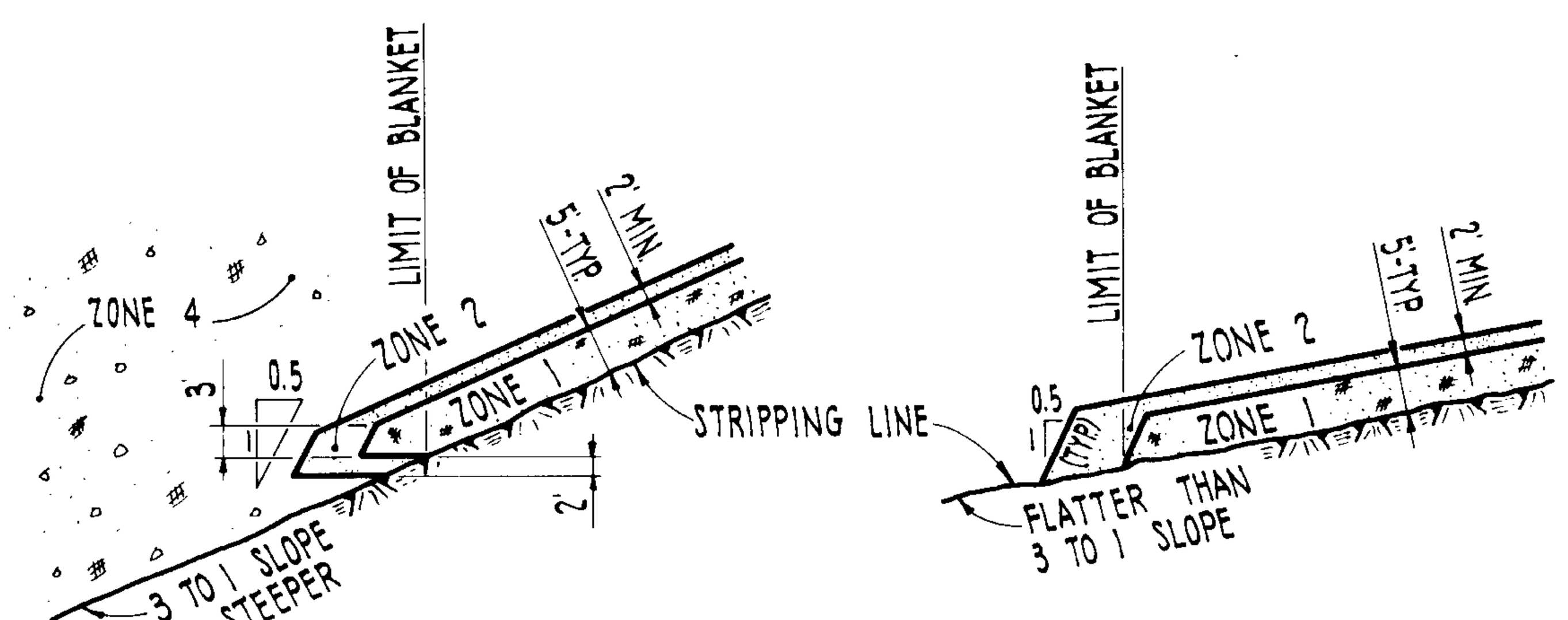
SECTION (A/22)

SCALE: NONE



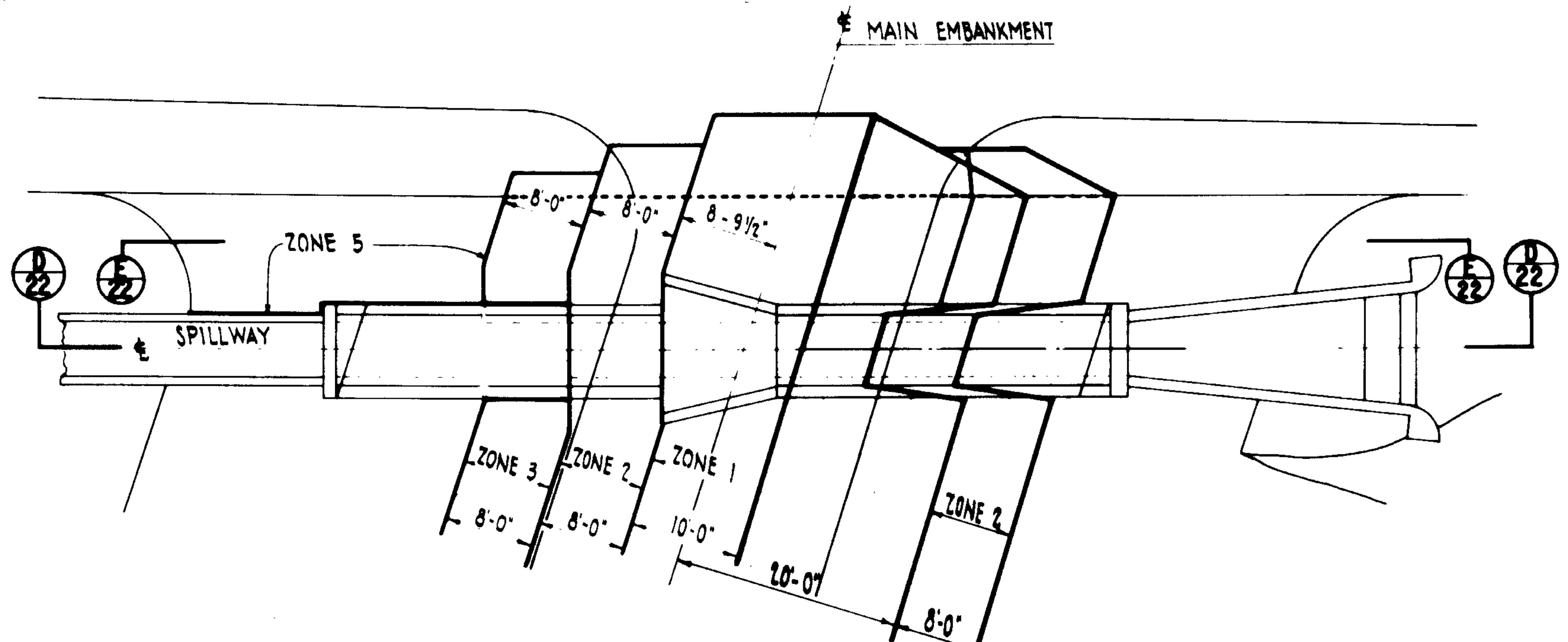
SECTION (B/22)

SCALE: NONE



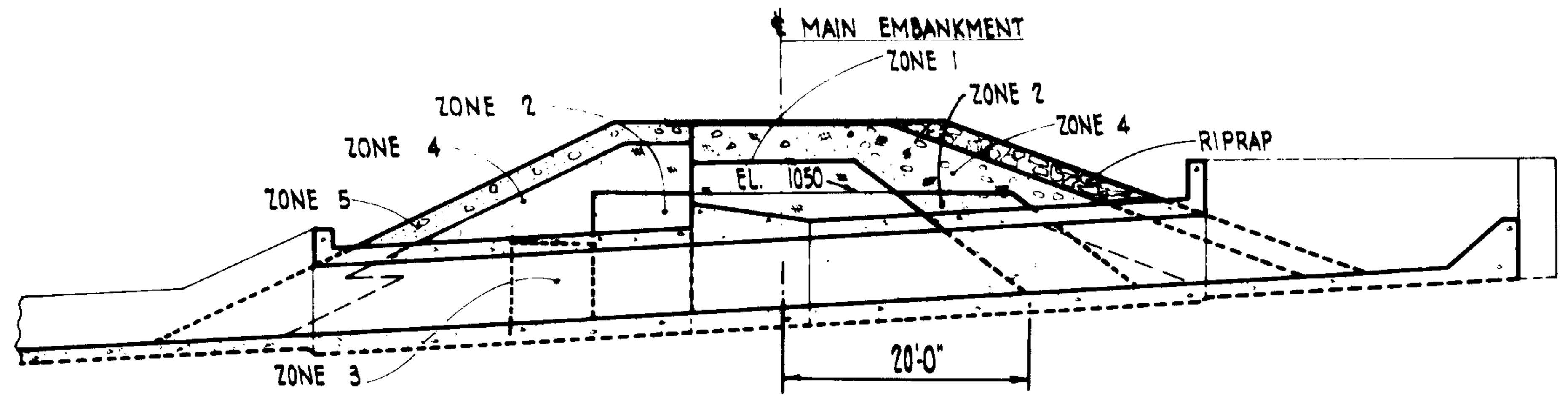
UPSTREAM BLANKET DETAILS (C/22)

SCALE: NONE



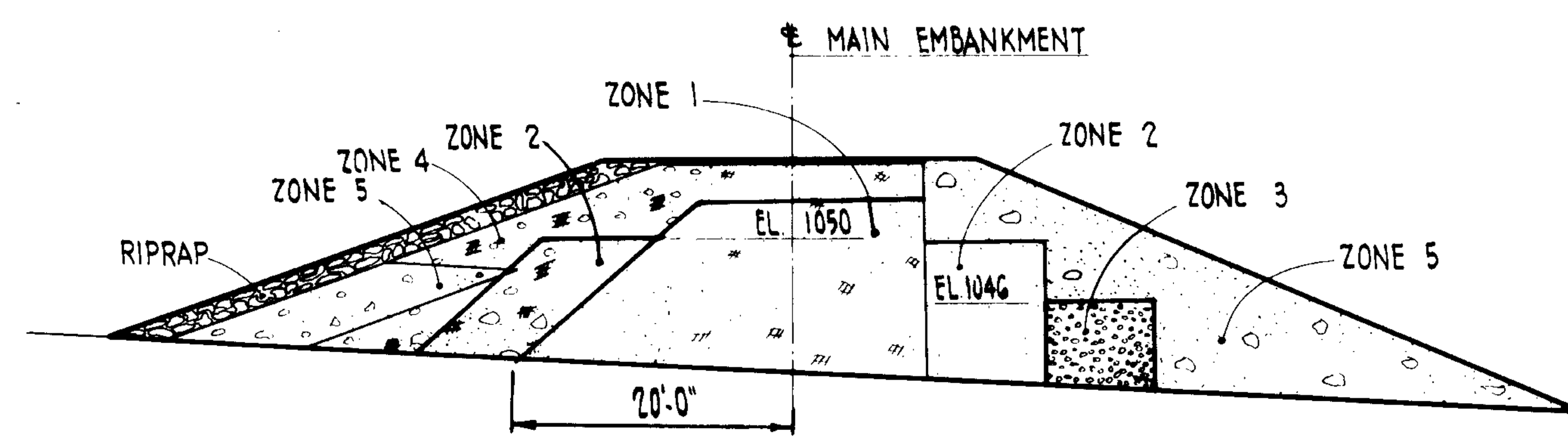
PLAN ~ EMBANKMENT FILLS AT SPILLWAY

SCALE: 3/32" = 1'-0"



SECTION (D/22)

SCALE: 3/32" = 1'-0"



SECTION (E/22)

SCALE: 3/32" = 1'-0"

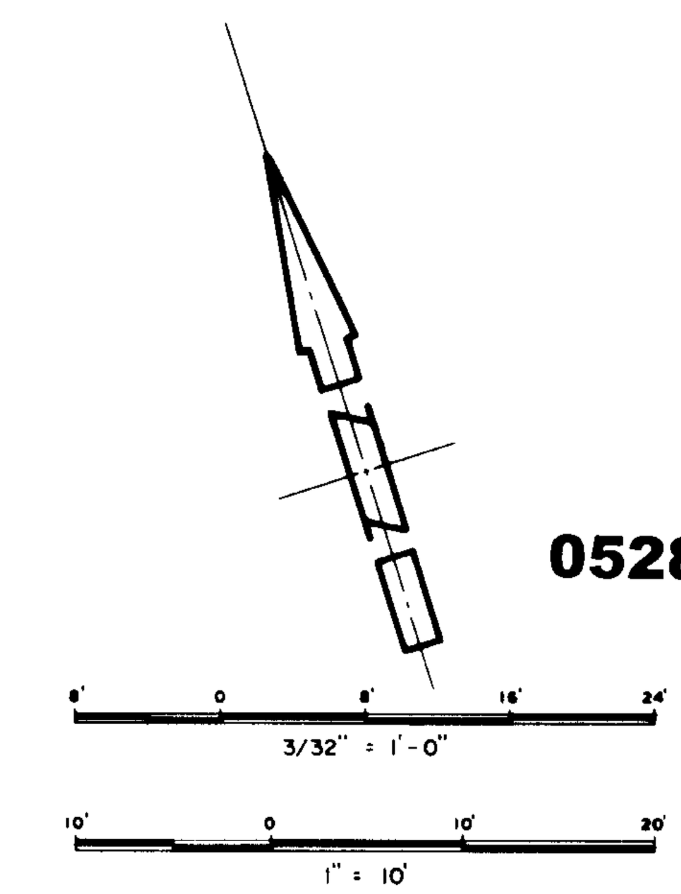
AS CONSTRUCTED
DATE 4/5/73 DFT H.K.R. CKD D.F.M.

NOTES

1. Aggregate base shall meet Class 2 gradation as required by State of California Specification.

REFERENCE DRAWINGS

FOR REFERENCE DRAWINGS SEE DRAWING NO. 17



05283

NO.	DATE	REVISIONS	BY	CHK	JOB ENG.	PROJ. ENG.	MGR.
△	12/11/70	ISSUED FOR CONSTRUCTION	T.E.M.				

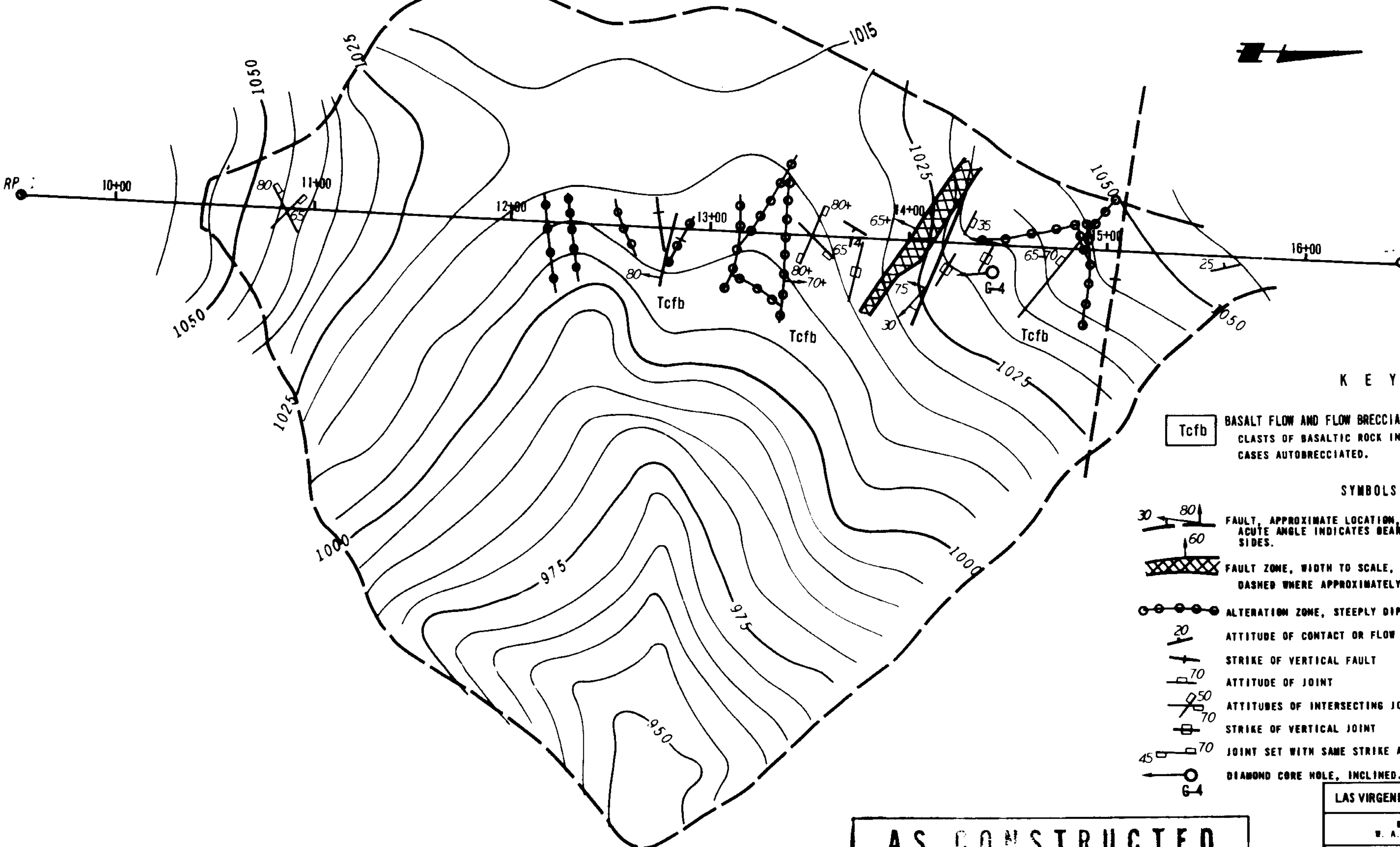
LAS VIRGENES MUNICIPAL WATER DISTRICT

BOYLE ENGINEERING
W. A. WAHLER & ASSOCIATES

WESTLAKE RESERVOIR

WEST & MAIN EMBANKMENT
DETAILS - SHEET 2 OF 2

DESIGNED F.W.G.	DATE: 11-70	JOB ENG. C.W.P.	PROJ. ENG.
DRAWN H.R.		DRAWING NUMBER	REV.
CHECKED C.W.P.	R.C.E.	22	
SCALE AS SHOWN			



K E Y

Tcfb — BASALT FLOW AND FLOW BRECCIA ROCK, MASSIVE: INCLUDES CLASTS OF BASALTIC ROCK IN BASALTIC MATRIX, IN MANY CASES AUTOBRECCIATED.

SYMBOLS

- 30, 80, 60 — FAULT, APPROXIMATE LOCATION, SHOWING ATTITUDE; ARROW AT ACUTE ANGLE INDICATES BEARING AND PLUNGE OF SLICKENSIDES.
- FAULT ZONE, WIDTH TO SCALE, SHOWING ATTITUDE; DASHED WHERE APPROXIMATELY LOCATED.
- ALTERATION ZONE, STEEPLY DIPPING; POSSIBLE FAULT
- 20 — ATTITUDE OF CONTACT OR FLOW STRUCTURE
- STRIKE OF VERTICAL FAULT
- 70 — ATTITUDE OF JOINT
- 50, 70 — ATTITUDES OF INTERSECTING JOINTS
- STRIKE OF VERTICAL JOINT
- 45, 70 — JOINT SET WITH SAME STRIKE AND DIP
- G-4 — DIAMOND CORE HOLE, INCLINED.

SCALE

50 0 50 FEET

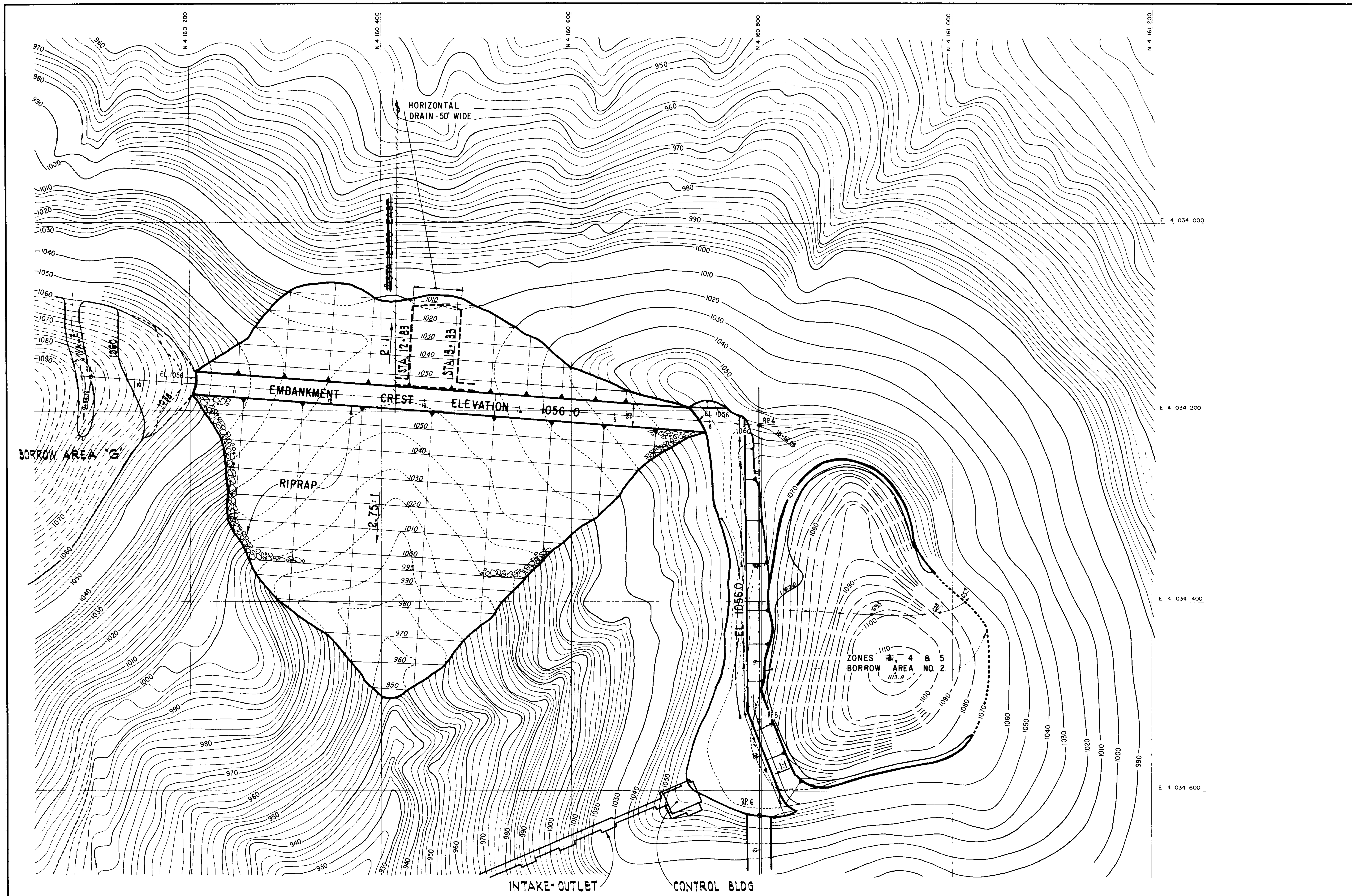
CONTOUR INTERVAL 5 FEET

AS CONSTRUCTED

DATE 12-13-73 DFT H.H.R CKD DTW

05284

LAS VIRGENES MUNICIPAL WATER DISTRICT
BOYLE ENGINEERING W. A. WAHLER & ASSOCIATES
WESTLAKE RESERVOIR EXCAVATED FOUNDATION GEOLOGIC MAP WEST EMBANKMENT
DESIGNED DATE 6/72 JOB ENG. PROJ. ENG.
DRAWN CHECKED L.A. Clayton R.C.E. SCALE AS SHOWN
DRAWING NUMBER 23-A REV



PLAN

SCALE: 1" = 50'

NOTES

AS CONSTRUCTED
DATE 4/5/73 DFT R.H.R. CKD D.T.M.

REFERENCE DRAWINGS

20 LONGITUDINAL PROFILES
24 SECTIONS

50' 0 50' 100'
1" = 50'

05285

NO.	DATE	REVISIONS	BY	CHK	JOB ENG.	PROJ. ENG.	MGR.
1	11/?/70	Issued For Construction	T.E.N.				

LAS VIRGENES MUNICIPAL WATER DISTRICT

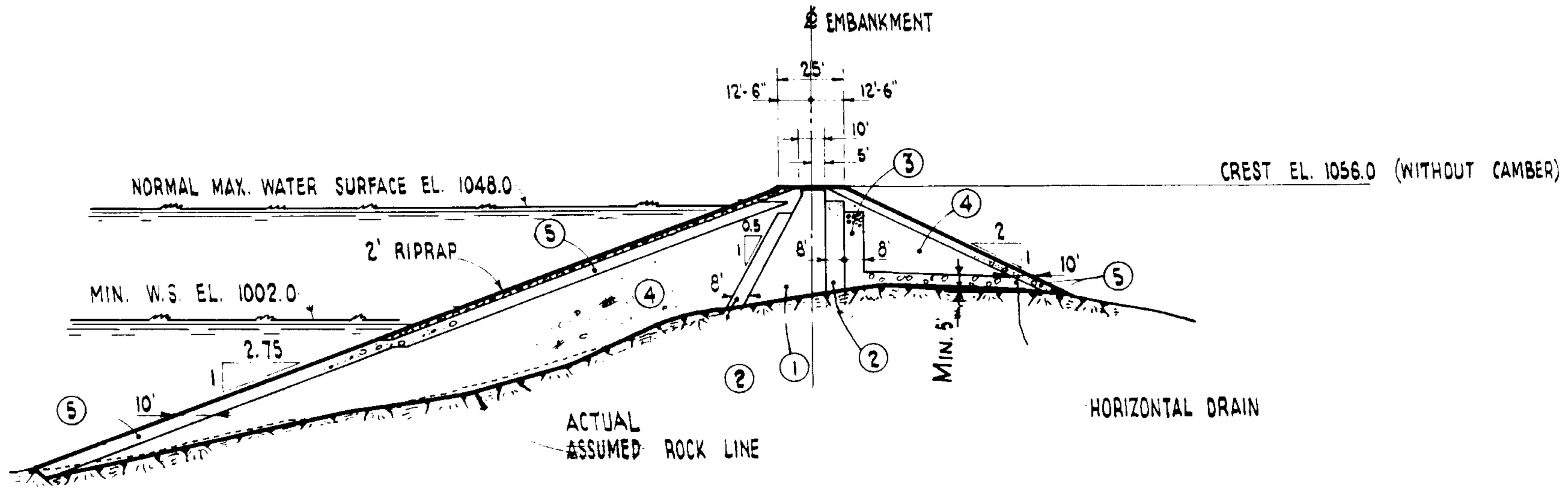
BOYLE ENGINEERING
W. A. WAHLER & ASSOCIATES

WESTLAKE RESERVOIR

WEST EMBANKMENT

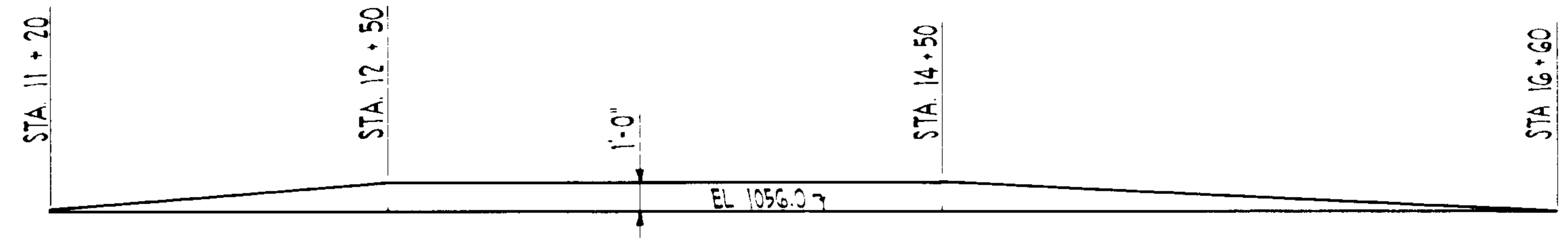
GENERAL LAYOUT

DESIGNED F.W.G.	DATE: 11-70	JOB ENG. C.W.P.	PROJ. ENG.
DRAWN			DRAWING NUMBER
CHECKED C.W.P.	R.C.E. 9986		23
SCALE AS SHOWN			REV.



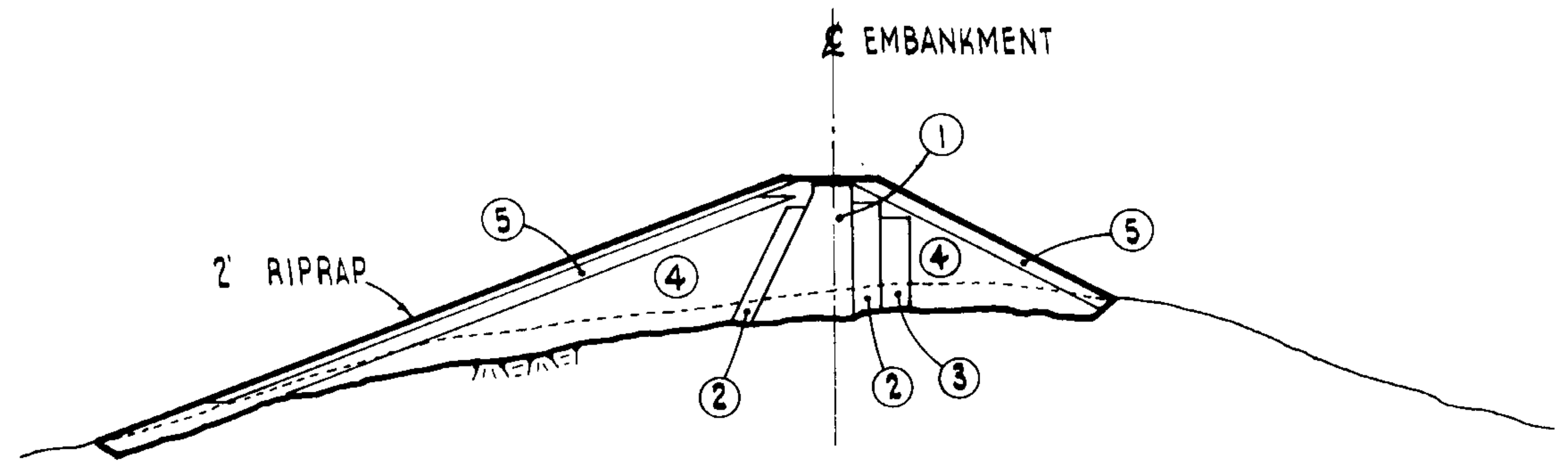
SECTION AT STA. 13+00

SCALE: 1" = 50'



CAMBER DIAGRAM AT ℄ OF CREST

HORIZ. SCALE: 1" = 50'
VERT. SCALE: 1" = 5'



SECTION AT STA. 14+00

SCALE: 1" = 50'

NOTES

1. Aggregate base shall meet Class 2 gradation as required by State of California Specification.

AS CONSTRUCTED
DATE 4/5/73 H.R. D.F.M.

REFERENCE DRAWINGS

FOR REFERENCE DRAWINGS SEE DRAWING NO. 23

05286

50' 0 50' 100'
1" = 50'

NO.	DATE	REVISIONS	BY	CH'K	JOB ENG.	PROJ. ENG.	MGR.
1	12/17/70	Issued For Construction	T.E.N.	R.R.E.	D.F.M.	J.N.	

LAS VIRGENES MUNICIPAL WATER DISTRICT

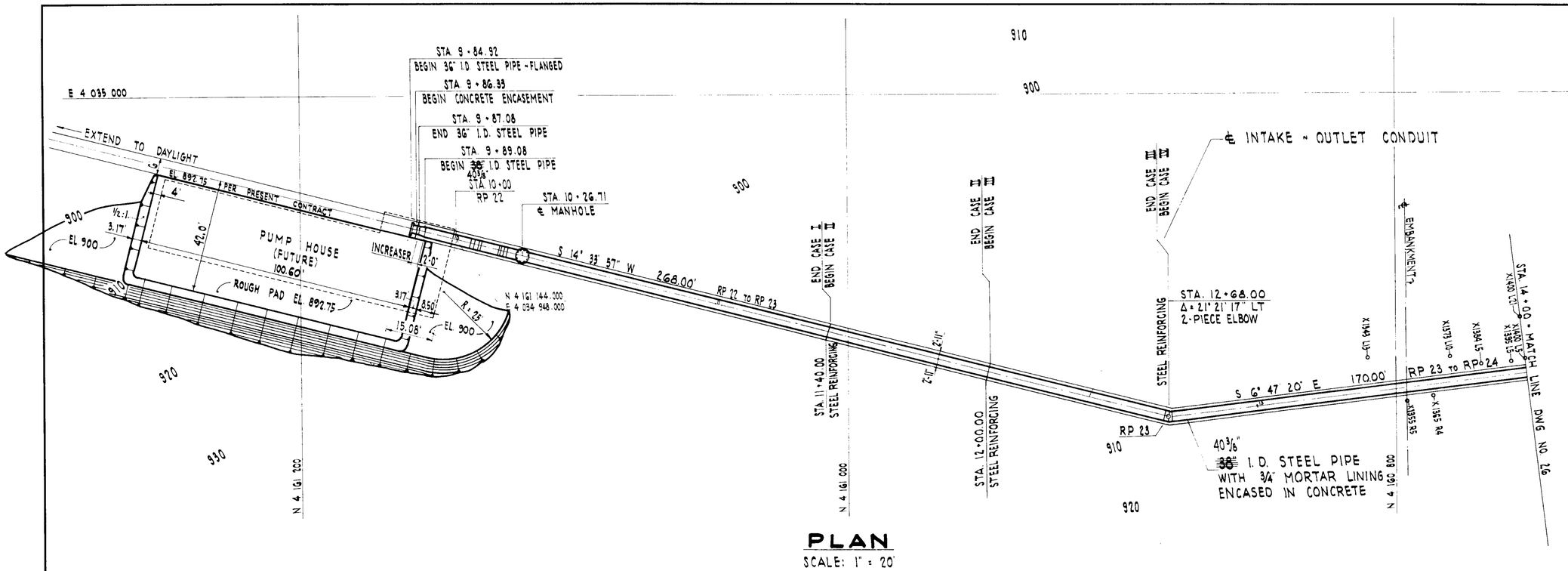
BOYLE ENGINEERING
W. A. WAHLER & ASSOCIATES

WESTLAKE RESERVOIR

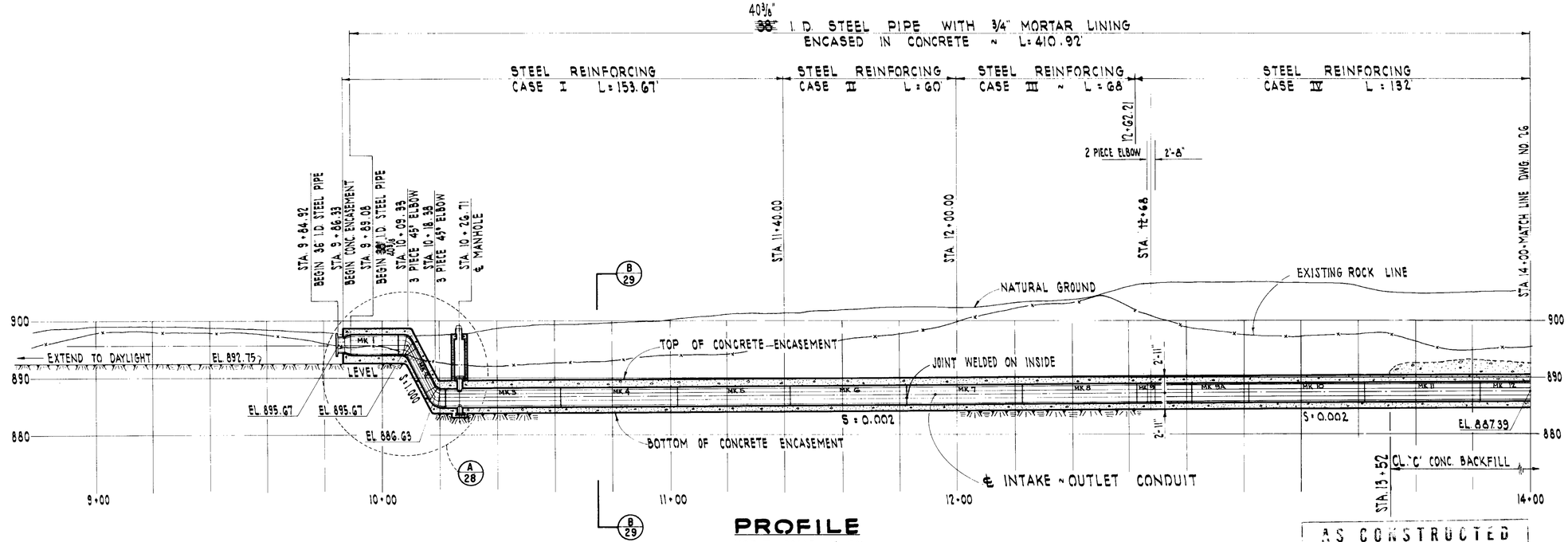
WEST EMBANKMENT

SECTIONS

DESIGNED F.W.G.	DATE: 11-70	JOB ENG. C.W.P.	PROJ. ENG.
DRAWN H.R.	L.A. Clayton R.C.E. 9986	DRAWING NUMBER 24	REV.
CHECKED C.W.P.			
SCALE AS SHOWN			



PLAN
SCALE: 1" = 20'



PROFILE
HORIZ. SCALE: 1" = 20'
VERT. SCALE: 1" = 10'

AS CONSTRUCTED
DATE 4/24/73 DFT [illegible] CKD D.F.M.

NOTES

1. The vertical alignment shown on these drawings is based on an assumed rock surface. After the embankment foundation is completed, the vertical alignment may be changed to fit existing rock conditions.
2. Steel pipe shall have a minimum wall thickness of ¼" except where otherwise shown.
3. Steel pipe shall have one coat of rust inhibitant paint applied in the shop, and shall have a ¾" thick mortar lining.
4. For General Concrete Notes see Drawing No. 28.

○ X 1400.15 INDICATES PRESSURE GROUT HOLE UP TO 25' IN DEPTH

REFERENCE DRAWINGS

26 PLAN AND PROFILE ~ SHEET 2 OF 2
27 DETAILS ~ SHEET 1 OF 2
28 DETAILS ~ SHEET 2 OF 2

1" = 10'

1" = 20'

05287

NO.	DATE	REVISIONS	BY	CHK	JOB ENG.	PROJ. ENG.	MGR.
△	4/24/73	ISSUED FOR CONSTRUCTION	TEM	ARC	D.F.M.		

LAS VIRGENES MUNICIPAL WATER DISTRICT

BOYLE ENGINEERING
W. A. WAHLER & ASSOCIATES

WESTLAKE RESERVOIR

INTAKE - OUTLET CONDUIT
PLAN AND PROFILE - SHEET 1 OF 2

DESIGNED MLW	DATE: 11-70	JOB ENG. D.F.M.	PROJ. ENG.	
DRAWN [illegible]			DRAWING NUMBER	REV.
CHECKED D.F.M.	R. C. E. [illegible]		25	
SCALE AS SHOWN				

REFERENCE DRAWINGS

FOR REFERENCE DRAWINGS SEE DRAWING NO. 25

05288

NO.	DATE	REVISIONS	BY	CHK	JOB ENG.	PROJ. ENG.	MGR.
△	11/11/70	Issued For Construction	TEN		DFM		

LAS VIRGENES MUNICIPAL WATER DISTRICT

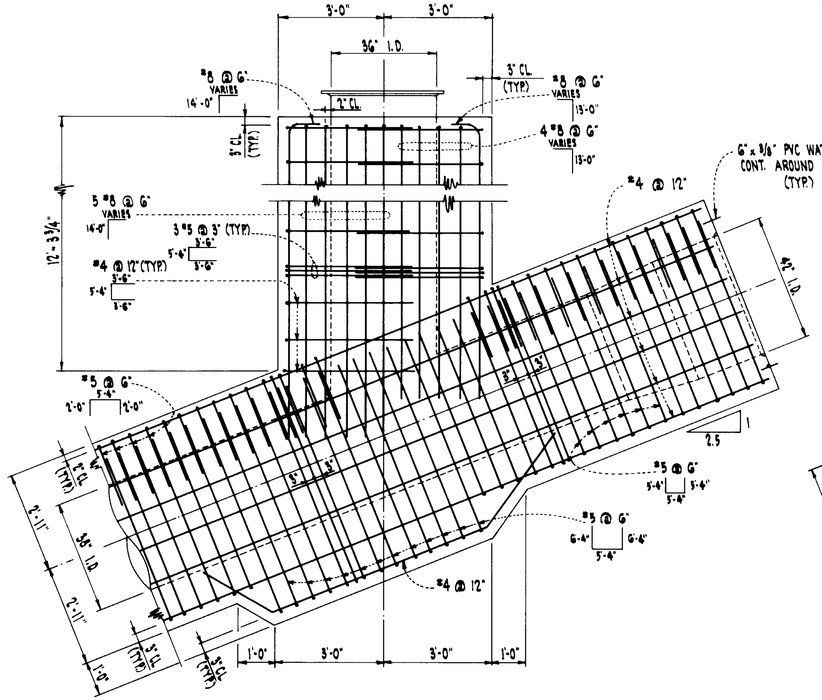
BOYLE ENGINEERING
W. A. WAHLER & ASSOCIATES

WESTLAKE RESERVOIR

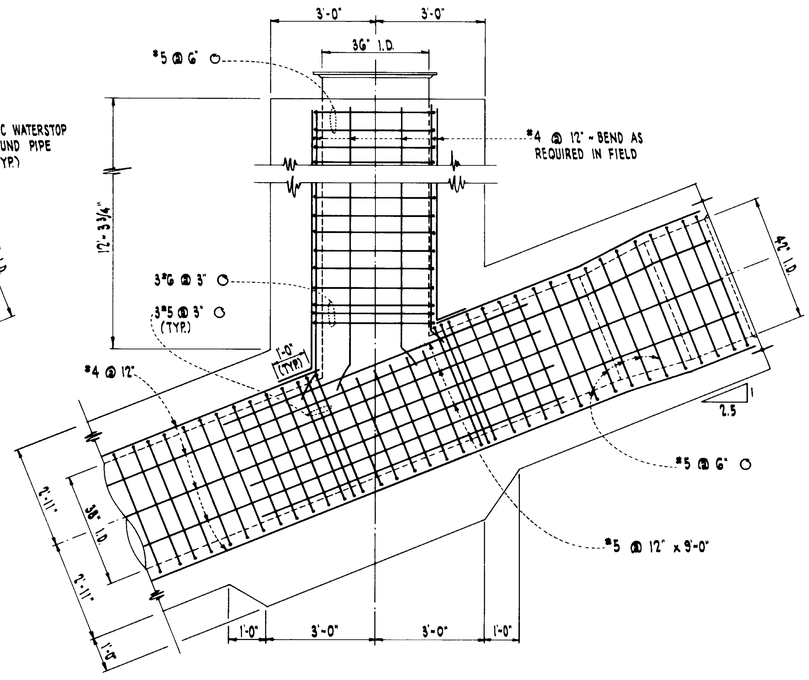
INTAKE - OUTLET CONDUIT

PLAN AND PROFILE - SHEET 2 OF 2

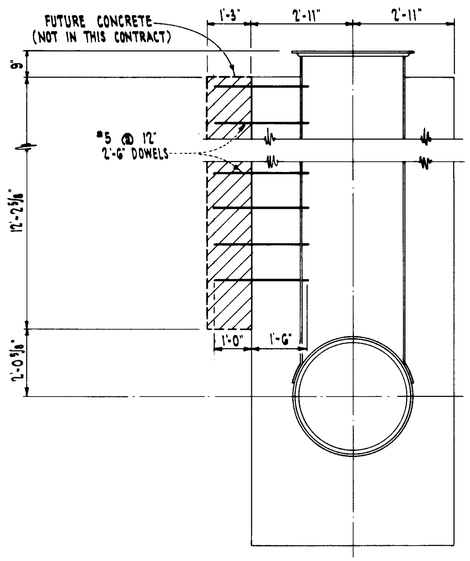
DESIGNED MSW | DATE: 11-70 | JOB ENG. D.F.M.
DRAWN TEN
CHECKED DFM
SCALE AS SHOWN
R.C.E.
DRAWING NUMBER 26
REV.



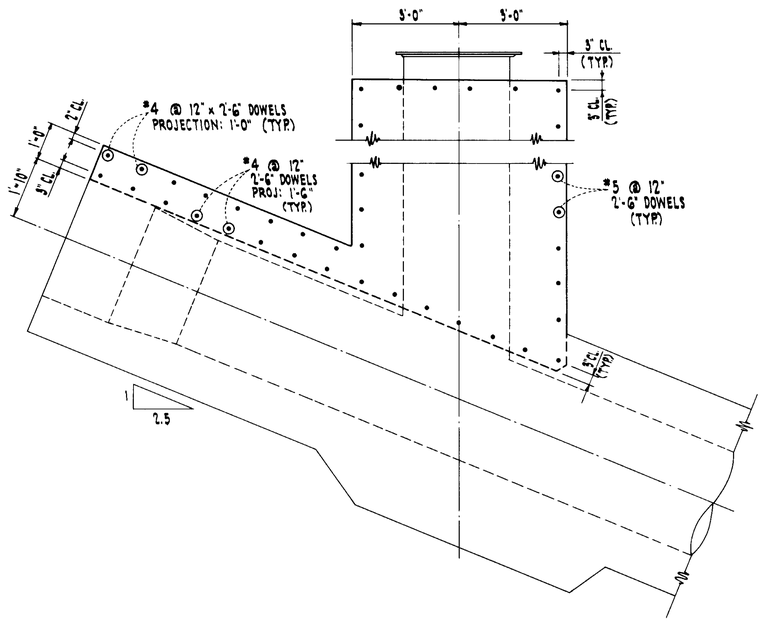
ELEVATION - OUTSIDE LAYER REINFORCEMENT
INTAKE - OUTLET NO. 5
SCALE: 1/2" = 1'-0"



ELEVATION - INSIDE LAYER REINFORCEMENT
INTAKE - OUTLET NO. 5
SCALE: 1/2" = 1'-0"



SECTION - SECOND STAGE REINFORCEMENT
INTAKE - OUTLET NO. 5
SCALE: 1/2" = 1'-0"



ELEVATION - SECOND STAGE REINFORCEMENT
INTAKE - OUTLET NO. 5
SCALE: 1/2" = 1'-0"

REFERENCE DRAWINGS

FOR REFERENCE DRAWINGS SEE SHEET NO. 25

AS CONSTRUCTED
DATE 4/24/73 DFT [illegible] CKD [illegible]

NO.	DATE	REVISION	BY	APP
1	4-29-71	ISSUED FOR CONSTRUCTION	R.P.E.	

DESIGNED BY R.P.E. DRAWN BY [illegible] CHECKED BY [illegible]

SCALE: 1/2" = 1'-0"
DATE: MAR. 1971

BOYLE ENGINEERING
SAN DIEGO SANTA ANA VENTURA
BAKERSFIELD
R.C.E. 19946

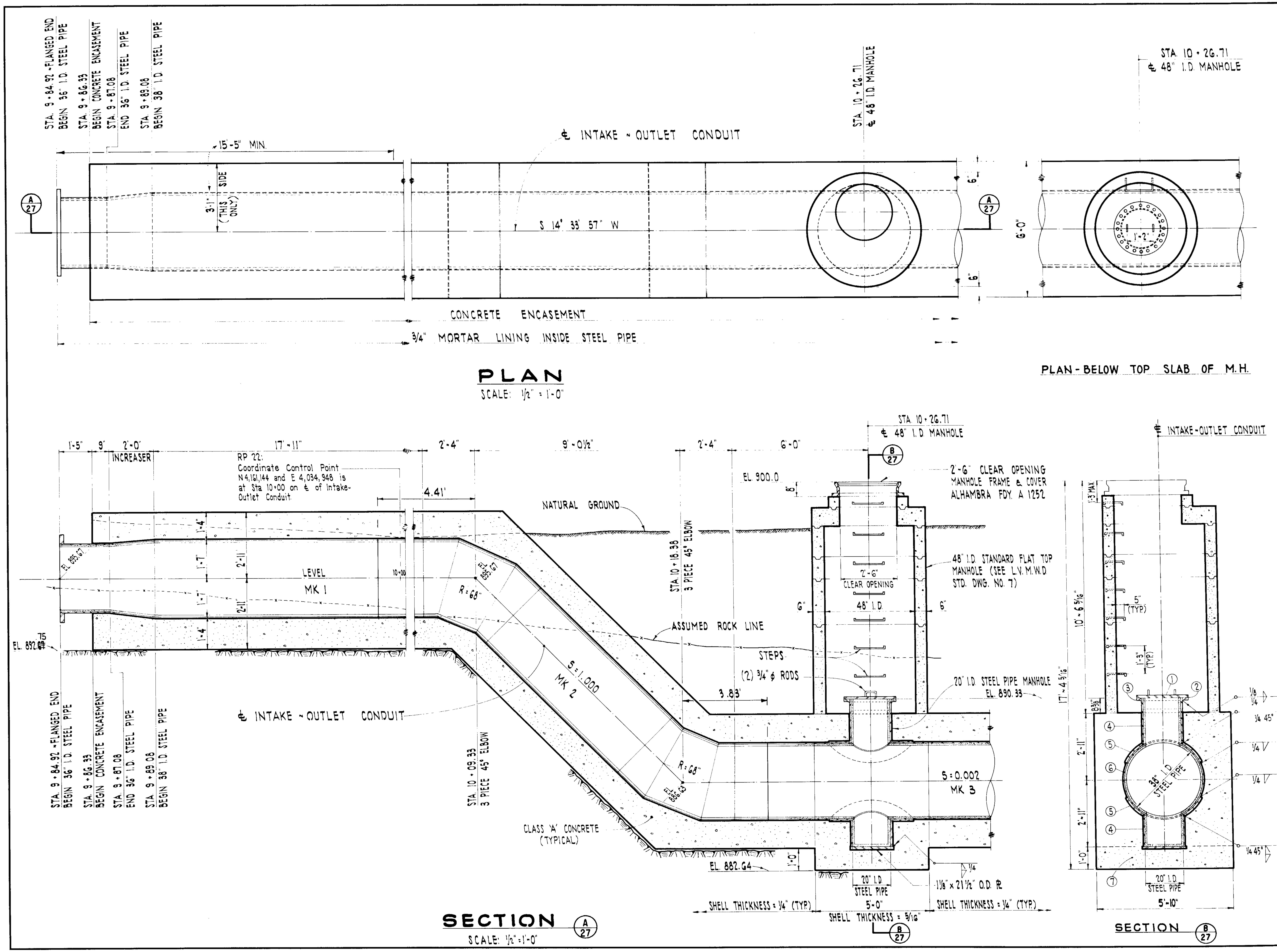
SHEET NO. 26 A OF 35 SHTS.
64-2577-00

05289

LAS VIRGENES MUNICIPAL WATER DISTRICT

WESTLAKE RESERVOIR

INTAKE - OUTLET
REINFORCING DETAILS



NOTES

1. Manhole steps shall be 3/4" galv. steel embedded in manhole wall. Alhambra Fdy. A 3315 or equal.
2. 20" I.D. steel pipe manhole shall conform to applicable sections of AWWA Standards C 207 and C 208.
3. Mortar lining shall be refinished in the field to provide 3/4" minimum cover for all exposed steel inside surfaces.
4. All exposed steel surfaces shall be painted with coal tar enamel in conformance with AWWA Std C 203 for above ground conditions; Section 5.

AS CONSTRUCTED
DATE 4/24/73 DFT [illegible] CKD DFM

LIST OF MATERIALS

ITEM NO.	DESCRIPTION
1	27 1/2" O.D. x 1 1/8" steel plate with 3/4" φ rod handles - use washers and galvanize.
2	1/16" cloth inserted rubber sheet packing gasket. (Fed. Spec. H-H-P-151).
3	27 1/2" O.D. AWWA C 207-55 Class D steel hub flange.
4	20" I.D. x 5/16" wall steel pipe with 3/4" mortar lining.
5	12" x 5/16" steel collar welded to pipe.
6	38" I.D. x 5/16" wall steel pipe with 3/4" mortar lining.
7	Concrete encasement.

REFERENCE DRAWINGS

25 PLAN AND PROFILE - SHEET 1 OF 3

1/2" = 1'-0"

05290

NO.	DATE	REVISIONS	BY	CHK	JOB ENG.	PROJ. ENG.	MGR.
△	[illegible]	ISSUED FOR CONSTRUCTION	[illegible]	[illegible]	DFM	[illegible]	[illegible]

LAS VIRGENES MUNICIPAL WATER DISTRICT

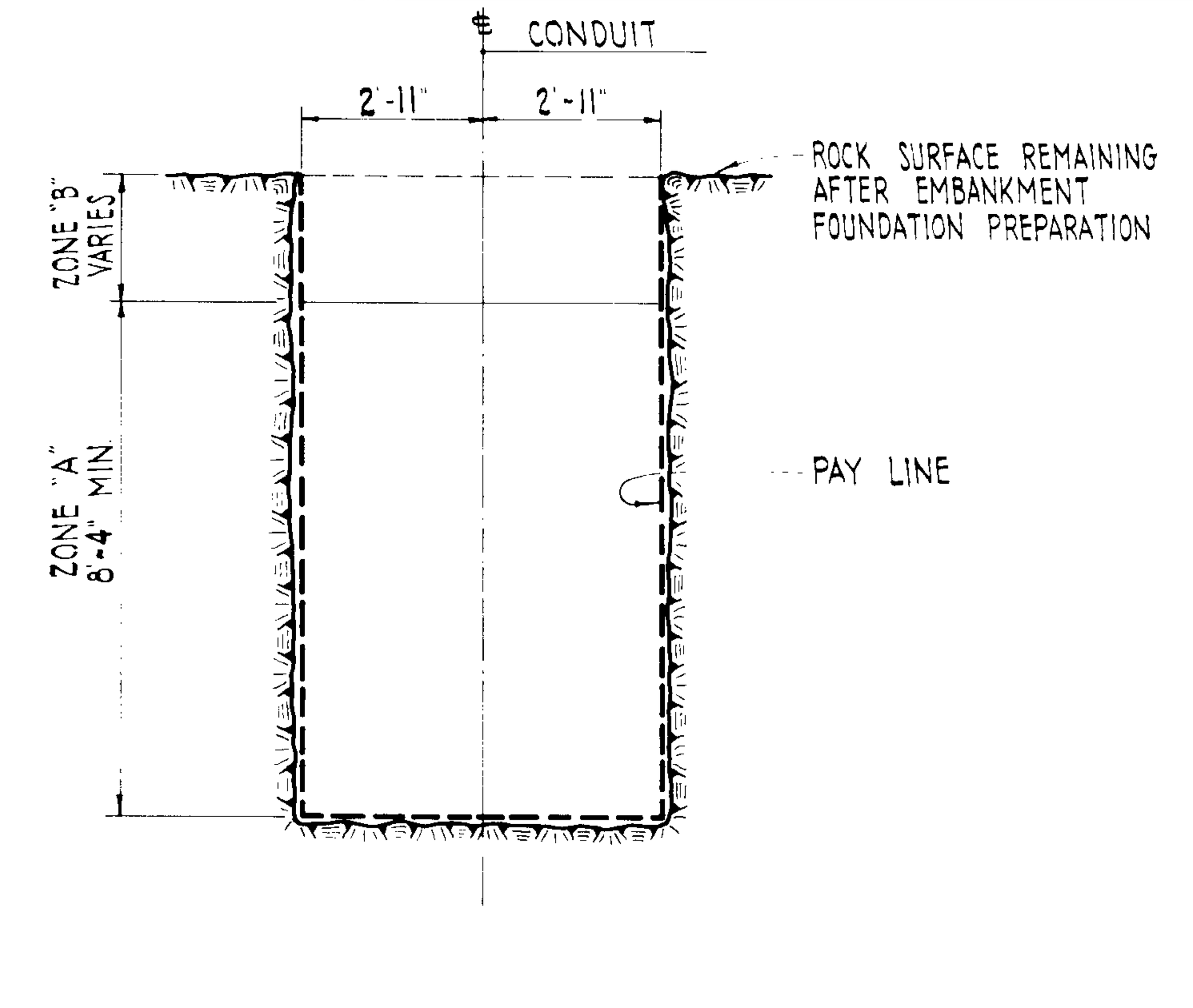
BOYLE ENGINEERING
W. A. WAHLER & ASSOCIATES

WESTLAKE RESERVOIR

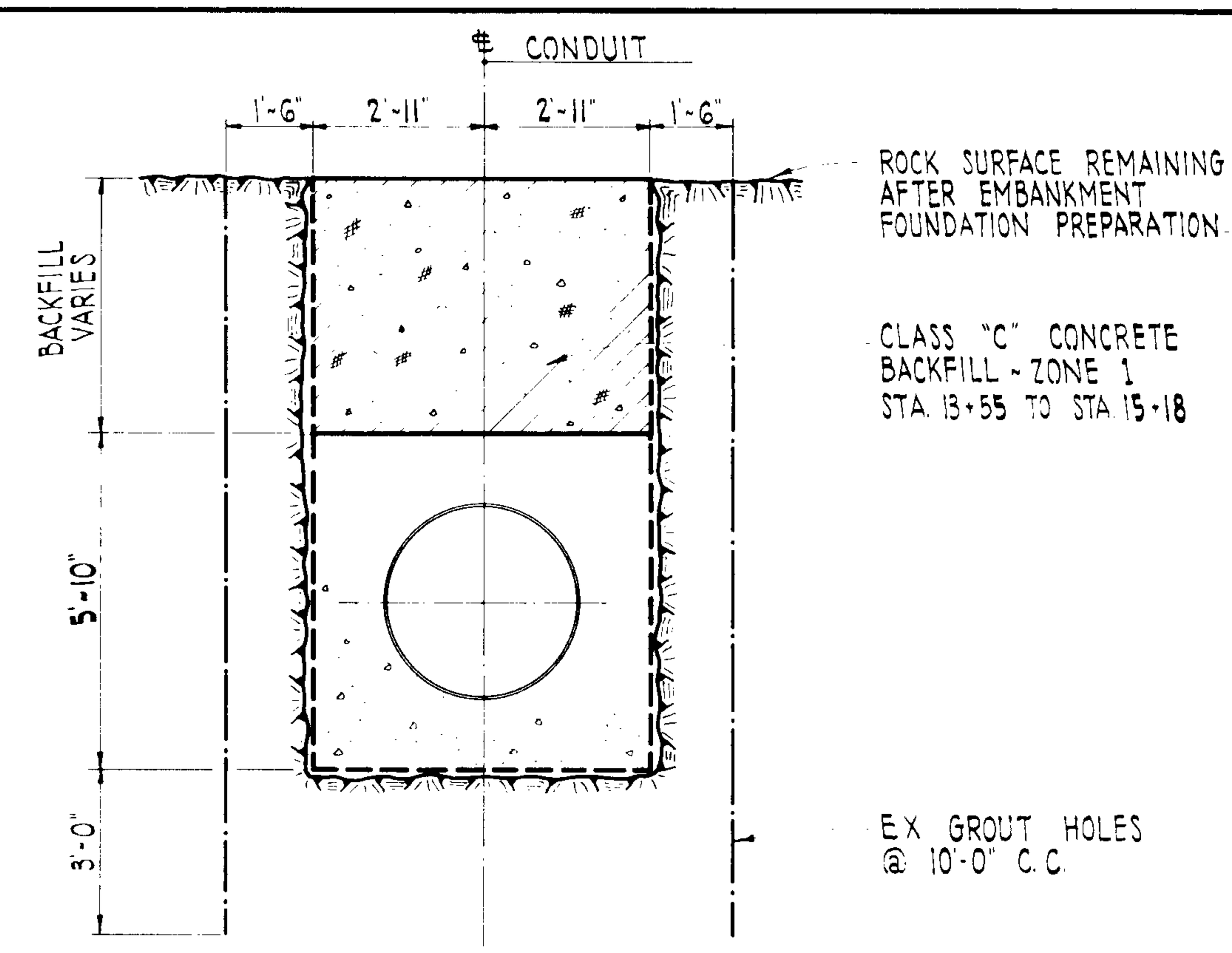
INTAKE - OUTLET CONDUIT

DETAILS - SHEET 1 OF 2

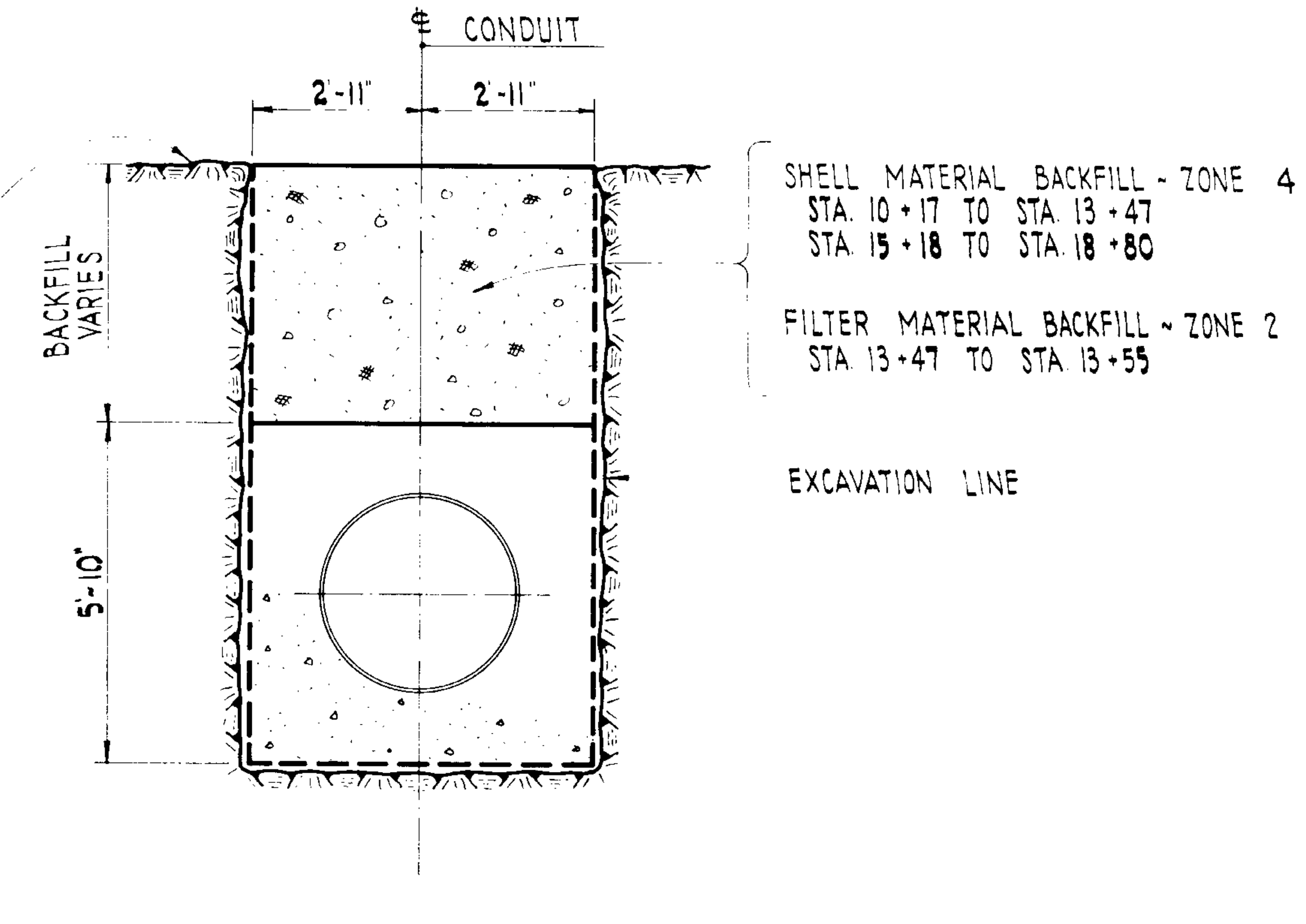
DESIGNED [illegible] DATE 11-70 JOB ENG. DFM PROJ. ENG. [illegible]
DRAWN K.R.
CHECKED DFM
SCALE AS SHOWN
L. A. Clayton R.C.E. 9986
DRAWING NUMBER 27
REV.



TYPICAL SECTION
CONDUIT TRENCH EXCAVATION
SCALE: 3/8" = 1'-0"



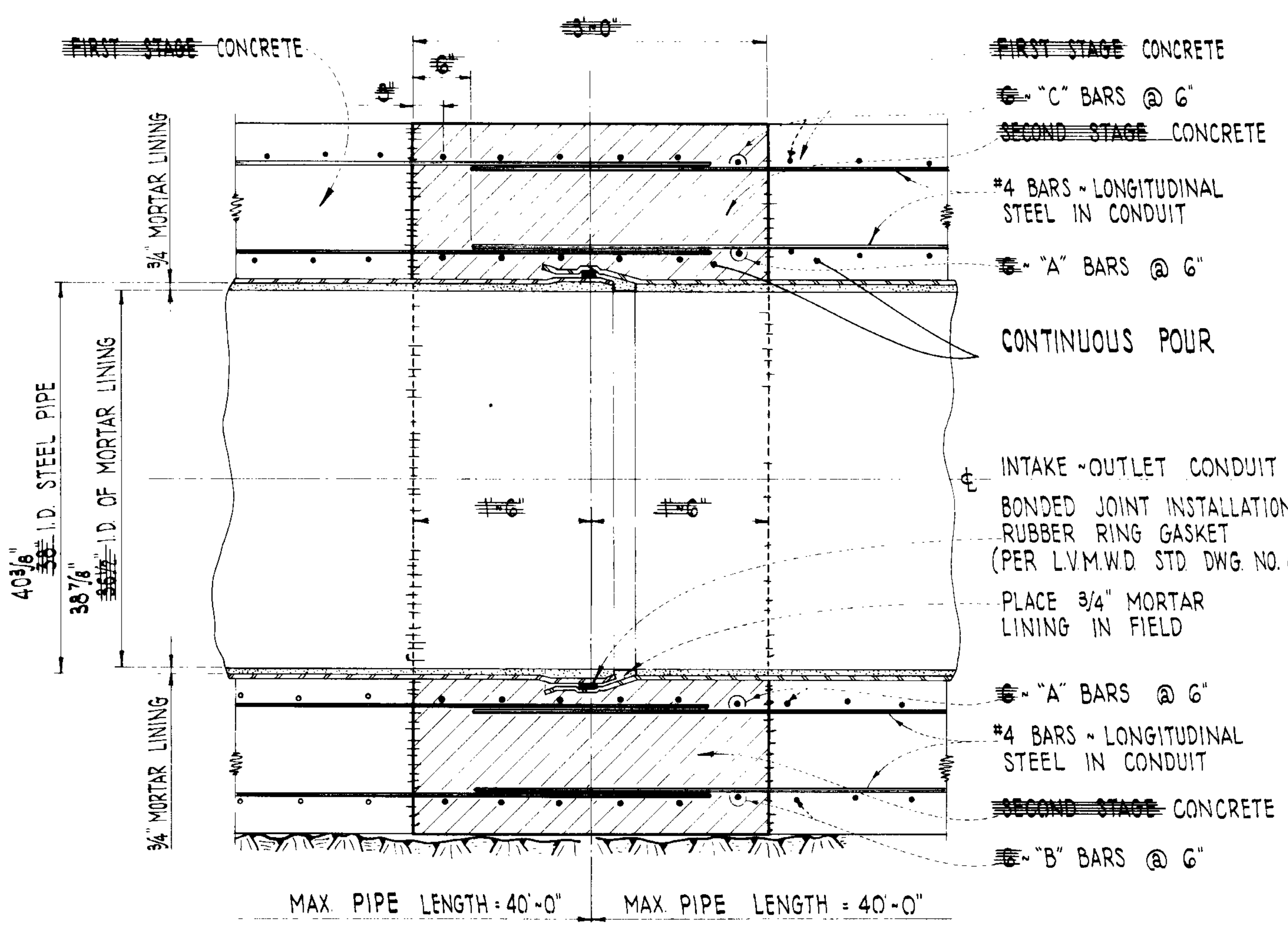
TYPICAL SECTION
CONDUIT BACKFILL FOR ZONE 1
SCALE: 3/8" = 1'-0"



TYPICAL SECTION
CONDUIT BACKFILL FOR ZONES 2, 3 & 4
SCALE: 3/8" = 1'-0"

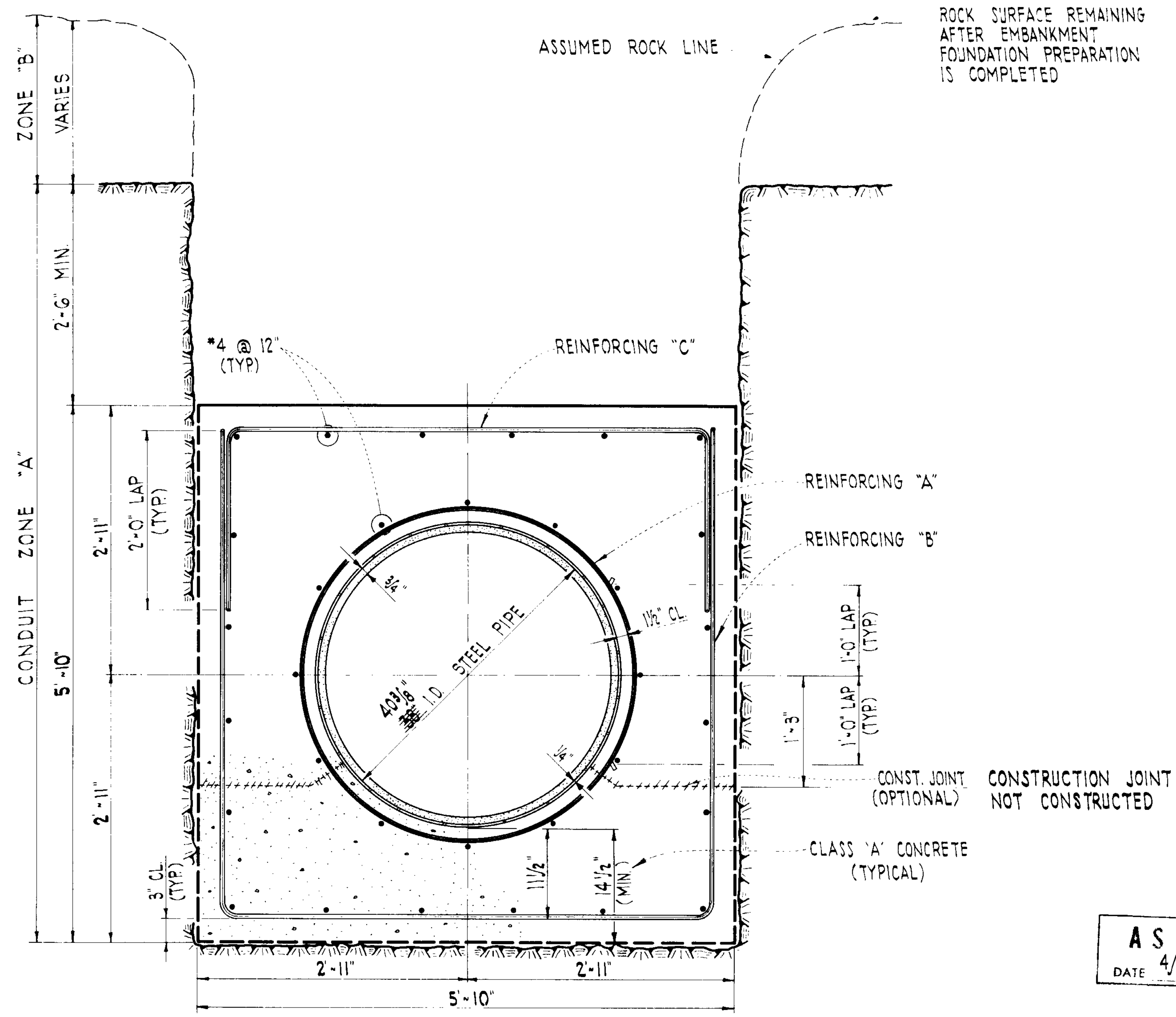
REINFORCING SCHEDULE

CASE	STATION FROM	STATION TO	LENGTH	REINFORCING "A"	REINFORCING "B"	REINFORCING "C"
I	9+86.33 16+50	11+40 19+10	413.67'	#5 @ 6"	#5 @ 6"	#5 @ 6"
II	11+40	12+00	60'	#7 @ 6"	#6 @ 6"	#6 @ 6"
III	12+00	12+68	68'	#8 @ 6"	#6 @ 6"	#6 @ 6"
IV	12+68	14+90	222'	#8 @ 6"	#7 @ 6"	#7 @ 6"
V	14+90	16+50	110'	#6 @ 6"	#6 @ 6"	#6 @ 6"



BELL & SPIGOT JOINT WITH
CONCRETE ENCASEMENT & REINFORCING

DETAIL (A/28)
SCALE: 1" = 1'-0"



TYPICAL SECTION OF CONDUIT WITH
CONCRETE ENCASEMENT & REINFORCING

DETAIL (B/28)
SCALE: 1" = 1'-0"

AS CONSTRUCTED
DATE 4/24/73 BY H.R. CKD D.F.M.

3/8" = 1'-0"
1" = 1'-0"

NOTES

1. ZONE "A" EXCAVATION: The overbreak beyond excavation lines shall not exceed 4" and inward projection from excavation lines shall not exceed 3". The area projecting inward shall not exceed 5% of the total area.
2. ZONE "B" EXCAVATION: The overbreak beyond excavation lines shall not exceed 9" and inward projection from excavation lines shall not exceed 6". The area projecting inward shall not exceed 10% of the total area.
3. Backfill material shall be compacted to not less than 95% density as determined by ASTM-D1557-66T test.
4. Grouting shall be started not less than 7 days after the Class "C" Concrete Backfill is completed.
5. Second stage concrete, as shown in Detail (A/28) shall be placed not less than 7 days after placement of first stage concrete.

GENERAL NOTES

1. All concrete shall be Class "A" (3000 psi @ 28 days) unless otherwise shown.
2. Class A concrete shall have a minimum of 6 sacks of cement for each cubic yard of mix.
3. Foundation concrete shall be placed only on firm, undisturbed rock, approved by District's representative.
4. Before placing concrete, verify requirements of sleeves, openings, utilities, embedded parts, etc.
5. All construction joint surfaces shall be sand blasted as to leave a clean roughened surface of sound concrete. Immediately prior to placing the next concrete lift, 1/2" of 1:2 mortar shall be placed on the cleaned surface of the previous lift.
6. Chamfer all exposed corners 3/4" unless otherwise shown.
7. Reinforcement shall conform to the latest ASTM designation A-615, Grade 40.
8. Minimum bar lap at splices and minimum projection of dowels, shall be 24 diameters of smaller bar, unless otherwise shown.
9. Class A and Class C concrete for intake-outlet conduit shall have San Gabriel Valley aggregates. For all other structures, concrete shall have aggregates treated by "heavy media" process and used from State approved stockpiles.
10. Before placement of concrete, the foundation surfaces shall be thoroughly cleaned by hand sweeping and high pressure air and/or water jets. Immediately prior to placing concrete, the surface of the foundation shall be free of standing water and loose material.
11. Class C concrete shall have a minimum 2000 psi ultimate strength at 28 days and shall have not less than 4 sacks of cement per cubic yard of concrete.

REFERENCE DRAWINGS

FOR REFERENCE DRAWINGS SEE DRAWING NO. 25.

05291

NO.	DATE	REVISIONS	BY	CHK	JOB ENG.	PROJ. ENG.	MGR.
△	11/71	ISSUED FOR CONSTRUCTION	T.E.N.	R.B.E.	D.F.M.	W.W.	

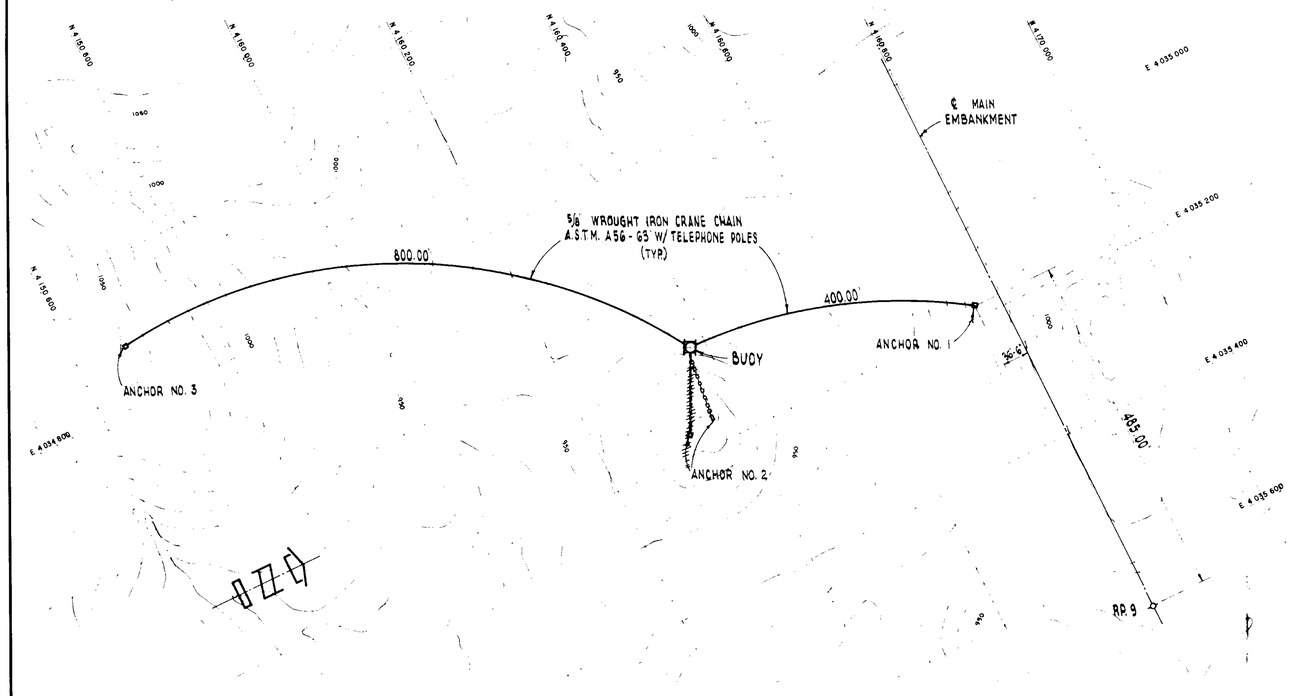
LAS VIRGENES MUNICIPAL WATER DISTRICT

BOYLE ENGINEERING
W. A. WAHLER & ASSOCIATES

WESTLAKE RESERVOIR

INTAKE-OUTLET CONDUIT
DETAILS - SHEET 2 OF 2

DESIGNED	DATE: 11-70	JOB ENG. D.F.M.	PROJ. ENG.
DRAWN H.R.			DRAWING NUMBER
CHECKED D.F.M.	L. A. Clayton R.C.E. 9984		28
SCALE AS SHOWN			REV.



PLAN - LOG BOOM

SCALE: 1" = 100'

ANCHOR NO. 1 — DETAIL (D/29)

SCALE: 1/4" = 1'-0"

NOTES:

1. USE 30'-0" CHAINS ON EACH SIDE OF THE BUOY.
2. THE CHAINS @ THE ANCHORS NO. 1, & 3 SHALL HAVE LENGTHS OF 20'-0". △
3. ALL METAL SHALL BE GALVANIZED UNLESS OTHERWISE SHOWN.
4. PAINT BUOY IN ACCORDANCE TO A.W.W.A. D102-64 SECT. 1.4 OUTSIDE PAINT NO. 3

ANCHOR BUOY — DETAIL (A/29)

SCALE: 1" = 10'-0"

ANCHOR SHACKLE — DETAIL (B/29)

SCALE: 1" = 1'-0"

ANCHORS NO. 2 & 3 - DETAIL (C/29)

SCALE: 1 1/2" = 1'-0"

05292

△	12/17/70	ISSUED FOR CONSTRUCTION	T.E.N.	R.L.E.	D.F.M.		
NO.	DATE	REVISIONS	BY	CH'K	JOB ENG.	PROJ. ENG.	MGR.

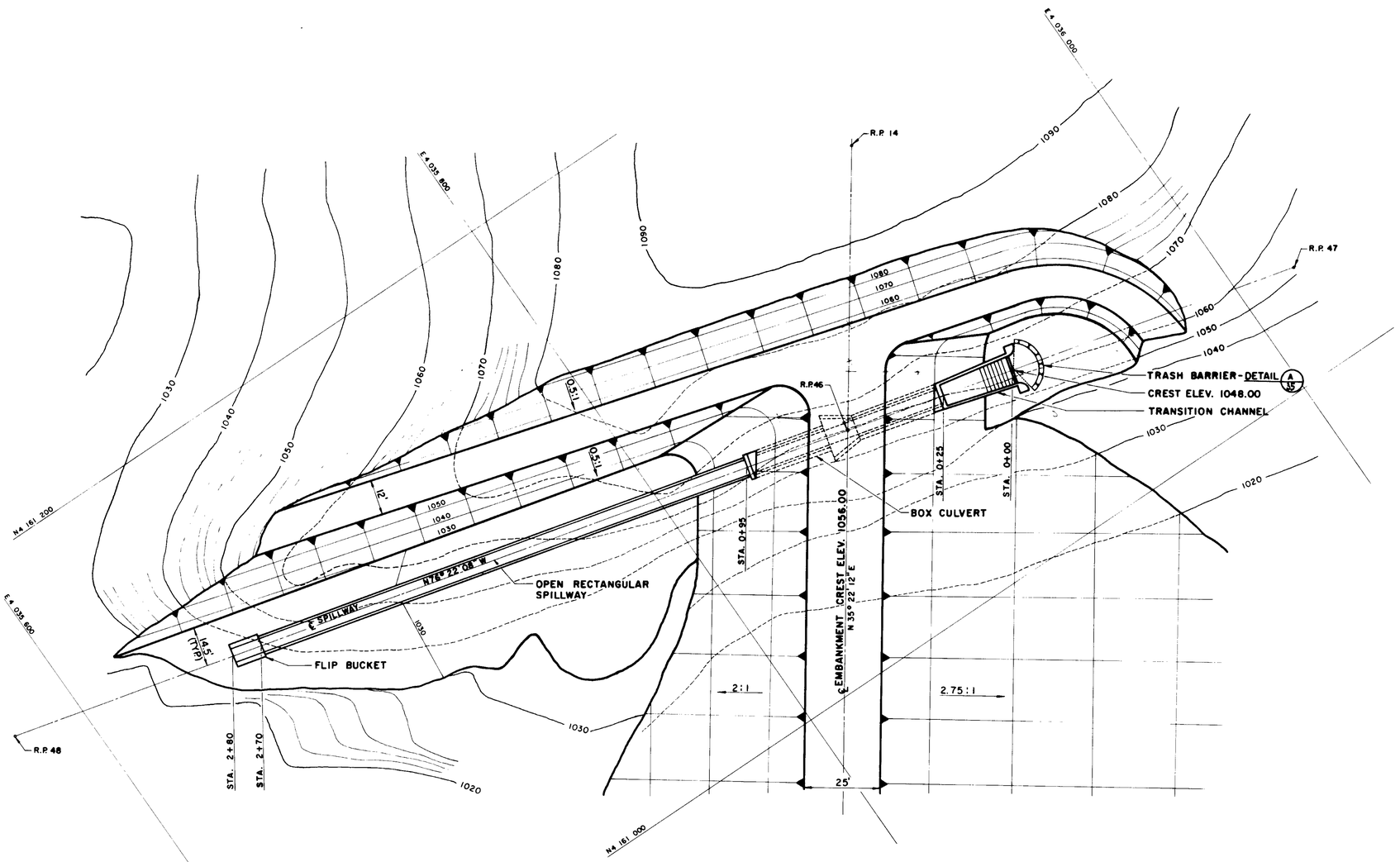
LAS VIRGENES MUNICIPAL WATER DISTRICT

BOYLE ENGINEERING
W. A. WAHLER & ASSOCIATES

WESTLAKE RESERVOIR
LOG BOOM
LOG BOOM DETAILS

DESIGNED M.G.T.	DATE: 11-70	JOB ENG. D.F.M.	PROJ. ENG.
DRAWN A.U.	L A Clayton R. C. E. 9986	DRAWING NUMBER 29	REV.
CHECKED DFM			
SCALE AS SHOWN			

AS CONSTRUCTED
DATE 4/25/73 DFT R.R.R. CKD DFM



PLAN

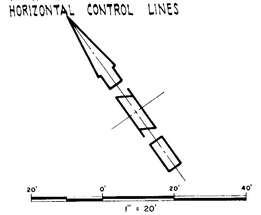
SPILLWAY AND ACCESS ROAD GENERAL LAYOUT

SCALE: 1" = 20'

AS CONSTRUCTED
DATE 12-13-73 BY W.W.R. CKD DFM

REFERENCE DRAWINGS

31	EXCAVATION
32	CONCRETE OUTLINES
33	REINFORCING - SHEET 1 OF 2
34	REINFORCING - SHEET 2 OF 2
35	TRASH BARRIER DETAILS
4	HORIZONTAL CONTROL LINES



05293

NO.	DATE	REVISIONS	BY	CHK	JOB ENG.	PROJ. ENG.	MGR.
2	3/26/74	REVISE SPILLWAY ALIGNMENT	T.E.M.	R.L.E.	R.L.E.		
1	11/1/73	ISSUED FOR CONSTRUCTION	T.E.M.	R.L.E.	D.F.M.		

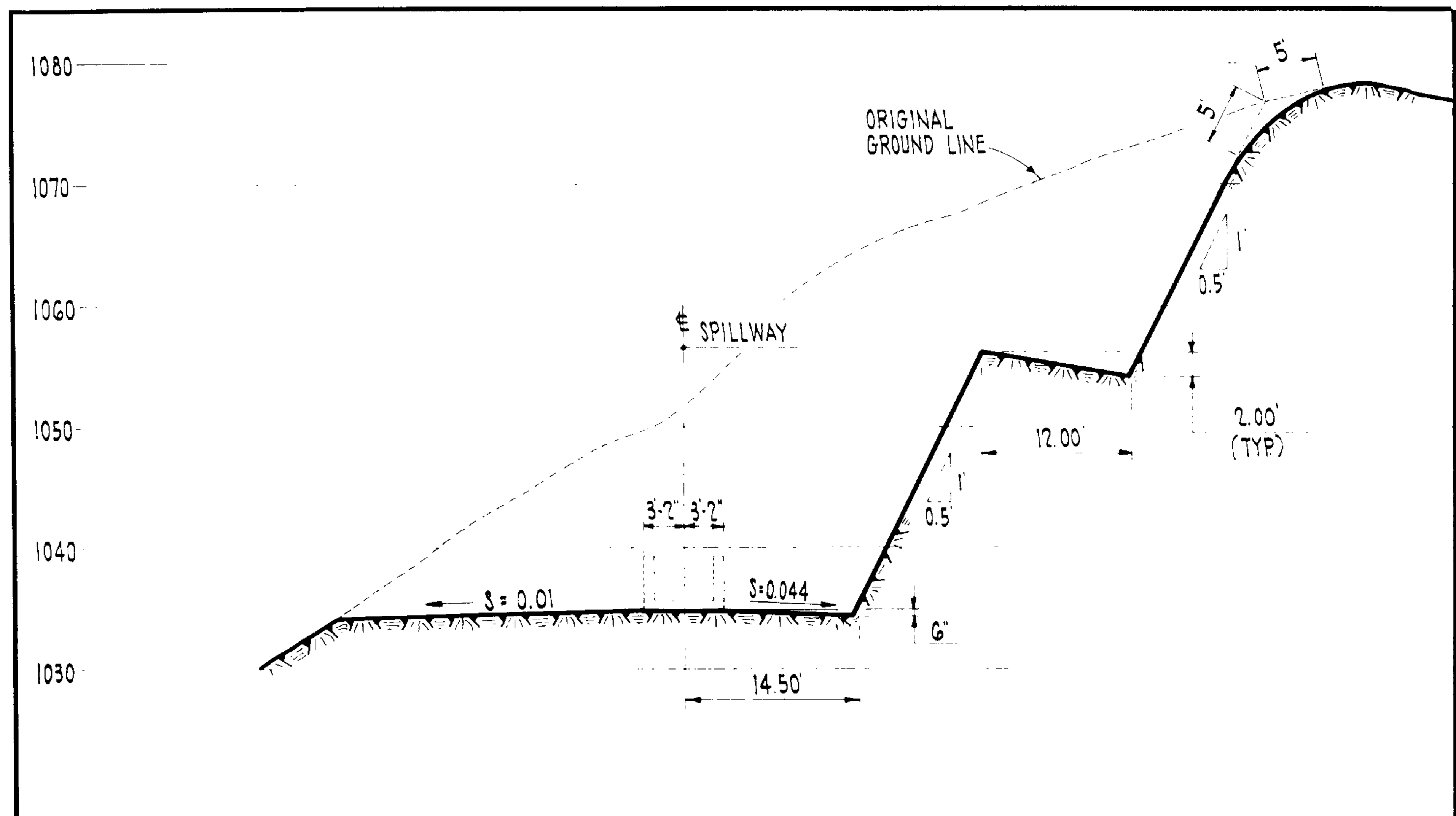
LAS VIRGENES MUNICIPAL WATER DISTRICT

BOYLE ENGINEERING
W. A. WAHLER & ASSOCIATES

WESTLAKE RESERVOIR

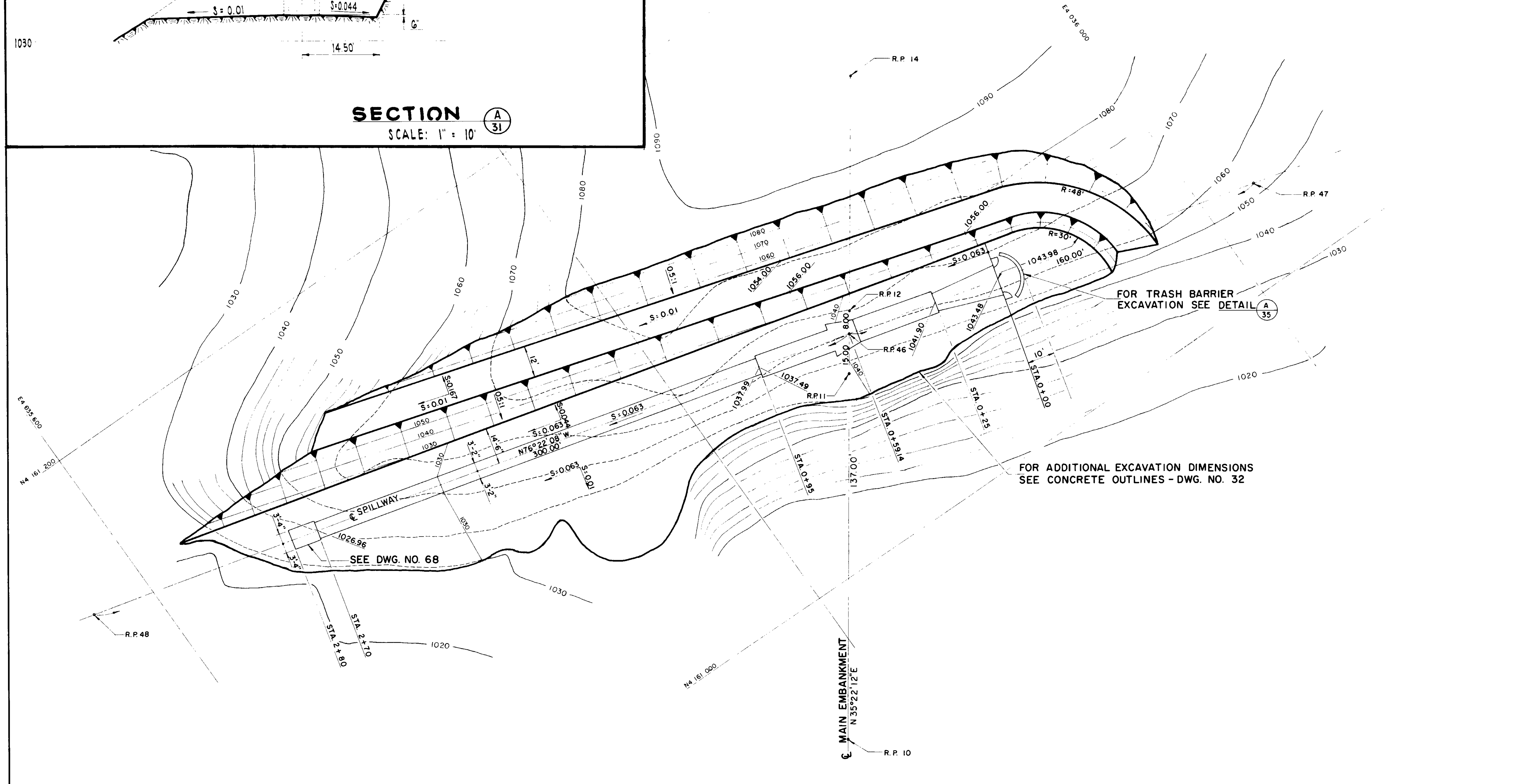
SPILLWAY
GENERAL LAYOUT

DESIGNED T.E.M.	DATE: 11-70	JOB ENG. D.F.M.	PROJ. ENG. R.L.E.
DRAWN T.E.M.			DRAWING NUMBER 30
CHECKED D.F.M.	L.A. Cearlock R. C. E. 9986		REV.
SCALE AS SHOWN			



SECTION (A/31)

SCALE: 1" = 10'



PLAN

SCALE: 1"=20'

AS CONSTRUCTED
DATE 12-13-73 BY H.H.R. CK'D D.T.M.

REFERENCE DRAWINGS

30 GENERAL LAYOUT

05294

1"= 20'

NO.	DATE	REVISIONS	BY	CH'K	JOB ENG.	PROJ. ENG.	MGR.
2	3/11/71	REVISE SPILLWAY ALIGNMENT	T.E.N.	R.L.E.	R.L.E.		
1	11/11/70	ISSUED FOR CONSTRUCTION	T.E.N.	R.L.E.	D.T.M.		

LAS VIRGENES MUNICIPAL WATER DISTRICT

BOYLE ENGINEERING
W. A. WAHLER & ASSOCIATES

WESTLAKE RESERVOIR

SPILLWAY

EXCAVATION

DESIGNED R.L.E. DATE: 11-70 JOB ENG. D.T.M. PROJ. ENG.

DRAWN ½R.

CHECKED D.T.M.

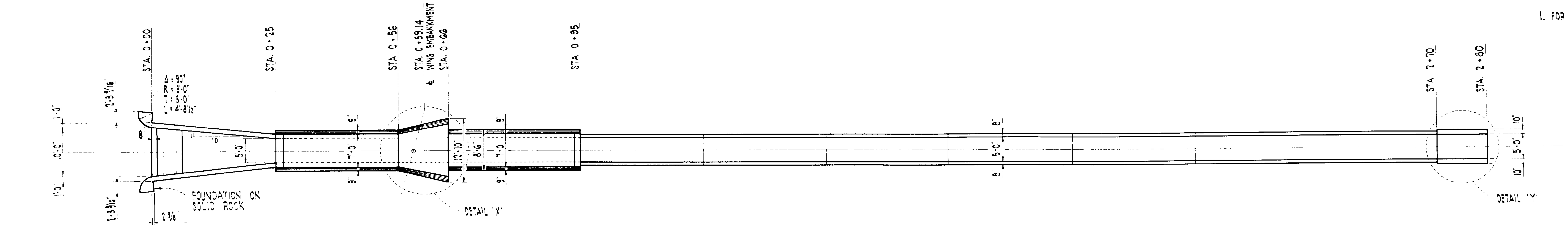
SCALE AS SHOWN

R.C.E. 9986

DRAWING NUMBER 31

NOTES

1. FOR GENERAL NOTES SEE DWS. 28

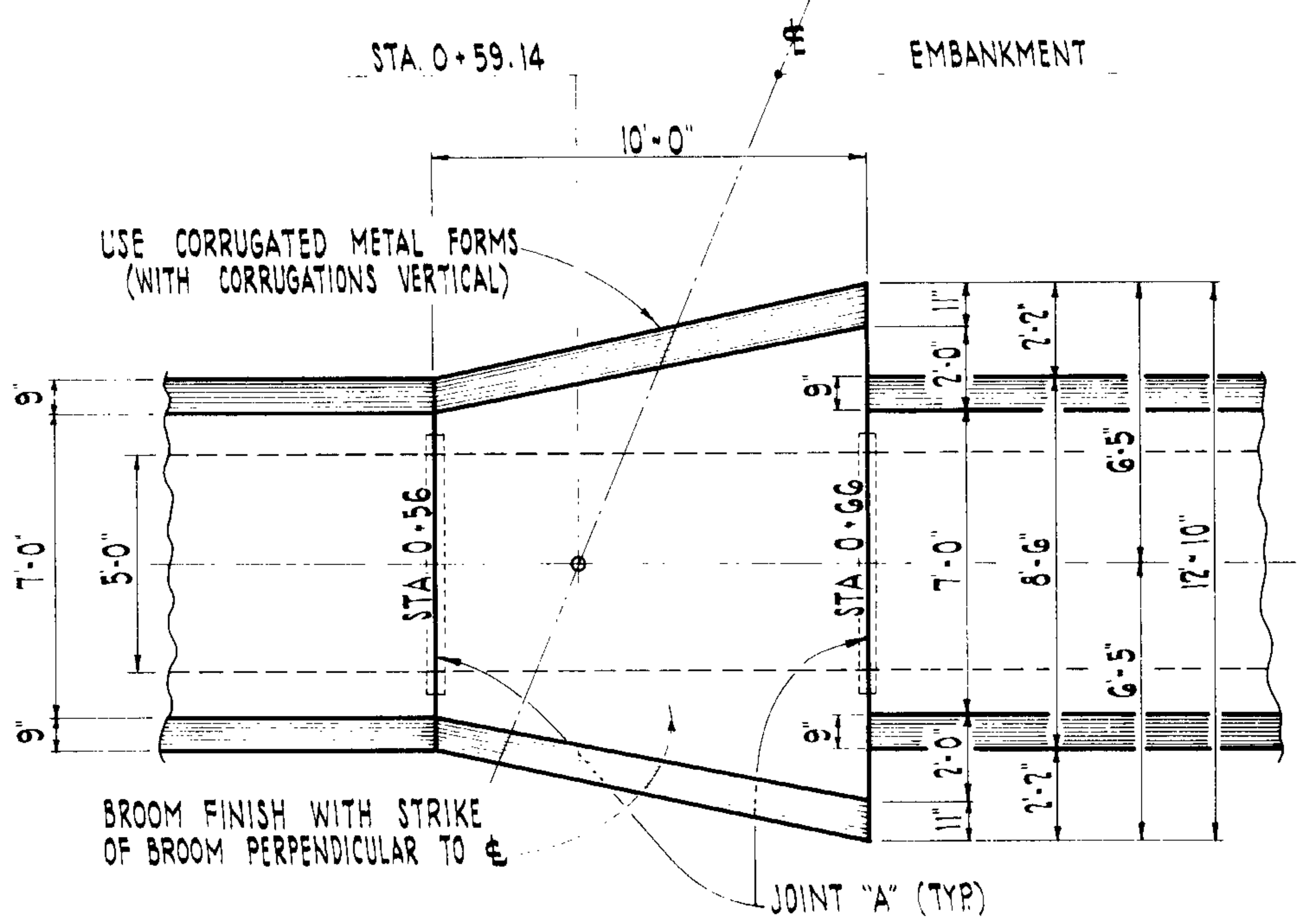


PLAN

LONGITUDINAL SECTION

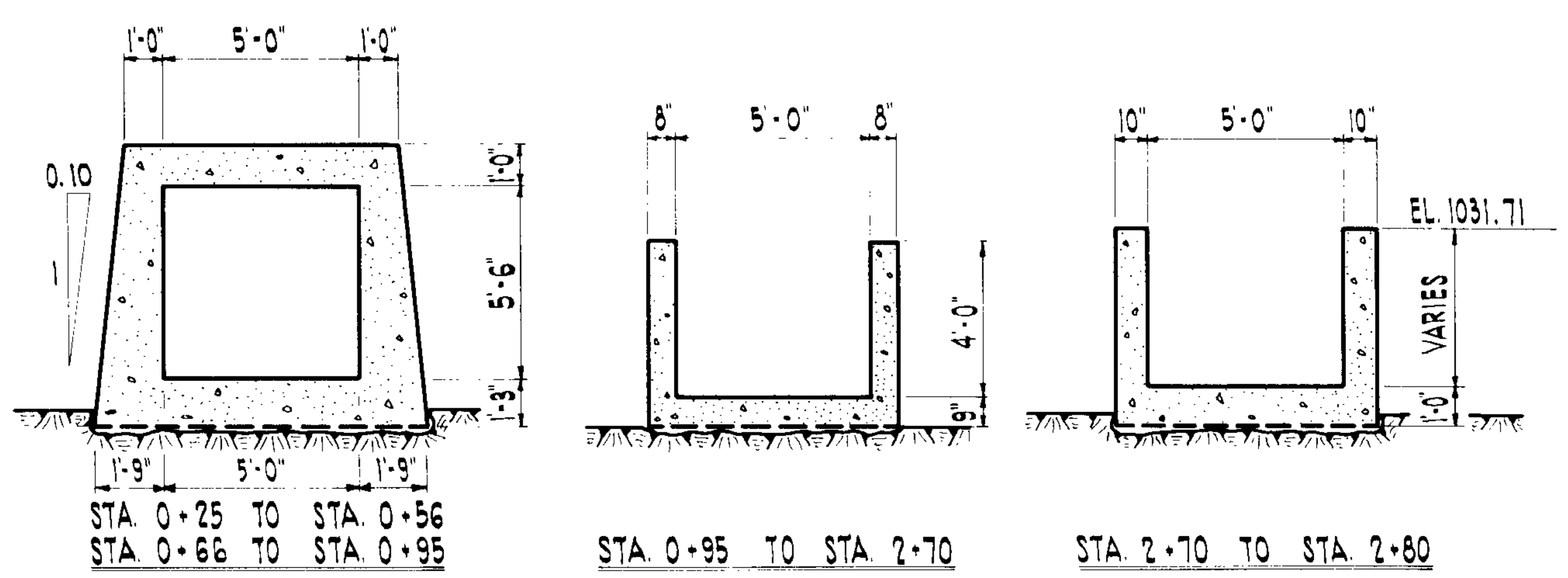
SPILLWAY ~ CONCRETE OUTLINES

SCALE: 3/32" = 1'-0"



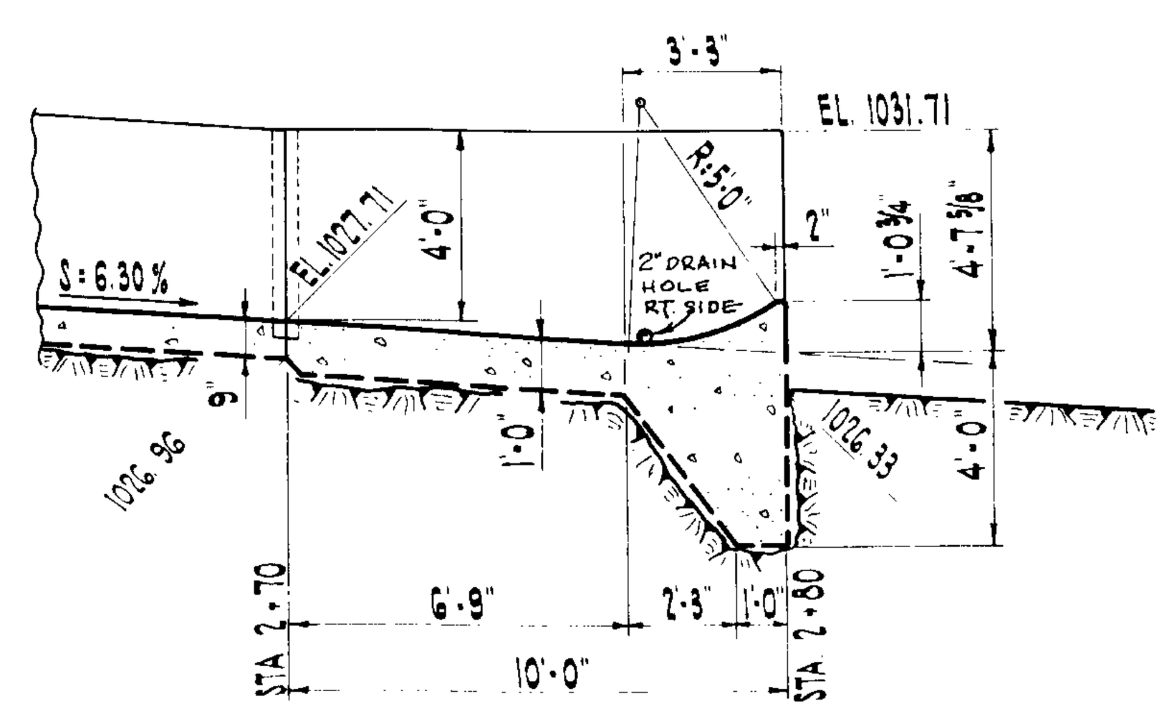
DETAIL "X"

SCALE: 1/4" = 1'-0"



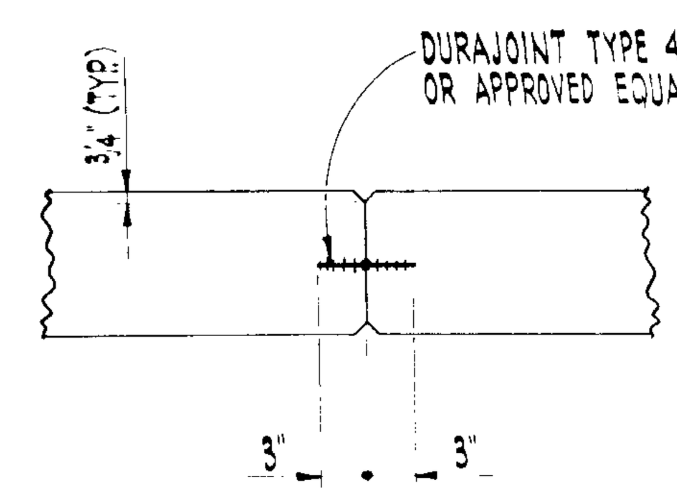
TYPICAL SPILLWAY SECTIONS

SCALE: 1/4" = 1'-0"



DETAIL "Y"

SCALE: 1/4" = 1'-0"



JOINT "A"

SCALE: NONE

05295

3/32" = 1'-0"

1/4" = 1'-0"

NO.	DATE	REVISIONS	BY	CH'K	JOB ENG.	PROJ. ENG.	MGR.
△	11/1/71	ISSUED FOR CONSTRUCTION	T.E.M.		DTM		

LAS VIRGENES MUNICIPAL WATER DISTRICT

BOYLE ENGINEERING
W. A. WAHLER & ASSOCIATES

WESTLAKE RESERVOIR

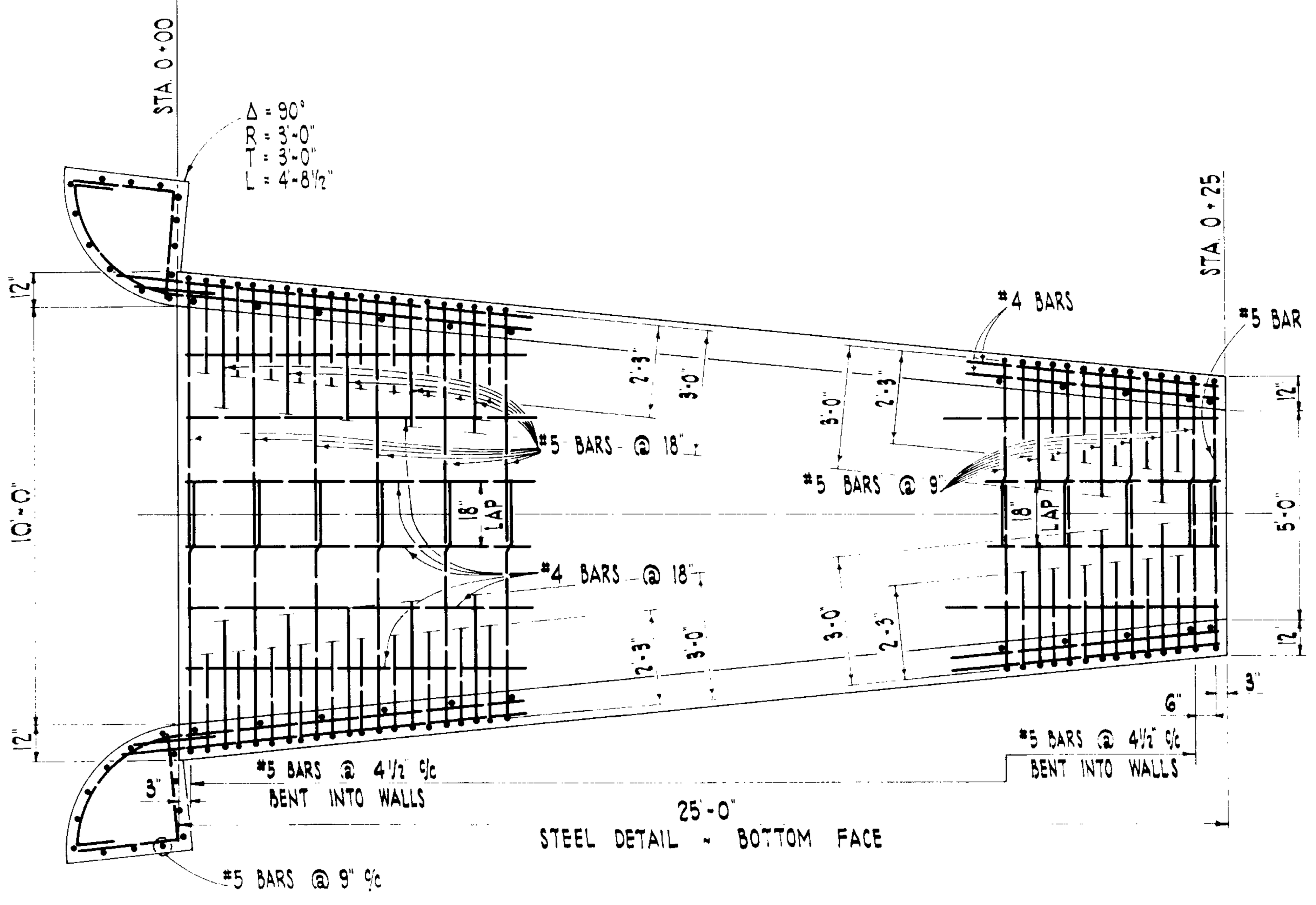
SPILLWAY

CONCRETE OUTLINES

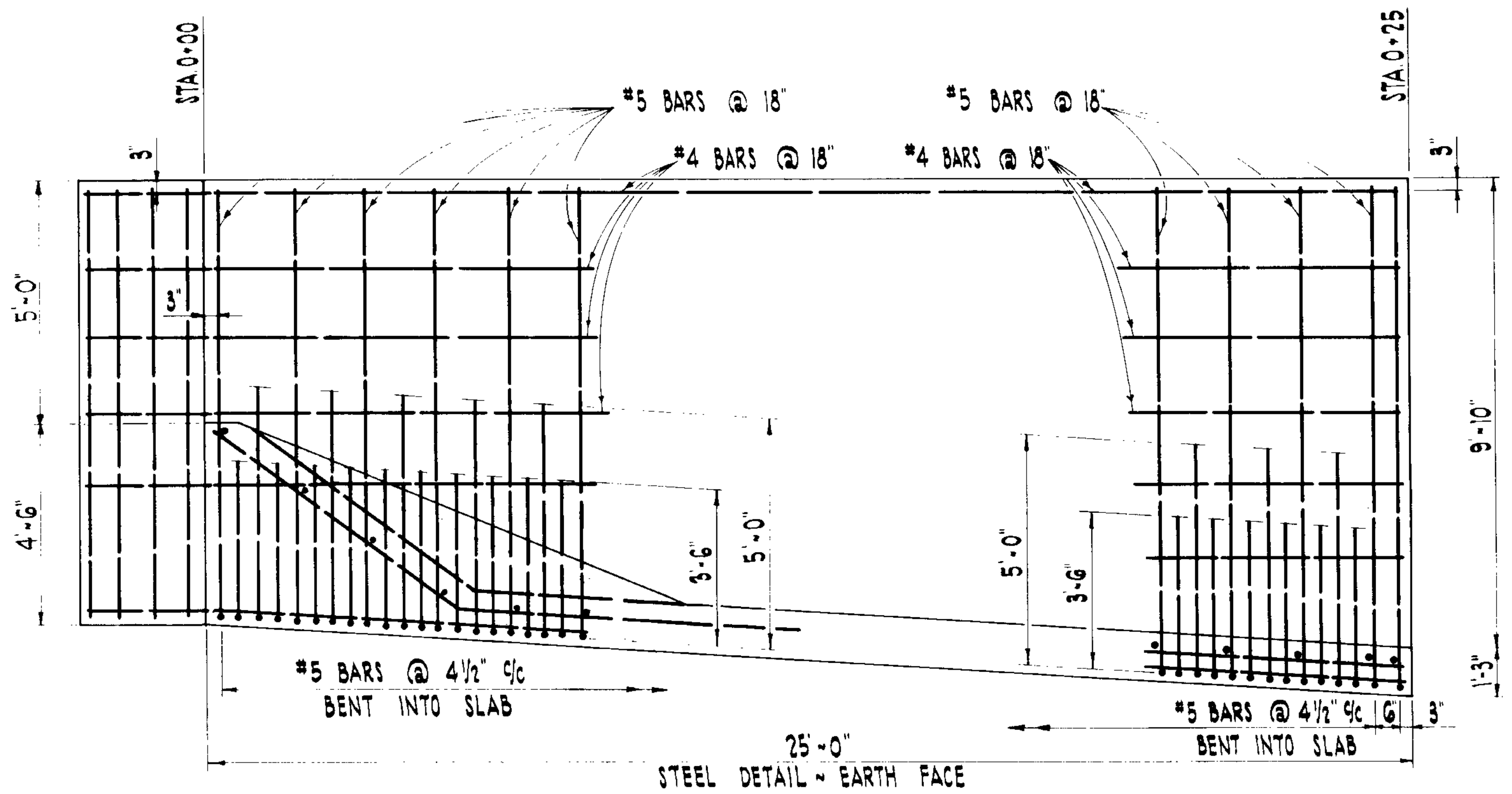
DESIGNED · DATE: 11-70 · JOB ENG. DTM · PROJ. ENG.
DRAWN · CHECKED DTM
SCALE AS SHOWN · R. C. E. 9986
DRAWING NUMBER 32 · REV.

NOTES

1. For General Concrete Notes see Drawing No. 28



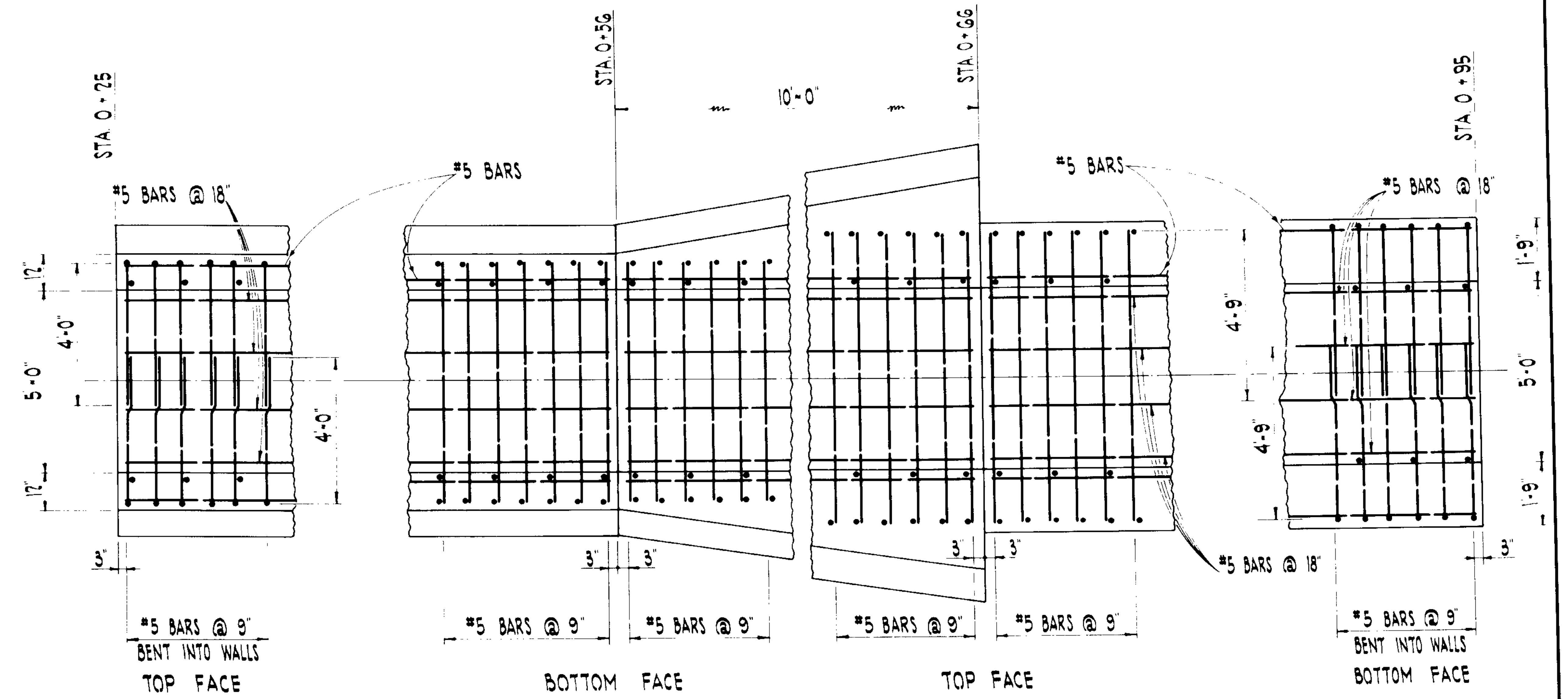
PLAN



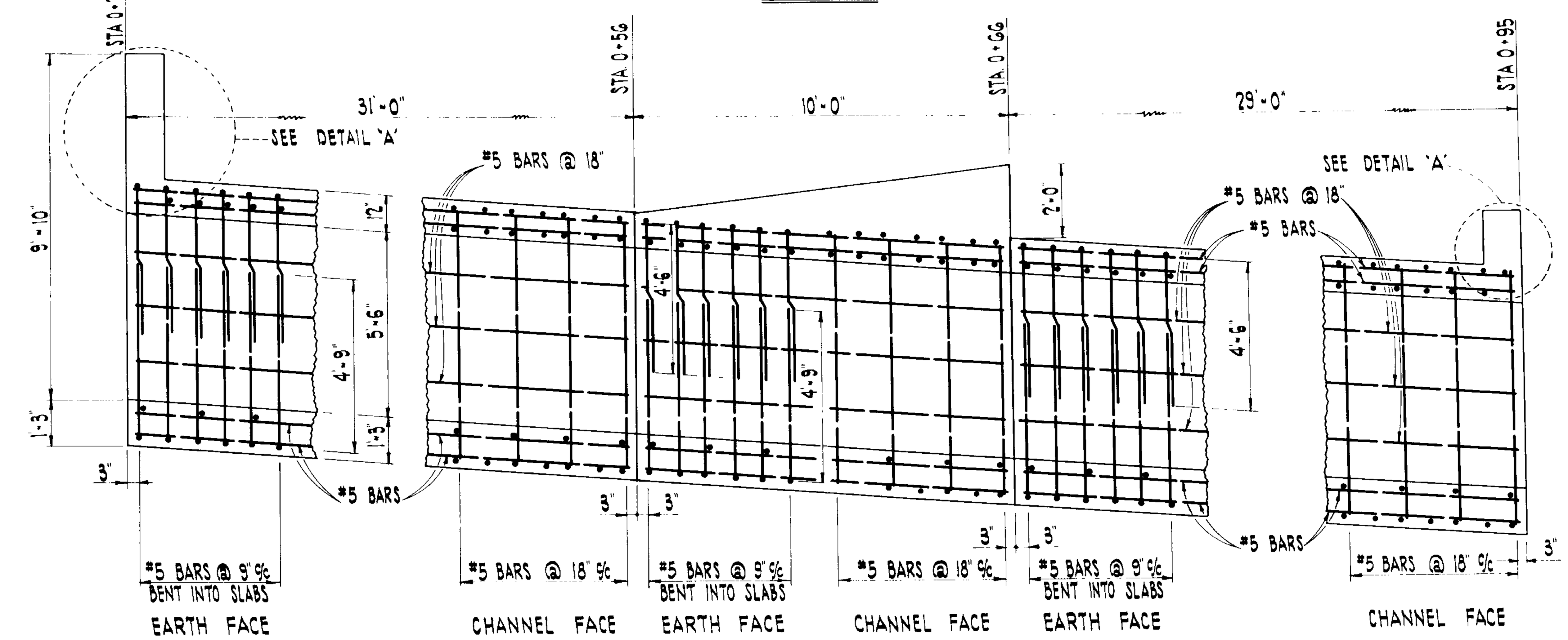
ELEVATION

SPILLWAY INLET TRANSITION

SCALE: 3/8" = 1'-0"



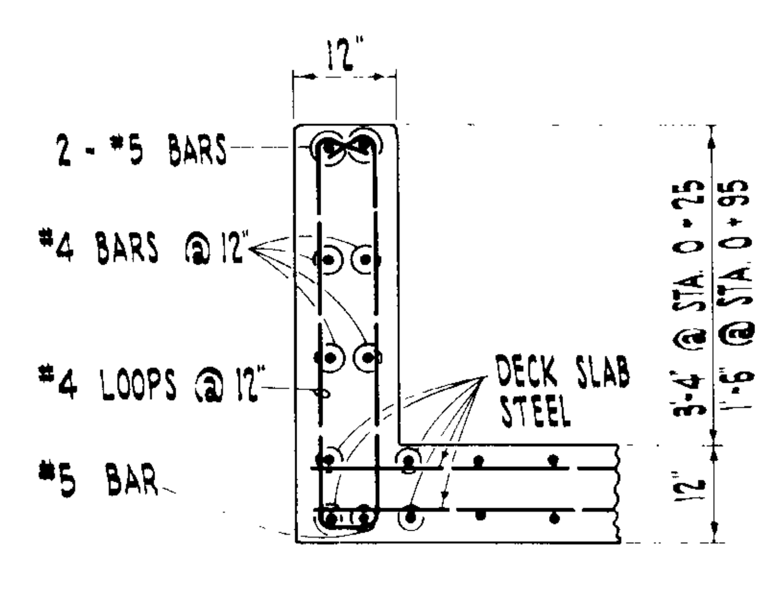
PLAN



ELEVATION

SPILLWAY BOX CULVERT SECTION

SCALE: 3/8" = 1'-0"



DETAIL 'A'

SCALE: 1/2" = 1'-0"

REFERENCE DRAWINGS

32 CONCRETE OUTLINES

05296

3/8" = 1'-0"

1/2" = 1'-0"

AS CONSTRUCTED DATE 12-13-73 HHR DFM

NO.	DATE	REVISIONS	BY	CH'K	JOB ENG.	PROJ. ENG.	MGR.
△	11/11/70	ISSUED FOR CONSTRUCTION	T.E.N.	R.K.S.	DFM		

LAS VIRGENES MUNICIPAL WATER DISTRICT

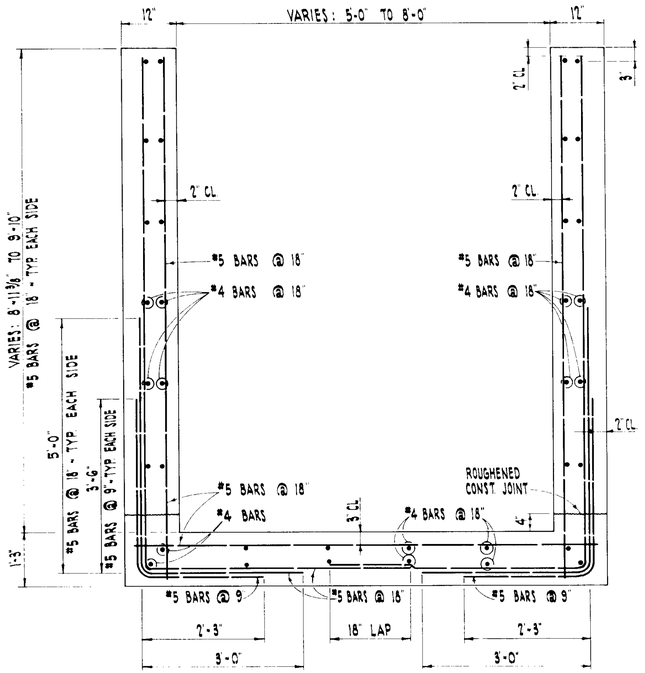
BOYLE ENGINEERING
W. A. WAHLER & ASSOCIATES

WESTLAKE RESERVOIR

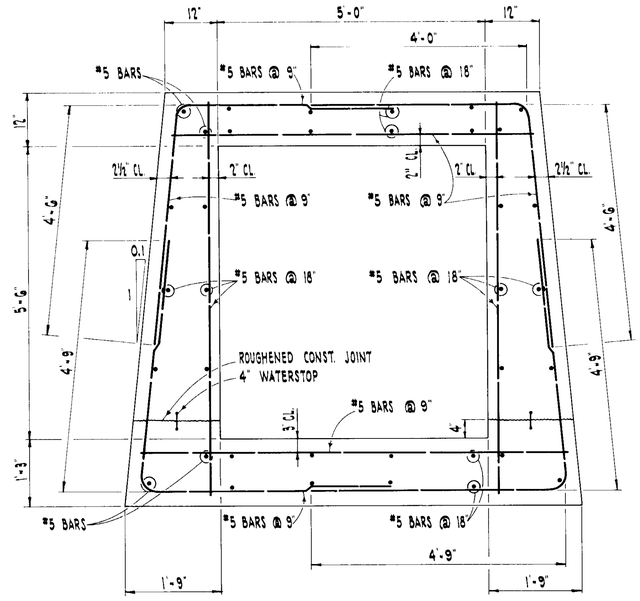
SPILLWAY

REINFORCING - SHEET 1 OF 2

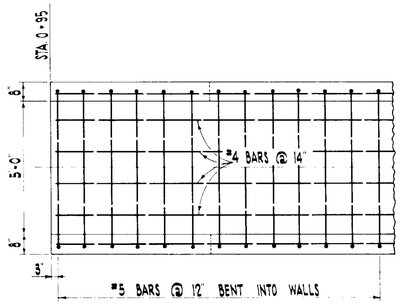
DESIGNED MJL · DATE: 11-70 · JOB ENG. DFM · PROJ. ENG.
DRAWN Y.R.
CHECKED DFM · R.C.E. 9986
SCALE AS SHOWN · DRAWING NUMBER 33 · REV.

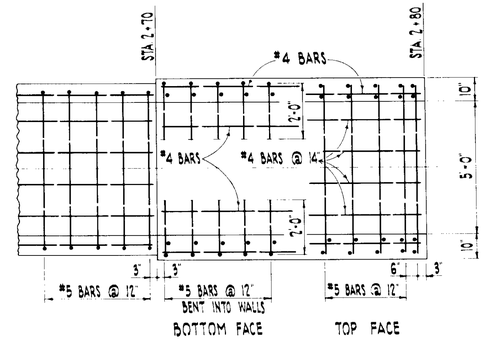


TYPICAL TRANSITION SECTION
STA. 0+10 TO STA. 0+25
SCALE: 3/4" = 1'-0"

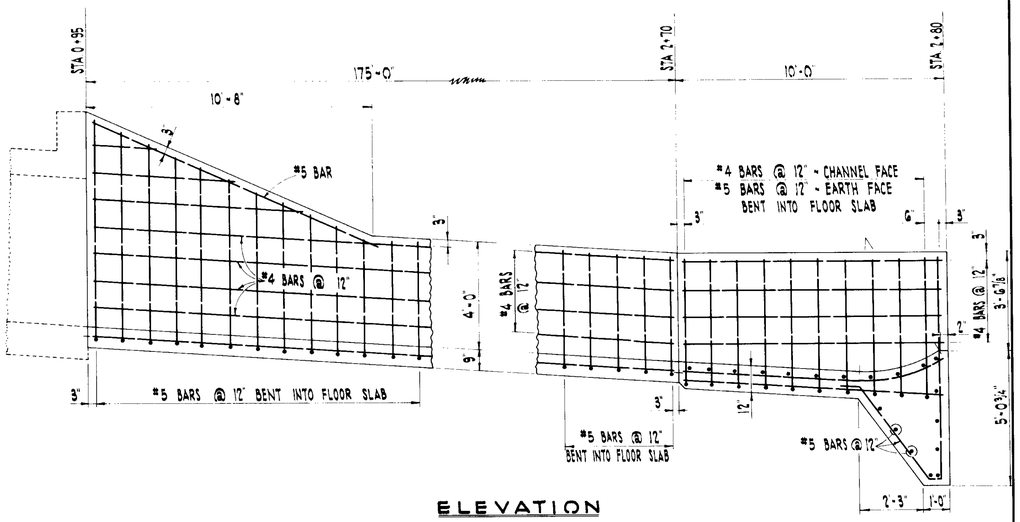


TYPICAL BOX CULVERT SECTION
SCALE: 3/4" = 1'-0"

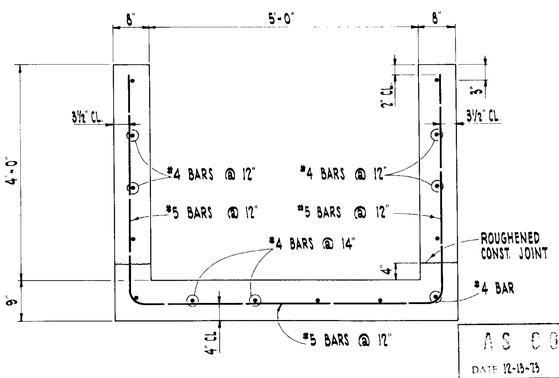




PLAN

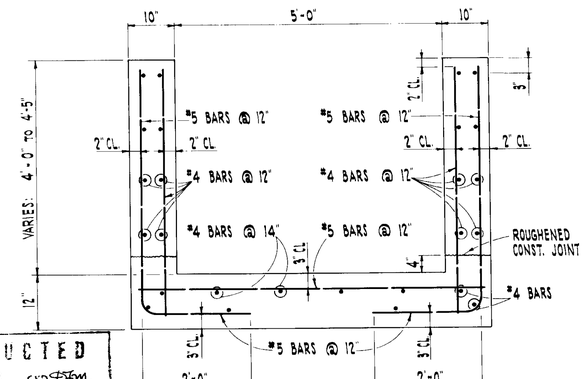


ELEVATION
OPEN RECTANGULAR CHANNEL SPILLWAY
SCALE: 3/8" = 1'-0"



AS CONSTRUCTED
DATE 12-15-75 BY [illegible] CKD [illegible]

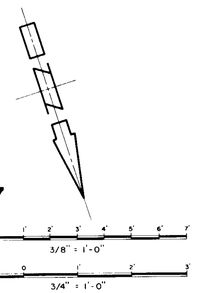
TYPICAL CHANNEL SECTION
STA.0+95.00 TO STA. 2+70
SCALE: 3/4" = 1'-0"



TYPICAL CHANNEL SECTION
STA. 2+70 TO STA. 2+76.75
SCALE: 3/4" = 1'-0"

REFERENCE DRAWINGS

32 CONCRETE OUTLINES



NO.	DATE	REVISIONS	BY	CHK	JOB ENG.	PROJ. ENG.	MGR.
△	12/15/75	ISSUED FOR CONSTRUCTION	T.E.M.R.L.	D.F.M.			

LAS VIRGENES MUNICIPAL WATER DISTRICT

BOYLE ENGINEERING
W. A. WAHLER & ASSOCIATES

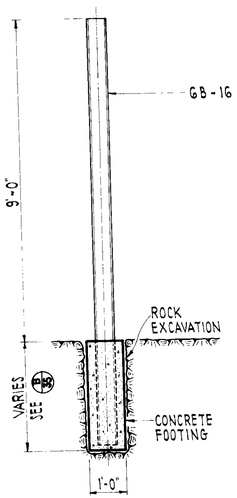
WESTLAKE RESERVOIR

SPILLWAY

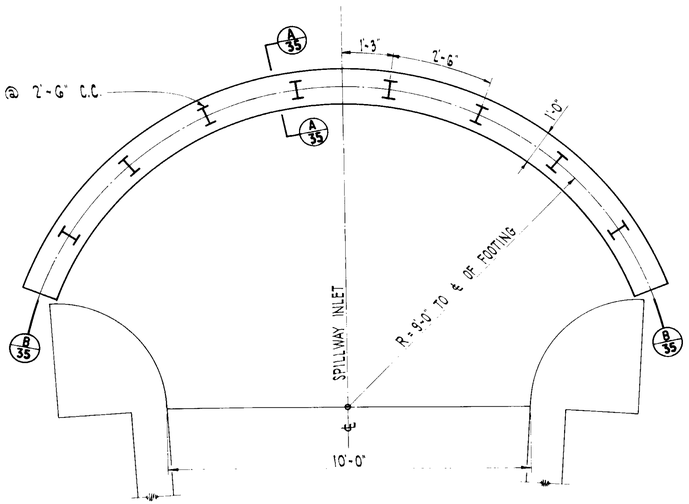
REINFORCING - SHEET 2 OF 2

DESIGNED	DATE: 11-70	JOB ENG.	PROJ. ENG.
DRAWN			
CHECKED			
SCALE AS SHOWN	R. C. E. 9986	DRAWING NUMBER	REV.

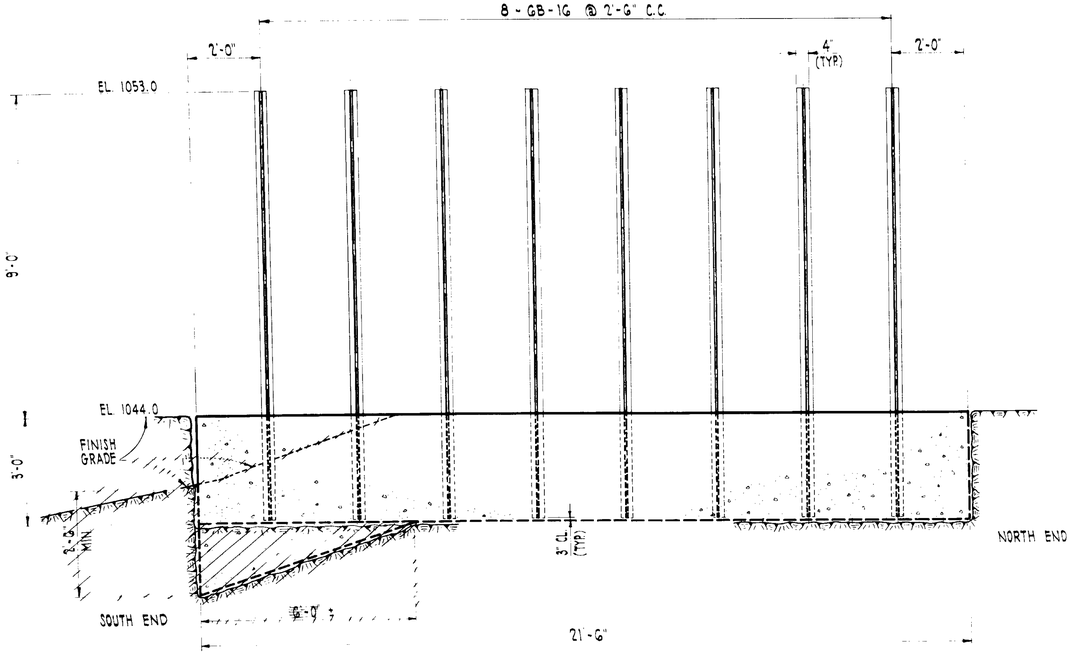
34



SECTION A/35



PLAN



SECTION B/35

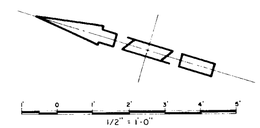
TRASH BARRIER ~ DETAIL A/35

SCALE: 1/2" = 1'-0"

AS CONSTRUCTED
DATE 4/25/73 DFT H.H.B. CKD D.T.M.

REFERENCE DRAWINGS

30 GENERAL LAYOUT



05298

NO.	DATE	REVISIONS	BY	CH'K	JOB ENG.	PROJ. ENG.	MGR.
△	9/1/70	ISSUED FOR CONSTRUCTION	T.E.M.	R.R.C.	D.T.M.	D.T.M.	R.R.C.

LAS VIRGENES MUNICIPAL WATER DISTRICT

BOYLE ENGINEERING
W. A. WAHLER & ASSOCIATES

WESTLAKE RESERVOIR

SPILLWAY

TRASH BARRIER DETAILS

DESIGNED M.A.T.	DATE: 11-70	JOB ENG. D.T.M.	PROJ. ENG. D.T.M.	
DRAWN Y.K.			DRAWING NUMBER	REV.
CHECKED D.T.M.	R. C. E. 9986		35	
SCALE AS SHOWN				