BETA UNIT

PLAN OF DEVELOPMENT

SHELL OIL COMPANY
UNIT OPERATOR
OCTOBER 1977

PLAN OF DEVELOPMENT

OF

THE BETA UNIT

Including

Parcels Covered By Leases

OCS-P 0296
OCS-P 0300
OCS-P 0301
OCS-P 0306
and
Unleased Tract 255

PREPARED AND SUBMITTED
BY
SHELL OIL COMPANY
UNIT OPERATOR
OCTOBER 1977

PLAN OF DEVELOPMENT

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SECTION I

INTRODUCTION

Shell Oil Company is to be the initial operator for the proposed Beta Unit. Other potential participants are Aminoil USA, Inc., Champlin Oil Company, Chanslor-Western Oil and Development Company, Chevron USA, Inc., Getty Oil Company, Hamilton Brothers Oil Company, Occidental Petroleum Company, and Union Oil Company of California. The Unit is located in Federal waters in the San Pedro Bay about nine miles off the Huntington Beach coast. It is to include 28,800 surface acres on five parcels covered by OCS Sale 35 Leases P-0296, P-0300, P-0301, P-0306 and the unleased Tract 255.

In accordance with Title 30, Code of Federal Regulation, 250.34, OCS Order Number 8, Pacific Region and the proposed OCS Order Number 15, this Plan of Development for the Beta Unit is submitted for approval. It includes the following: the geologic setting, field history and reservoir evaluation, platforms, drilling plans and facilities, production plans and facilities, pipelines and shore facilities and an appendix. Oil spill contingency plans are included in the appendix.

This plan covers the initial development program which includes:

1) Fabrication and installation of a drilling platform jacket and decks in 265 feet of water (Platform Ellen).

2) Fabrication and installation of a companion production platform and decks in 255 feet of water (Platform Elly) connected to the drilling Platform Ellen by a 200-foot bridge.

3) Fabrication and installation on the production Platform Elly facilities necessary

   a) to test, collect, separate, heat, treat, dehydrate, measure and transport the production

   b) to clean, treat, pressure and inject both the produced water and source water for waterflooding operations

   c) to generate the necessary power for artificial lift, injection, compression, transport, etc.

4) Construction and installation of two API type drilling rigs on the drilling Platform Ellen

5) Installation of a clean oil line to shore with sufficient onshore facilities to measure and distribute the oil to the various local refineries.

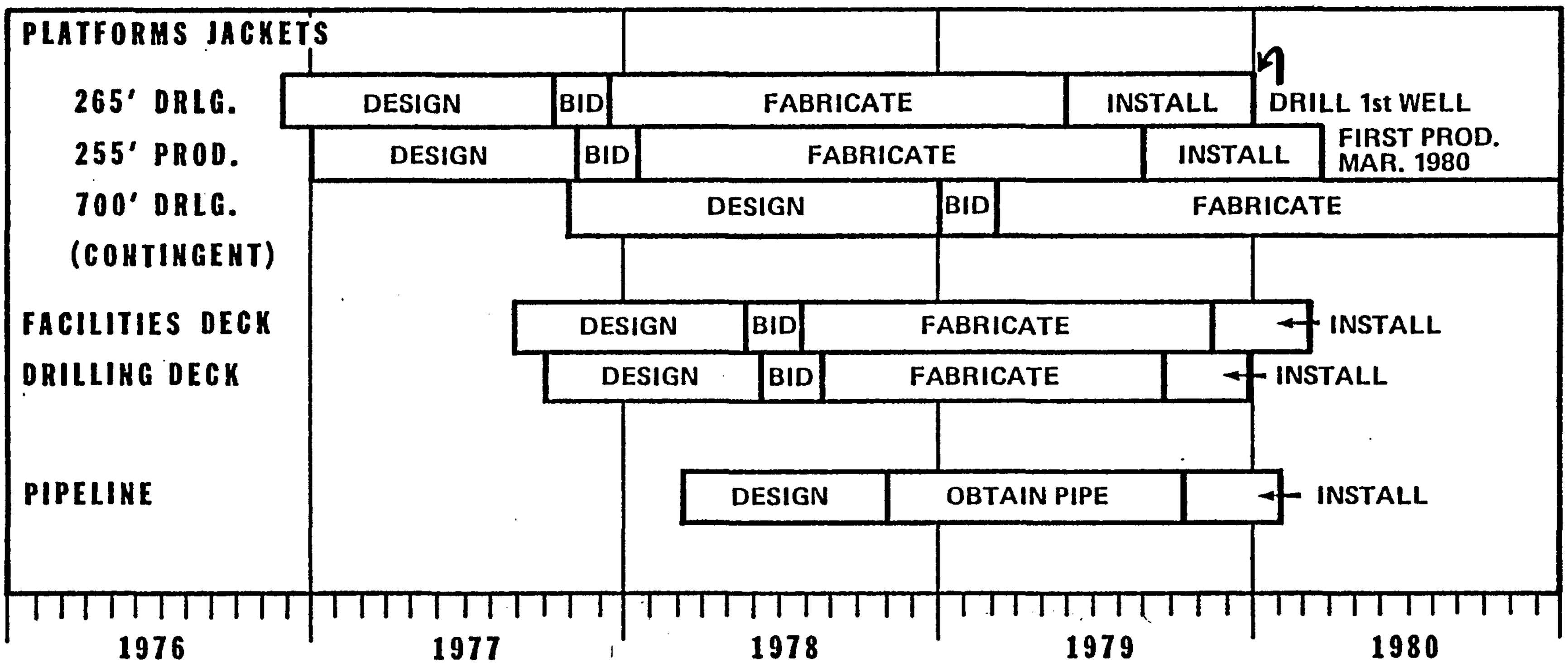
The plan envisions that an additional drilling platform in 700 feet of water will be required to develop the accumulation. The production Platform Elly will have the potential capacity to process the foreseeable production from the field.

From the drilling Platform Ellen, we plan the capability of drilling up to 80 wells including service and waterflood injectors, at angles up to 70°.

The exploration program indicates that the accumulation contains oil in seven separate producing intervals, A through G. Gas-oil ratios range from 160 to 230 cubic feet per barrel. Oil gravities range from 10-12° API in the A and G zones to 20-22° API in the upper D zone. Oil production from the drilling Platform Ellen is expected to peak at a rate of about 16,000 B/D in 1982 if the development program is not delayed. The estimated peak rate from both the 265 and 700-foot water depth drilling platforms will be 26,000 B/D of 14-16° API oil in 1984 if our development plan proceeds according to schedule.

That schedule is shown on page 1-3.

BETA FIELD DEVELOPMENT PLAN



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SECTION II

GEOLOGIC SETTING

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SECTION II

GEOLOGIC SETTING

2.1 Introduction

The area of planned development is located on the northeast shelf and slope of the San Pedro Basin in the offshore portion of the Peninsular Ranges Province (Figure 2.1). Major structural features in the vicinity of the area are the northwest trending Palos Verdes and Newport-Inglewood fault zones. These zones consist of throughgoing strike-slip faults with components of vertical offset and numerous secondary faults and folds that are typical of the structural style of the region.

Oil is currently produced from accumulations in folded structures associated with the Palos Verdes and Newport-Inglewood fault zones both onshore and offshore in San Pedro Bay. The proposed plan will develop a similar accumulation in a faulted anticline along the Palos Verdes fault zone within the Wilmington graben (Figures 2.2 and 2.3). The selected shallow-water platform sites are near the modern shelf edge in an area between the Palos Verdes fault zone and the San Gabriel submarine valley. Water depths are between 250 to 270 feet. The nearest oil production is from an offshore extension of the Huntington Beach oil field, about six miles to the northeast.

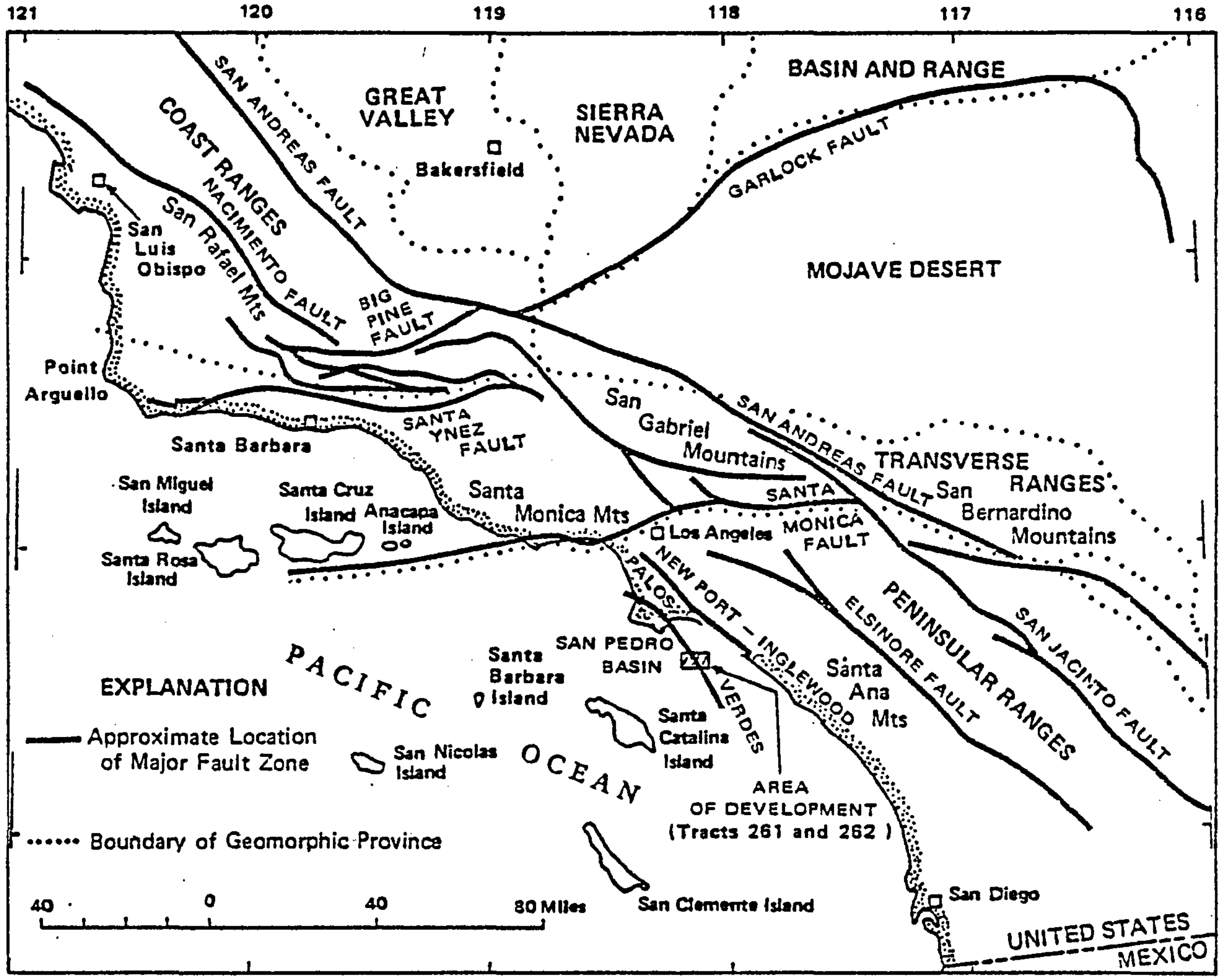
The details of the geology of San Pedro Bay and vicinity are discussed in reports by Junger and Wagner (1977), Greene (1976) and Vedder, et al., (1969).

2.2 Area Geology

Sedimentary strata in the area of development range in age from lower Miocene to Holocene. The section is predominantly interbedded turbidite sands and deep-water marine shales. The uppermost units of late Pleistocene and Holocene age include shallow water marine shale and fluvial-marine sand and gravel filled channel deposits. Basement rocks are blue schist and metamorphosed quartz diorite. Stratigraphic relationships of major units are illustrated in Figure 2.4. Quaternary stratigraphy is shown on Figure 2.5 and described in detail in a report by MESA[2], Inc., et al., (Appendix 8.1).

Structural closure for the oil accumulation is provided by a northwest-trending anticline in Miocene and Pliocene strata on the southwest flank of the Wilmington graben. The anticline is truncated on the southwest by a main branch of the Palos Verdes fault zone. Secondary faults with small displacements divide the structure into several blocks (Figures 2.3 and 2.4).

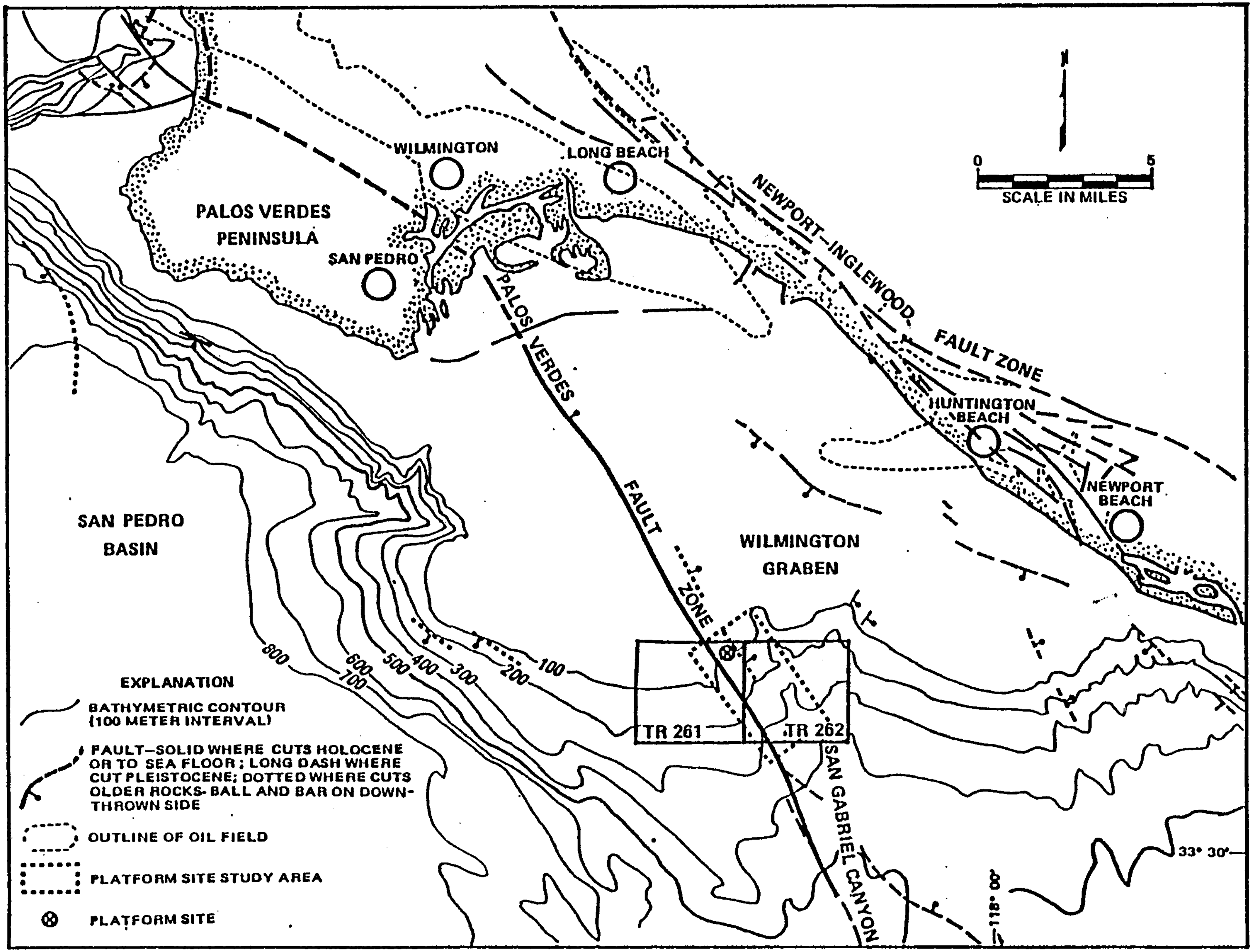
No faults can be definitely traced into Pleistocene units on CDP seismic records; however, the main branch of the Palos Verdes fault and one secondary fault (Beta fault) appear to correlate with near-surface faults that have been identified on high-resolution geophysical profiles (Figure 2.4). Indicated fault displacements in the Pliocene and lower part of the Pleistocene are schematic and not intended to represent actual values.



Index map of Southern California showing development area, fault zones and boundaries of Geomorphic Provinces, modified from Yerkes and others (1965).

FIGURE 2–1

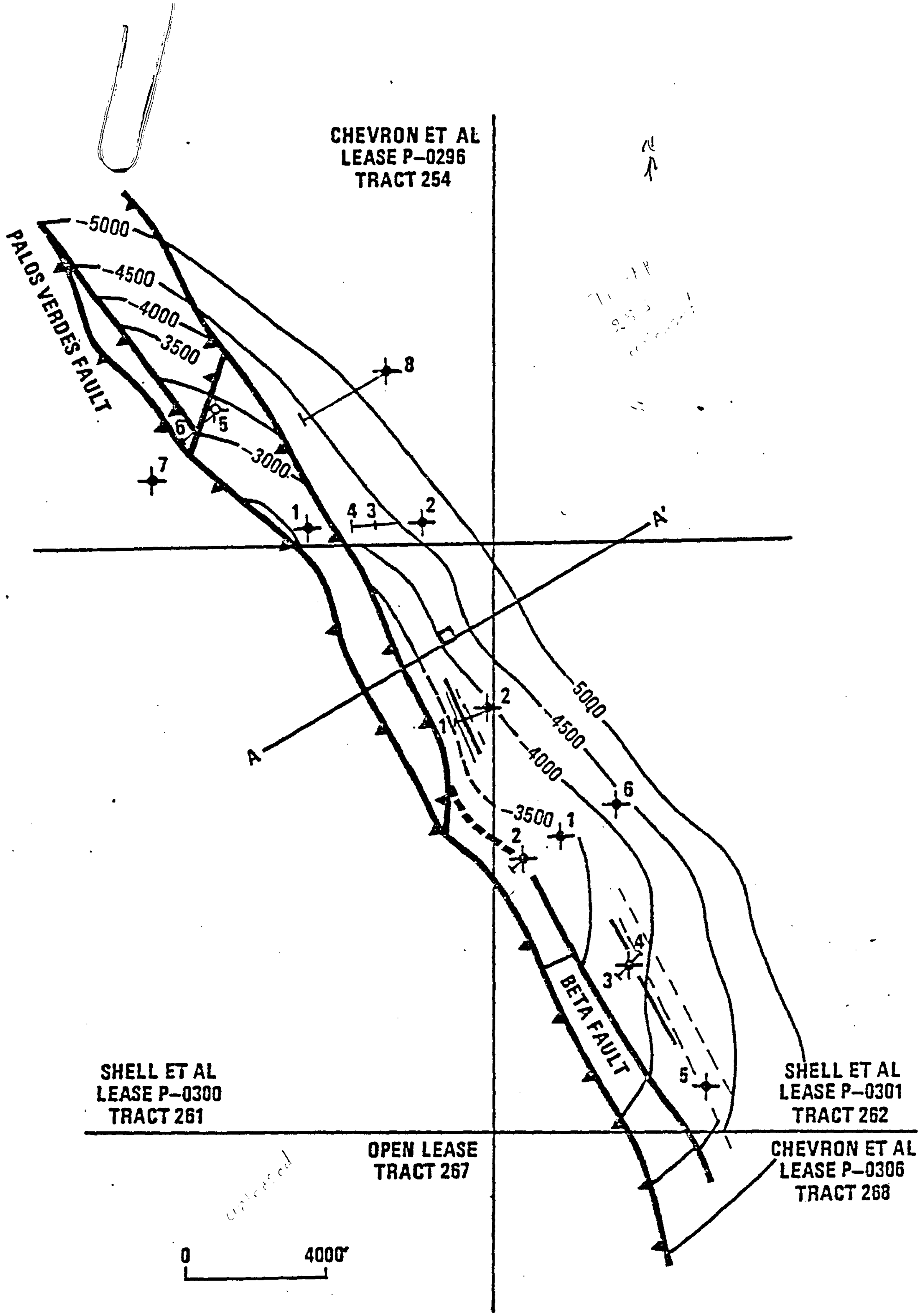
ZW 2621



After Junger and Wagner (1977)

FIGURE 2-2

LOCATION MAP OF SAN PEDRO BAY AND VICINITY SHOWING STRUCTURAL AND GEOGRAPHIC FEATURES



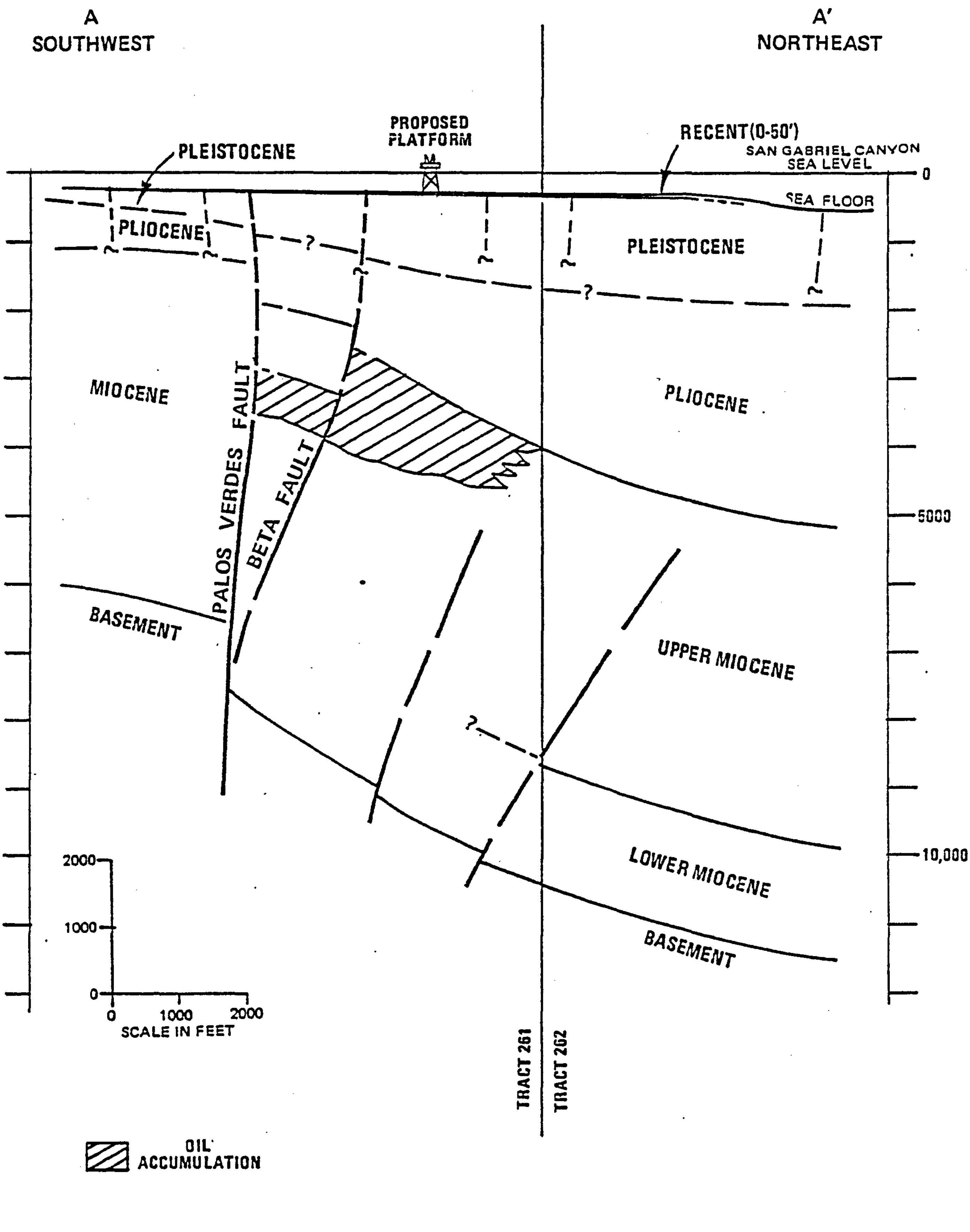
ABANDONED (HYDROCARBONS ENCOUNTERED)

SHALLOW WATER PLATFORM SITE

ZM 2618

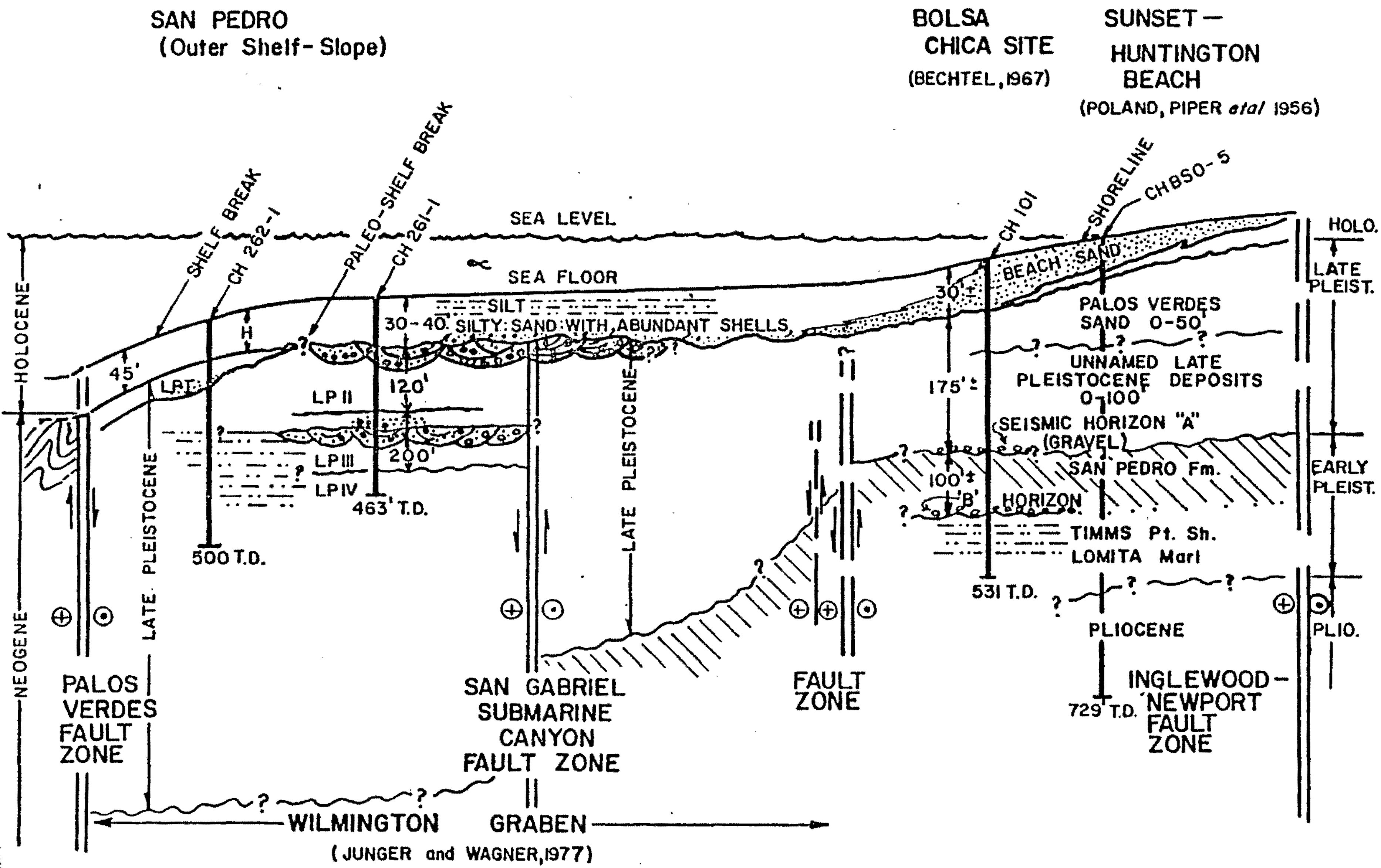
STRUCTURE MAP
(UPPER MIOCENE LAYER)

FIGURE 2–3



CROSS SECTION THROUGH SHALLOW WATER PLATFORM SITE AREA

FIGURE 2–4



Quaternary Stratigraphy

FIGURE 2-5

SECTION III

FIELD HISTORY AND RESERVOIR EVALUATION

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SECTION III

FIELD HISTORY AND RESERVOIR EVALUATION

3.1 Drilling History of OCS Tracts 254, 261 and 262 (OCS-P 0296, OCS-P 0300 & OCS-P 0301)

A number of wells were drilled on the OCS tract 254 and one on Tract 261 prior to the December 1975 lease sale (See Table 3-1). Several of the wells had heavy oil (tar) shows in thinly bedded Pliocene sands. Most did not penetrate the Miocene sands, however, and provided little geological information.

In July through October 1976, Shell drilled OCS-P 0301 No. 1 to a total depth of 8305 feet, penetrating the entire Miocene section at an updip position on the east side of the Palos Verdes Fault. The well encountered a net oil column of 520 feet at the top of the Miocene sands. Chevron initiated their exploratory drilling on tract 254 in late July 1976 by drilling OCS-P 0296 No. 1. It encountered a net oil column of 250 feet. Shell and Chevron drilled a total of 18 exploratory wells to date to evaluate the prospect. Additional exploratory drilling continues on Tract 254. Table 3-2 gives pertinent data for the exploratory wells.

3.2 Reservoir Description

The Beta accumulation is located at a structurally high position along the east side of the Palos Verdes Fault. It is located at the top of the Upper Miocene (Delmontian) between 2700 and 4700 feet subsea. It extends along the Palos Verdes Fault approximately five miles. The beds dip generally to the northeast from 10 to 30 degrees. Oil-water contacts limit the width of the accumulation to approximately one mile.

The Beta Fault divides the reservoir into at least three fault blocks, the North and South Sliver and the Main Block (See Figure 3-1). Several wells drilled in the Main block have encountered both normal and reverse faults. Low fault displacements make it difficult, however, to determine the extent of faulting or the fault trends from seismic.

The reservoir consists of an assemblage of sands, shales, and silts deposited through a submarine fan channel system. The thicker shales have been used to divide the accumulation into seven different zones lettered A through G. Each of these zones is composed of numerous turbidite sequences. Figure 3-2 is a cross section through Shell et al OCS-P 0301 No. 1 and shows the zonal correlation.

Water levels are different in each zone and show some variation from the north to the south end of the structure. The deepest proven water level was encountered in the D sand in Chevron's OCS-P 0296 No. 2 well at 4650 feet subsea. All other zones have shallower water levels, but are generally below 4000 feet subsea. Limited drilling has indicated that the A through E sands are wet in the North Sliver, but oil bearing in the South.

3.3 Well Test Data

During the exploratory drilling program, four Shell et al wells and three Chevron et al wells were production tested. Detailed data for these tests are tabulated in Tables 3-3 through 3-8.

3.4 Reservoir Fluid Properties

Produced oil and sidewall samples show a decrease in API gravity degrees within individual sands from the structural crest to the water levels. Average zonal gravities increase from the A sands to the top of D and then decrease from the top of D downward. Figure 3-3 shows the estimated gravity versus depth for each zone. The D sand is treated as two separate zones due to the wide variation in gravity. The estimated average produced gravity for the 265 foot platform is 16° API.

Produced gravity from Shell et al OCS-P 0301 No. 3 and sidewall gravity data from Shell et al OCS-P 0301 No. 5 show evidence of a heavier oil gravity at the south end of the structure. The reason for the lower gravity is uncertain. Figure 3-4 shows the estimated gravity curves by zone for the south end. A deep water platform in 700 feet of water would be expected to produce an average of 13° to 14° API oil.

PVT studies have been used to relate oil viscosities to oil gravities. Figure 3-5 shows the relationship derived from test samples.

The Formation Volume Factor and gas in solution are shown on Figure 3-6. The curves are based on Beal and Standings correlations (AIME Petrol. Trans., Vol. 165, 1946 and Drilling and Production Practice, 275, API, 1947) and have been verified by PVT studies.

The bubble point pressure is very near reservoir pressure. There have been no measurable quantities of H_2S in any of the produced gas samples. Sulfur content of the crude ranges from 3 to 4 percent.

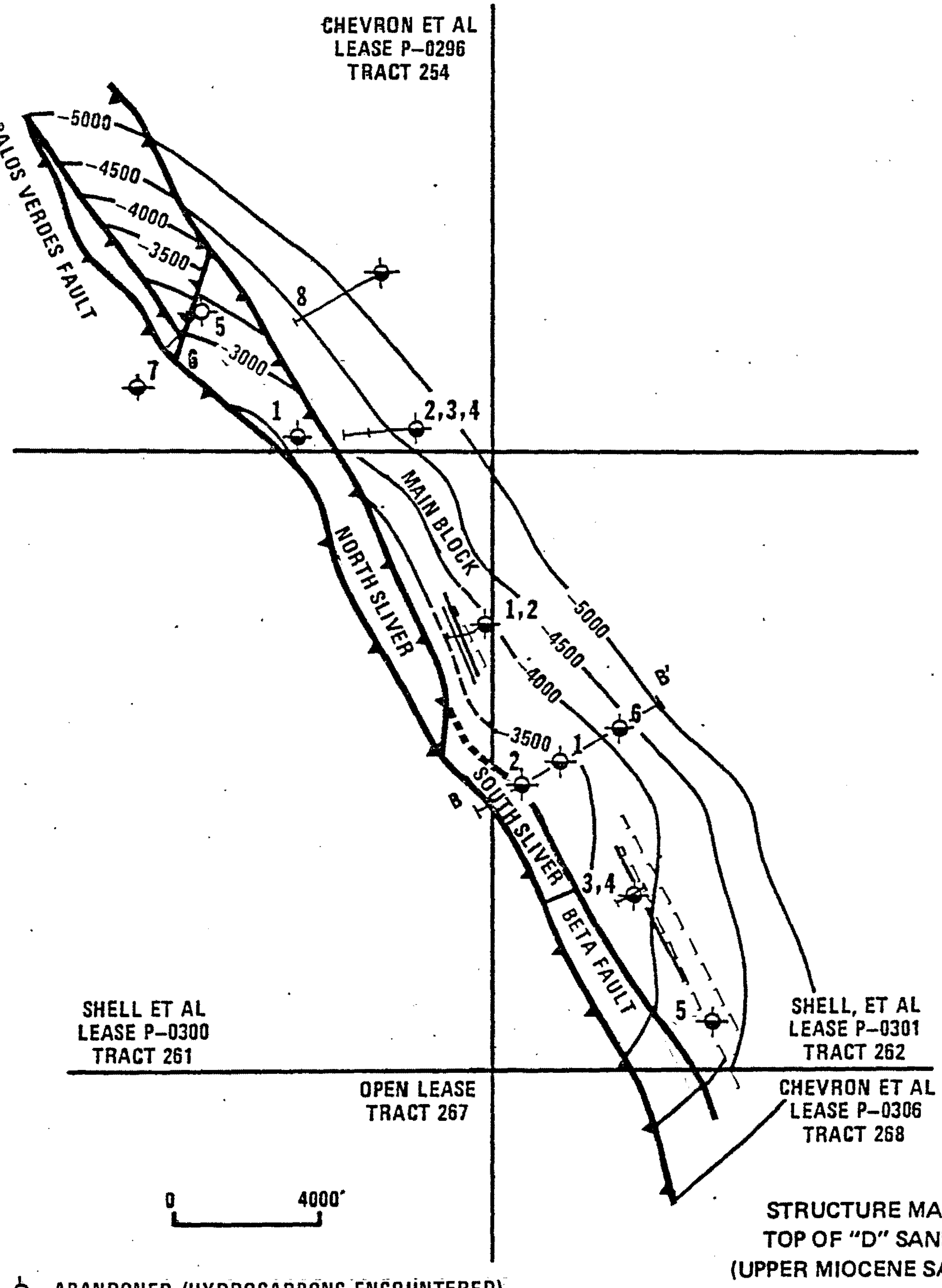
3.5 Development Plans

It is planned to drill up to 60 wells on Tracts 261 and 262 and up to 20 wells on tract 254 from the 265 foot platform. The development plan is based on 15 acre spacing and a maximum drilling angle of 70°. The preliminary well locations are shown on Figure 3-7. This development plan will be modified, however, as new geological and well performance data are obtained.

Future plans will likely include a 700 foot platform to produce the deep portions of the reservoir. Approximately 60 wells at 15 acre spacing will be required.

3.6 Anticipated Production

The estimated peak oil production rate from the 265 foot platform will be approximately 16,000 B/D in 1982. The estimated peak oil rate from both the 265 and 700 foot platforms will be 26,000 B/D in 1984.



STRUCTURE MAP
TOP OF "D" SAND
(UPPER MIOCENE SAND)

FIGURE 3–1

X-SECTION B-B'
BETA PREDEVELOPMENT

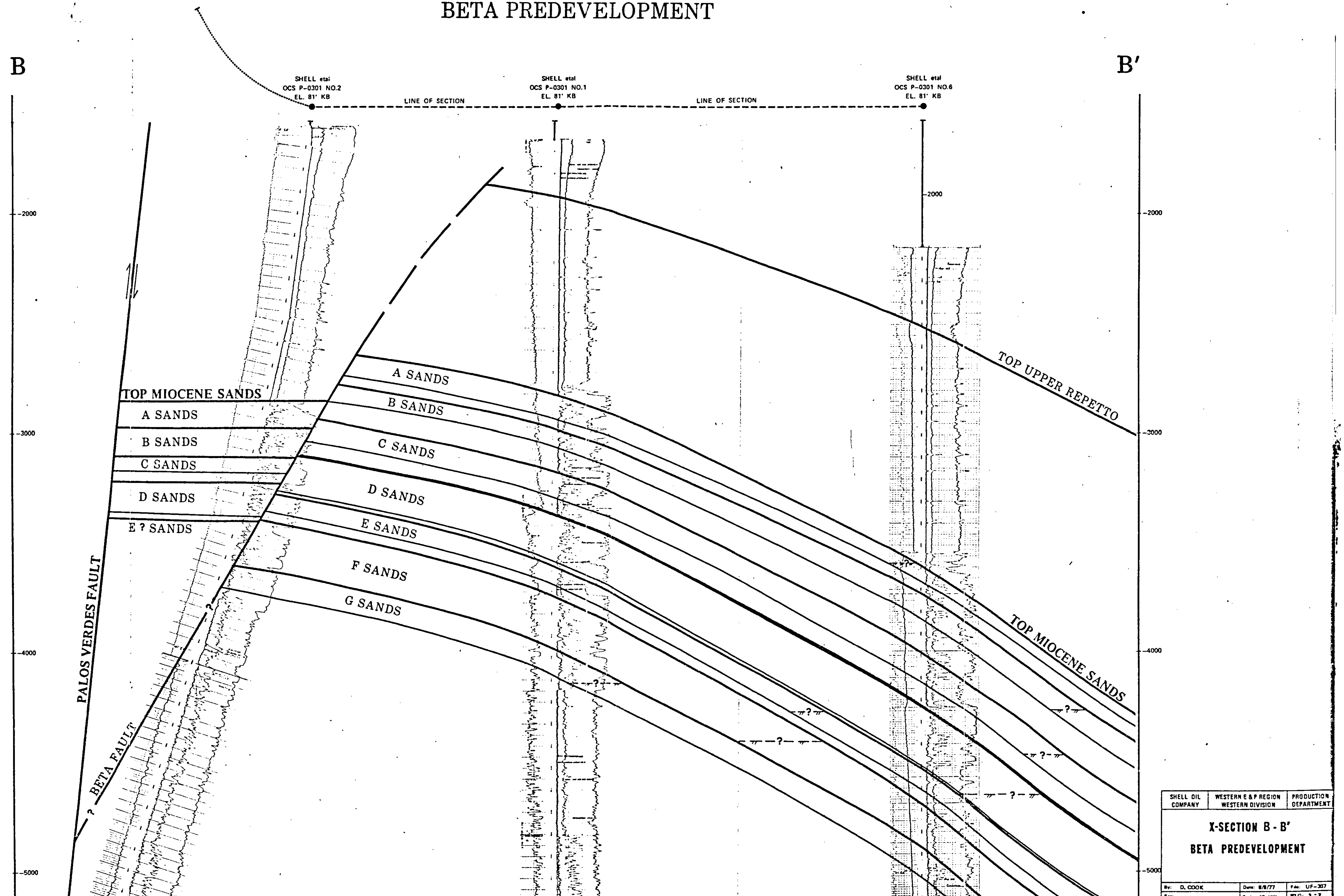


FIGURE 3–2

GRAVITY CURVES

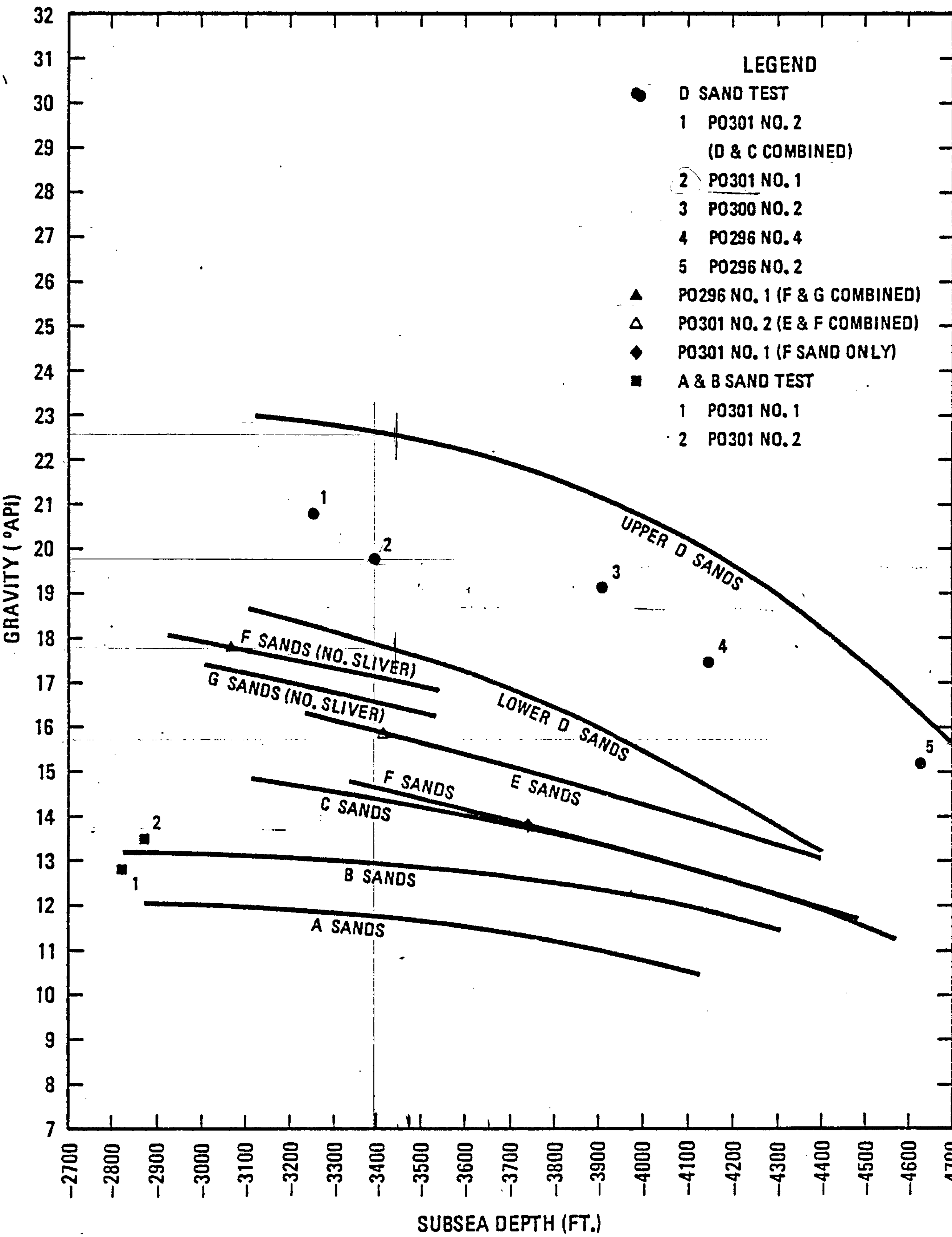


FIGURE 3–3

ZF–2661 A

GRAVITY CURVES – SOUTH END OF STRUCTURE
(SOUTH OF MIDPOINT BETWEEN WELLS P–0301 NO.1 AND P–0301 NO. 2)

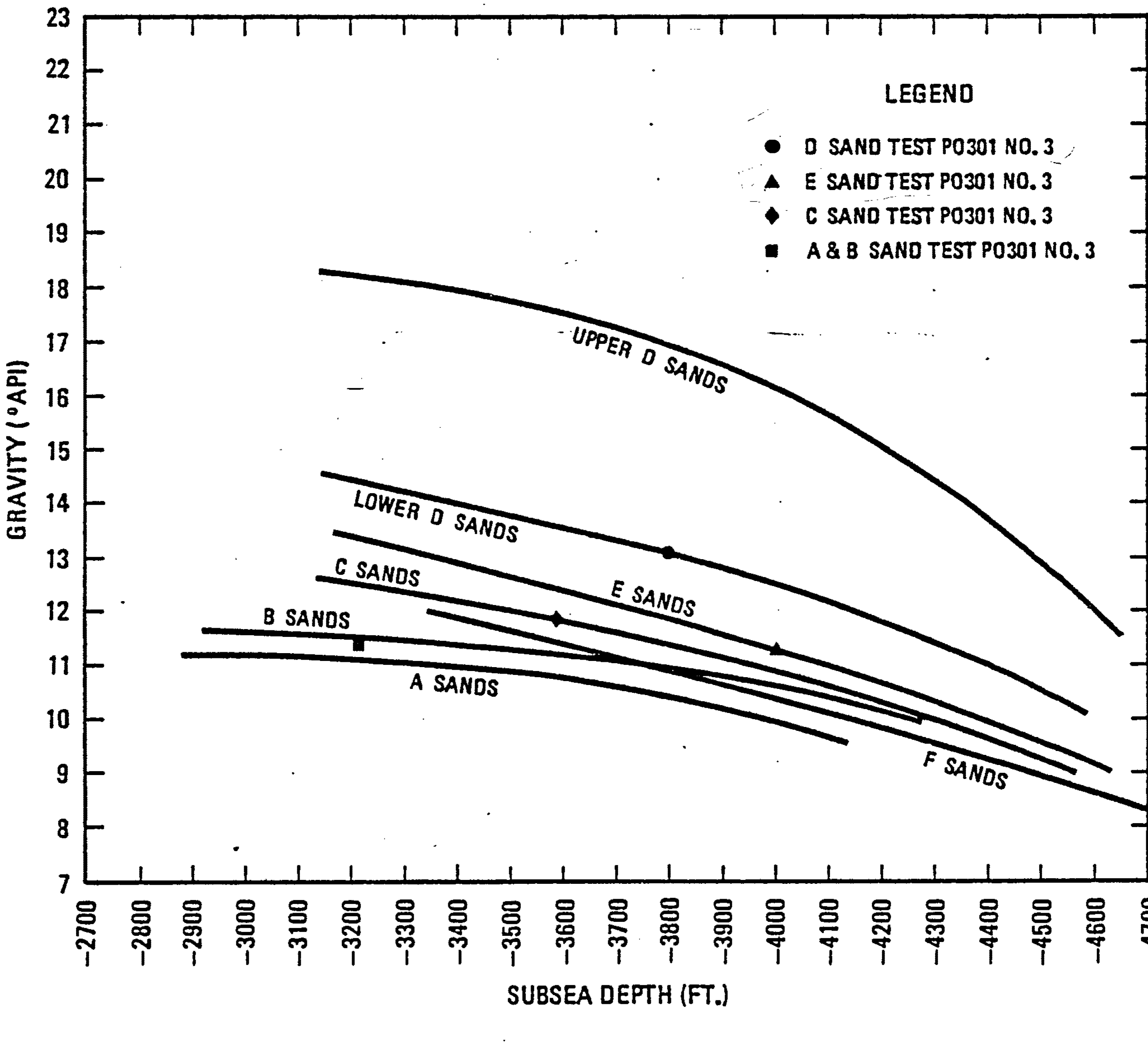


FIGURE 3–4

ZF–2661 B

OIL VISCOSITY VS API GRAVITY
BETA PROSPECT
GAS SATURATED AT 140°F

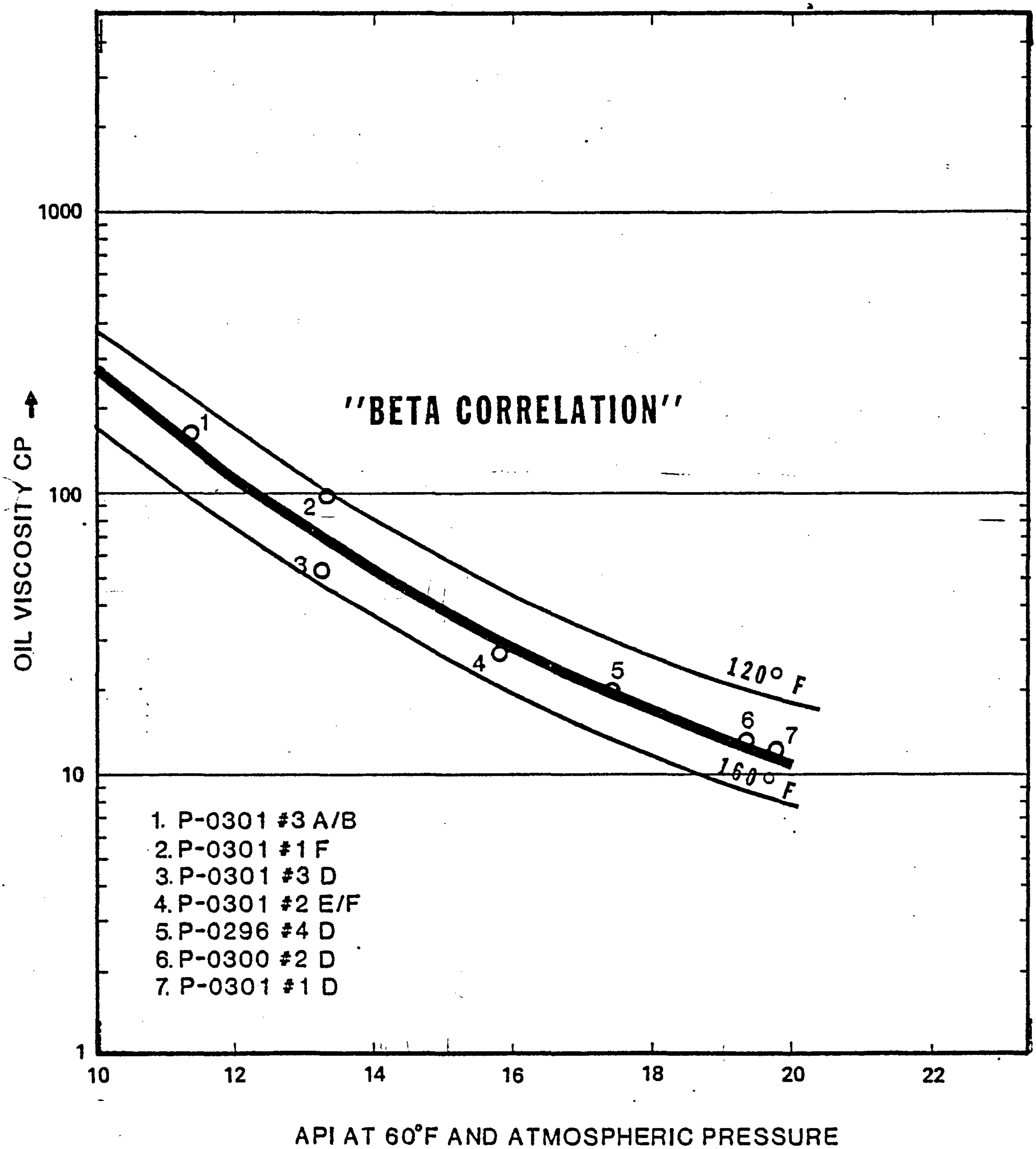


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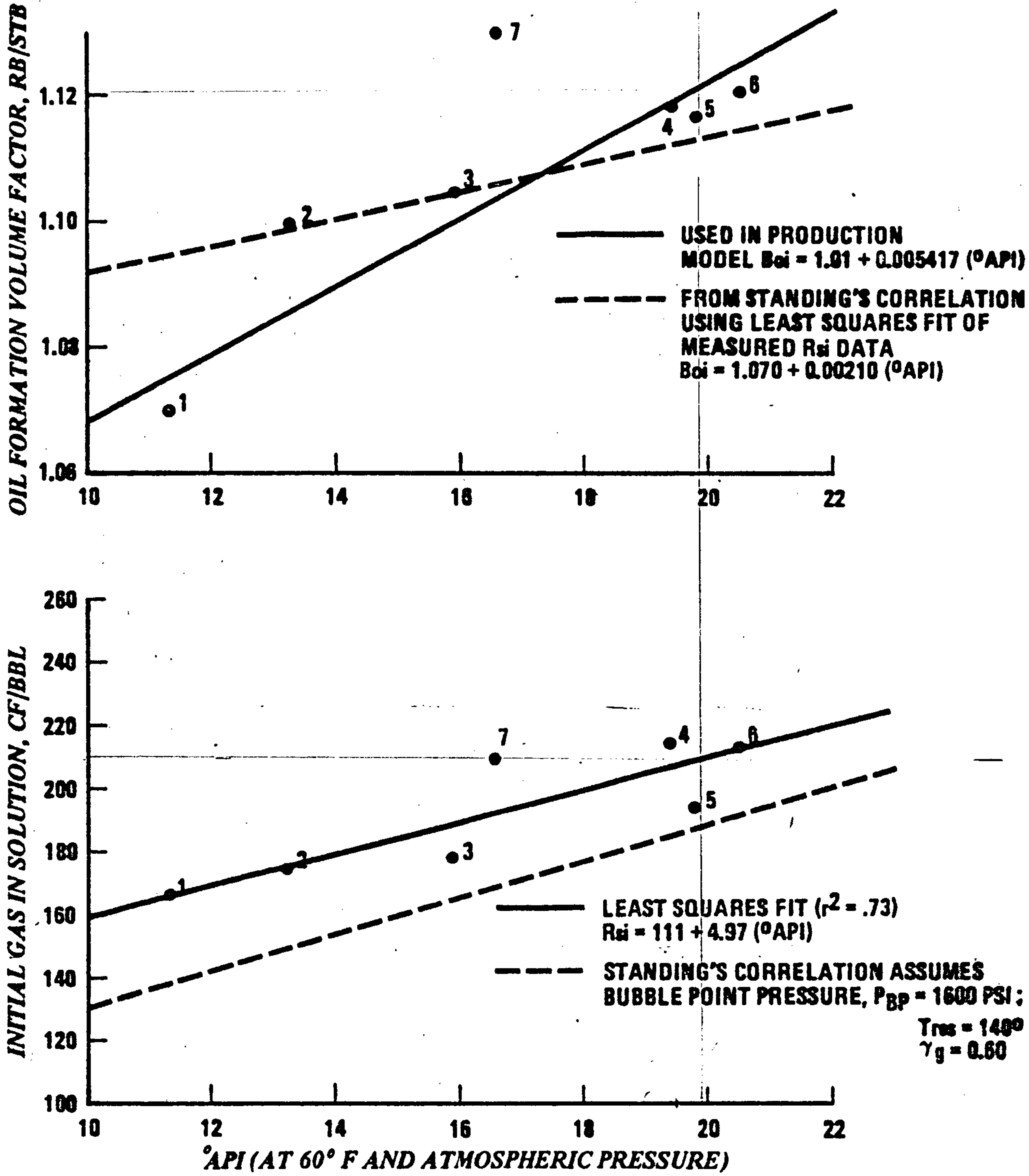
FIGURE 3–5

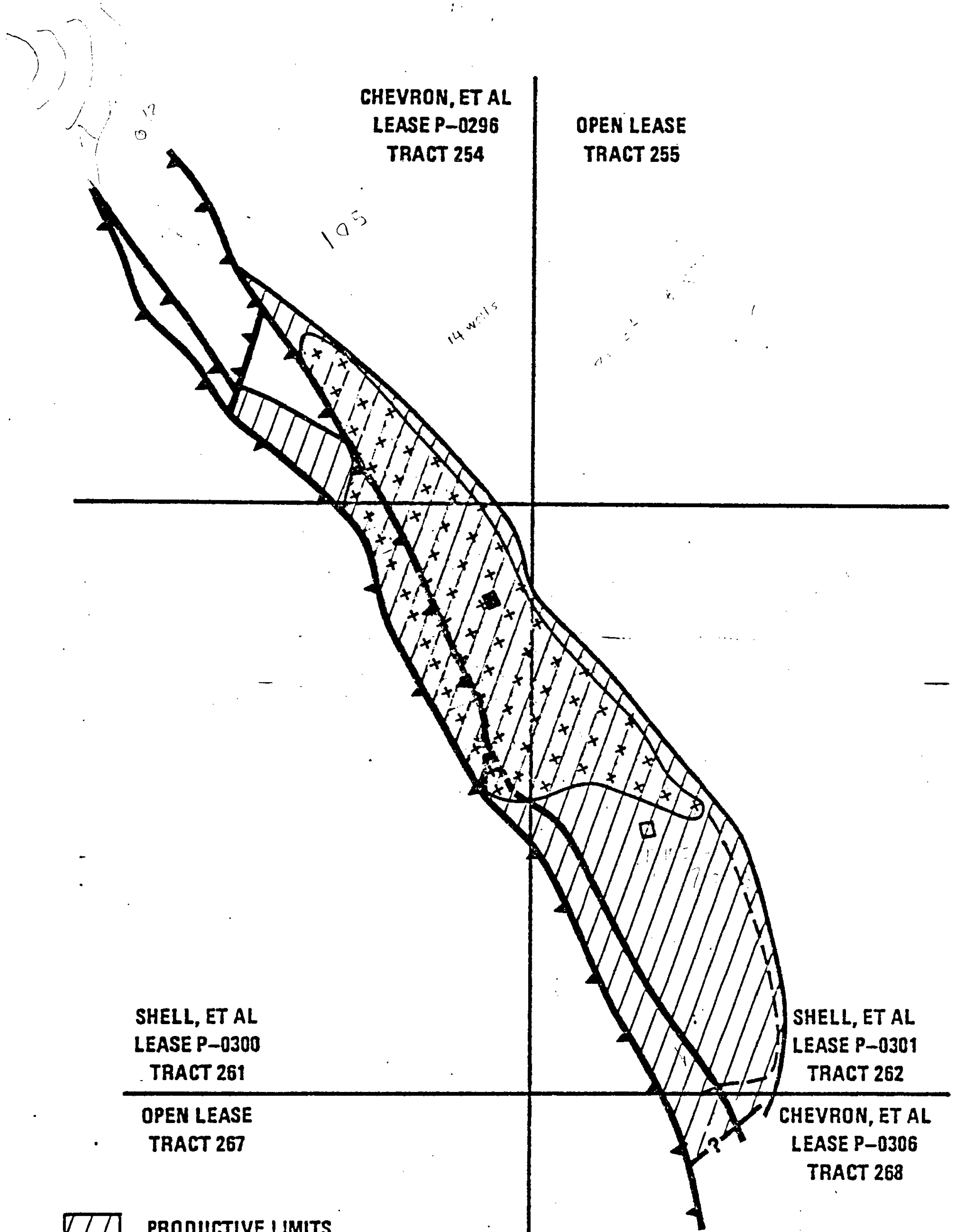
FLUID PROPERTIES
BETA RESERVOIR



		P_{BP}, psi	T, °F	°API	Boi, RB/STB	Rsi, CF/BBL	CALCULATED* Rsi, CF/BBL
1	301–3 A/B	1563	138	11.3	1.070	167	138
2	301–3 D	1779	147	13.2	1.100	175	166
3	301–2 E/F	1595	144	15.9	1.105	179	161
4	301–1 D	1597	139	19.4	1.119	216	184
5	300–2 D	1397	158	19.8	1.117	195	152
6	301–2 C/D	1503	140	20.5	1.121	215	177
7	296–4 D	1825	155	16.6	1.130	210	188

$$*R_s = \gamma_g \left[\frac{P_{BP} \cdot 10^{0.0125\,API}}{18 \cdot 10^{0.00091\,T}} \right]^{1.2048}$$ (FROM STANDING)

FIGURE 3–6



PRODUCTIVE LIMITS
■ PROPOSED 265' PLATFORM
\+ PRELIMINARY WELL LOCATIONS
□ PROBABLE LOCATION OF DEEP PLATFORM
— — — APPROXIMATE REACH OF DEEP PLATFORM

WELL LOCATIONS AND PRODUCTIVE LIMITS MAP

FIGURE 3–7

ZF–2581 S

PRE-LEASE SALE DRILLING ACTIVITY

WELLS	APPROXIMATE SURFACE LOCATION X	APPROXIMATE SURFACE LOCATION Y	BOTTOM HOLE LOCATION	T.D. MEASURED	D.F. ELEVATION	DATE DRILLED
Socal 10R-26	1428765	523840	Straight Hole	2000'	22'	05/11/64
Socal 10R-16	1422860	519070	Straight Hole	5375'	27'	11/17/59
Socal 10R-32A	1428600	529570	Straight Hole	2512'	17'	06/01/64
Cuss 10-119	1421710	527040	Straight Hole	2850'	27'	
Signal III-3	1427060	523440	Straight Hole	3525'	32'	11/12/64
Richfield C.H. #1	1423140	529700	Straight Hole	5151'		07/08/58
Mobil SP-20	1427880	528940	Straight Hole	5700'	22'	02/08/65
Signal III-2	1422070	534840	Straight Hole	6037'	32'	10/25/64

Table 3-1

BETA PREDEVELOPMENT DRILLING ACTIVITY

		SURFACE LOCATION X	SURFACE LOCATION Y	BOTTOM HOLE LOCATION X	BOTTOM HOLE LOCATION Y	T.D. MEASURED	T.D. VERTICAL	D.F. ELEVATION	DATE DRILLED
OCS TRACT 254									
Chevron, ET AL P0296	No.1	1424768	523215	1424512	522108	10895	10690	27	07/20/76
	No.2	1427783	523353	1427599	523426	6090	6082	27	11/25/76
	No.3	1427783	523353	1426486	523323	5193	4915	27	01/17/77
	No.4	1427783	523353	1425943	523219	5336	4714	27	02/03/77
	No.5	1422266	526457	1422314	526391	4680	4678	27	03/07/77
	No.6	1422266	526457	1421250	525407	5115	4675	27	03/28/77
	No.7	1420620	524520	1420830	524791	7505	7466	29	04/09/77
	No.8	1426856	527389	1424543	526206	6076	4987	29	08/11/77
OCS TRACT 261									
Shell, ET AL P0300	No.1	1429659	518289	1428716	517599	4850	4581	81	04/11/77
	No.2	1429659	518289	1429659	518174	5002	4979	81	05/12/77
OCS TRACT 262									
Shell, ET AL P0301	No.1	1431456	514741	1431607	514896	8305	8288	81	07/03/76
	No.2	1430536	514196	1429351	513959	6266	6083	81	10/22/76
	No.3	1433391	511268	1430854	509928	8084	7169	72	01/04/77
	No.4	1433391	511268	1433789	511417	4962	4911	72	05/13/77
	No.5	1435480	508088	1435557	508086	5582	5580	72	05/31/77
	No.6	1433016	515608	1433074	515618	5244	5241	81	06/09/77

Table 3-2

TABLE 3-3

PRODUCTION TEST DATA
WELL NO. P-0301 #1

	"A/B" Zone 2905-3164 10/4-10/14/76	"D" Zone 3446-3652 9/28/76	"F" Zone 3815-4018 9/7-9/24/76
Perfs:	2907-2929; 2935-2953; 2958-2973; 2980-3002; 3074-3096; 3113-3123;	3456-3484; 3490-3530, 3539-3449; 3557-3575; 3580-3589; 3595-3609;	3817-3830; 3834-3852; 3857-3879 3883-3937; 3956-3993; 4003-4018
Net Pay (Ft)	62 (A) 38; (B) 24	133	138
Average Porosity	30%	27%	28%
Average Water Saturation	35%	23%	32%
Hours Tested	-	10 (Flowed 5)	-
Choke Size	3"	96/64"	3"
Flowing Tubing Pressure	0	185-315 psi	0
Cumulative Produced Volumes			
Oil (BBLS)	100 cc's	93.4	7 Est.
Gas (MCF)	-	12.9 Est.	1 Est.
Water (BBLS)	-	11.63 (Includes Load)	-
GOR (CF/BBL)	-	138 CF/B Est.	-
Calculated 24 Hour Production Rates			
Oil (B/D)	-	473 B/D	5 Est. During Swab
Gas (MCF/D)	-	65 Est.	9 Est.
Water (B/D)	-	-	-
Oil Gravity (^{o}API)	12.7^o	19.6^o	13.7^o
Pressure Analysis			
Pwf (Avg.) (psi)	800 minimum	1415 (@ 3329 ss)	1455 (@ 3712 ss) q=3.4 B/D
P* (psi)	1210? @ 2792 ss	1544 (@ 3329 ss)(.464 psi/ft)	1696 (@ 3712 ss) .457 psi/A
Drawdown DP (Avg.) (psi)	410 max.	129 (145 max.)	241 (500 max.)
Length PBU (Hrs)	12.6	7	12 3/4
Semi-Log Straight Line ?	No	Yes (In 1.5 hr.)	Yes (In 4 hrs.)
q (B/D)	24	97	
m (psi/cycle)	-	18.5	112
μ_o (cp)	240 cp	13.2	105
k_o (md)	-	95	
h (ft)	62'	133' (57' above Fill @ 3423')	138' (Perfed)
k_oh (md-ft)	-	12635	
Skin	-	-2.2	
r_w (ft)	-	0.35	
C_o (psi-1)	-	8.3 x 10-6	
B_o (Res BBL/STBBL)	1.03	1.119	
Completion Data			
Casing Size/Liner Size	9 5/8"/-	9 5/8"/-	9 5/8"/-
Slot Size/Gravel Size	-/-	-/-	-/-
Completion Type/Lift Type	CP*/N_2	CP*/N_2, Flow	CP*/Swabbing

*CP=Casing Perforations

PRODUCTION TE ATA
WELL NO. P-0301 #2

	"A/B" Zone 2980-3176	"C/D" Zone 3328-3507	"E/F" Zone 3532-3676
	12/19-12/23/76	12/13-12/14/76	12/2-12/9/76
Perfs:	2988-3020; 3025-3037; 3049-3055; 3059-3070; 3091-3102; 3106-3122; 3126-3155; 3160-3165; 3172-3177;	3229-3273; 3278-3299; 3348-3369; 3373-3390; 3396-3411; 3417-3432; 3437-3440- 3444-3449; 3452-3461; 3466-3474; 3478-3482; 3486-3502;	3533-3539; 3545-3561; 3566-3580; 3584-3598, 3601-3618; 3635-3675;
Net Pay (Ft)	83 (A) 44; (B) 39	132 (C) 48; (D) 84	79 (E) 51; (F) 28
Average Porosity	30% Avg. (A) 31; (B) 29	24.4% Avg. (C) 25; (D) 24	20.6% Avg. (E) 22; (F) 18
Average Water Saturation	39% Avg. (A) 35; (B) 43	30.3% Avg. (C) 29; (D) 31	41.4% Avg. (E) 41; (F) 42
Hours Tested	99	22 1/2	25
Choke Size	50/64"	46/64"	76/64"
Flowing Tubing Pressure	75	80	180
Cumulative Produced Volumes			
Oil (BBLS)	100 cc's	179.1	35.9
Gas (MCF)	-	29.65	6?
Water (BBLS)	-	42.2 (Includes Load)	14.6 (Includes Load)
GOR (CF/BBL)	-	166	170?
Calculated 24 Hour Production Rates			
Oil (B/D)	0	110-360	40-60
Gas (MCF/D)	0	18-60	7-10
Water (B/D)	0	2-7	8-12
Oil Gravity (^{o}API)	13.4^{o}	20.6^{o}	15.7^{o}

Pressure Analysis

	A/B 12/19	12/20	12/21	12/22	C/D	E/F
Pwf (Avg.) (psi)	700	1000	900	900	1190	1148
P* (psi)	1247 (.434)	1276	?	?	1470 (@ 3174 ss) .463 psi/ft	1570 (@ 3452 ss) (.455p)
Drawdown DP (Avg.) (psi)	547	276	376	376	280 (370 max.)	422 (520 max.)
Length PBU (Hrs)	11.6	13.2	12.1		24.0	15.8
Semi-Log Straight Line ?	No	No	No	No	Yes (In 7 hrs.)	No. Used Type Curve Analysis
q (B/D)	-				123	42.6
m (psi/cycle)	-				66.3	149.6
μ_o (cp)	-				11.6	32.4
k_o (md)	-				29.5	20.5
h_o (ft)	-				132	79'
$k_o h$ (md-ft)	-				3877	1620
Skin	-				+0.94	-1.5
r_w (ft)	-				0.51	0.50
C_o (psi-1)	-				8.2 x 10-6	8.6 x 10-6
B_o (Res BBL/STBBL)	-				1.108	1.03

Completion Data

	A/B	C/D	E/F
Casing Size/Liver Size	9 5/8"/-	9 5/8"/-	9 5/8"/-
Casing Size/Gravel Size	-/-	-/-	-/-
Completion Type/Lift Type	CP*/N_2	CP*/Flow	CP*/N_2

*CP=Casing Perforation

TABLE 3-4

PRODUCTION TES..ATA
WELL NO. P-0301 #3

27/107

	"A/B" Zone 3305-3628 5/3-5/9/77	"C" Zone 3669-3842 4/23-4/28/77	"D" Zone 3904-4130 4/9-4/16/77		"E" Zone 4168-4258 3/19-3/31/77
Perfs:	3310-3314; 3317-3323; 3325-3332; 3336-3352; 3355-3390; 3399-3411; 3422-3434; 3444-3457; 3461-3472; 3476-3481; 3490-3495; 3498-3514; 3518-3554; 3561-3565; 3576-3579; 3582-3584; 3595-3597; 3610-3618; 3622-3630;	3672-3688; 3692-3737; 3740-3768; 3772-3790; 3794-3807; 3810-3814; 3817-3828; 3830-3836; 3840-3845;	3906-3909; 3912-3925; 3928-3939; 3942-3971; 3976-3983; 3987-4030; 4033-4073; 4076-4080; 4083-4118; 4123-4131;		4170-4234; 4238-4241; 4245-4261;
Net Pay (Ft)	111 (A) 52; (B) 59	96	154		58
Average Porosity	29.9% Avg. (A) 31; (B) 29	24%	23%		22%
Average Water Saturation	38.4% Avg. (A) 40; (B) 37	33%	30%		37%
Hours Tested	87	72	85		90
Choke Size	-	-	-		-
Flowing Tubing Pressure	-	-	-		-
Cumulative Produced Volumes					
Oil (BBLS)	107.6	161.6	272.6		91.1
Gas (MCF)	-	-	-		-
Water (BBLS)	106	109	126.8		65.4
GOR (CF/BBL)	-	-	-		-
Calculated 24 Hour Production Rates					
Oil (B/D)	24.6	51.5	144.5		33.8
Gas (MCF/D)	-	-	-		-
Water (B/D)	1.8	3.9	23.5		11.9
Oil Gravity (°API)	11.3°	11.5°	13.0°		11.2°
Pressure Analysis			(4/11-4/13)	(4/15)	(PBU Prior to Rod Pumping)
P_{wf} (Avg.) (psi)	400	945	866	1413	600
P* (psi)	1456 (@ 3151)	1613 (@ 3489 ss)	1687(3643 ss)	1702(3644 ss)	1840 (@ 3915 ss)
Drawdown DP (Avg.) (psi)	1056	668	821	289	1240
Length PBU (Hrs)	38.6	32.8	40.6	14	39.4
Semi-Log Straight Line ?	Yes (In 6 hrs)	Yes (In 100 min)	Yes(In 2 hrs)	Yes(In 95 min)	Yes (In 5-8 hrs)
q (B/D)	23.9 29.57	55.8	168	34	45.7
m (psi/cycle)	40.1	93.5	120	44	350
μ_o (cp)	150	124	63.9	63.9	120
k_o (md)	141	134	102	56.3	47.2
h_o (ft)	111	96	154	154	58
$k_o h$ (md-ft)	15651	12864	15708	8671	2738
Skin	+23.6	+2.07	+ 1.96	+1.46	-1.09
r_w (ft)	0.5	0.5	0.5	0.5	0.5
C_w (psi-1)	8 x 10-6	8 x 10-6	8 x 10-6	8 x 10-6	8 x 10-6
B_o (Res BBL/STBBL)	1.071	1.075	1.08	1.08	1.071
Completion Data					
Casing Size/Liner Size	9 5/8"/5 1/2"	9 5/8"/5 1/2"	9 5/8"/5 1/2"		9 5/8"/5 1/2"
Slot Size/Gravel Size	.030"/10 x 20 (USM)	.040"/10 x 16 (USM)	.030"/10 x 20 (USM)		.040"/10 x 16 (USM)
Completion Type/Lift Type	ICGP*/Rod Pump	ICGP*/Rod Pump	ICGP*/N_2		ICGP* /Rod Pump

*ICGP = Inside Casing Gravel Pack

TABLE 3-5

PRODUCTION TEST DATA
WELL NO. P-0300 #2

"D" Zone 3979-4215
5/27-6/4/77
Open Hole Gravel Pack.

Net Pay (Ft)	145
Average Porosity	29%
Average Water Saturation	30%
Hours Tested	91
Choke Size	112/64"
Flowing Tubing Pressure	90-100 psi

Cumulative Produced Volumes

Oil (BBLS)	1537.6
Gas (MCF)	275.3-324.5
Water (BBLS)	182.9
GOR (CF/BBL)	179-211

Calculated 24 Hour Production Rates

Oil (B/D)	1185.9
Gas (MCF/D)	212.3-250.2
Water (B/D)	24.2
Oil Gravity (^{o}API)	18.9^{o}

Pressure Analysis

	PBU #1	PBU #2	PBU #3
Pwf (Avg.) (psi)	1614.7	1604.6	1293.1
P* (psi)	1729.5 (@ 3767 ss)	1730.5 (@ 3767 ss)	1725 (@ 3767 ss)
Drawdown DP (Avg.) (psi)	114.8	125.9	431.9
Length PBU (Hrs)	23	4.5	24
Semi-Log Straight Line ?	Yes (In 12 min.)	Yes (In 15 min.)	Yes (In 30 min.)
q (B/D)	496.8	413.2	1210.1
m (psi/cycle)	18.75	16.63	45
μ_o (cp)	15.9	15.9	15.9
k_o (md)	354	301	360
h_o (ft)	145	145	145
$k_o h$ (md-ft)	51330	43645	52200
Skin	-0.64	+0.76	+3.89
r_w (ft)	.625	.625	.625
C_o (psi-1)	8 x 10-6	8 x 10-6	8 x 10-6
B_o (Res BBL/STBBL)	1.113	1.113	1.113

Completion Data

Casing Size/Liner Size	9 5/8"/7"
Slot Size/Gravel Size	.030"/10 x 20 (USM)
Completion Type/Lift Type	OHGP*/N_2, Flow

*OHGP= Open Hole Gravel Pack

TABLE 3-6

TABLE 3-7.

PRODUCTION TEST DATA

	Well No. P-0296 #1 "F/G" Zone 3082'-3497 DST #3 11/5-11/7/76 (Prior to Gravel Packing) DST #5 11/13-11/15/76 (After Gravel Packing) Perfs: 3082-3154; 3172-3198; 3204-3238; 3254-3274; 3286-3326; 3344-3452;	Well No. P-0296 #2 "D" Zone 4610-4662 1/10-1/11/77 Open Hole: 4610-4662	Well No. P-0296 #4 "D/E" Zone 4735-5005 2/23-3/1/77 Open-Hole Gravel Pack
Net Pay (Ft)	209 (F) 114; (G) 95	59	154 (D) 131; (E) 23
Average Porosity	24% Avg. (F) 24; (G) 24	25%	23.4% Avg. (D) 23.5; (E) 23
Average Water Saturation	42% Avg. (F) 40; (G) 45	45%	42% Avg. (D) 40; (E) 50
Hours Tested	(DST #3) 56 (DST #5) 53	12	64 hrs. 19 min.
Choke Size	(DST #3) 20/64 (DST #5) 38/64	40/64	64/64
Flowing Tubing Pressure		Nitrogen Lift Throughout Test	120 psi
Cumulative Produced Volumes			
Oil (BBLS)	262 Total (DST #3) 140 (DST #5) 122	17	455
Gas (MCF)	?	?	105
Water (BBLS)	232 Total (DST #3) 81 (DST #5) 151 Note: Water Volumes Include Load	14	126
GOR (CF/BBL)	?	?	230
Calculated 24 Hour Production Rates			
Oil (B/D)	(DST #3) 62 (DST #5) 62	111	225 (Final Flow Period)
Gas (MCF/D)			52
Water (B/D)	(DST #3) 1 (DST #5) 9	166	7
Oil Gravity (^oAPI)	(DST #3) 17.7^o (DST #5) 17.0^o	15.0^o	17.3^o

Pressure Analysis

	Well #1	Well #2	Well #4 Buildups (#3)	(#4)	(#5)
		Pressure Data Questionable			
P_{wf} (Avg.) (psi)	(DST #3) 820 (DST #5) 510		1251	1141	1062
P* (psi)	(DST #3) 1557 (@ 3240 ss)(.465 psi/ft)		1824	1820	1840
Drawdown DP (Avg.) (psi)	(DST #3) 585 (DST #5) 1047		573	679	778
Length PBU (Hrs)	(DST #3) 13.7 (DST #5) 14.1		21.7	23.5	2.9
Semi-Log Straight Line ?	(DST #3) Yes (DST #5) No		Yes(10.3 hrs.)	Yes(Straight Line)	Yes 1 hr.
q (B/D)	(DST #3) 62		201	280	286
m (psi/cycle)	(DST #3) 140		126	189	180
μ_o (cp)	(DST #3) 21.9		19*	19*	19*
k_o (md)	(DST #3) 9.0		26.4**	24.6**	26.3**
h^o (ft)	192(Both DST's)(Do not know where fill was after DST #3)		154	154	154
$k_o h$ (md-ft)	(DST #3) 1728		4066	3789	4050
Skin	(DST #3) +.5 (DST #5) +3.8(Assuming same k_o as DST #3)		-0.14	-0.90	-0.30
r_w (ft)	.5 (Both DST's)		0.5	0.5	0.5
C_o (psi-1)	8.3 x 10-6 (Both DST's)		8x10-6	8x10-6	8x10-6
B_o (Res BBL/STBBL)	(DST #3) 1.10		1.10	1.10	1.10

* Temperature Corrected Average μ_o = 15.9
** Temperature Corrected Average k_o = 21.5

Completion Data

	Well #1 (DST#3)	Well #1 (DST#5)	Well #2	Well #4
Casing Size/Liner Size	(DST#3) 10 3/4"/-	(DST#5) 10 3/4"/5 1/2"	14" Hole/-	10 3/4"/7 5/8"
Slot Size/Gravel Size	(DST#3) -/-	(DST#5) .040"/8 x 12 (USM)	-/-	.030"/10 x 16 (USM)
Completion Type/Lift TYpe	(DST#3) CP*/N_2	(DST#5) ICGP**/N_2	Open Hole/N_2	OHGP***/N_2, Flow

*CP = Casing Perforations
**ICGP = Inside Casing Gravel Pack
***OHGP = Open Hole Gravel Pack

WELL TEST ANALYSES SUMMARY

Well No.	Zone	Cum. Oil Prod. (BBLS)	Calc. Rate (B/D) Oil	Wtr	Completion Type (5)	r_w (ft)	Ko (md)	Skin
P-0301 No. 1	F	7	5	-	CP	All Test Data Questionable		
	D	93.4	400	-	CP	.35	95(1)	-2.2
	A/B	100cc's	-	-	CP	All Test Data Questionable		
P-0301 No. 2	E/F?	35.9	40 - 60	8 - 12	CP	.5	20.5(1)	-1.5
	C/D	179.1	110 - 360	2 - 7	CP	.5	29.5(1)	-0.9
	A/B	100cc's	-	-	CP	All Test Data Questionable		
P-0301 No. 3	E	91.1	34	11.9	ICGP	.5	47.2(2)	-1.1(2)
	D	272.6	145	23.5	ICGP	.5	102	+2.0
	C	161.6	52	3.9	ICGP	.5	134	+2.1
	A/B	107.6	25	1.8	ICGP	.5	141	+23.6
P-0300 No. 2	D	887.7	383	30.5	OHGP	.625	354	-0.6
P-0300 No. 2	D	1537.6	1186	24.2	OHGP	.625	360	+3.9
P-0296 No. 1	F/G	140	62	1	CP	.5	9.0(1)	+0.5
P-0296 No. 1	F/G	122	62	9	ICGP	-	-	+3.8(4)
P-0296 No. 2	D	17	111	166	OPEN-HOLE	Pressure Buildup Questionable		
P-0296 No. 4	D	85	168	33	OHGP	.5	26.4(3)	-0.1
P-0296 No. 4	D	229	256	24	OHGP	.5	24.6(3)	-0.9
P-0296 NO. 4	D	455	279	7	OHGP	.5	26.3(3)	-0.3
P-0296 No. 7	3152-3178'	4-5	8.8	19.5	CP	Pressure buildup questionable		
P-0296 No. 7 (DST No. 4)	2520-3050'	57	32	37	ICGP	Pressure buildup questionable		-
P-0296 No. 7 (DST No. 5)	2520-3050	39	23	5	ICGP	.51	4.47-6.74	+5.1 to +9.1

(1) Value Questionable Due to Sand Fill
(2) Values Questionable - Poor Production Period Prior to PBU
(3) Corrected Average Ko = 21.5 MD
(4) Assumes Same Ko As In DST No. 3
(5) CP= cased-hole, perforated; ICGP = inside casing gravel pack; OHGP = open-hole gravel pack.

TABLE 3-8

SECTION IV

PLATFORM SITE AND STRUCTURES

TABLE OF CONTENTS

SECTION IV

PLATFORM SITE AND STRUCTURES

4.1 Introduction

The Beta Field will initially be developed with a drilling platform and a companion production platform. The drilling platform, as shown in Figure 4-1, will be a standard 8-leg jacket located in 265 feet of water. The platform will have two deck levels, each about 108 feet by 175 feet, with space for 80 wells and two drilling rigs. The production platform, shown in Figure 4-2, will be a 12-leg jacket in 255 feet of water. Located on two deck levels, each about 200 feet by 140 feet, will be enough space for handling all expected production at Beta. A personnel and pipeline bridge about 200 feet long will link the two platforms.

Both platforms were designed in accordance with the latest drafts of USGS OCS Order No. 8 and API RP 2A to safely withstand the loads caused by severe storm waves or earthquakes or during launching and installation. The platforms' main legs are framed with diagonal and horizontal bracing which provides a high level of redundancy and adds substantially to the structural integrity. The structures will be secured to the ocean bottom with piles driven through and welded to the legs of the jackets. Because the platforms will be near the Palos Verdes and Newport-Inglewood faults and close to the San Pedro shelf edge, we have paid special attention to seismic design criteria and soil stability analysis. Further details on these topics, oceanographic criteria, platform analyses, fabrication and installation are summarized below. More details are included in the reports on the geological and geophysical site evaluations, soil borings, and oceanographic conditions which are listed as Appendices 8.1 through 8.5.

4.2 Geotechnical Considerations

The drilling and production platforms are sited in areas which are safe from potential hazards such as near-surface faults and areas of possible soil instability. The location of the platforms with respect to these geotechnical considerations is shown in Figure 4-3.

4.2.1 Bathymetry

The seafloor in the area of the platform site is essentially featureless and slopes to the southeast at about 2 degrees. (Figure 4-3). Further details on bathymetry in the area are discussed in a report by MESA[2], Inc. (Appendix 8.1)

4.2.2 Soil Conditions

Three soil borings have been drilled in the vicinity of the site as shown on Figure 4-3. Borings 261-1 and 261-2 were drilled to depths of 463 feet and 61 feet respectively and Boring 262-1 was drilled to a depth of 500 feet. Detailed logs of these borings and the results of basic soil mechanics tests are given in the reports by Woodward-Clyde Consultants (Appendices 8.2 and 8.3). Additional information on the stratigraphy and depositional history is included in Appendix 8.1.

Briefly, the soils in the vicinity of the proposed platform site are marine Holocene and fluvial-marine Late Pleistocene clastic sediments. At Boring 261-1, the Holocene section is about 40 feet thick and consists of clayey silt and silty clay layers and a basal silty sand layer. The underlying Late Pleistocene units consist of sand and gravel channel-fill to a depth of about 80 feet and then predominantly clayey silts to the depth explored. In Boring 261-1, there is a lower gravel layer from a depth of 225 feet to 250 feet within the clayey silts.

A final site investigation will be conducted at the proposed platform site in the near future. Static and cyclic loading tests have been conducted on soil samples obtained in the preliminary borings. Similar tests will be conducted on samples obtained in the final soil borings. These final borings and laboratory tests will be used to finalize the foundation design including pile length, wall thickness and driveability.

4.2.3 Near-surface Faulting

In order to guide the final siting of the platforms in the optimum location relative to both near-surface faulting and any areas of potential instability, a detailed geophysical study was conducted over an area of 8.5 square miles which includes the platform site. This survey was run by General Oceanographics, Inc., using precision bathymetric profiling, Uniboom, sparker, side scan sonar and magnetometer equipment on a 500-foot square grid over most of the area. Within this area a 2-square mile segment was surveyed using the Sonia subbottom profiler on a 250-foot square grid. A portion of the interpreted geophysical data in Appendix 8.1 is reproduced as Figure 4-3.

The platform site is located near the Palos Verdes fault zone and a fault zone which is located along the San Gabriel submarine canyon. Two minor faults are located between these major fault zones and a zone of minor transverse faults appears to be located in the vicinity of the disturbed area downslope from the platform site. The relationship of these near-surface faults to deeper faults and folds in the vicinity of the platform sites has been discussed in Section 2.2. A report by Damei and Moore, Geoseismic Investigation of the Palos Verdes Fault Zone, (Appendix 8.5) assesses the seismic activity along the Palos Verdes and Newport-Inglewood Faults.

4.2.4 Slope Stability

On the basis of the surveys described in Section 4.2.3, we conclude (Appendix 8.1) that the survey area and the adjacent shelf-basin slope are stable. There is no evidence of slumping or downslope movement in the strata at the platform site. From this investigation, there is no reason to anticipate liquefaction or other instability at the site.

South and southwest of the site, two small areas have been identified as possibly having past instability. These are shown as "disturbed areas" on Figure 4-3. The area 2000 feet to the southwest of the platform site appears to be a slide associated with fault F3 but is also subject to alternative interpretations. The area 1200 feet downslope from the platform site corresponds to a topographic bulge, and there is a lack of continuity of reflectors in this area. The feature is located immediately below the Late Pleistocene shelf break and may be related to either depositional processes or slumping related to the shelf break or to movement along a series of minor transverse faults. In the San Gabriel submarine canyon, over 4000 feet east of the platform site, the walls are generally stable at slopes of as much as 30 degrees.

4.2.5 Hydrocarbon Seeps

In a review of all available fathometer, water column bubble detector and high resolution geophysical profiles and side scan sonar records, MESA[2], Inc. identified and mapped only three questionable seeps within 1000 feet of the shallow water site (Figure 4-3). These seeps are not considered to be hazards because they are not associated with faults, seafloor disruption or anomalous reflections on geophysical records.

No gas was encountered in the shallow section during the drilling of six exploratory wells and three soil borings in the area. Additionally, higher resolution and more closely spaced geophysical data indicates that most of the zones which are mapped as possible gas by BBN-Geomarine Services Company in a report (refer to Section 4.8) on potential shallow drilling hazards are instead zones that reflect contrasting lithologies.

4.2.6 Subsidence

The potential for surface subsidence due to reservoir fluid withdrawal is negligible. A pressure maintenance program using water injection will begin soon after the start of production and continue throughout the life of the field. Little or no reduction in pore pressure is anticipated; accordingly, no compensating settlement of overburden is expected.

4.2.7 Hydrology

Electric logs indicate that exploratory wells penetrated no fresh water sands. However, if fresh water sands are encountered during development drilling, they will be isolated from deeper zones containing salt water or hydrocarbons by setting and cementing casing before drilling below their base.

4.3 Oceanographic Design Criteria

The platforms have been designed for severe storms having less than a one percent chance of exceedance in a given year. The design wave, wind, currents, and tide criteria for the site are as follows:

Wave	
Maximum Height (Crest-Trough)	45 feet
Period of Maximum Wave	9 to 15 seconds
Wind (5 second average; assumed in the wave direction; measured at +30 ft. elevation)	64 knots
Current (assumed in the wave direction)	
Surface	2.8 fps
Mid-depth	1.6 fps
Bottom	0.6 fps
Tide (including storm surge)	6.0 feet (above MLLW)

These oceanographic design criteria were derived from a study by Evans Hamilton, Inc. (Appendix 8.4). Normal oceanographic/ meteorological conditions were found to be favorable for operations.

4.4 Earthquake Design Criteria

The location of the Beta Field within an area of recognized seismicity requires that all structures be designed for an earthquake environment. The platforms have been designed for a two-level design requirement as outlined in API RP 2A. For the first level earthquake criteria, the platforms will resist shaking having a low probability of occurrence without damage. All platform structural members would remain elastic.
For the Beta Field, this criteria is defined by Zone 4, Soil Type C in 1977 API RP 2A. Peak horizontal acceleration is 0.25g. The probability that the platforms will experience this earthquake activity is about 0.005 per year - a 200 year recurrence interval.

Furthermore, the platforms can safely withstand the second level criteria, associated with a rare intense earthquake, without collapse. In this unlikely event, some members would suffer inelastic deformation but the platforms possess the necessary ductility and redundancy to prevent collapse. Ground motions are twice those of the first level criteria. At the Beta Field, the probability of an earthquake exceeding this criteria is less than 0.001 per year - a recurrence interval greater than 1000 years.

4.5 Corrosion Control

The platform will be protected from corrosion by coatings in the splash zone and above, and by cathodic protection below mean water level.

The protective coating system is an established concept and employs standard materials used in accordance with conventional corrosion protection practices. It has been used successfully for over ten years in the Gulf of Mexico. Two types of protective coatings are used:

1. Galvanizing applied to grating, ladders, cages and other difficult to paint hardware.

2. Painting the exterior surfaces of the structures will be multi-coated from the minus 8-foot elevation to the top of the structure with an inorganic zinc-vinyl system.

A conventional sacrificial anode system will provide the corrosion protection for the below-water portion of the platforms. Aluminum anodes will be uniformly located throughout the structures as a function of the structures' surface area and projected life.

4.6 Shipping Lanes

While the proposed platform development plan is within the Gulf of Santa Catalina Traffic Separation Scheme, it is clear of both traffic lanes and their buffer zones. Navigational aids will be installed and maintained as required by the Coast Guard. The structures will have a beneficial effect by acting as aids to navigation.

The contingent deep-water platform, in about 700 feet of water, is within the Buffer Zone. However, since the Traffic Separation Scheme will not be permanently fixed until substantial exploratory drilling has been completed, and since just a slight shift of the scheme would put the platform location within the Separation Zone, we believe that the contingent platform will not hinder shipping. As plans for this platform are finalized, we will keep the appropriate agencies informed of our siting constraints.

4.7 Platform Visibility

Lease stipulations require that these platforms be camouflaged by appropriate painting. We suggest that the Supervisor, in consultation with the Coast Guard and the Operator, determine the appropriate color.

Figure 4 is the view from the bluff at Huntington Beach looking toward the platform site. In the foreground is Aminoil's Platform Emmy about 1.3 miles offshore. The exploratory drilling rig just to the left of the center of the picture is near the platform site. The other drilling rig, further to the left is near the contingent deep water platform site. Visibility conditions equal to or better than this probably occur less than 10 percent of the time. Therefore, the platforms should not be visible from shore 90 percent of the time.

4.8 Cultural Resources

An assessment of cultural resources is included in a report by BBN-Geomarine Services Company entitled "Geophysical Interpretation and Assessment of Cultural Resources and Potential Shallow Drilling Hazards for a Part of Offshore California Tracts 035-261 and 035-262 San Pedro Bay, dated April 1976. This report has been previously submitted to the Oil and Gas Supervisor, Pacific Area, U. S. Geological Survey. An interpretation of additional magnetometer records is included in Appendix 8.1. No magnetic anomalies or seafloor objects were identified in the area of the platform sites by either study.

4.9 Platform Analysis

The structures have been designed for the described combinations of environmental conditions, operational loads, gravity, buoyancy, and pressures associated with fabrication, transportation, installation, and use in their proposed offshore location. Analytically determined member stresses are limited to the allowable stresses and other design limitations set forth in API RP 2A.

The design wave condition was analyzed utilizing a Shell-developed three dimensional computer program. The design wave was stepped through the structure and the wave position causing the largest base shear was determined. The structural model was then analyzed using the joint loads corresponding to the largest base shear. The pile-soil system was modeled using the static nonlinear load-deflection characteristics of the soil.

The earthquake analyses were performed utilizing two dynamic response computer programs. The platforms were designed utilizing scaled recorded time histories, artificial time histories and the response spectra as given in API RP 2A for Zone 4 and soil type C. The elastic level earthquake (.25 g peak acceleration) was analyzed using a Shell-developed three dimensional finite element program capable of performing both time history and response spectrum analyses. The inelastic analyses were performed using a two dimensional inelastic frame analysis program specifically developed for this application. Scaled time histories of ground motion were input and the platforms checked for the required ductility. These analyses included non-linear modeling of the structure-foundation systems.

Load-out, launch and installation of the platforms were also analyzed and all members designed for these forces. The platforms are designed to be stable under launch and during installation before the piling are fully installed.

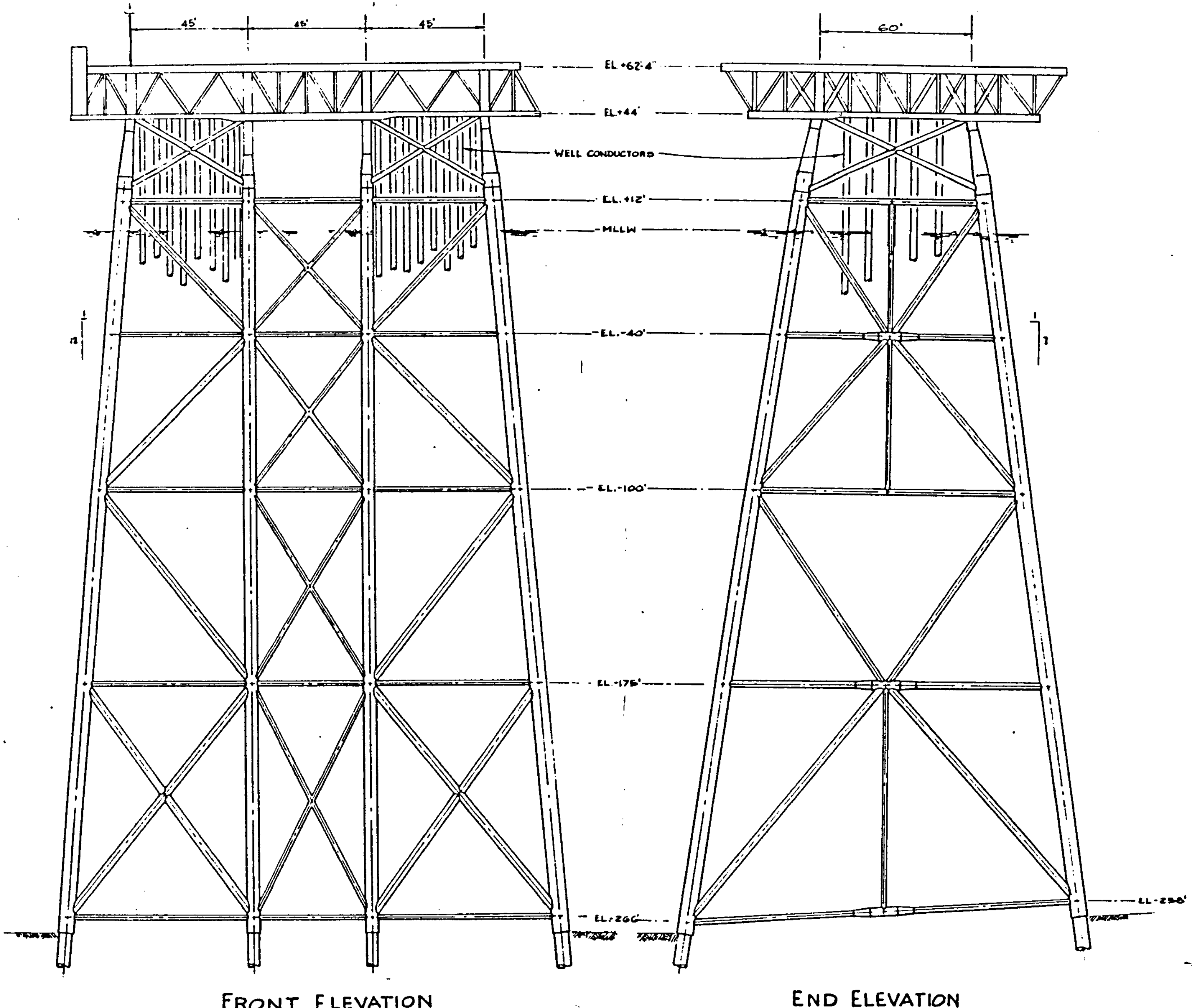
4.10 Fabrication and Installation

The jacket type platform is a proven concept for offshore structures. The principal components of this type of platform are the deck, the jacket, and the piling. To implement this project, a contractor or contractors will fabricate and assemble these components, and barge them from the assembly yard to the offshore site for the installation. Sites for construction and assembly will be determined when contracts are awarded. The jackets, after being transported to the site on a launch barge will be launched and then lowered to the ocean floor by a derrick barge assisted by controlled flooding of the jacket. After the jacket is secured by piling, the deck sections and equipment will be set in place on the jacket. Jacket installation is currently scheduled for 1979.

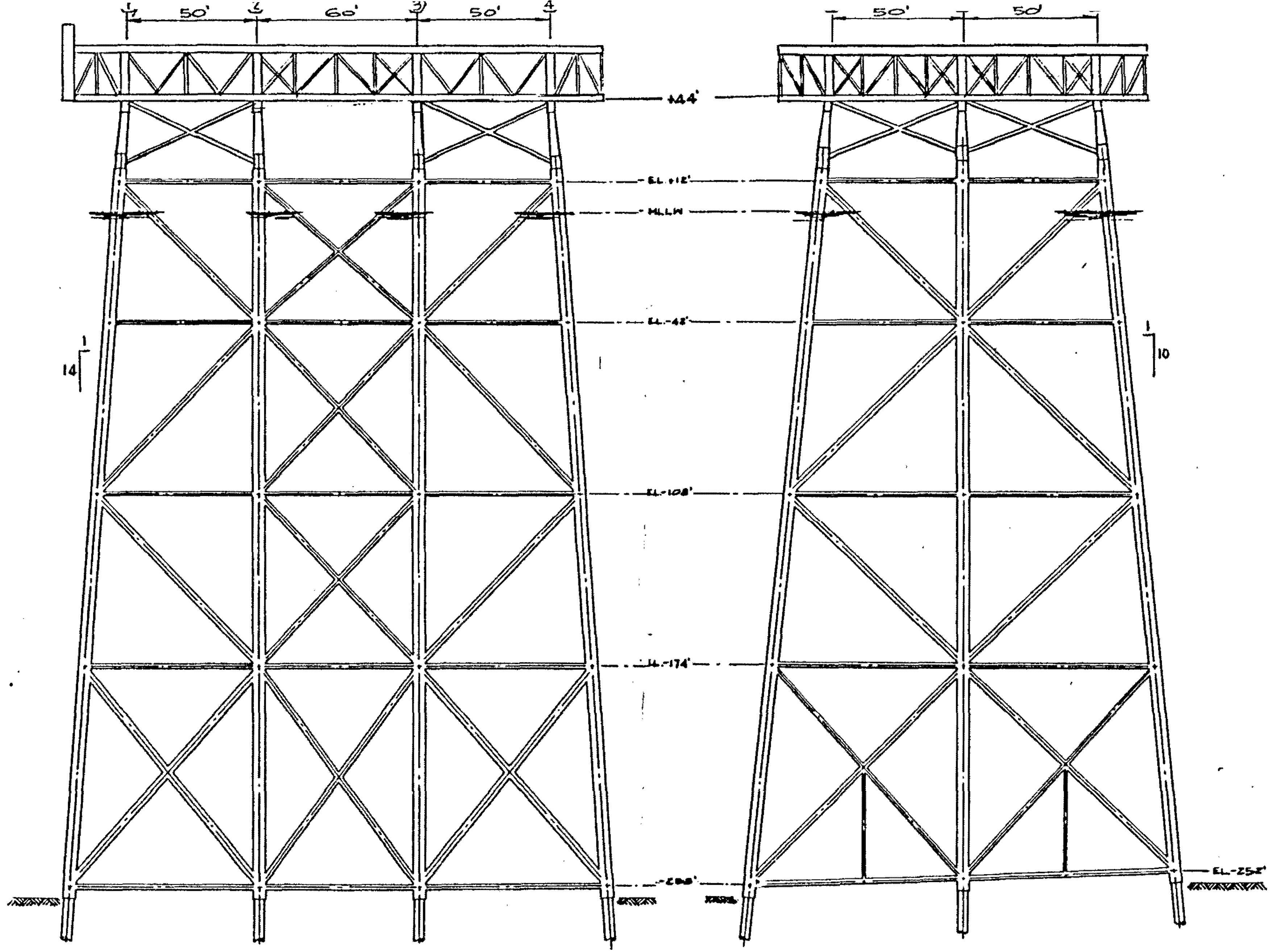
4.11 Platform Removal

Following the depletion of all producing zones developed from the platforms, the site will be cleared in accordance with permit requirements.

FIGURE 4-1



DRILLING PLATFORM
SAN PEDRO BLOCK 261



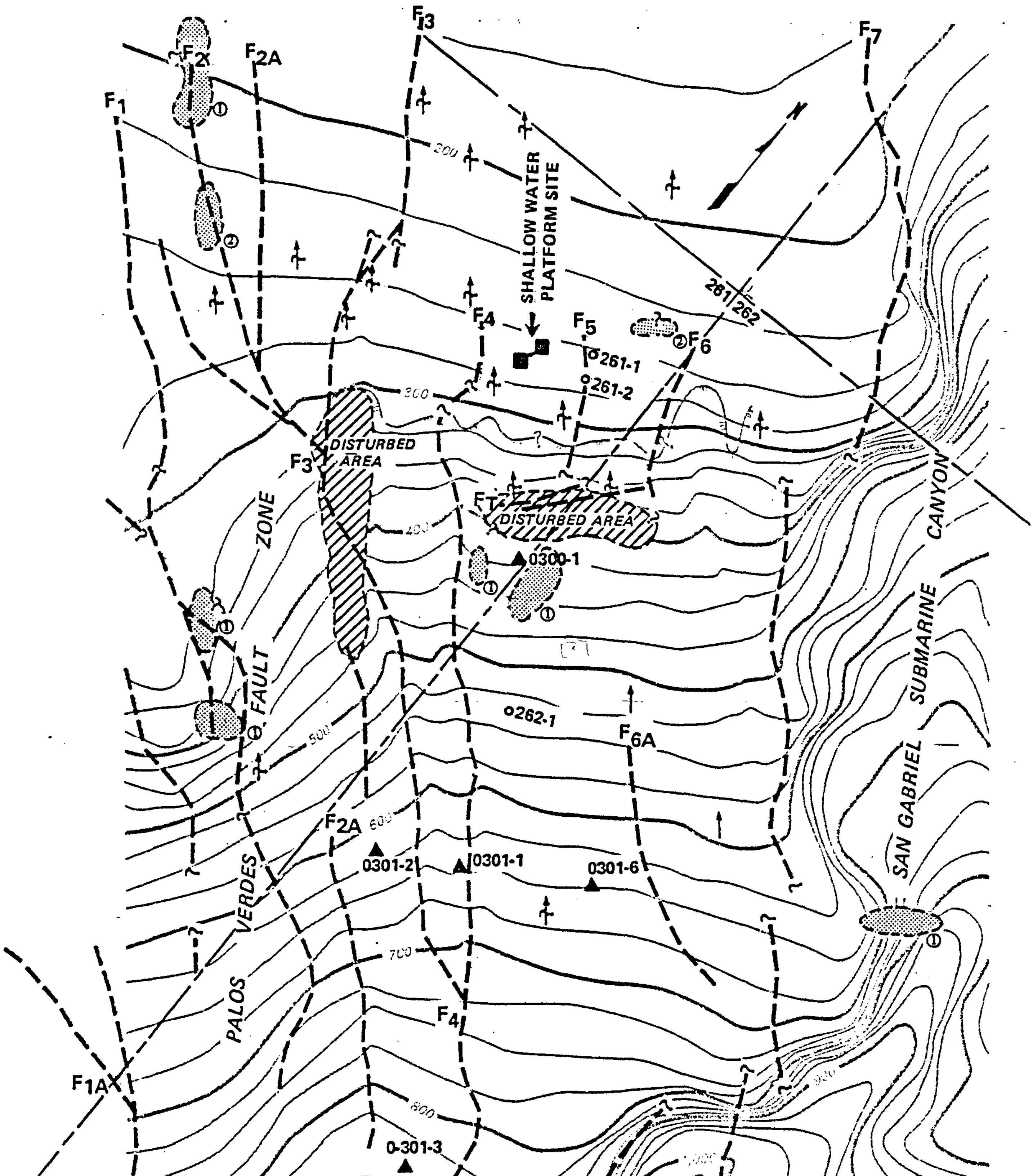
FRONT ELEVATION

END ELEVATION

PRODUCTION PLATFORM

SAN PEDRO BLOCK 261

FIGURE 4-2



LEGEND

- FAULTS MAPPED NEAR SURFACE
- PALEO SHELF BREAK
- TOPOGRAPHIC AND/OR STRUCTURAL ANOMALY
- ↑ GAS AND OIL(?) SEEP
- GAS AND OIL(?) SEEP AREA
  - ① DEFINITE
  - ② PROBABLE
  - ? QESTIONABLE
- ▲ EXPLORATION WELLS
- o SOIL BORING

CONTOURS ARE WATER DEPTH IN FEET

SHELL OIL COMPANY	WESTERN E & P REGION WESTERN DIVISION	PRODUCTION DEPARTMENT

GEOTECHNICAL CONSIDERATIONS

OCS NO. P–0300, P–0301
TRACT NO. 35–261,262
BLOCK NO. 33 N–37W,36W
0' 1000' 2000'

By: RCS	Date: 11-1-77	File: ZF–2752
For:	FIGURE 4-3	Encl.:


Figure 4

SECTION V

DRILLING FACILITIES

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SECTION V

DRILLING FACILITIES

5.1 Introduction

The 265-foot water depth drilling platform will have slots for a maximum of 80 wells. Two drilling rigs and associated crews and services will be required to drill the wells presently planned.

Preliminary drilling equipment layouts are shown as drawings at the end of this section. The rigs will be platform-type rigs. After the initial drilling phase is completed, one rig will be removed. The rig left on the platform will be designed to move from one end to the other as required for well servicing, work-overs and redrills. The deep-water platform will be designed to accomodate two rigs. One of the rigs will be a platform-type and designed to be left on the platform to handle well work after the primary drilling phase is completed.

Drilling operations, testing and training, pollution prevention systems and safety systems will be in accordance with OCS and EPA regulations and industry standards.

5.2 Drilling Equipment

5.2.1 Rig Components

Two platform-type derricks, 147 feet high for 12,000 foot drilling and 750,000 pound hook-load capacities, will be used. The derricks will be designed in accordance with A.P.I. Standards.

Drawworks - 1000 H.P. electrically powered.

Rotary Table - Independently powered.

The hook, traveling block, and crown block will be of 350+ ton load rated capacity to match the derrick.

The drill string will be 4½", Grade E drill pipe.

5.2.2 Substructures

A drilling skidbase is to be provided to support the derrick, drawworks subbase, and connecting stairways.

Each substructure will be supported on a skidbase, which will rest on two elevated skidbeams. The skidbase will be equipped with a hydraulic jacking system to facilitate movement along the well rows. The substructure will also be equipped with hydraulic jacks for lateral skidding. Mechanical restraint equipment will prevent substructure movement as desired.

5.2.3 Drilling Mud System

A separate mud system will be provided for each drilling rig.

Each rig will be equipped with two mud pumps (800 HP each), a mud slugging tank (100 bbl±), a circulating tank (250 bbl±), and a reserve mud tank (300 bbl±). In addition, a completion fluid system of 1200 barrels will be required. The completion fluid will be used for all underreaming or perforating through the pay interval and for gravel packing operations.

A low solids, gas free mud will be maintained using high speed shale shakers, desanders, desilters, and degassers. The shale shakers will be equipped with cuttings recovery systems to handle any oil-contaminated cuttings for disposal. Cuttings that cannot be adequately cleaned will be diverted to a waste cuttings holding tank, to be hauled ashore for disposal.

Mud volumes will be closely monitored using a pit volume totalizer system, an incremental flowrate indicator, and a precision fill-up measurement system. These warning systems will have visual and audible alarm signals at the driller's console. Bulk material handling system will be provided with 1000 cu. ft. storage capacity for barite. Additional mud and completion fluid additives (chemicals, lost circulation material, gravel, etc.,) will be palletized.

5.2.4 Cementing Unit

For use on both rigs, a diesel powered dual cementing unit and four 1000 cubic foot bulk storage tanks will be provided for well cementing operations. In addition, a single cementing unit when combined with a blender will be used for completion work.

5.2.5 General Layout

The drilling rig will be located on the upper deck. This will include the mud package, power package, skid base, substructure and derrick. The living quarters, offices and heliport will be located above the power package. Above the mud package will be the pipe racks and the rig crane.

On the lower deck will be the cementing units, gravel packing equipment and storage for all liquid and dry material.

5.3 Drilling Operations

5.3.1 Casing Program

Casing setting depths and cementing will be in accordance with the USGS Pacific Area OCS Order No. 2 and/or field rules. The attached casing programs show the USGS exploratory requirements and proposed field rules. Our plan for field rules is based on data from our exploratory drilling, shallow hazard surveys and the soil borings taken to date. Additional soil borings are currently underway.

We have not seen evidence of shallow gas in our exploratory drilling and the shallow seismic data does not indicate the presence of shallow gas. With this data we propose the following casing and drilling program:

1. 24-inch drive pipe be set 200+ feet below the mud line.

2. The conductor casing string be eliminated.

3. The surface casing be set from 1200 to 1500 feet below the mud line.

4. An additional casing string will be set on top of the pay or at T.D. The setting depth of this string will be determined by the well completion program.

5. A total depth of 5000 feet subsea (4735 feet below the mud line). This is the anticipated T.D. of wells drilled on the down dip side of the structure.

The soil borings currently underway will help in determining the depth to which the 24-inch drive pipe can be driven. The 200 feet below the mud line is proposed as a minimum depth for the drive pipe. The additional data will be presented when it becomes available.

5.3.2 Well Completions

The reservoir consists of an assemblage of sands, shales and silts. The thicker shales divide the reservoir into seven zones. Because the sands are unconsolidated, sand control is required and it will be achieved by gravel packing a slotted liner (or screen) inside cemented, jet perforated casing or in underreamed open hole.

Several zones will be simultaneously opened into a common wellbore and interzonal isolation will be needed in some cases to provide for the control of fluids either entering or leaving the wellbore and to allow for the optimum exploitation and conservation of the reserves.

The attached figures, 5-4, 5-5 and 5-6 show schematically the mechanical configurations which will allow both gravel packing and interzonal isolation. It is not possible to select a single completion type at the present time and it is now expected that all of the completion types shown may be used.

5.3.3 Wellhead Equipment

Either unitized or conventional flanged wellheads will be used during the drilling phase. The wellhead assemblies will be suitable for free flow and submersible or hydraulic pumping.

5.3.4 Blowout Preventer Equipment

Low and high pressure blowout preventer systems will be used as required by OCS Order No. 2 and/or field rules. These systems will be hydraulically operated and will include remote control.

The low pressure system will consist of a 21 3/4-inch, 2000 psi annular-type blowout preventer with diverter system installed for drilling below the 24-inch conductor casing string. After 16-inch or 13 3/8-inch surface casing is landed and cemented, the low pressure BOP stack will be removed. A 3000 psi W.P. BOP stack will be installed on the surface casing head. The BOP equipment will include an annular preventer, a blind ram and one pipe ram if approved in field rules.

Both systems will have the appropriate choke manifold, kill and bleed lines, and fill-up lines as required by OCS Order No. 2 and/or field rules.

5.3.5 Drilling Platform Drainage

The drilling platform will be divided into two drainage systems for separate handling. Drainage from the top deck, from drip pans in the rig substructure and from the rig floor will gravitate to a "waste tank" located on the lower deck. Drainage from the lower deck areas will drain to a sump tank below the lower deck, from which the liquids will be pumped into the waste tank. Wash water from the cuttings washer will also gravitate to the waste tank. Oily waste water from the waste tank will be sent to the production platform for treatment. Washed cuttings and oil free sediments from the waste tank will gravitate to the skim pile for disposal.

5.3.6 Safety

Appropriate OCS and OSHA Safety regulations will be followed.

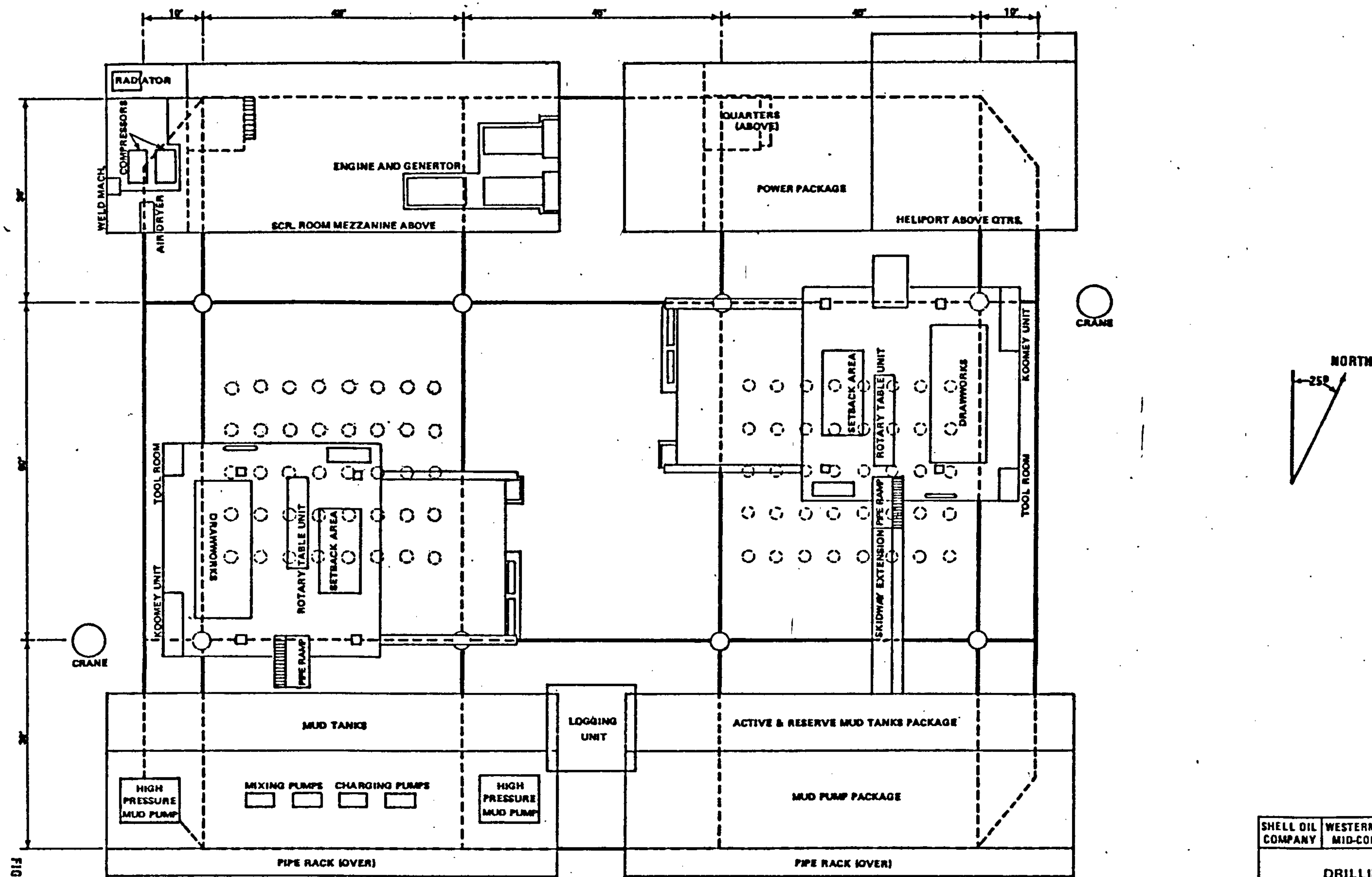
5.3.7 Fire Prevention and Suppression

In addition to the platform systems described in the Production Facilities section, portable fire extinguishers will be provided for the rig floor and BOP areas.

5.3.8 Crew and Supply Transport

Drilling crews will work regular 8-hour shifts and will be transported between shore and platform by boat. Day shifts are expected to consist of 25 people and night shifts 18 people. Supply boats will transport supplies as required.

Weather should have little effect on boats or crew and supply boat operations, but emergency facilities and supplies will be provided to allow at least one week of normal operations under storm conditions.

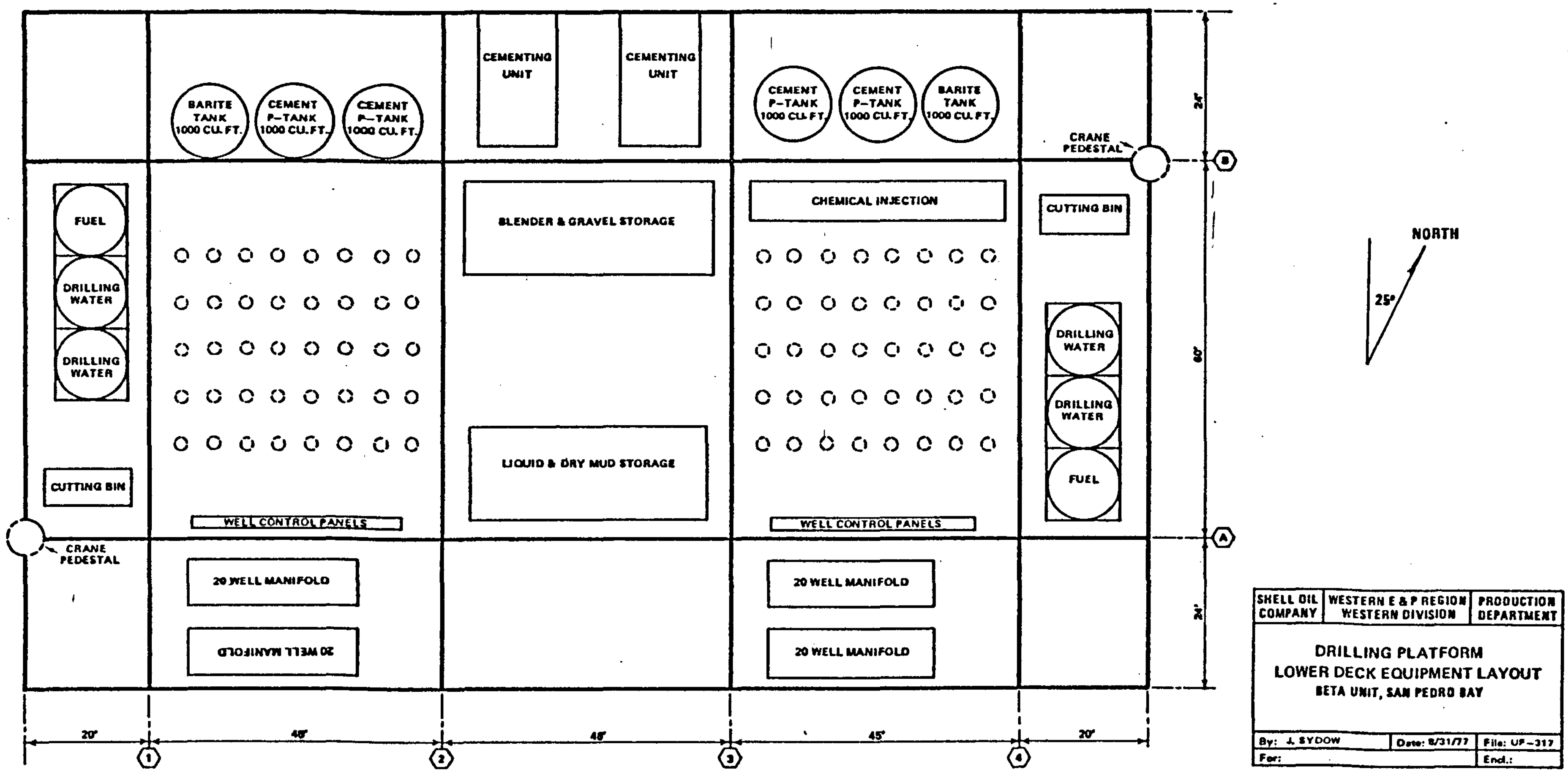


SHELL OIL COMPANY	WESTERN E & P REGION MID-CONTINENT DIV.	PRODUCTION DEPARTMENT

DRILLING PLATFORM
TOP DECK EQUIPMENT LAYOUT
BETA UNIT, SAN PEDRO BAY

By: J. SYDOW	Date: 8/31/77	File: UF-318
For:		Encl.:

FIGURE 8-1



CEMENTING UNIT
CEMENTING UNIT
BARITE TANK 1000 CU. FT.
CEMENT P-TANK 1000 CU. FT.
CEMENT P-TANK 1000 CU. FT.
CEMENT P-TANK 1000 CU. FT.
CEMENT P-TANK 1000 CU. FT.
BARITE TANK 1000 CU. FT.
CRANE PEDESTAL
FUEL
DRILLING WATER
DRILLING WATER
BLENDER & GRAVEL STORAGE
CHEMICAL INJECTION
CUTTING BIN
NORTH
25°
DRILLING WATER
DRILLING WATER
FUEL
LIQUID & DRY MUD STORAGE
CUTTING BIN
WELL CONTROL PANELS
WELL CONTROL PANELS
CRANE PEDESTAL
20 WELL MANIFOLD
20 WELL MANIFOLD
20 WELL MANIFOLD
20 WELL MANIFOLD
24'
60'
24'
20'
48'
48'
45'
20'
SHELL OIL COMPANY
WESTERN E & P REGION WESTERN DIVISION
PRODUCTION DEPARTMENT
DRILLING PLATFORM
LOWER DECK EQUIPMENT LAYOUT
BETA UNIT, SAN PEDRO BAY
By: J. SYDOW
Date: 8/31/77
File: UP-317
For:
Encl.:

FIGURE 5-2

DRILLING PROGNOSIS
BETA PLATFORM

PROPOSED CASING PROGRAM
#1. PRESENT USGS REQUIREMENTS
#2 PROPOSED FIELD RULES

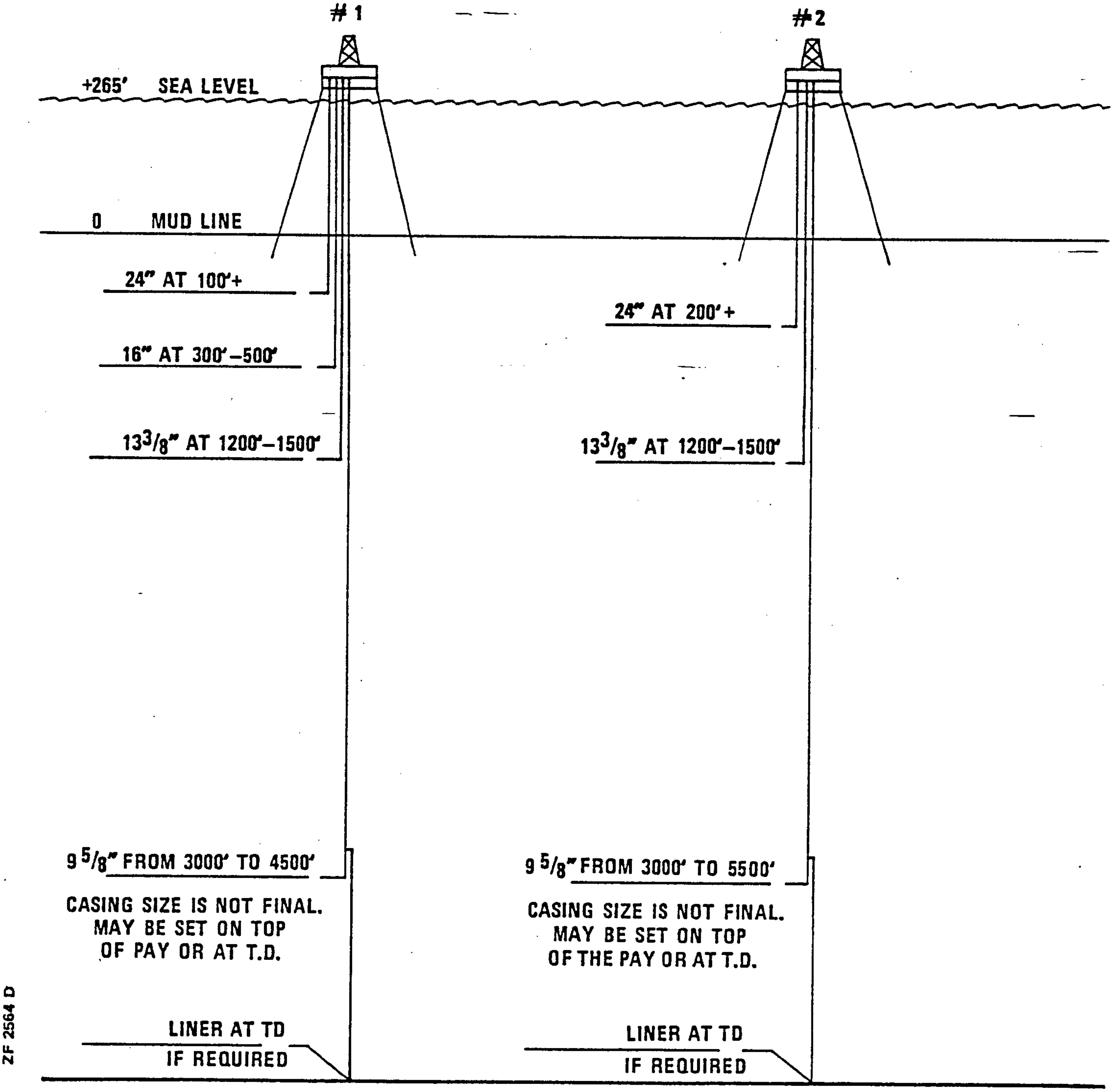
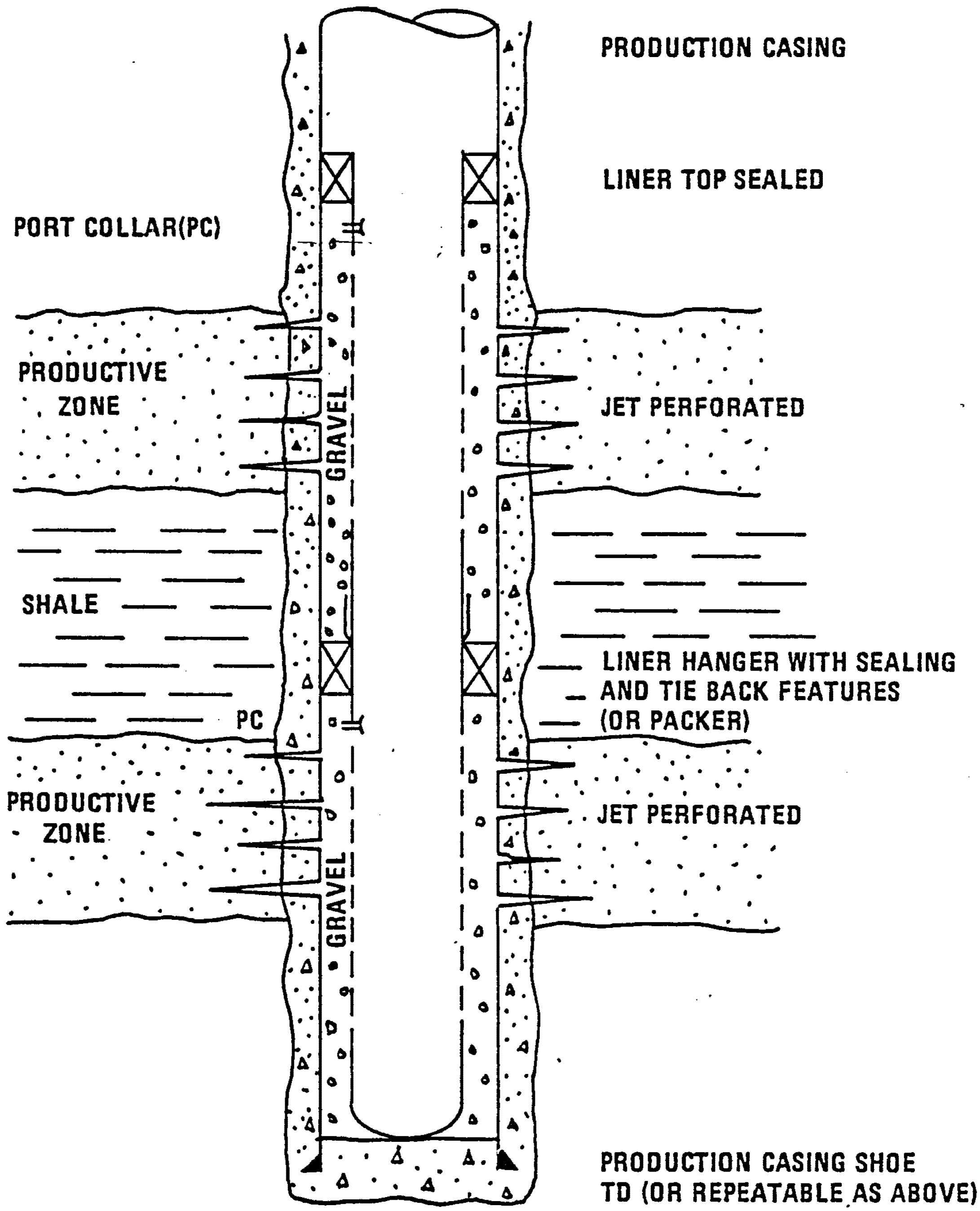


FIGURE 5–3

SCHEMATIC OF CASED–HOLE TYPE COMPLETION



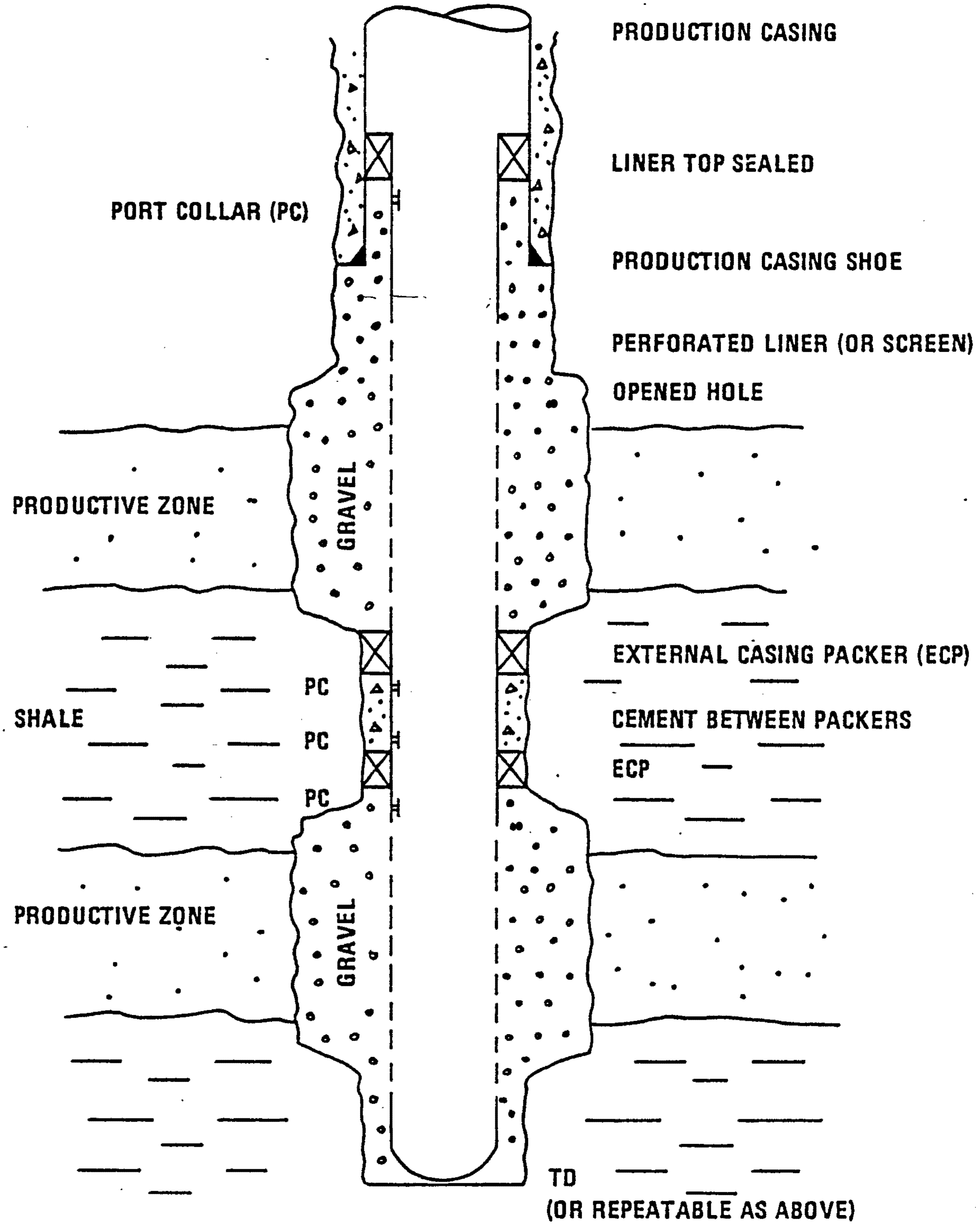
SIMPLIFIED PROCEDURE

1. DRILL THROUGH PRODUCTIVE INTERVAL – RUN LOGS
2. RUN AND CEMENT CASING
3. JET PERFORATE COMPLETION ZONES – WASH PERFORATIONS
4. RUN LOWER LINER AND GRAVEL PACK
5. RUN OPEN LINER(S) AND GRAVEL PACK
   (ALTERNATIVE TO STEPS 4 & 5 – RUN ENTIRE LINER, SET PACKERS – GRAVEL PACK THROUGH PORT COLLARS FROM BOTTOM UP)
6. WASH AND REPACK AS REQUIRED

FIGURE 5– 4

ZF 2748A

SCHEMATIC OF OPEN–HOLE TYPE COMPLETION

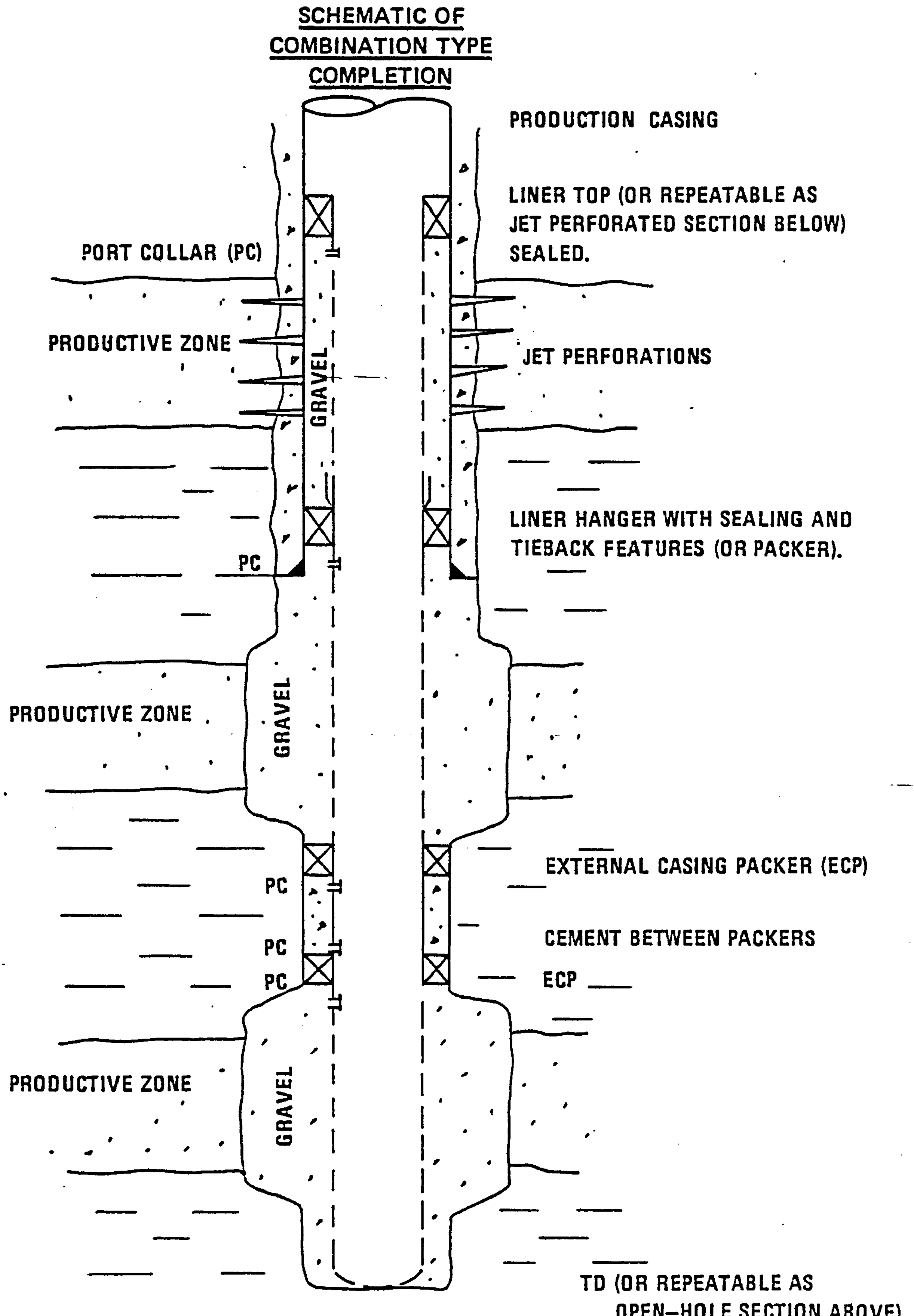


SIMPLIFIED PROCEDURE

1. SET PRODUCTION CASING
2. DRILL THROUGH PRODUCTIVE INTERVAL–LOG
3. OPEN HOLE THROUGH PRODUCTIVE ZONES–RUN LINER, SET OPEN HOLE PACKERS
4. GRAVEL PACK PRODUCTIVE ZONES (FROM BOTTOM UP) THROUGH PORT COLLARS
5. CEMENT BETWEEN ZONES (FROM BOTTOM UP) THROUGH PORT COLLARS
6. WASH AND REPACK AS REQUIRED

ZF 2748B

FIGURE 5–5



SIMPLIFIED PROCEDURE

1. FOR OPEN-HOLE SECTION, SAME AS OPEN HOLE TYPE COMPLETION
2. FOR CASED-HOLE SECTION, SAME AS CASED HOLE TYPE COMPLETION

FIGURE 5- 6

ZF 2748C

SECTION VI

PLATFORM FACILITIES

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6.6 Attachments

Drawing No. Z9-499d	265 Ft. Water Depth Platform Complex - Prospect Beta
Drawing No. Z9-499c	Simplified Process Flow-Platform Production Facilities, Prospect Beta
Drawing No. Z9-499a	Simplified Process Flow-Remote Platform Production Facilities - Prospect Beta
Drawing No. C6-1714	Equipment Layout - Lower Deck, 12-Leg Facilities Platform - Prospect Beta
Drawing No. C6-1715	Equipment Layout - Upper Deck, 12-Leg Facilities Platform - Prospect Beta
Drawing No. C6-1716	Process Flow Sheet - Sheet 1, Beta Prospect
Drawing No. C6-1717	Process Flow Sheet - Sheet 2, Beta Prospect
Drawing No. Z9-501	Production/Injection Forecast - Beta Prospect
Drawing No. ZF-2627	Wellhead Arrangement
Drawing No. Z9-499b	Single Train Oil Dehydration - Prospect Beta
Drawing No. Z9-499	Simplified Process - Produced Water Treatment - Prospect Beta
Drawing No. Z9-500	Forecast of NO_x Emission Addition/Reduction Program

SECTION VI

PLATFORM FACILITIES

6.1 Introduction

This section describes the various facilities and equipment to be installed. The majority of this equipment will be installed on a separate production facility platform located adjacent to the 265 foot water depth drilling platform. Drawing Z9-499d is a plot plan of the two platform complex. These facilities will serve not only this drilling platform, but also any future remote drilling platform(s).

The facilities will consist of production process facilities for treating oil, produced water, source water, and produced gas, utility systems, and support facilities. These are intended to make the field operation as self-sufficient as possible. Drawing Z9-499a is a simplified flow diagram of the facilities.

By having a centrally located facilities platform, other future remote platforms would require only a minimum of facilities. Drawing Z9-499a is a simplified flow diagram of the facilities required for the remote platform(s).

Reservoir pressure maintenance will be accomplished by injecting the produced water and by injecting a source water. Perhaps a suitable subsurface aquifer will be found to supply the source water. However, since the presence of this aquifer is unconfirmed, the facility design will assume a "worst case", i.e., use of sea water for the source water. Because of the considerable uncertainty as to the volume of produced water which will need to be processed, considerable flexibility is incorporated in the design to accommodate up to about 100,000 B/D of produced water initially.

6.2 Production Process Facilities

Drawings No. C6-1716 and C6-1717 depict the process flow for the production facilities platform and for the adjacent drilling platform. Drawings C6-1714 and C6-1715 depict the equipment layout on the facility platform lower deck and upper deck, respectively.

6.2.1 Design Criteria

The design criteria are based 1) upon observations from the eight exploratory wells drilled on the two tracts and 2) pressure maintenance by waterflooding.

a) Maximum bottomhole pressure = 1600 psig
b) Bottomhole temperature = 140° - 160°F
c) Oil Gravity = 12° API to 20° API
d) Gas/Oil Ratio (GOR) = 200 Scf/bbl
e) Maximum Water Injection Pressure at surface = 2000 psig
f) Maximum shut-in wellhead tubing pressure = 2000 psig (with pump)
g) Production/Injection Forecast - See Drawing Z9-501

6.2.2 Wellheads, Flowlines, and Manifolds

A typical wellhead configuration for a submersible pumped well is shown in Drawing ZF-2627. The 80 well slots are divided into two groups of 40. Each group of forty slots consists of five rows of eight slots each. Initially, 60 well conductors will be installed with the remaining 20 well slots reserved for future use.

All wells will be equipped initially with downhole hydraulically controlled safety valves in accordance with OCS Order No. 5.

Flowlines for the 60 wells will connect to a manifold system. Flow from the wells will normally be routed to a bulk production header. Well test will be accomplished by selectively routing individual wells into either of two well test/cleanup headers.

Although all wells will be produced initially, within a year some wells will be converted to water injectors. Provisions are included in the manifold arrangement for readily converting any given well from producer to injector.

6.2.3 Artificial Lift

It is anticipated that artificial lift will be required for all wells initially or soon after completion. Initial provisions for submersible electric pumping will be provided. Plans include provision for hydraulic pumping in the future if required. The hydraulic power water system surface facilities are described in Section 6.3.7.

6.2.4 Oil Processing and Shipping

Three separate trains of oil dehydration equipment are provided. Drawing Z9-499b is a simplified flow diagram of one of these trains. Two of the trains will be installed initially; the third will be added when need is recognized.

The produced crude oil and water are directed through one of the three parallel trains. The stream is first heated to about 140°F in two heat exchangers. Three phase separation occurs in the free water knockout vessel. The vessel operates at 50 psig. Gas is separated and sent into the gas compression system. An oil/water emulsion phase is separated and sent to the treater for the final step of oil dehydration. Free water is separated and sent to the produced water treating system.

Before entering the treater, the emulsion is heated in two heat exchangers to approximately 220°F. In the treater, the remaining water is removed and the clean oil flows to the clean oil storage tank.

From this tank, the oil is metered for sales through the LACT and pumped into the pipeline.

6.2.5 Produced Water Cleanup and Injection

Prior to injection of the produced water, it must be treated to remove suspended solids and oil. The treatment process is shown in simplified form in Drawing Z9-499. Treatment consists of a skim tank for removal of oil by gravity separation. Water is then passed through an induced gas flotation cell. The third stage of treatment is filtration through downflow mixed media (anthracite plus sand) filters.

The filtered water is accumulated in a surge tank. From the tank, the water is pumped through cartridge-type polishing filters. Gas turbine driven injection pumps then boost the water to the required injection pressure.

Under normal operations, all produced water will be injected. However, there will be times when it will be necessary to discharge produced water overboard. The water so discharged will be sufficiently cleaned to meet the EPA requirements for discharge into the ocean.

6.2.6 Produced Sand/Solids Handling

It is anticipated that some sand and clay will be produced in conjunction with the oil and water. Facilities are provided to collect these materials and to dewater them. The EPA requirements allow overboard discharge of these solids provided no free oil is present. Since it is not known at this time whether that criteria can be met, provisions are included for collection of the solids and for barging them to shore for disposal.

6.2.7 Gas Processing and Compression

Gas is collected from various points in the production handling system. A prime source of gas is from the casing-tubing annulus. In order to minimize the back-pressure on the producing formation, it is necessary that these gases be removed. A casing gas gathering system is provided for this purpose.

Additional gas breakout occurs in the free water knockout, in the treater, and in the stock tank. Provisions are included for collecting all of these gases and compressing them for use as fuel gas for the various gas turbines on the platform. All well tests have indicated that the gas contains no measurable quantity of hydrogen sulfide (H_2S).

Virtually all of the natural gas produced will be consumed onboard the platform as fuel. However, at peak production rates, gas production may slightly exceed fuel gas requirements. To provide for this contingency, a compressor is provided to boost the pressure to about 2000 psig for injection into the reservoir.

No gas pipeline to shore is provided since it is not anticipated that excess gas for sales would be available in quantities sufficient to justify its installation.

6.2.8 Condensate Handling

Condensate from the natural gas collection and compression system is blended back into the crude oil system.

6.2.9 Well Test/Well Cleanup Facilities

Well tests will be performed by selectively routing the well to be tested to one of two well test vessels. Gas, water and oil metering from these vessels will allow accurate well tests to be performed.

The vessels serve a second function. That function is as a "well cleanup scrubber" for newly completed wells. This would allow segregation of the production from that well until drilling muds, etc. are purged from the well.

6.2.10 Source Water Treatment and Injection

Equipment is provided to treat seawater as a supplemental source of injection water. Treatment consists of filtration to remove suspended solids and deaeration to remove oxygen. Gas turbine driven pumps boost the pressure for injection.

6.2.11 Relief and Vent Systems

Overpressure protection for the various pressure vessels is provided by appropriately sized pressure relief valves. These valves discharge into a collection system which routes the vapor through a "Vent Scrubber" to prevent liquid carryover prior to venting. Two separate collection systems and scrubbers are provided. One provides protection for the low pressure vessels (less than 5 psig) and the second provides protection for the high pressure vessels.

6.3 Utility Systems

In order for platform operations to be as self-sufficient as possible, the following utility systems are provided:

6.3.1 Electric Power Generation

Space is provided for up to six (6) 2400 KW generators. The generators will be driven by gas turbines capable of utilizing either natural gas or diesel as fuel. These generators will provide power for artificial lift, for various process and production needs as well as providing power for one of the two drilling rigs on the adjacent drilling platform.

If additional remote drilling platforms are installed, it is intended that these generators would supply power via submarine electric cable for electrical loads on those platforms.

6.3.2 Emergency Power Generation

A separate diesel driven generator of approximately 500 KW capacity will provide backup power to certain critical loads such as lighting, navigation aids, instrument air compressors, quarters, etc.

6.3.3 Fuel Gas System/Auxiliary Fuel

All of the prime movers on the platform will utilize produced natural gas as the primary fuel. However, all will be equipped to utilize diesel as an auxiliary fuel at times when the gas production is insufficient to meet all of the fuel needs.

On board storage for about 1000 bbls. of diesel is provided. Connections at the boat landing level will allow taking aboard diesel fuel from work boats, barges, etc.

6.3.4 Process Heating System

Process heat requirements are fulfilled by means of a closed circulating system utilizing low pressure (15 psig) steam as the heat media. The source of the heat will be waste heat recovery units on the gas turbines.

6.3.5 Potable Water/Sewage Treatment

Provision is made for supplying water from shore by means of a supply boat.

Sanitary sewage will be treated through a packaged sewage treatment unit. The effluent from the unit will comply with the EPA requirements.

6.3.6 Instrument Air System

Air for operation of pneumatic instruments will be supplied by a system consisting of compressors and air dryers.

6.3.7 Power Water System for Artificial Lift

A closed power water system will be provided for driving downhole hydraulic pumps. The system will be designed for 3000 B/D at 3000 psig. Make up water for the system will be treated produced water.

6.3.8 Deck Drainage/Sump System

In order to prevent spills of oil or other pollutant materials from reaching the ocean, both the drilling platform and the production platform will be equipped with drainage collection systems in all areas where spills are likely to occur. These "drip pans" collect the spilled material and route it to a water sump. Oil is collected in an oil sump and pumped back into the oil handling system. Water is collected in a drain water surge tank and pumped back into the produced water cleanup system. Under normal operations (i.e., routine cleanup and washdown of small spills) no discharge of either oil or water into the ocean will occur.

Should the capacity of the pumping system be exceeded (e.g., during a heavy rainstorm or when firewater is being used), the excess water which can not be pumped back into the produced water system will discharge into an emergency sump or skim pile. In the unlikely event that any oil carries over into the skim pile, provisions are included to recover the oil.

6.4 Support Facilities

6.4.1 Personnel Quarters

Personnel Quarters will be sized to accommodate those people who would routinely be quartered on the platform. Sleeping accommodations, kitchen and lunchroom; locker room, and restroom-washroom facilities will be provided.

6.4.2 Fire Suppression System

The design of the fire supression system will include the following:

a) a fixed automatic water spray system in the wellhead areas as required by OCS Order No. 8
b) a looped fire water system with two (2) fire water pumps on the facilities platform and two (2) fire water pumps on the drilling platform. These pumps will be located remotely from one another so that the likelihood of damage to more than one is remote
c) dry chemical extinguishers
d) foam generation equipment

6.4.3 Navigation Aids

A navigational aid system which complies with the U. S. Coast Guard's regulation will be provided.

6.4.4 Emergency Shutdown System (ESD) and Automatic Shut-in of Wells

All wells, including those artifically lifted, will be initially equipped with surface controlled subsurface safety devices. These devices will be installed in the well below the mudline and held open by the application (from the surface of the platform) of hydraulic and pneumatic pressure. Any accidental or deliberate bleeding off of the pressure will cause these devices to close and thereby stop any flow from the well, from either the tubing or the casing annulus, from below the device.

The pneumatic system holding open these and other safety shut-in devices on the platform equipment is spread throughout the platform. Monitors of critical functions and manual bleed-off valves at ESD stations will cause the system pressure to bleed off if an abnormal condition is detected. Accidental breaking of the system piping will also cause the system to bleed off and shut-in the wells.

6.4.5 Safety and Escape Equipment

Escape systems and life jackets will be provided on each of the platforms. The quarters building will be located near the bridge to provide a ready means of egress from the drilling platform.

6.5 Measures to Minimize Environmental Impact

Although no specific rules governing emissions apply to platforms offshore, it is planned to take appropriate steps to insure that no significant adverse effects will result from the installation and operation of these production facilities. Discharges to the ocean will comply with regulatory requirements.

6.5.1 Gas Turbine Emissions

The gas turbines which are used as the prime movers for the electric power generators and for the water injection pumps are the primary source of emissions. Although subject to change, the current plan calls for installing a total of eight (8) gas turbines with a total rating of about 20,000 horsepower. All of the turbines will be located on the 255-foot water depth production platform and will be sized to handle anticipated production from both the 265-foot water depth drilling platform and the future deep water platform. All turbines will be dual fuel (i.e., they will be equipped to burn either produced natural gas or diesel as fuel).

In order to minimize the environmental impact of these sources, the following steps will be taken:

a) Special turbines designed for low emissions of NO_x will be purchased.

b) Shell will shut down the Ventura gas plant and plans to shut down a number of natural gas engines in its Ventura Field. These will, in effect, offset the emissions of NO_x from the proposed gas turbine installation. A forecast of both the emission <u>decrease</u> at Ventura and the emission <u>increase</u> as a result of the proposed installation is shown in Drawing Z9-500.

c) Sulfur content of the fuel gas and the diesel fuel will comply with the equivalent regulations which apply onshore (i.e., fuel gas will contain less than 50 grains total sulfur as H_2S per 100 standard cubic feet and diesel fuel will contain a maximum of 0.25% sulfur by weight.)

6.5.2 Hydrocarbon Emissions

The offshore processing facilities will be designed to minimize hydrocarbon emissions. All vessels and tanks will be equipped with vapor recovery.

Although plans for onshore facilities are not definite at this time, they will be minimal. If tankage is required, it will be equipped with vapor recovery so that no emissions onshore will occur.

6.5.3 Discharges to the Ocean

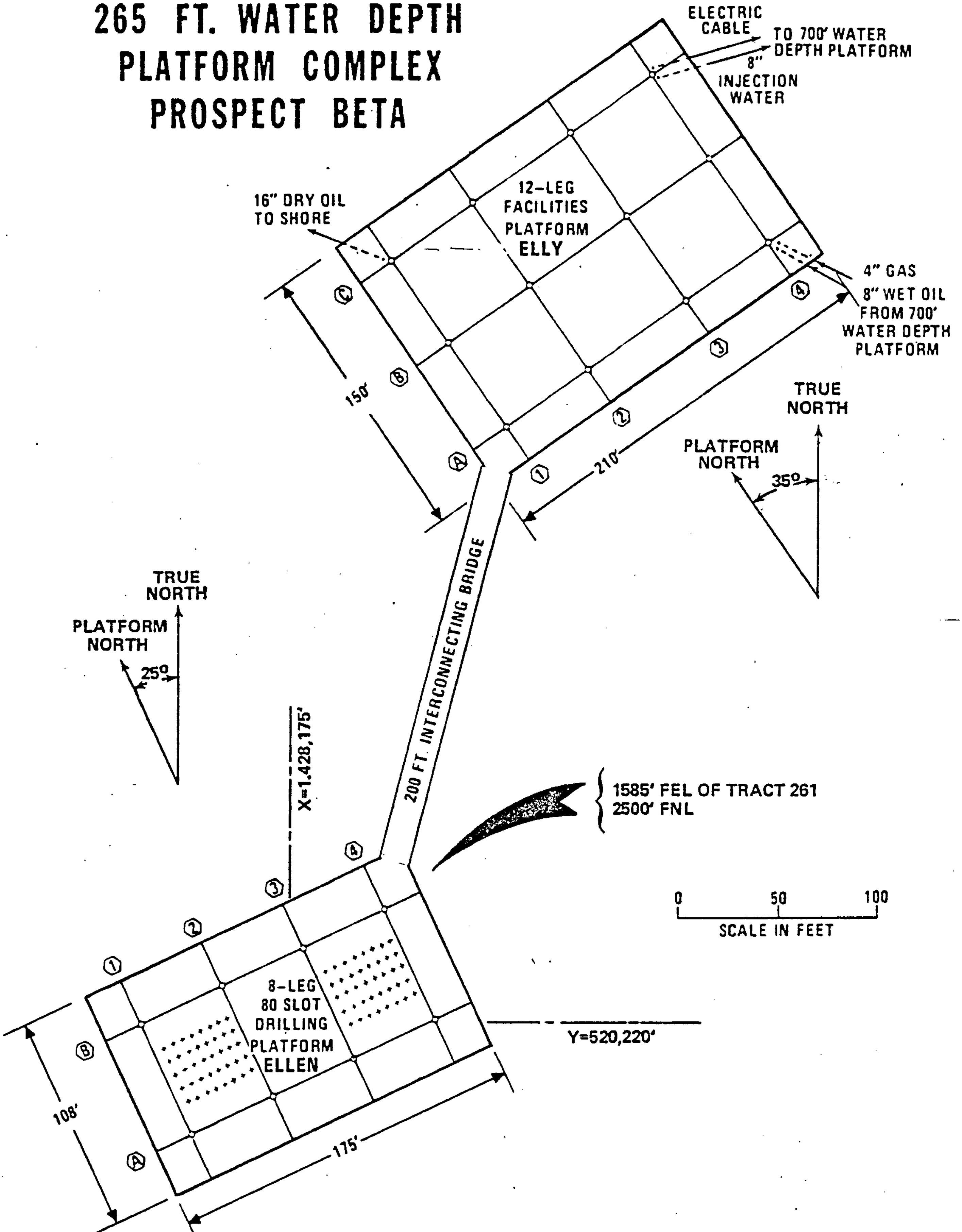
The pollutant concentrations in ocean discharges will be within the limits prescribed by EPA in their Interim Final NPDES Effluent Guidelines with one exception; deck drainage will achieve "discharge of no free oil to the surface waters". This deck drainage requirement was stipulated by EPA and the industry in API versus EPA, Ninth Circuit Court of Appeals, 76-3588. The limitations prescribed are listed below:

Far Offshore Category

Water Source	Oil & Grease (mg/l) Maximum for Any One Day	Oil & Grease (mg/l) Average Daily Values for thirty consecutive days	Residual Chlorine (mg/l)
Produced Water	72	48	NA
Deck Drainage Drill Cuttings Produced Sand	No discharge of free oil to the surface waters		NA
Sanitary Waste	NA	NA	1.0 Minimum
Domestic Waste	NA	NA	NA

NA - Not Applicable.

265 FT. WATER DEPTH PLATFORM COMPLEX PROSPECT BETA



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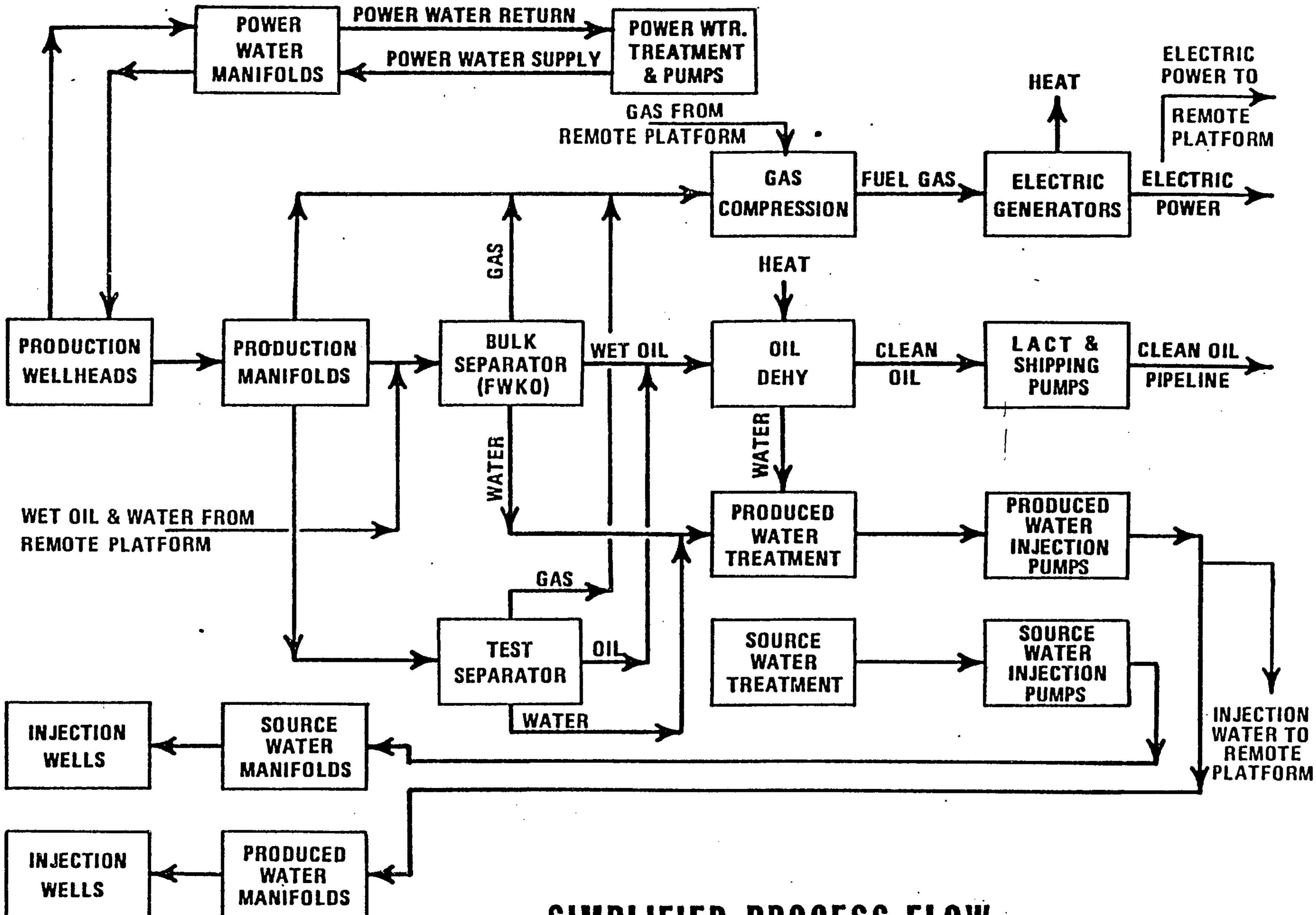
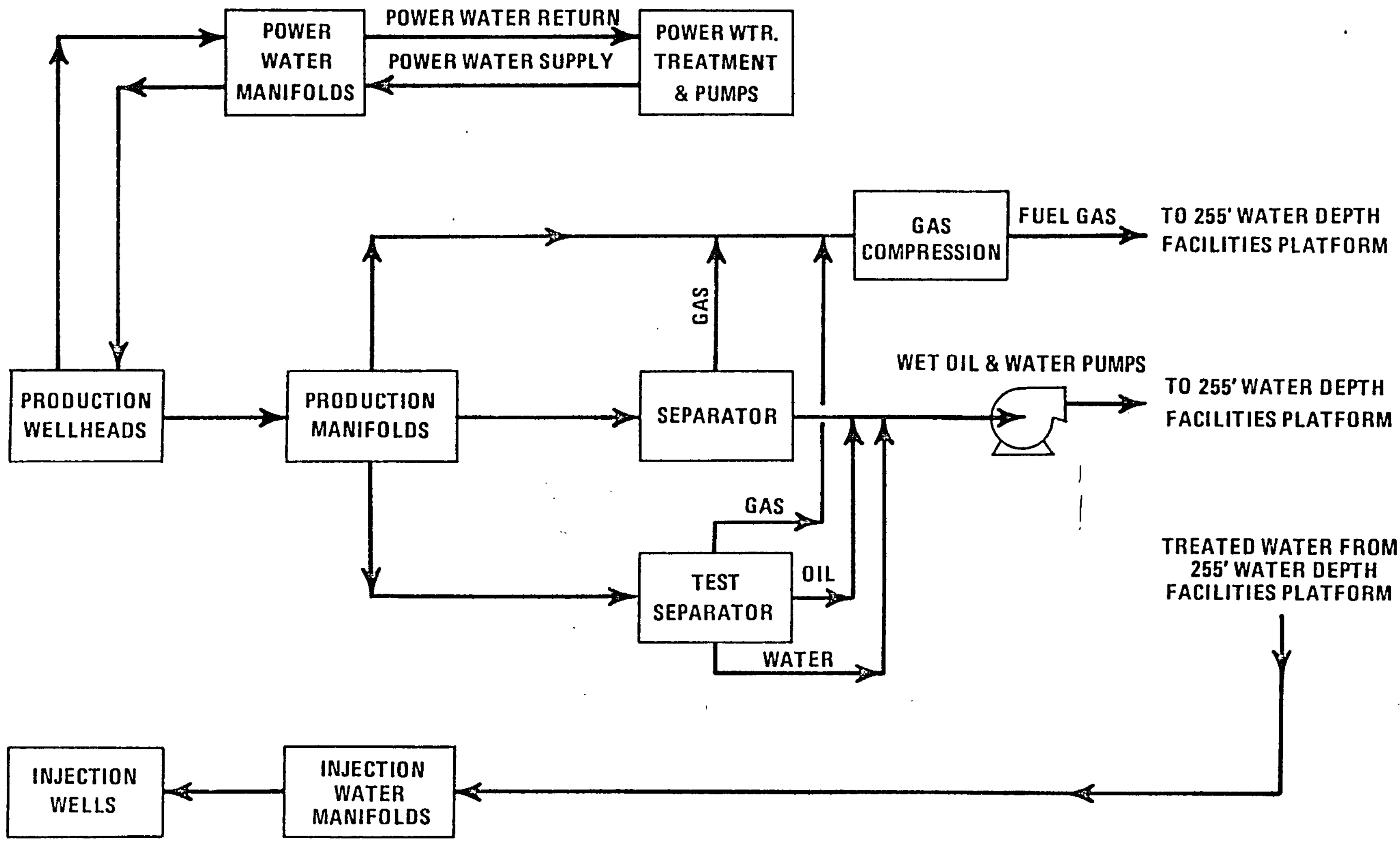


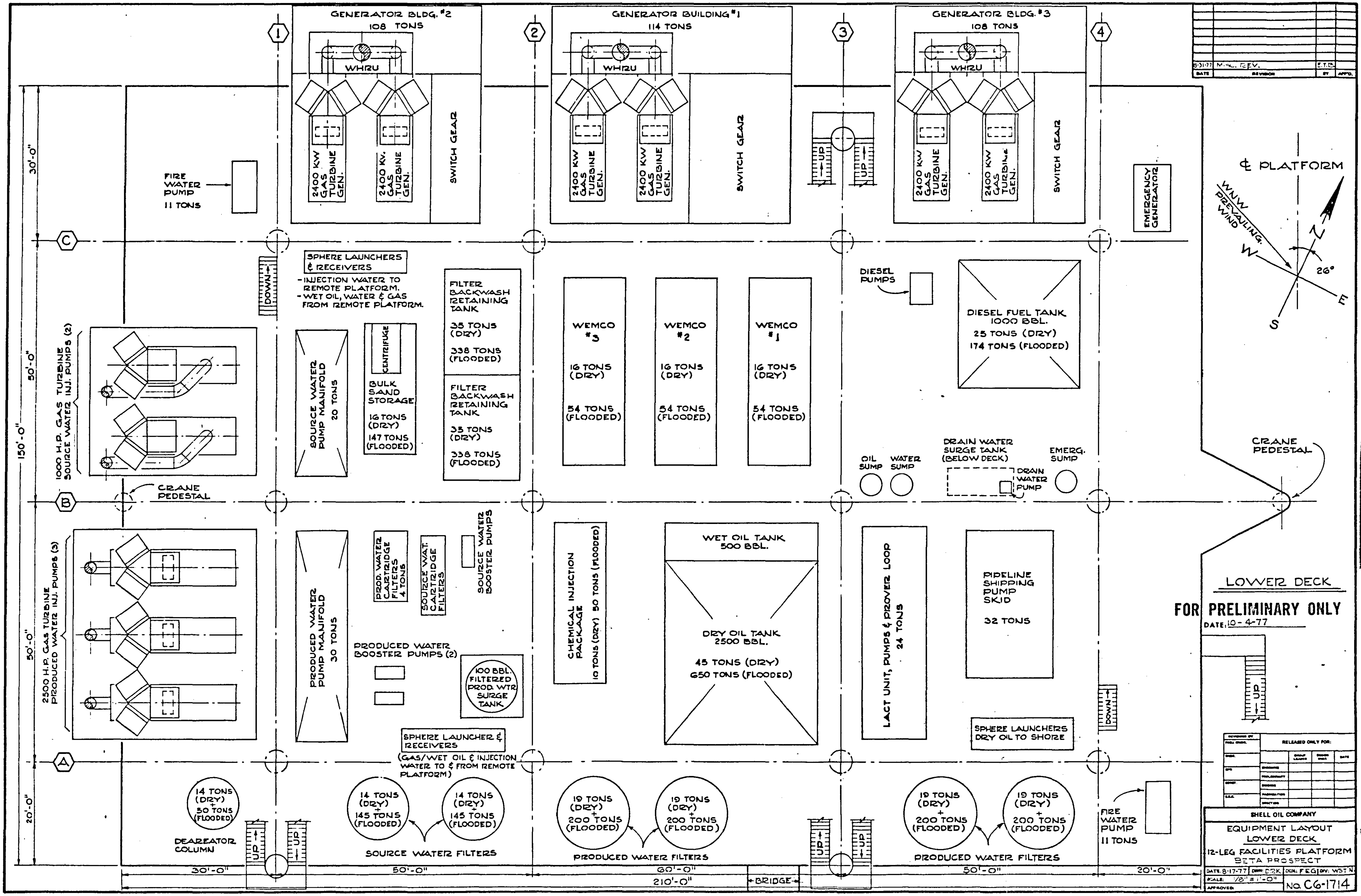
SIMPLIFIED PROCESS FLOW
PLATFORM PRODUCTION FACILITIES
PROSPECT BETA

ETB 8/2/77
Z9-499c

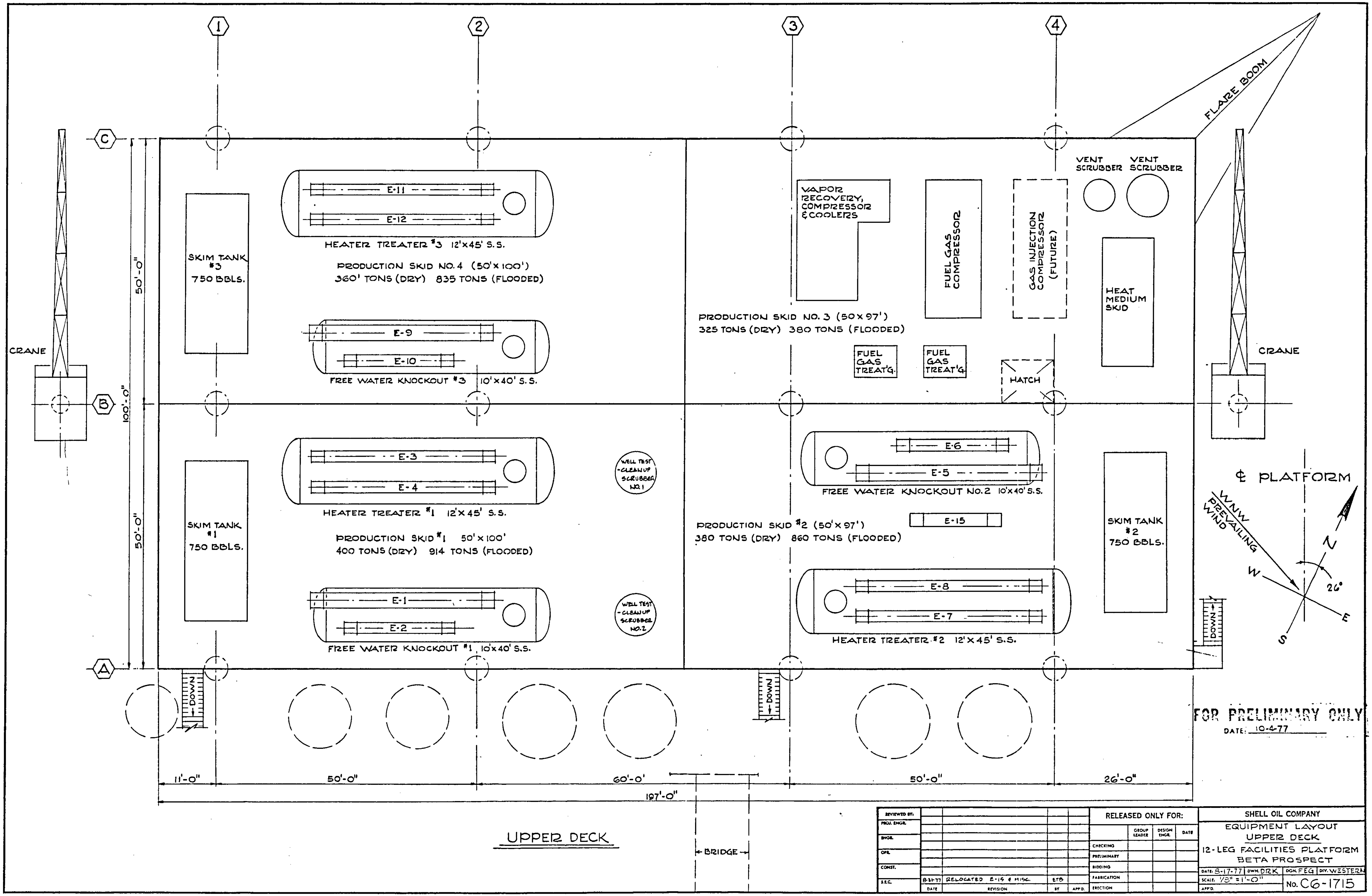


SIMPLIFIED PROCESS FLOW
REMOTE PLATFORM PRODUCTION FACILITIES
PROSPECT BETA

ETB 8/1/77
Z9-499a



GENERATOR BLDG. #2
108 TONS
GENERATOR BUILDING #1
114 TONS
GENERATOR BLDG. #3
108 TONS
WHRU
2400 KW GAS TURBINE GEN.
2400 KV. GAS TURBINE GEN.
SWITCH GEAR
FIRE WATER PUMP
11 TONS
UP
DOWN
EMERGENCY GENERATOR
℄ PLATFORM
WNW PREVAILING WIND
N
W
E
S
26°
SPHERE LAUNCHERS & RECEIVERS
-INJECTION WATER TO REMOTE PLATFORM.
-WET OIL, WATER & GAS FROM REMOTE PLATFORM.
FILTER BACKWASH RETAINING TANK
35 TONS (DRY)
338 TONS (FLOODED)
CENTRIFUGE
BULK SAND STORAGE
16 TONS (DRY)
147 TONS (FLOODED)
SOURCE WATER PUMP MANIFOLD
20 TONS
1000 H.P. GAS TURBINE SOURCE WATER INJ. PUMPS (2)
WEMCO #3
WEMCO #2
WEMCO #1
16 TONS (DRY)
54 TONS (FLOODED)
DIESEL PUMPS
DIESEL FUEL TANK
1000 BBL.
25 TONS (DRY)
174 TONS (FLOODED)
OIL SUMP
WATER SUMP
DRAIN WATER SURGE TANK (BELOW DECK)
DRAIN WATER PUMP
EMERG. SUMP
CRANE PEDESTAL
2500 H.P. GAS TURBINE PRODUCED WATER INJ. PUMPS (3)
PRODUCED WATER PUMP MANIFOLD
30 TONS
PROD. WATER CARTRIDGE FILTERS
4 TONS
SOURCE WAT. CARTRIDGE FILTERS
SOURCE WATER BOOSTER PUMPS
PRODUCED WATER BOOSTER PUMPS (2)
100 BBL. FILTERED PROD. WTR SURGE TANK
CHEMICAL INJECTION PACKAGE
10 TONS (DRY) 50 TONS (FLOODED)
WET OIL TANK
500 BBL.
DRY OIL TANK
2500 BBL.
45 TONS (DRY)
650 TONS (FLOODED)
LACT UNIT, PUMPS & PROVER LOOP
24 TONS
PIPELINE SHIPPING PUMP SKID
32 TONS
SPHERE LAUNCHERS DRY OIL TO SHORE
SPHERE LAUNCHER & RECEIVERS
(GAS/WET OIL & INJECTION WATER TO & FROM REMOTE PLATFORM)
14 TONS (DRY) + 50 TONS (FLOODED)
DEAREATOR COLUMN
14 TONS (DRY) + 145 TONS (FLOODED)
SOURCE WATER FILTERS
19 TONS (DRY) + 200 TONS (FLOODED)
PRODUCED WATER FILTERS
FIRE WATER PUMP
11 TONS
1
2
3
4
A
B
C
30'-0"
50'-0"
150'-0"
50'-0"
20'-0"
30'-0"
50'-0"
60'-0"
50'-0"
20'-0"
210'-0"
BRIDGE
LOWER DECK
FOR PRELIMINARY ONLY
DATE: 10-4-77
8-31-77 M.S.L. REV. E.T.D.
DATE REVISION BY APPD.
RELEASED ONLY FOR:
SHELL OIL COMPANY
EQUIPMENT LAYOUT
LOWER DECK
12-LEG FACILITIES PLATFORM
BETA PROSPECT
DATE 8-17-77 DRN DRK
SCALE 1/8" = 1'-0"
APPROVED
NO. C6-1714

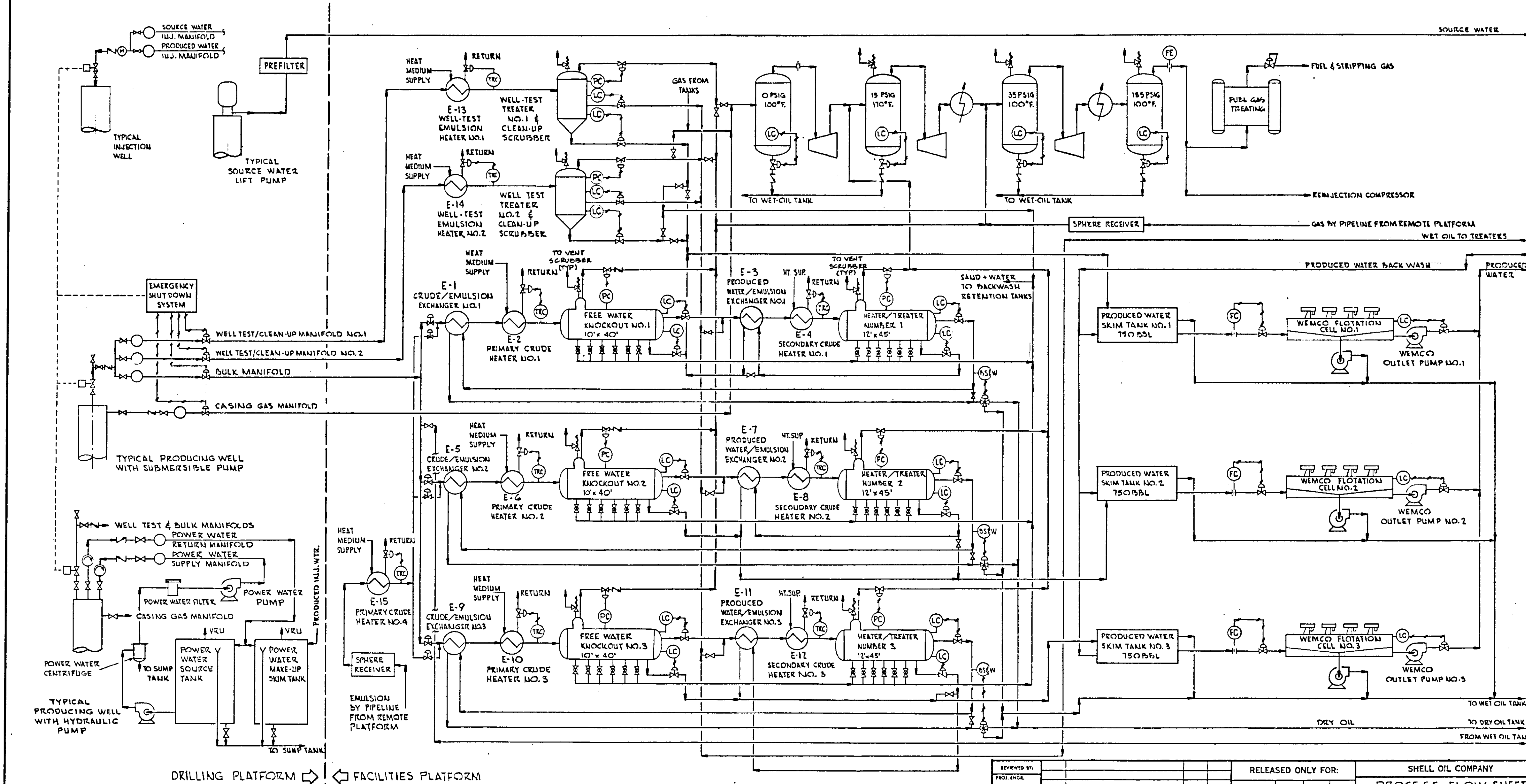


REVIEWED BY:					RELEASED ONLY FOR:			
PROJ. ENGR.						GROUP LEADER	DESIGN ENGR.	DATE
ENGR.					CHECKING			
OPR.					PRELIMINARY			
CONST.					BIDDING			
S.E.C.	8-31-77	RELOCATED E-15 & MISC.	ETB		FABRICATION			
	DATE	REVISION	BY	APP'D.	ERECTION			

SHELL OIL COMPANY

EQUIPMENT LAYOUT
UPPER DECK
12-LEG FACILITIES PLATFORM
BETA PROSPECT

DATE: 8-17-77 | DWN. DRK | DGN. FEG | DIV. WESTERN
SCALE: 1/8" = 1'-0" | No. C6-1715
APP'D.



REVIEWED BY:				
PROJ. ENGR.				
ENGR.				
OPR.				
CONST.				
S.E.C.	8-31-77	DELETED BULK MANIFOLD NO.2	ETB	
	DATE	REVISION	BY	APP'D.

RELEASED ONLY FOR:

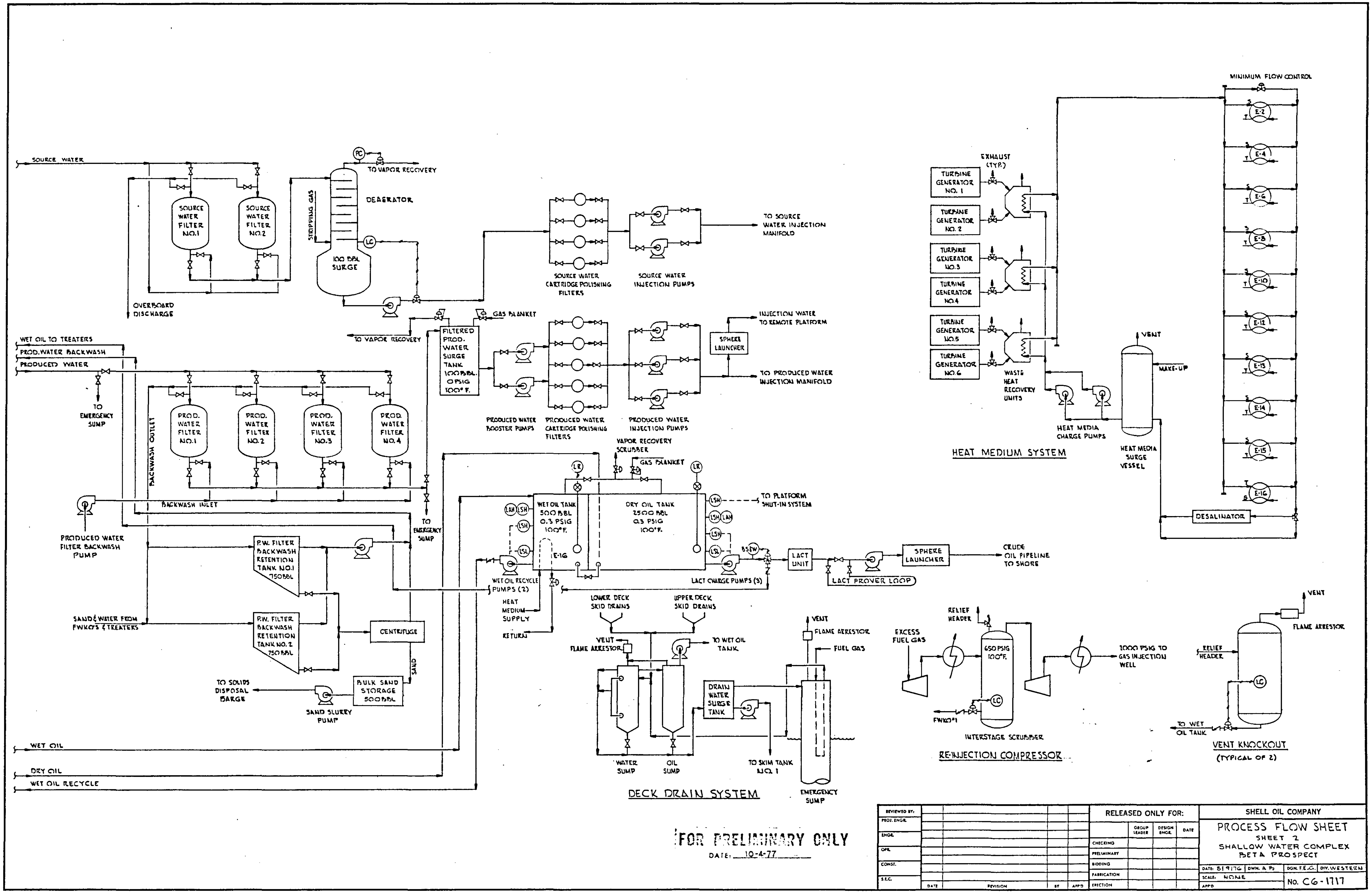
	GROUP LEADER	DESIGN ENGR.	DATE
CHECKING			
PRELIMINARY			
BIDDING			
FABRICATION			
ERECTION			

SHELL OIL COMPANY

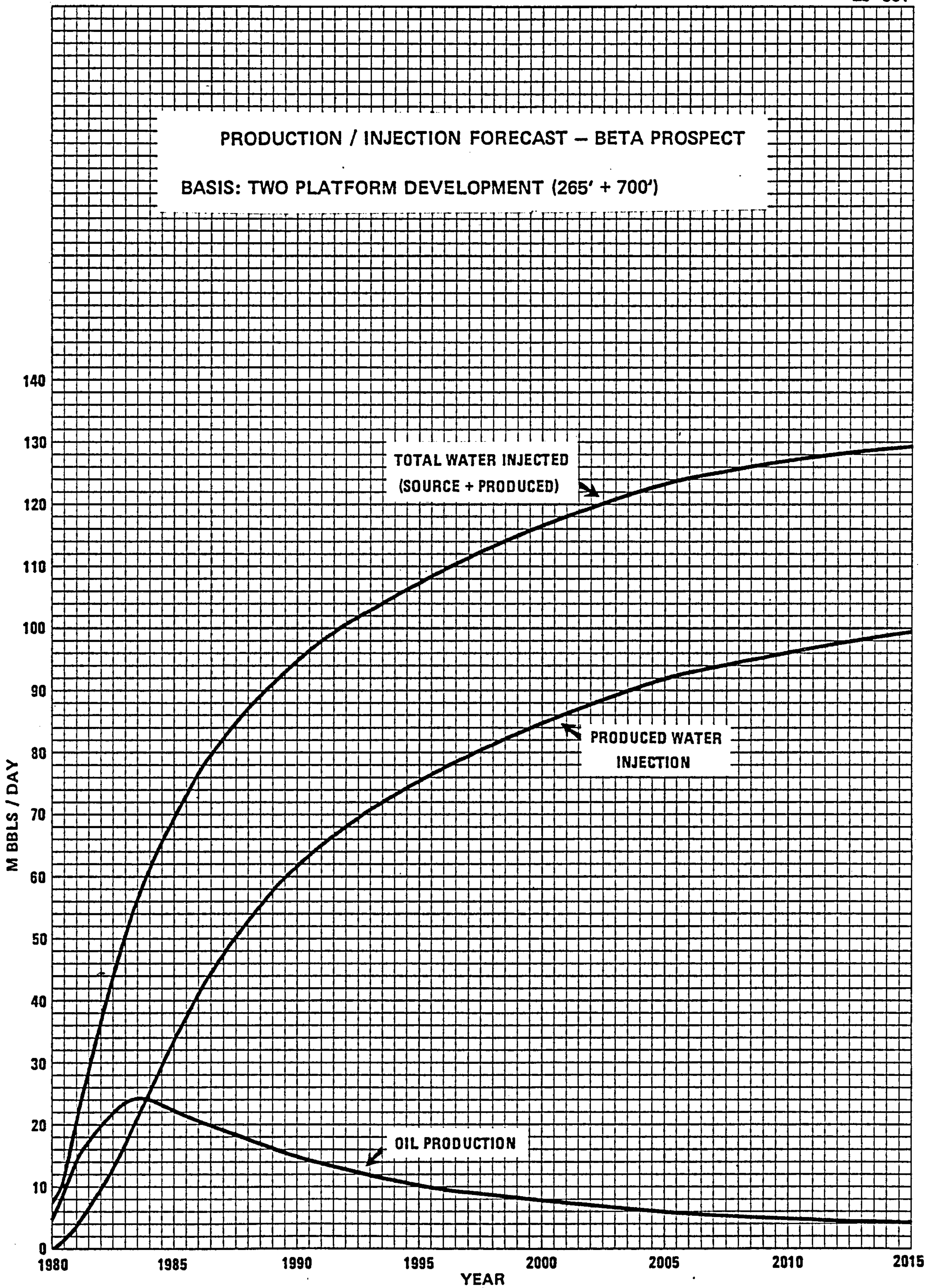
PROCESS FLOW SHEET
SHEET 1
SHALLOW WATER COMPLEX
BETA PROSPECT

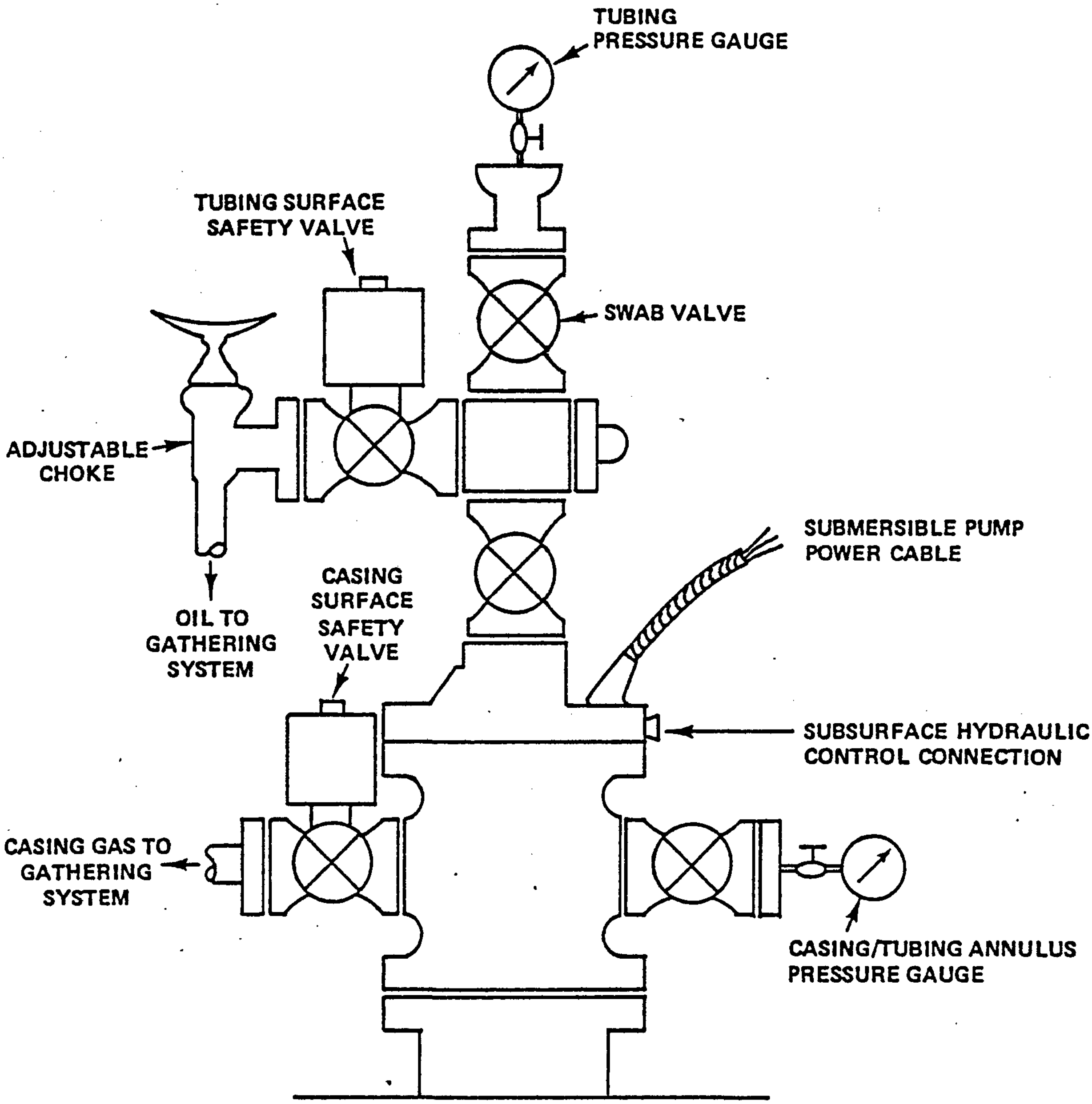
DATE: 8/9/76 | DWN. A P. | DGN. F.E.G. | DIV. WESTERN
SCALE: NONE
APP'D
No. CG-1716

FOR PRELIMINARY ONLY
DATE: 10-4-77

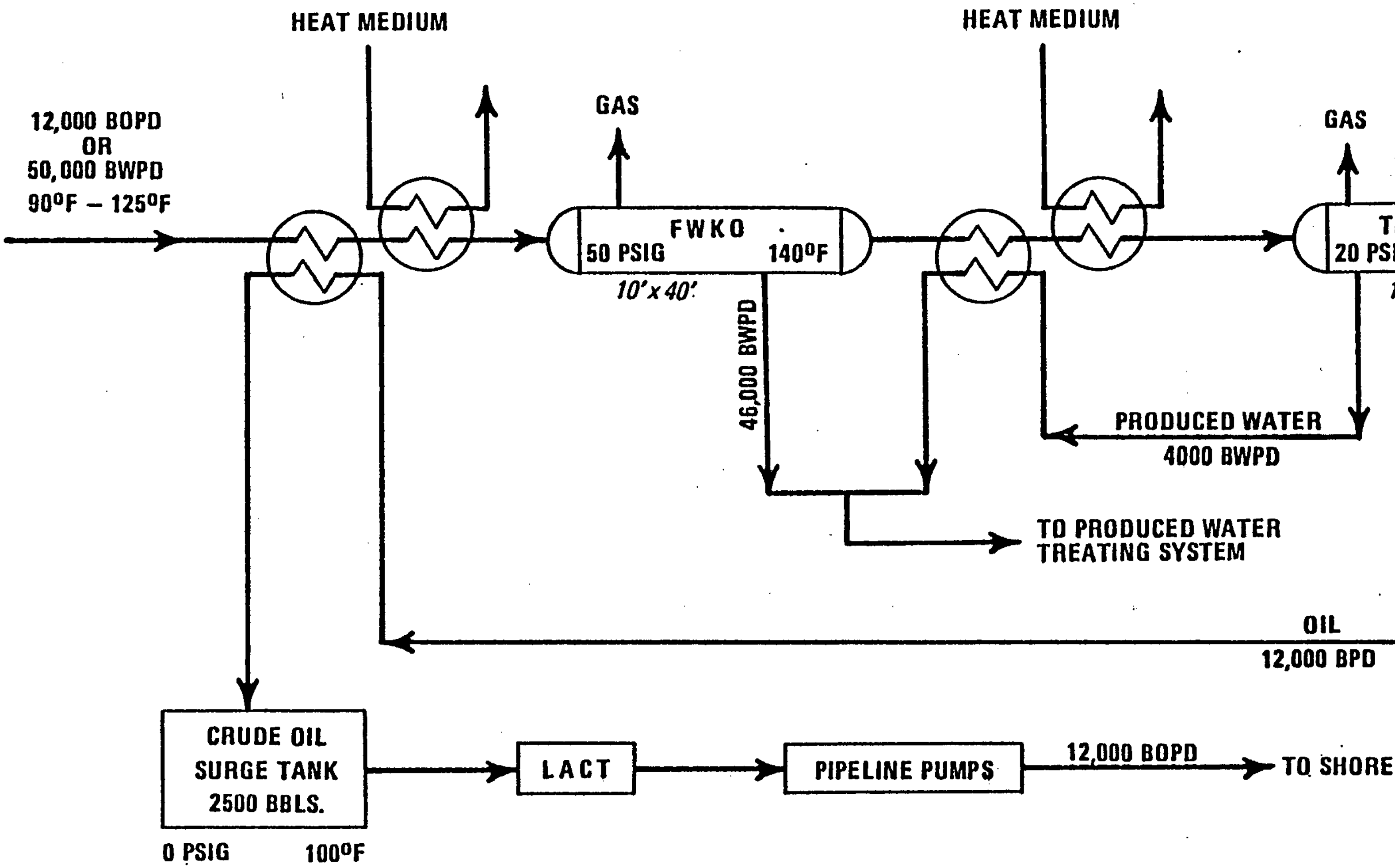


SOURCE WATER
SOURCE WATER FILTER NO.1
SOURCE WATER FILTER NO.2
OVERBOARD DISCHARGE
PC
TO VAPOR RECOVERY
STRIPPING GAS
DEAERATOR
LC
100 BBL SURGE
SOURCE WATER CARTRIDGE POLISHING FILTERS
SOURCE WATER INJECTION PUMPS
TO SOURCE WATER INJECTION MANIFOLD
GAS BLANKET
TO VAPOR RECOVERY
FILTERED PROD. WATER SURGE TANK 100 BBL. 0 PSIG 100° F.
WET OIL TO TREATERS
PROD. WATER BACKWASH
PRODUCED WATER
TO EMERGENCY SUMP
BACKWASH OUTLET
PROD. WATER FILTER NO.1
PROD. WATER FILTER NO.2
PROD. WATER FILTER NO.3
PROD. WATER FILTER NO.4
PRODUCED WATER BOOSTER PUMPS
PRODUCED WATER CARTRIDGE POLISHING FILTERS
PRODUCED WATER INJECTION PUMPS
SPHERE LAUNCHER
INJECTION WATER TO REMOTE PLATFORM
TO PRODUCED WATER INJECTION MANIFOLD
BACKWASH INLET
PRODUCED WATER FILTER BACKWASH PUMP
TO EMERGENCY SUMP
P.W. FILTER BACKWASH RETENTION TANK NO.1 750 BBL
P.W. FILTER BACKWASH RETENTION TANK NO.2 750 BBL
SAND & WATER FROM FWKO'S & TREATERS
CENTRIFUGE
SAND
BULK SAND STORAGE 500 BBL
TO SOLIDS DISPOSAL BARGE
SAND SLURRY PUMP
WET OIL
DRY OIL
WET OIL RECYCLE
VAPOR RECOVERY SCRUBBER
GAS BLANKET
LR
LAH
LSH
LSL
WET OIL TANK 500 BBL 0.3 PSIG 100°F.
DRY OIL TANK 2500 BBL 0.3 PSIG 100°F.
E-16
TO PLATFORM SHUT-IN SYSTEM
BS&W
WET OIL RECYCLE PUMPS (2)
HEAT MEDIUM SUPPLY
RETURN
LACT CHARGE PUMPS (3)
LACT UNIT
LACT PROVER LOOP
SPHERE LAUNCHER
CRUDE OIL PIPELINE TO SHORE
LOWER DECK SKID DRAINS
UPPER DECK SKID DRAINS
VENT
FLAME ARRESTOR
TO WET OIL TANK
DRAIN WATER SURGE TANK
WATER SUMP
OIL SUMP
TO SKIM TANK NO. 1
VENT
FLAME ARRESTOR
FUEL GAS
EMERGENCY SUMP
DECK DRAIN SYSTEM
EXHAUST (TYP.)
TURBINE GENERATOR NO. 1
TURBINE GENERATOR NO. 2
TURBINE GENERATOR NO.3
TURBINE GENERATOR NO.4
TURBINE GENERATOR NO.5
TURBINE GENERATOR NO.6
WASTE HEAT RECOVERY UNITS
HEAT MEDIA CHARGE PUMPS
VENT
MAKE-UP
HEAT MEDIA SURGE VESSEL
HEAT MEDIUM SYSTEM
MINIMUM FLOW CONTROL
E-2
E-4
E-6
E-8
E-10
E-12
E-13
E-14
E-15
E-16
DESALINATOR
RELIEF HEADER
EXCESS FUEL GAS
650 PSIG 100°F.
LC
FWKO#1
INTERSTAGE SCRUBBER
1000 PSIG TO GAS INJECTION WELL
RE-INJECTION COMPRESSOR
VENT
FLAME ARRESTOR
RELIEF HEADER
LC
TO WET OIL TANK
VENT KNOCKOUT (TYPICAL OF 2)
FOR PRELIMINARY ONLY
DATE: 10-4-77
REVIEWED BY:
PROJ. ENGR.
ENGR.
OPR.
CONST.
S.E.C.
DATE
REVISION
BY
APP'D
RELEASED ONLY FOR:
GROUP LEADER
DESIGN ENGR.
DATE
CHECKING
PRELIMINARY
BIDDING
FABRICATION
ERECTION
SHELL OIL COMPANY
PROCESS FLOW SHEET
SHEET 2
SHALLOW WATER COMPLEX
BETA PROSPECT
DATE: 8-9-76
DWN. A. P.
DGN. F.E.G.
DIV. WESTERN
SCALE: NONE
APP'D
NO. C6-1717


PRODUCTION / INJECTION FORECAST – BETA PROSPECT
BASIS: TWO PLATFORM DEVELOPMENT (265' + 700')
TOTAL WATER INJECTED
(SOURCE + PRODUCED)
PRODUCED WATER
INJECTION
OIL PRODUCTION
M BBLS / DAY
YEAR
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
1980
1985
1990
1995
2000
2005
2010
2015

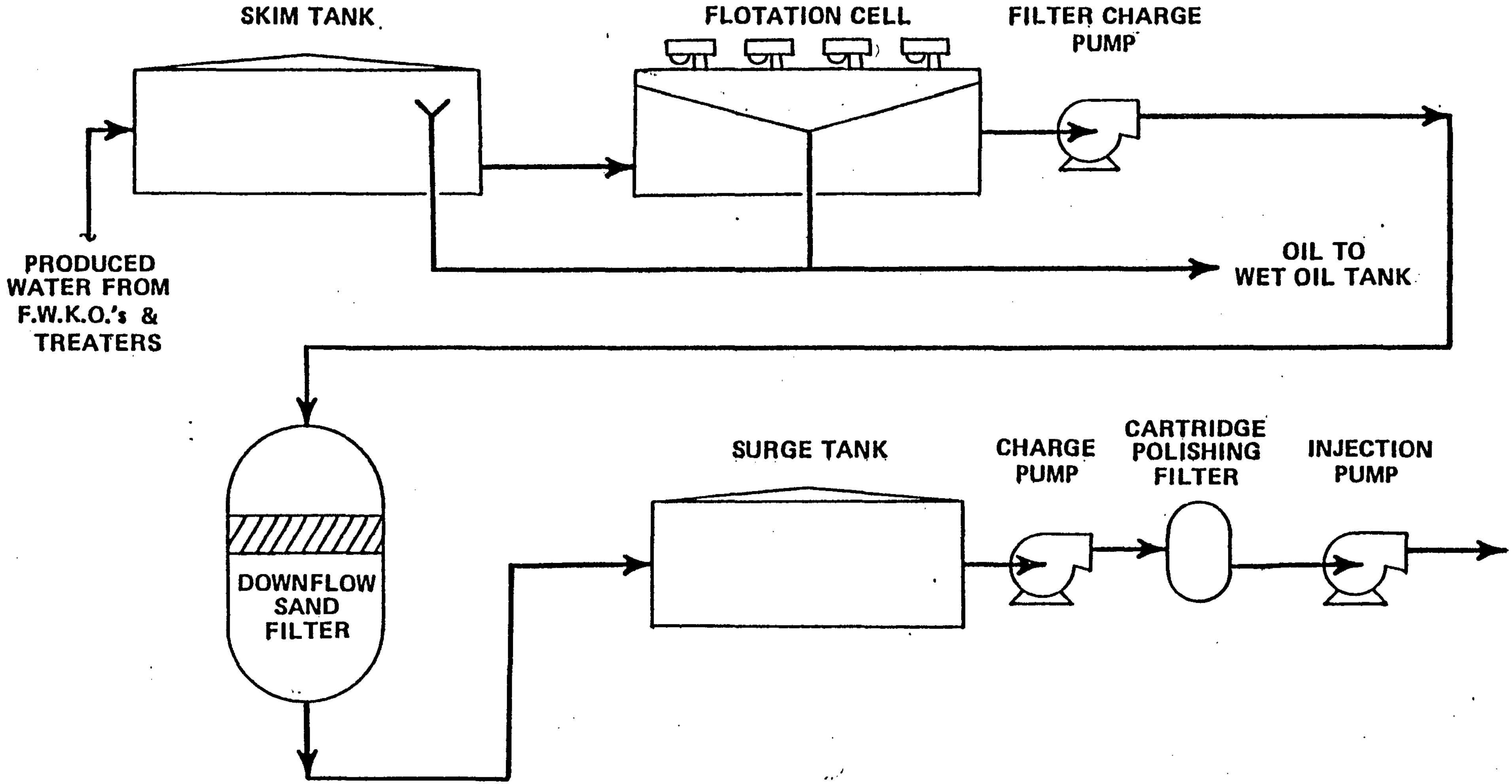


REVIEWED BY:	RELEASED ONLY FOR:				SHELL OIL COMPANY			
PROJ. ENGR.					WELLHEAD ARRANGEMENT			
ENGR.		GROUP LEADER	DESIGN ENGR.	DATE				
OPR.	CHECKING							
	PRELIMINARY							
CONST.	BIDDING				DATE: 9–8–77	DWN. RLK	DGN. GPD	DIV. WESTERN
S.E.C.	FABRICATION				SCALE:	No. ZF 2627		
	ERECTION				APP'D.			



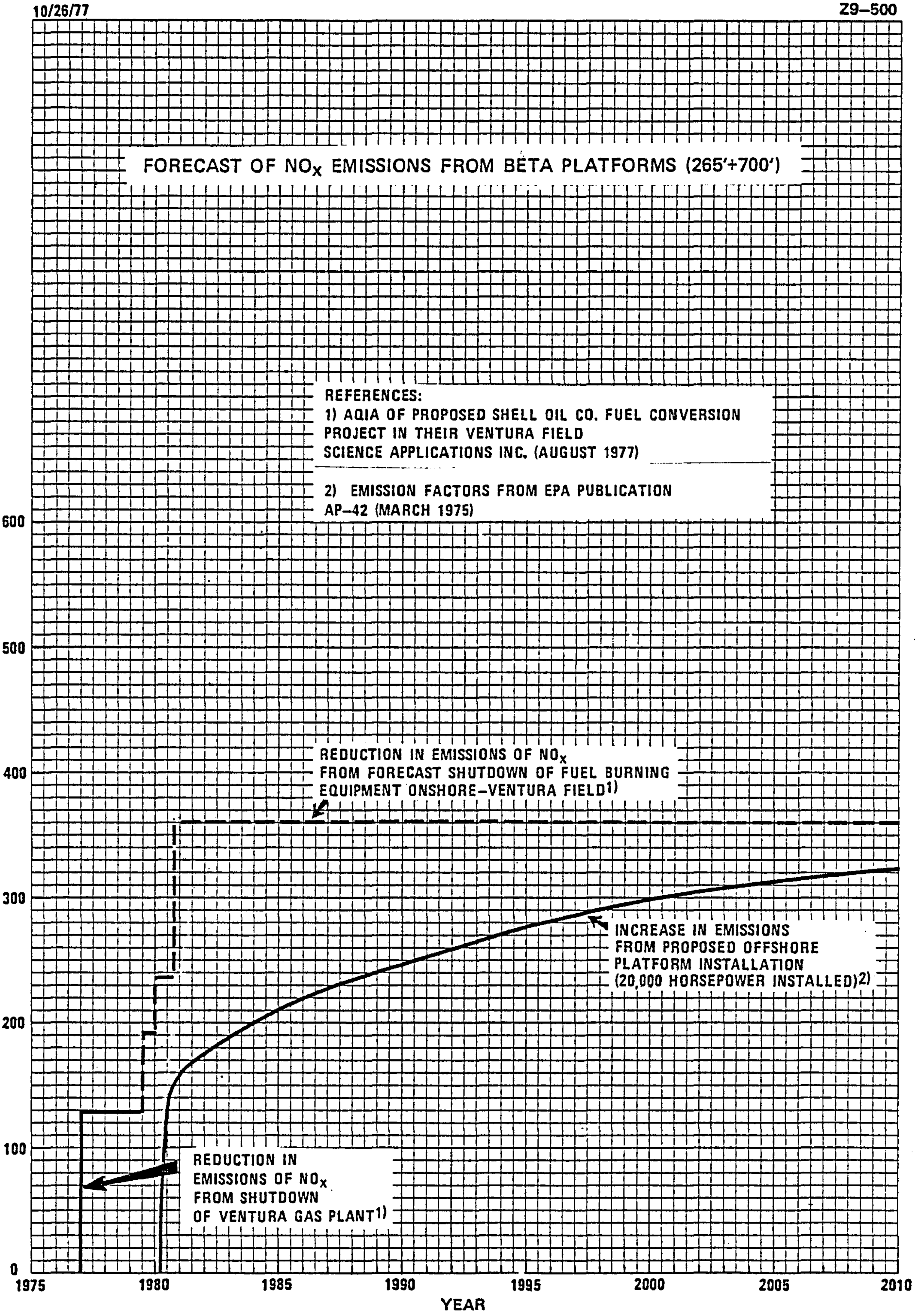
SINGLE TRAIN OIL DEHYDRATION PROSPECT BETA

ETB 8/2/77
Z9-499b



SIMPLIFIED PROCESS FLOW PRODUCED WATER TREATMENT PROSPECT BETA

ETB 7/29/77
Z9-499


FORECAST OF NO_x EMISSIONS FROM BETA PLATFORMS (265'+700')
REFERENCES:
1) AQIA OF PROPOSED SHELL OIL CO. FUEL CONVERSION PROJECT IN THEIR VENTURA FIELD SCIENCE APPLICATIONS INC. (AUGUST 1977)
2) EMISSION FACTORS FROM EPA PUBLICATION AP–42 (MARCH 1975)
REDUCTION IN EMISSIONS OF NO_x FROM FORECAST SHUTDOWN OF FUEL BURNING EQUIPMENT ONSHORE–VENTURA FIELD[1)]
INCREASE IN EMISSIONS FROM PROPOSED OFFSHORE PLATFORM INSTALLATION (20,000 HORSEPOWER INSTALLED)[2)]
REDUCTION IN EMISSIONS OF NO_x FROM SHUTDOWN OF VENTURA GAS PLANT[1)]
NO_x EMISSIONS (TONS / YEAR)
0
100
200
300
400
500
600
1975
1980
1985
1990
1995
2000
2005
2010
YEAR

SECTION VII

SUBSEA PIPELINE AND ONSHORE FACILITIES

TABLE OF CONTENTS | Page

SECTION VII

SUBSEA PIPELINE AND ONSHORE FACILITIES

7.1 Introduction

A subsea pipeline to transport the clean crude from the dehydration facilities on the platform is planned for installation during late 1979 or early 1980. Pipeline capacity will be sufficient for handling production from not only the platforms in the Unit but also from other San Pedro Bay parcels which might logically be included in this system. It is expected that Unit production will peak at about 26,000 B/D oil and that the oil will be shipped to shore via pipeline.

7.1.1 Long Beach is the preferred landfall, from which the oil may be routed to various refineries. We plan to install a 16-inch line capable of transporting 40,000 B/D oil to shore with shore facilities to handle the 26,000 B/D expected maximum oil production.

7.1.2 Huntington Beach is a possible landfall, from which the oil could be routed to Chevron's Huntington Beach pipeline terminal and thence to their El Segundo Refinery. A 16" line to shore would transport 40,000 B/D oil but, even with onshore heating and blending, this volume of oil could not be moved through Chevron's pipelines.

7.1.3 Seal Beach landfall with a 16" line would require onshore installation of eleven miles of 16" or 20" pipeline to Shell's Wilmington Refinery.

7.1.4 The preferred pipeline route is shown on maps included in this section.

7.2 Pipeline Routes and Facilities

7.2.1 The subsea portion of the pipeline route to Long Beach is approximately 14 miles long. Landfall is planned on Pier J near the Queen Mary as shown on Figure 7-2. The proposed route would parallel the THUMS clean oil lines to the THUMS seven company distribution manifold about two miles inland. A site along the route, but preferably near the THUMS manifold is planned for facilities consisting of a scraper trap, meters, a tank equipped for vapor recovery, pumps and manifold. The facilities could easily be expanded to handle larger than expected oil production.

7.2.2 The pipeline route to the Huntington Beach coast is approximately nine miles long and is the shortest distance to shore. With landfall near the foot of the bluff immediately west of the Huntington Beach city limits, a possible route would cross the beach, pass through a bore under Pacific Coast Highway, cross privately owned oilfield property west of the bluff, thence along city streets to an existing Chevron pipeline terminal about three miles inland. Acquisition of about one acre of land is required for facilities. These facilities will consist of heaters or heat exchangers for heating the crude from 55°-60°F to 110°-120°F, scraper trap, meters, a tank equipped for vapor recovery and pumps. Since other pipelines in the area are believed to be near capacity, installation of up to 38 miles of additional onshore pipeline will be required to handle crude volumes much in excess of 25-30,000 B/D.

7.2.3 The subsea pipeline route to Seal Beach is slightly more than 11 miles long, but requires installation of 11 miles or so of new land line to Shell's Wilmington Refinery. A 16" line will move 40,000 B/D oil to shore. Onshore facilities are required in or near Seal Beach which will consist of a scraper trap, meters, a tank equipped for vapor recovery, pumps, scraper launcher and about 11 miles of 16" or 20" land line. Sites along the route are needed for metering oil to other refiners.

7.3 Design Criteria and Objectives

7.3.1 Basis for Design

The oil line to shore would be designed for a maximum throughput of at least 40,000 barrels per day of sour crude. Since all gas produced will be used on the platform for power generation and oil dehydration, gas transportation facilities are not planned.

7.3.2 Applicable Regulations and Codes

The oil line will be designed in compliance with USGS, Conservation Division, Branch of Oil & Gas Operations, Pacific Region, OCS Order No. 9, dated June 1, 1971, ANSI B31.4-1974, "Liquid Petroleum Transportation Piping Systems", and Department of Transportation Regulation 49, Part 195, as amended

August 18, 1976, "Transportation of Liquids by Pipeline". Portions of the pipeline routes within the jurisdiction of the State of California would be designed in compliance with any additional State regulations in effect at that time. In addition to the above, the pipeline design and operating procedures would follow API Recommended Practice RP 1111, Design, Construction, Operation and Maintenance of Offshore Hydrocarbon Pipelines, March 1976, and the Department of Interior/Department of Transportation memorandum of understanding of June 11, 1976.

7.3.3 Stability

The offshore portions of the pipeline will be designed to resist movement under the action of on-bottom currents predicted to occur during the design 100-year storm. Stability will be achieved by proper design of submerged pipeline weight. The pipeline, appropriately protected, will be placed on the ocean bottom.

7.3.4 Maximum Operating Pressure

Maximum operating pressures of the line will be 1440 psi and be designed to withstand this maximum operating pressure under applicable codes and regulations.

7.3.5 External Pressure

The pipeline will be designed to withstand external loads, including hydrostatic pressures with the pipeline void and with its absolute internal pressure equal to one atmosphere.

7.3.6 Other Stresses

The pipeline will be designed under applicable codes and regulations to withstand stresses which result from installation, thermal and fluid expansion effects, earthquake and other dynamic effects, dead loads, and surges.

7.3.7 External Corrosion Protection

The pipeline will be protected against external corrosion by means of external coatings and cathodic protection. Choice of coating materials and cathodic protection systems, impressed current or sacrificial anodes, will be based on detailed studies of the selected pipeline route.

7.3.8 Internal Corrosion Protection

Internal corrosion in this clean oil pipeline is not expected. However, the use of inhibitors is planned. Testing and monitoring for internal corrosion will dictate the extent of the program.

7.3.9 Construction Method

The construction technique used for the offshore portion of the pipeline is influenced by relative economics and availability of equipment at the time of installation. The use of the pull method is planned at the present time, but is subject to review.

The pipeline's near shore end would be buried in the section through the beach and surf zone to the MLL water level, excepting that all of the pipeline inside the Long Beach breakwater would be buried.

The onshore portion of the pipeline would be installed using conventional land-type pipeline construction methods and equipment. Testing and inspection of all sections of the pipeline would be in compliance with all applicable codes and regulations.

7.3.10 Pipeline Operation

The pipeline will be operated and regularly inspected in compliance with USGS and DOT regulations. Safety and monitoring devices, such as leak detectors, shut-ins, etc. will be provided in accordance with OCS Order No. 9. Recordkeeping and reporting will be in accordance with all federal and state regulations.

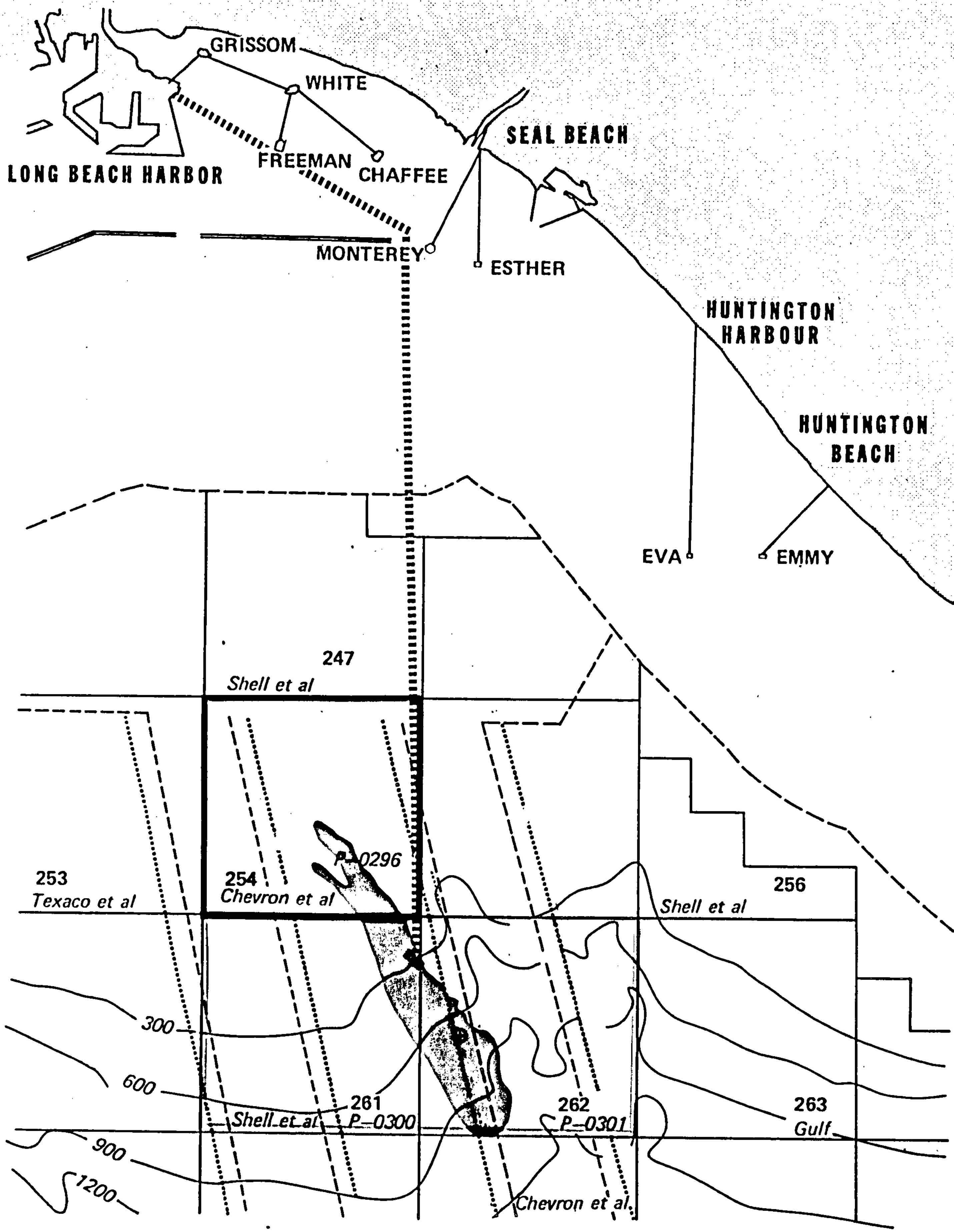
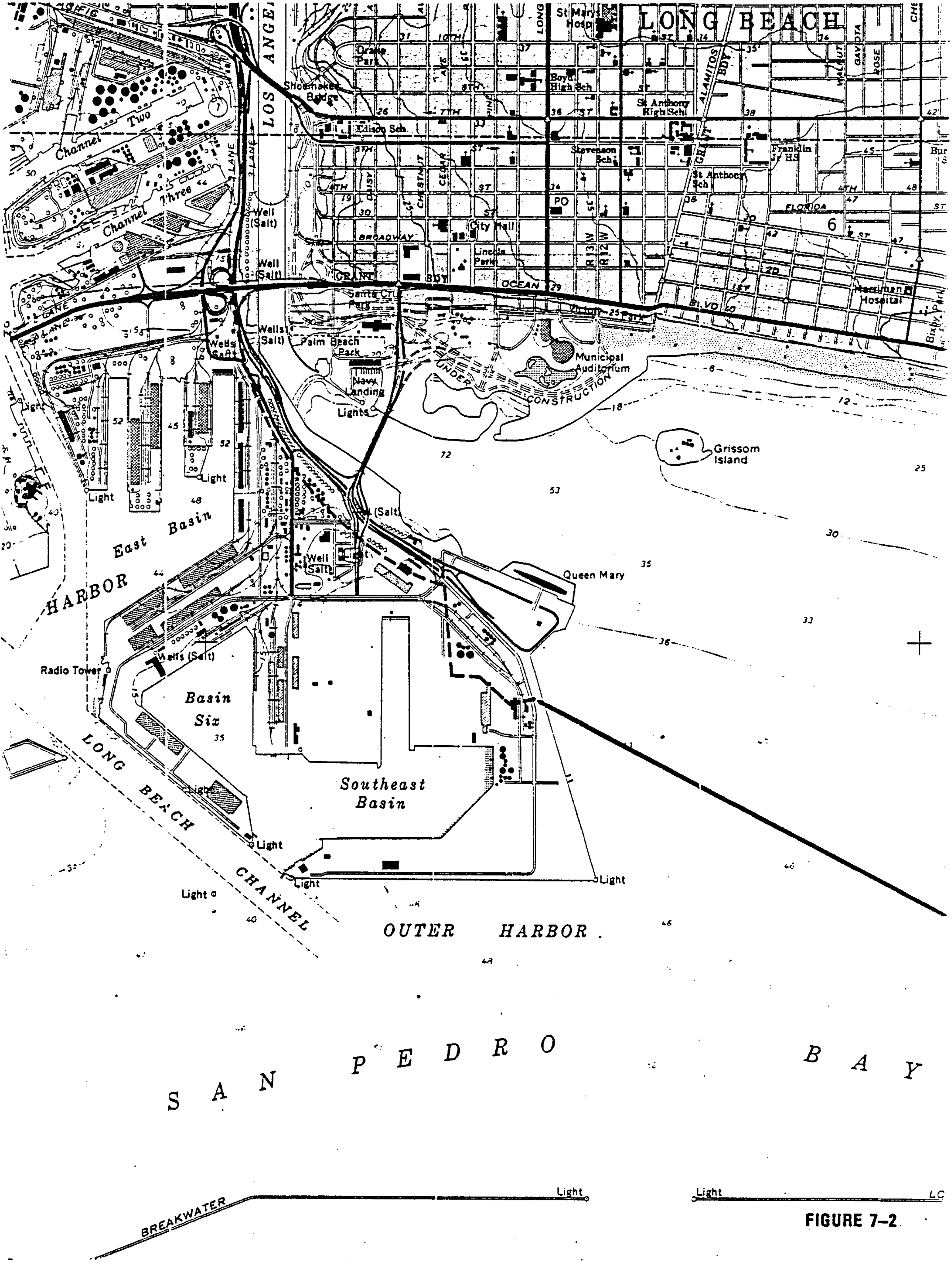

GRISSOM
WHITE
SEAL BEACH
LONG BEACH HARBOR
FREEMAN
CHAFFEE
MONTEREY
ESTHER
HUNTINGTON HARBOUR
HUNTINGTON BEACH
EVA
EMMY
247
Shell et al
253
Texaco et al
254
Chevron et al
P-0296
256
Shell et al
300
600
900
1200
261
Shell et al
P-0300
262
P-0301
263
Gulf
Chevron et al

FIGURE 7–1



LONG BEACH
St Marys Hosp
Drake Park
Shoemaker Bridge
Boyd High Sch
St Anthony High Sch
Edison Sch
Stevenson Sch
Franklin Jr HS
St Anthony Sch
City Hall
PO
Lincoln Park
Harriman Hospital
LOS ANGELES
ALAMITOS
GRANT
OCEAN
BLVD
BROADWAY
FLORIDA
CHESTNUT
CEDAR
DAISY
WALNUT
GAVIOTA
ROSE
Bixby Park
R 13 W
R 12 W
Channel Two
Channel Three
Well (Salt)
Wells (Salt)
Santa Cruz Park
Palm Beach Park
Navy Landing
Lights
Victory Park
Municipal Auditorium
UNDER CONSTRUCTION
Grissom Island
Queen Mary
East Basin
HARBOR
Radio Tower
Basin Six
Southeast Basin
LONG BEACH CHANNEL
Light
OUTER HARBOR
SAN PEDRO BAY
BREAKWATER

FIGURE 7–2

SECTION VIII

APPENDIX

The following reports, other than Governmental regulations and industry standards, were utilized and referenced in preparation of this Plan of Development:

8.1 MESA^2 (1977) Beta Platform Site Evaluations

8.2 Woodward-Clyde Consultants (1977) Soil Boring, Sampling and Laboratory Testing Program, Tract No. 261, San Pedro Bay, Offshore Southern California.

8.3 Woodward-Clyde Consultants (1977) Soil Boring, Sampling, and Laboratory Testing Program, Tract No. 262, San Pedro Bay, Offshore Southern California.

8.4 Evans-Hamilton, Inc. (1976) An Environmental Design Study for the Southern California Outer Continental Shelf.

8.5 Dames and Moore (1977) Geoseismic Investigation of the Palos Verdes Fault Zone.

8.6 Dames and Moore (1977) Pipeline Route Survey, San Pedro Shelf, California

8.7 Shell Oil Company (1977) Critical Operations and Curtailment Plan.

8.8 Shell Oil Company (1977) Oil Spill Contingency Plan for Beta Unit Development.

8.9 United States Department of the Interior, Bureau of Land Management (1975) Final Environmental Statement, Volumes 1-5; Proposed 1975 Outer Continental Shelf Oil and Gas General Lease Sale, Offshore Southern California (OCS Sale No. 35)

8.10 Greene, H. G., Clarke, S. H., Jr., Field, M. E., Linker, F. I., and Wagner, H. C., (1975) Preliminary Report on the Environmental Geology of Selected Areas of the Southern California Continental Borderland: U. S. Geological Survey open-file report, 75-596, page 50-66.

8.11 Junger, Arne and Wagner, H. C., (1977) Geology of the Santa Monica and San Pedro Basins, California Continental Borderland: U. S. Geological Survey Map MF-820.

8.12 Veder, J. G., Beyer, L.A., Junger, A., Moore, G. W., Roberts, A. E., Taylor, J. C., and Wagner, H. C. (1974) Preliminary Report on the Geology of the Continental Borderland of Southern California: U. S. Geological Survey miscellaneous Field Studies Map MF-624.

8.13 Yerkes, R. F., McCulloh, T. H., Schoellhamer, J. E., and Vedder, J. G., (1965) Geology of the Los Angeles Basin, California -- An Introduction: U. S. Geological Survey Professional Paper 420-a, page 57