SN 13233
CANEXPE

CANYON EXPRESS PROJECT
CAMDEN HILLS, ACONCAGUA, AND KING'S PEAK FIELD DEVELOPMENT

MMS R-O-W PERMIT APPLICATION SUPPORT

DESIGN CRITERIA

PREPARED FOR

CANYON EXPRESS PROJECT

INTEC PROJECT H-1257.01

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TABLE OF CONTENTS

1. WEST FLOWLINE DESIGN CRITERIA

This section describes the design criteria applicable to the west flowline system. Information required to be included with the right-of-way application by 30 CFR 250.1007 (a)(3) and (a)(4), can be found in this section.

1.1 Design Information

- Product to be transported: Gas

- The west flowline starts at MC348 and terminates at MP 261 with a conventional riser at Canyon Station junction platform at MP 261. The west flowline includes a number of sections connected to it:

  - 12-inch OD pigging jumper, connecting the west flowline to the east flowline
  - Pipeline end termination sled, designated Camden Hills West PLET, starting point (Station 0.0) of the west flowline
  - 6-inch jumper connecting Camden Hills (C.H.) West PLET to well MC 348-1
  - In-line sled by well MC 348-2 (C.H. West Sled at MC 348-2)
  - 6-inch jumper connecting C.H. West Sled at MC 348-2 to well MC 348-2
  - In-line sled by well MC 305-1 (Aconcagua West Sled at MC 305-1)
  - 6-inch jumper connecting Aconcagua West Sled at MC 305-1 to well MC 305-1
  - In-line sled by well MC 305-2 (Aconcagua West Sled at MC 305-2)
  - 6-inch jumper connecting Aconcagua West Sled at MC 305-2 to well MC 305-2
  - In-line sled by well MC 217-3 (King's Peak West Sled at MC 217-3)
  - 6-inch jumper connecting King's Peak West Sled at MC 217-3 to well MC 217-3
  - In-line sled by well MC 217-2 (King's Peak West Sled at MC 217-2)
  - 6-inch jumper connecting King's Peak West Sled at MC 217-2 to well MC 217-2
  - In-line sled by well MC 133-2 (King's Peak West Sled at DC 133-2)
  - 6-inch jumper connecting King's Peak West Sled at DC 133-2 to well DC 133-2
  - Spoolpiece connecting flowline to riser at Canyon Station platform (MP 261 Junction Platform)
  - Riser at platform, from El. (-) 299 feet to topside interface piping

  The west flowline system sections are described in Table 1-1.

- The west flowline riser is pre-installed within the Canyon Station platform, thus protected by the platform framing. It does not require riser guard.

TABLE 1–1: WEST FLOWLINE SYSTEM SECTIONS

West Flowline System Section	Approx. Length (ft)	Planned Water Depth Range[3] (ft)	O.D. (in)	W.T. (in)	Pipe Spec	Pipe Grade
12-inch Pigging Jumper	60	7,210	12.75	0.800	API 5L	X-65
West Flowline Deep Section	211,980	7,210 to 2,400	12.75	0.800	API 5L	X-65
West Flowline Intermediate Section[1]	27,160	2,400 to 1,300	12.75	0.855	API 5L	X-65
West Flowline Shallow Section[2]	51,650	1,300 to 299	12.75	0.900	API 5L	X-65
6-inch Jumpers	60	7,210 to 6,370	6.625	0.562	API 5L	X-65
Flowline-to-Riser Spoolpiece	100	299	1.125	1.125	API 5L	X-65
Conventional Riser at Canyon Station	300	299 to surface	12.75	1.125	API 5L	X-65

Note 1: The planned water depth range for the 0.855-inch WT line pipe is in the Intermediate section. However, it can be safely installed in water depths up to 7,210 feet.

Note 2: The planned water depth range for the 0.900-inch WT line pipe is in the Shallow section. However, it can be safely installed in water depths up to 7,210 feet.

Note 3: As a contingency, linepipe planned to be installed in Shallow section could be installed in deeper waters. Linepipe planned for installation in Intermediate section could be installed in deeper waters. Note that the reverse is not allowed, that is, 0.800-inch WT linepipe cannot be installed in water depths shallower than 2,400 feet; 0.855-inch WT linepipe cannot be installed in water depths shallower than 1,300 feet. See supporting calculations in Appendix A.

- Type of Cathodic Protection:
  - Impressed Current System: None
  - Sacrificial Anode System:
    1. Type of Anode: Indium activated Aluminum (Al-Zn-In)
    2. Spacing: 360 ft
    3. Net Weight of Unit Anode: 150 lbs.
  - Pipeline Anode Life: 20 years

- Description of External Coating System:
  Riser: Vulcanized Rubber along splash zone, 17 mils FBE elsewhere
  Spoolpiece: 17 mils FBE
  Flowline: 17 mils FBE
  12-inch pigging jumper: 17 mils FBE
  6-inch jumpers: 17 mils FBE

- Submerged Specific Gravity, SG, equals the empty weight in air divided by the weight of seawater displaced, taking into account the FBE coating (weight of FBE is assumed 90 pcf). The SG for different west flowline sections is shown in Table 1-2.

TABLE 1-2: WEST FLOWLINE SYSTEM SPECIFIC GRAVITY

West Flowline Section	Line Pipe OD x WT (inches)	Weight in Air (lb/ft)	Weight of Displaced Water (lb/ft)	Submerged Weight (lb/ft)	Empty Submerged SG
Riser & spoolpiece section	12.75 x 1.125	140.65	57.05	83.60	2.47
Shallow section	12.75 x 0.900	114.85	57.05	57.81	2.01
Intermediate section	12.75 x 0.855	109.56	57.05	52.52	1.92
Deep section	12.75 x 0.800	103.04	57.05	45.99	1.81
6-inch jumper	6.625 x 0.562	37.06	15.48	21.59	2.39

- Maximum source pressure (MSP) for each field are given below:
  - Camden Hills MSP = 6,625 psig, well MC 348-2 at 7,205 feet water depth
  - Aconcagua MSP = 5,846 psig, well MC 305-2 at 6,990 feet water depth
  - King's Peak MSP = 6,000 psig, well MC 133-2 at 6,370 feet water depth

- Gas weight at shut-in condition = 14.0 pcf at 6,625 psig
  13.6 pcf at 5,846 psig
  13.6 pcf at 6,000 psig

- Required design pressure

  The required design pressure at shut-in condition will depend on which well is driving the shut-in condition, and on the water depth of interest. The general equation for the required design pressure, Preq, is:

  Preq = MSP – Ppackedgas – Pext
  where:
  MSP = maximum source pressure
  Ppacked gas = Internal gas weight (at shut-in condition) from source elevation to elevation of interest
  Pext = external water pressure

  The required design pressure, for water depths of interest are given in Table 1-3 below, assuming a seawater weight of 64 pcf. It can be seen that the MSP of 6,625 psig of well MC 348-2 at 7,205 feet water depth leads to the highest values of the required design pressure. These highest values will be used to check that the required design pressure does not exceed the maximum allowable operating pressure (MAOP) of the west flowline system.

TABLE 1-3: REQUIRED DESIGN PRESSURE FOR EACH MAXIMUM SOURCE PRESSURE							
Water depth (ft)	Pext (psig)	MSP = 6,625 psig at 7,205 ft W.D.		MSP = 5,846 psig at 6,990 ft W.D.		MSP = 6,000 psig at 6,370 ft W.D.	
		Ppacked Gas (psig)	Preq (psig)	Ppacked Gas (psig)	Preq (psig)	Ppacked Gas (psig)	Preq (psig)
0	0	700	5,925	660	5,186	602	5,398
299	133	671	5,821	632	5,081	573	5,294
1,300	578	574	5,473	537	4,731	479	4,943
2,400	1,067	467	5,091	434	4,346	375	4,558
7,210	3,204	0	3,421	-21	2,662	-79	2,875

- Design Capacity for Flowline: 250 MMSCFD gas
- Hydrostatic Test Pressure: 7,450 psig @ MWL
  hold time = 8 hours (minimum)
- 80% of Hydrotest pressure: 5,960 psig @ El.(+) 0.0 ft
- MAOP of Receiving Facilities = 2,160 psig (ANSI 900)
- Flowline stability against effects of water currents and storms is ensured by its submerged weight. Additional design precautions are not required to enable the pipeline to withstand soft bottoms, earthquakes, and other environmental factors.

  Canyon Express performed extensive geotechnical and geophysical investigation regarding the King's Peak diapir. A summary of this work is included in Appendix B, which conclusively establishes that the pertinent slopes of the King's Peak diapir are stable.

- Rated working pressure for the fittings to the west flowline system:
  - Flanges connecting the spoolpiece-to- riser and spoolpiece-to-flowline
    Design pressure: 10,000 psig
  - Multi-phase flowmeter (MPFM) at each 6-inch jumper
    Design pressure: 10,000 psig
  - Flanges connecting MPFM to 6-inch jumper
    Design pressure: 10,000 psig
  - 6-inch connectors (6-inch jumper to tree, 6-inch jumper to sled)
    Design pressure: 7,500 psig
  - 6-inch valves (attached to 6-inch branch in in-line sleds)
    Design pressure: 10,000 psig
  - 12-inch valves attached to Aconcagua West Sled at MC 305-1, and to Camden Hills West PLET
    Design pressure: 7,500 psig

- 11-inch connectors to 12-inch pigging jumper at Camden Hills
  Design pressure: 5,900 psig

- Maximum Allowable Operating Pressure (MAOP) of each section of the west flowline system is least of the following:
  - Design pressure, $P = (2 \times S \times (t - ca) \div D) \times F \times E \times T$

    Where:
    S = SMYS = 65,000 psi

    t = Nominal wall thickness of section of interest
    ca = Corrosion allowance = 0.1 inch for Canyon Express flowlines
    D = Nominal outside diameter of pipe section of interest
    F = Construction design factor = 0.6 for riser component, =0.72 for submerged component (30 CFR 250.1002)
    E = Longitudinal joint factor, E = 1 for API 5L seamless linepipe
    T = Temperature derating factor, T = 1 for Canyon Express system maximum temperature is 150° F

  - 80% of Hydrostatic test pressure

  - Pressure rating of section components or fittings

At each west flowline section, the required design pressure is presented in Figure 1-1 below to confirm that it is less than MAOP. The required design pressure (Preq) values below are those shown in Table 1-3. All supporting calculations are included in Appendix A.

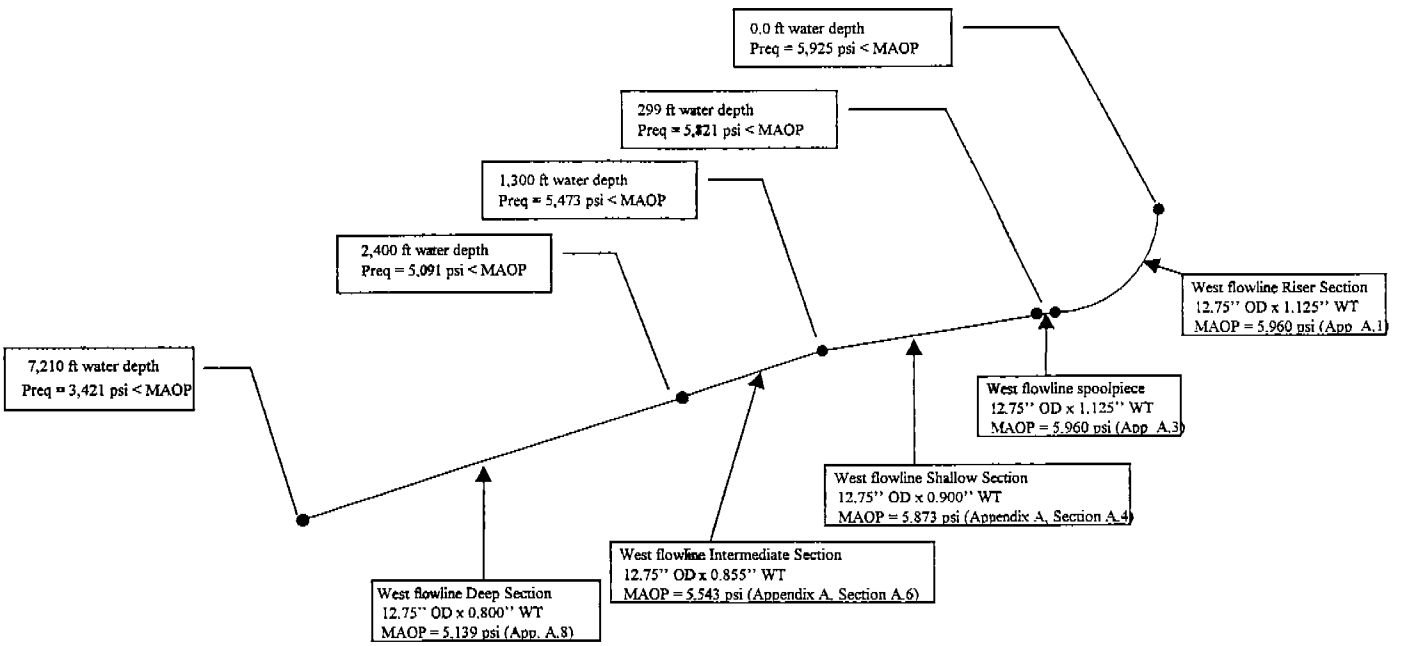

FIGURE 1-1: WEST FLOWLINE SECTION REQUIRED PRESSURE VS. MAOP

1.2 West Flowline Burial Requirements

The flowline will be installed in water depths greater than 200 FSW and jetting or burial is not required.

1.3 West Flowline Crossings

The west flowline system crosses four existing pipelines at water depths and locations as shown in Table 3-1. The required separation between the Canyon Express West Flowline and the existing pipelines will be afforded by mean of mattress appropriately placed on existing pipelines, as shown in drawing H1257.01-1.B2-DRW-16-012.

TABLE 1-4: CANYON EXPRESS WEST FLOWLINE CROSSING COORDINATES

Crossed Pipeline	Approximate Water Depth (ft)	FGSI Offshore Survey Crossing Coordinates (ft) (NAD27,UTM16)	
		X	Y
Viosca Knoll Gathering System 20-inch Pipeline at MP 261	310	1,291,657	10,640,921
Destin 24-inch Pipeline at MP 261	310	1,291,693	10,640,832
Shell 16-inch Pipeline at VK 692	410	1,294,630	10,633,533
Equilon 16-inch Pipeline at VK 780	930	1,297,525	10,608,325

2. EAST FLOWLINE DESIGN CRITERIA

This section describes the design criteria applicable to the east flowline system. Information required to be included with the right-of-way application by 30 CFR 350.1007 (a)(3) and (a)(4) can be found in this section.

2.1 Design Information

- Product to be transported: Gas
- The east flowline starts at MC 348 and terminates at MP 261 with a conventional riser at Canyon Station junction platform at MP 261. The east flowline includes a number of sections connected to it:
  - Pipeline end termination sled, designated Camden Hills east PLET, starting point (Station 0.0) of the east flowline
  - In-line sled by well MC 305-3 (Aconcagua East Sled at MC 305-3)
  - 6-inch jumper connecting Aconcagua East Sled at MC 305-3 to well MC 305-3
  - In-line sled by well MC 305-4 (Aconcagua East Sled at MC 305-4)

- 6-inch jumper connecting Aconcagua East Sled at MC 305-4 to well MC 305-4
- In-line sled by well DC 177-2 (King's Peak East Sled at DC 177-2)
- 6-inch jumper connecting King's Peak East Sled at DC 177-2 to well DC 177-2
- In-line sled by well DC 133-3 (King's Peak East Sled at DC 133-3)
- Spoolpiece connecting flowline to riser at Canyon Station platform (MP 261 Junction Platform)
- Riser at platform, from El. (-) 299 feet to topside interface piping

The east flowline system sections are described in Table 2-1.

- The east flowline riser is pre-installed within the Canyon Station platform, thus protected by the platform framing. It does not require riser guard.

TABLE 2–1: EAST FLOWLINE SYSTEM SECTIONS

East Flowline System Section	Approx. Length (ft)	Planned Water Depth Range[3](ft)	O.D. (in)	W.T. (in)	Pipe Spec	Pipe Grade
East Flowline Deep Section	2087,930	7,280 to 2,400	12.75	0.800	API 5L	X-65
East Flowline Intermediate section[1]	27,140	2,400 to 1,300	12.75	0.855	API 5L	X-65
East Flowline Shallow Section[2]	51,910	1,300 to 299	12.75	0.900	API 5L	X-65
6-inch Jumpers	60	7,210 to 6,370	6.625	0.562	API 5L	X-65
Flowline-to-Riser Spoolpiece	100	299	1.125	1.125	API 5L	X-65
Conventional Riser at Canyon Station	310	299 to surface	12.75	1.125	API 5L	X-65

Note 1: The planned water depth range for the 0.855-inch WT line pipe is in the intermediate section. However, it can be safely installed in water depths up to 7,280 feet. See calculation in Appendix A.

Note 2: The planned water depth range for the 0.900-inch WT line pipe is in the shallow section. However, it can be safely installed in water depths up to 7,280 feet. See calculation in Appendix A.

Note 3: As a contingency, linepipe planned to be installed in shallow section could be installed in deeper waters. Linepipe planned for installation in intermediate section could be installed in deeper waters. Note that the reverse is not allowed, that is, 0.800-inch WT linepipe cannot be installed in water depths shallower than 2,400 feet; 0.855-inch WT linepipe cannot be installed in water depths shallower than 1,300 feet.

- Type of Cathodic Protection:
  - Impressed Current System: None
  - Sacrificial Anode System:
    1. Type of Anode: Indium activated Aluminum (Al-Zn-In)
    2. Spacing: 360 ft
    3. Net Weight of Unit Anode: 150 lbs.
  - Pipeline Anode Life: 20 years

- Description of External Coating System:
  Riser: Vulcanized Rubber along splash zone, 17 mils FBE elsewhere
  Spoolpiece: 17 mils FBE
  Flowline: 17 mils FBE
  12-inch pigging jumper: 17 mils FBE
  6-inch jumpers: 17 mils FBE

- Submerged Specific Gravity, SG, equals the empty weight in air divided by the weight of seawater displaced, taking into account the FBE coating (weight of FBE is assumed 90 pcf). The SG for different west flowline sections is shown in Table 2-2.

TABLE 2-2: EAST FLOWLINE SYSTEM SPECIFIC GRAVITY

East Flowline Section	Line Pipe OD x WT (inches)	Weight in Air (lb/ft)	Weight of Displaced Water (lb/ft)	Submerged Weight (lb/ft)	Empty Submerged SG
Riser & spoolpiece section	12.75 x 1.125	140.65	57.05	83.60	2.47
Shallow section	12.75 x 0.900	114.85	57.05	57.81	2.01
Intermediate section	12.75 x 0.855	109.56	57.05	52.52	1.92
Deep section	12.75 x 0.800	103.04	57.05	45.99	1.81
6-inch jumper	6.625 x 0.562	37.06	15.48	21.59	2.39

- Maximum source pressure (MSP) for each field are given below:
  - Camden Hills MSP = 6,625 psig, well MC 348-2 at 7,205 feet water depth
  - Aconcagua MSP = 5,846 psig, well MC 305-2 at 6,990 feet water depth
  - King's Peak MSP = 6,000 psig, well MC 133-2 at 6,370 feet water depth

- Gas weight at shut-in condition = 14.0 pcf at 6,625 psig
  13.6 pcf at 5,846 psig
  13.6 pcf at 6,000 psig

- Required design pressure

  The required design pressure at shut-in condition will depend on which well is driving the shut-in condition, and on the water depth of interest. The general equation for the required design pressure, Preq, is:

  Preq = MSP – Ppackedgas – Pext
  where:
  MSP = maximum source pressure
  Ppackedgas = Internal gas weight (at shut-in condition) from source elevation to elevation of interest
  Pext = external water pressure

  The required design pressure, for water depths of interest are given in Table 2-3 below, assuming a seawater weight of 64 pcf. It can be seen that the MSP of 6,625 psig of well MC 348-2 at 7,205 feet water depth leads to the highest values

of the required design pressure. These highest values will be used to check that the required design pressure does not exceed the maximum allowable operating pressure (MAOP) of the west flowline system.

TABLE 2-3: REQUIRED DESIGN PRESSURE FOR EACH MAXIMUM SOURCE PRESSURE

Water Depth (ft)	Pext (psig)	MSP = 6,625 psig at 7,205 ft W. D.		MSP = 5,846 psig at 6,990 ft W. D.		MSP = 6,000 psig at 6,370 ft W. D.	
		Ppacked Gas (psig)	Preq (psig)	Ppacked Gas (psig)	Preq (psig)	Ppacked Gas (psig)	Preq (psig)
0	0	700	5,925	660	5,186	602	5,398
299	133	671	5,821	632	5,081	573	5,294
1,300	578	574	5,473	537	4,731	479	4,943
2,400	1,067	467	5,091	434	4,346	375	4,558
7,280	3,236	0	3,397	-27	2,638	-86	2,850

- Design Capacity for Flowline: 250 MMSCFD gas
- Hydrostatic Test Pressure: 7,450 psig @ MWL
  hold time = 8 hours
- 80% of Hydrotest pressure: 5,960 psig @ El.(+) 0.0 ft
- MAOP of Receiving Facilities = 2,160 psig (ANSI 900)
- Flowline stability against effects of water currents and storms is ensured by its submerged weight. Additional design precautions are not required to enable the pipeline to withstand soft bottoms, earthquakes, and other environmental factors.
- Rated working pressure for the fittings to the east flowline system:
  - Flanges connecting the spoolpiece-to- riser and spoolpiece-to-flowline
    Design pressure: 10,000 psig
  - Multi-phase flowmeter (MPFM) at each 6-inch jumper
    Design pressure: 10,000 psig
  - Flanges connecting MPFM to 6-inch jumper
    Design pressure: 10,000 psig
  - 6-inch connectors (6-inch jumper to tree, 6-inch jumper to sled)
    Design pressure: 7,500 psig
  - 6-inch valves (attached to 6-inch branch in in-line sleds)
    Design pressure: 10,000 psig
  - 12-inch valves attached to King's Peak East Sled at DC 133-3, and to Camden Hills East PLET
    Design pressure: 7,500 psig

- 11-inch connectors to 12-inch pigging jumper at Camden Hills
  Design pressure: 5,900 psig

- Maximum Allowable Operating Pressure (MAOP) of each section of the east flowline system is least of the following:
  - Design pressure, $P = (2 \times S \times (t - ca) \div D) \times F \times E \times T$
    Where:
    S = SMYS = 65,000 psi

    t = Nominal wall thickness of section of interest
    ca = Corrosion allowance = 0.1 inch for Canyon Express flowlines
    D = Nominal outside diameter of pipe section of interest
    F = Construction design factor = 0.6 for riser component, =0.72 for submerged component (30 CFR 250.1002)
    E = Longitudinal joint factor, E = 1 for API 5L seamless linepipe
    T = Temperature derating factor, T = 1 for Canyon Express system maximum temperature is 150° F

  - 80% of Hydrostatic test pressure

  - Pressure rating of section components or fittings

At each east flowline section, the required design pressure is presented in Figure 2-1 below to confirm that it is less than MAOP. The required design pressure (Preq) values below are those shown in Table 2-3. All supporting calculations are shown in Appendix A.

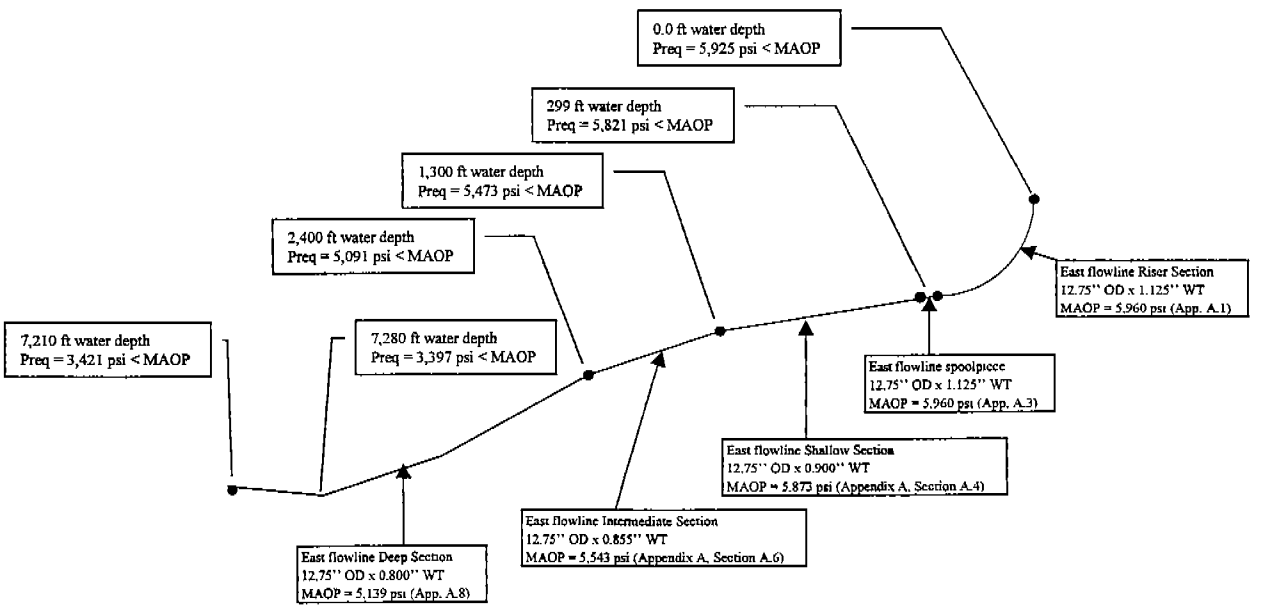

FIGURE 2-1: EAST FLOWLINE SECTION REQUIRED PRESSURE VS. MAOP

2.2 East Flowline Burial Requirements

The flowline will be installed in water depths greater than 200 FSW and jetting or burial is not required.

2.3 East Flowline Crossings

The east flowline system crosses four existing pipelines at water depths and locations as shown in Table 2-4. The required separation between the Canyon Express East Flowline and the existing pipelines will be afforded by mean of mattress appropriately placed on existing pipelines, as shown in drawing H1257.01-1.B2-DRW-16-012.

TABLE 2-4: CANYON EXPRESS EAST FLOWLINE CROSSING COORDINATES

Crossed Pipeline	Approximate Water Depth (ft)	FGSI Offshore Survey Crossing Coordinates (ft) (NAD27,UTM16)	
		X	Y
Viosca Knoll Gathering System 20-inch Pipeline at MP 261	310	1,292,361	10,641,154
Destin 24-inch Pipeline at MP 261	310	1,292,340	10,641,207
Shell 16-inch Pipeline at VK 692	410	1,295,003	10,634,588
Equilon 16-inch Pipeline at VK 780	930	1,298,581	10,607,794

3. SINGLE METHANOL DISTRIBUTION UMBILICAL DESIGN INFORMATION

The single methanol distribution umbilical or line (SMDL) starts at Canyon Station junction platform at MP 261 and terminates at MC 348. The cross-section of the SMDL is shown in Drawing H1257.01-1.B2-DRW-014, "Single Methanol Distribution Line – Canyon Express System". Also shown in this drawing are the relevant weights for the SMDL. The flow direction in this line is from the platform to the fields.

The most stringent design requirement for the SMDL is controlled by the riser section, which will be protected by a J-tube. The design verification is as follows:

Maximum Source Pressure = 7,500 psig

S = SMYS = 80,000 psi
Outside Diameter, D = 2.875-inch
Wall Thickness, t = 0.237-inch
Corrosion Allowance, CA = 0.01-inch
Test Pressure = 9,380 psig (minimum)

Design Pressure, $P = \left(2 x S x \frac{(t - ca)}{D}\right) x F x E x T$

F = 0.6, for riser pipe

E = 1, for Electric Resistance Welded Longitudinal Seam (High Frequency Induction Welding)

T = 1, for temperature less than 250 F

Thus

$$P = \frac{(2 x 80{,}000 x (0.237 - 0.01))}{2.875 x 0.60 x 1 x 1}$$

P = 7,580 psi

P(80%) 7,504 (80% of minimum hydrotest pressure)

Preq = Design Pressure = 7,500 psig, MSP

Design check: Preq = 7,500 ≤ MAOP = 7,504 psig

The SMDL crosses four existing pipelines at water depths and locations as shown in Table 3-1. The separation between the Canyon Express SMDL and the existing pipelines will be afforded by mean of mattress appropriately placed on existing pipelines, as shown in drawing H1257.01-1.B2-DRW-16-013.

TABLE 3-1: CANYON EXPRESS SMDL CROSSING COORDINATES

Crossed Pipeline	Approximate Water Depth (Ft)	FGSI Offshore Survey Crossing Coordinates (ft) (NAD27,UTM16)	
		X	Y
Viosca Knoll Gathering System 20-inch Pipeline at MP 261	310	1,291,888	10,641,017
Destin 24-inch Pipeline at MP 261	310	1,291,912	10,640,959
Shell 16-inch Pipeline at VK 692	410	1,294,756	10,633,888
Equilon 16-inch Pipeline at VK 780	930	1,297,860	10,608,151

4. ELECTRO/HYDRAULIC UMBILICAL

The electro/hydraulic umbilical or line (EHL) starts at Canyon Station junction platform at MP 261 and is connected to all fields. The cross-section of the main line from Canyon Station to King's Peak is shown on Drawing H1257.01-1.B2-DRW-16-005, "Main Electro/Hydraulic Umbilical - Canyon Station to King's Peak – Canyon

Express System". The cross-section from King's Peak to Camden Hills is shown on Drawing H1257-1.B2-DRW-16-004, "Main Electro/Hydraulic Umbilical - King's Peak to Camden Hills – Canyon Express System".

From each field, the electro/hydraulic umbilical reaches each well by means of infield umbilicals. The cross-section of all infield umbilicals within King's Peak field is shown on Drawing H1257.01-1.B2-DRW-16-006, "King's Peak Infield Electro/Hydraulic Umbilical – Canyon Express System". The cross-section of all infield umbilicals within Aconcagua and Camden Hills fields is shown in Drawing H1257.01-1.B2-DRW-16-007, "Aconcagua and Camden Hills Infield Electro/Hydraulic Umbilical – Canyon Express System".

The EHL crosses four existing pipelines at water depths and locations as shown in Table 4-1. The separation between the Canyon Express EHL and the existing pipelines will be afforded by mean of mattress appropriately placed on existing pipelines, as shown in drawing H1257.01-1.B2-DRW-16-013.

TABLE 4-1: CANYON EXPRESS EHL CROSSING COORDINATES

Crossed Pipeline	Approximate Water Depth (ft)	FGSI Offshore Survey Crossing Coordinates (ft) (NAD27,UTM16)	
		X	Y
Viosca Knoll Gathering System 20-inch Pipeline at MP 261	310	1,292,117	10,641,091
Destin 24-inch Pipeline at MP 261	310	1,292,121	10,641,080
Shell 16-inch Pipeline at VK 692	410	1,294,877	10,634,230
Equilon 16-inch Pipeline at VK 780	930	1,298,243	10,607,967

5. CONSTRUCTION INFORMATION

Proposed construction start date for the Canyon Express 12-inch flowlines (east and west) is 1-May-2001, with an approximate total duration of three months. The flowlines will be installed by a combination of the J-lay method and the conventional S-lay method. The handover between S-lay and J-lay will be in approximately 2,300 feet water depth. In order to accommodate the S-lay mode of installation, a greater corridor width was surveyed up to approximately 3,100 feet water depth. This is detailed on the maps provided with the "Archeological, Engineering, and Hazard Study of Canyon Express Project" under a separate cover by Fugro Geoservices, Inc.

Fugro Geoservices, Inc performed a route survey. The aforementioned report is part of the Canyon Express right-of-way application. The coordinates of all manmade features are documented therein, and will be recorded into an onboard navigation and

positioning system of the pipelay vessel. We request approval to utilize the navigation system to comply with NTL 98-20, Section IV.B in lieu of buoying each potential hazard.

The installation contractor will perform an as-built pipeline survey. Representative pipeline spans will be analyzed for their static configuration and dynamic fatigue lives. Corrective action for individual spans will be provided where it is required.

Proposed construction start date for the Canyon Express umbilicals (single methanol distribution umbilical and electro/hydraulic umbilical) is 1-Sep-2001, with an approximate total duration of 3 months. The umbilicals will be installed by the reeling method.

After the two umbilicals are installed, the infield umbilical segments are planned for installation (approximate starting date 8-Dec-2001), with an approximate duration of 1-1/2 months.

The jumpers connecting the 12-inch flowlines to the trees, as well as the 12-inch pigging jumper, are planned for installation next (approximate starting date 15-Jan-2002), with an approximate duration of 1-1/2 months.

cc: (Continued)

Amoco Production Company
P. O. Box 3092
Houston, Texas 77253-3092
(Certified Mail No. Z 580-779-573)

Vastar Resources
15375 Memorial Drive
Houston, Texas 77079-4101
(Certified Mail No. Z 580-779-574)

Shell Deepwater Production Inc.
P. O. Box 60834
New Orleans, Louisiana 70160
(Certified Mail No. Z 580-779-575)

Kerr MeGee Oil & Gas Corporation
16666 Northchase Drive
Houston, Texas 77060-6019
(Certified Mail No. Z-580-779-576)

Chevron USA Inc.
935 Gravier Street
New Orleans, Louisiana 70112
(Certified Mail No. Z 580-779-577)

Shell Offshore Inc.
P. O. Box 60834
New Orleans, Louisiana 70160-0834
(Certified Mail No. Z 580-779-578)

Devon SFS Operating Inc.
840 Gessner Road, Suite 1400
Houston, Texas 77024-4237
(Certified Mail No. Z 580-779-579)

cc: (Continued)

Shell Gas Gathering Company
P. O. Box 2648
Houston, Texas 77252-2648
(Certified Mail No. Z 580-779-580)

Williams Gulf Coast L.P.
60828 A Highway 1148 West
Plaquemine, Louisiana 70764
(Certified Mail No. Z 580-779-581)

Viosca Knoll Gathering Company
7200 Texas Commerce
600 Travis Street
Houston, Texas 77002
(Certified Mail No. Z 580-779-582)

Destin Pipeline Company, L.L.C.
P. O. Box 2563
Birmingham, Alabama 35202-2563
(Certified Mail No. Z 580-779-583)

NONDISCRIMINATION IN EMPLOYMENT

As a condition precedent to the approval of the granting of the subject pipeline right-of-way, the grantee, TotalFinaElf E&P USA, Inc. hereby agrees and consents to the following stipulation, which is to be incorporated into the application for said right-of-way.

During the performance of this grant, the grantee agrees as follows:

> During the performance under this grant, the grantee shall fully comply with paragraphs (1) through (7) of section 202 of Executive Order 11246, as amended (reprinted in 41 CFR 60-1.4(a)), which are for the purpose of preventing discrimination against persons on the basis of race, color, religion, sex or national origin. Paragraphs (1) through (7) of section 202 of Executive Order 11246, as amended, are incorporated in this grant by reference.

Signature

2/23/01

Date

ATTACHMENT A

The following Designated Oil & Gas Lease Operators and Right-of-Way Holders have been furnished information regarding the proposed pipeline installation by Certified Mail, Return Receipt Requested. (Note: The status of blocks listed below is current, per research of MMS records by J. Connor Consulting, Inc.).

MISSISSIPPI CANYON

BLOCK 348

Marathon Oil Company	OCS-G 19939	Oil & Gas Lease
Open		Right-of-Way

BLOCK 349

PanCanadian GOM Inc.	OCS-G 19940	Oil & Gas Lease
Open		Right-of-Way

BLOCK 305

TotalFinaElf E&P USA, Inc.	OCS-G 19935	Oil & Gas Lease
Open		Right-of-Way

BLOCK 85

Amoco Production Company	OCS-G 8797	Oil & Gas Lease
Open		Right-of-Way

BLOCK 41

Amoco Production Company	OCS-G 3679	Oil & Gas Lease
Open		Right-of-Way

DESOTO CANYON

BLOCK 265

Open		Oil & Gas Lease
Open		Right-of-Way

ATTACHMENT A- Continued

DESOTO CANYON

BLOCK 221

Open		Oil & Gas Lease
Open		Right-of-Way

BLOCK 177

Amoco Production Company	OCS-G 10445	Oil & Gas Lease
Open		Right-of-Way

BLOCK 133

Amoco Production Company	OCS-G 10444	Oil & Gas Lease
Open		Right-of-Way

BLOCK 89

Amoco Production Company	OCS-G 10441	Oil & Gas Lease
Open		Right-of-Way

BLOCK 45

Open		Oil & Gas Lease
Open		Right-of-Way

VIOSCA KNOLL

BLOCK 1003

TotalFinaElf E&P USA, Inc.	OCS-G 21160	Oil & Gas Lease
Open		Right-of-Way

BLOCK 1002

Vastar Resources	OCS-21159	Oil & Gas Lease
Open		Right-of-Way

BLOCK 958

Open		Oil & Gas Lease
Open		Right-of-Way

ATTACHMENT A- Continued

VIOSCA KNOLL

BLOCK 914		
Amoco Production Company Open	OCS-G 8785	Oil & Gas Lease Right-of-Way
BLOCK 913		
Amoco Production Company/ Shell Deepwater Production Inc. Open	OCS-G 8784	Oil & Gas Lease Right-of-Way
BLOCK 869		
Kerr McGee Oil & Gas Corporation Open	OCS-G 13065	Oil & Gas Lease Right-of-Way
BLOCK 825		
Kerr McGee Oil & Gas Corporation Open	OCS-G 5778	Oil & Gas Lease Right-of-Way
BLOCK 781		
Chevron USA Inc. Open	OCS-G 16547	Oil & Gas Lease Right-of-Way
BLOCK 780		
Shell Offshore Inc. Open	OCS-G 6884	Oil & Gas Lease Right-of-Way
BLOCK 736		
Shell Offshore Inc. Open	OCS-G 13987	Oil & Gas Lease Right-of-Way
BLOCK 692		
Devon SFS Operating Inc. Shell Gathering Company	OCS-G 7898 OCS-G 19668 (Segment No. 11680)	Oil & Gas Lease Right-of-Way

ATTACHMENT A- Continued

MAIN PASS

BLOCK 260

Devon SFS Operating Inc. Open	OCS-G 7828	Oil & Gas Lease Right-of-Way

BLOCK 261

Devon SFS Operating Inc. / Vastar Resources	OCS-G 13035	Oil & Gas Lease
Williams Gulf Coast L.P.	Appurtenance ROW	
Viosca Knoll Gathering Company	OCS-G 14292 (Segment No. 10232)	Right-of-Way
Viosca Knoll Gathering Company	OCS-G 14292 (Segment No. 10711)	Right-of-Way
Destin Pipeline Company, L.L.C.	OCS-G 20542 (Segment No. 11930)	Right-of-Way
Destin Pipeline Company, L.L.C.	OCS-G 20547 (Segment No. 11935)	Right-of-Way

APPENDIX A: SUPPORTING CALCULATIONS

A.1 Riser (12.75-inch x 1.125-inch) at El. (+) 0.0 ft

P = (2 x S x (t - ca) ÷ D) x F x E x T

ca = corrosion allowance = 0.10-inch
F = 0.60 (CFR Title 30 Part 250, Subpart J - Riser component)
E = 1.00
T = 1.00 (Max. Temp.: 36° F)
P = (2 x 65,000 x (1.125-0.10) ÷ 12.75) x 0.60 x 1.00 x 1.00

P = 6,271 psig (design pressure)

P(80%) = 5,960 psig (80% of hydrotest pressure)

P(components) = 10,000 psig (riser flanges)

MAOP = 5,960 psig (least of the above three values)

Design check: Preq = 5,925 psig < MAOP = 5,960 psig: OK

A.2 Riser (12.75-inch x 1.125-inch) at El. (-) 299.0 ft

P = (2 x S x (t - ca) ÷ D) x F x E x T

ca = corrosion allowance = 0.10-inch
F = 0.60 , E = 1.00, T = 1.00
P = (2 x 65,000 x (1.125-0.10) ÷ 12.75) x 0.60 x 1.00 x 1.00

P = 6,271 psig (design pressure)

P(80%) = 0.8 x (7,450) = 5,960 psig

P(components) = 10,000 psig (riser flanges)

MAOP = 5,960 psig

Design check: Preq = 5,821 psig < MAOP = 5,960 psig: OK

A.3 Spoolpiece (12.75-inch x 1.125-inch) at El. (-) 299.0 ft

P = (2 x S x (t - ca) ÷ D) x F x E x T

ca = corrosion allowance = 0.10-inch
F = 0.72 (Pipeline component), E = 1.00, T = 1.00
P = (2 x 65,000 x (1.125-0.10) ÷ 12.75) x 0.72 x 1.00 x 1.00

P = 7,525 psig (design pressure)

P(80%) = 0.8 x (7,450) = 5,960 psig

P(components) = 10,000 psig (riser/spoolpiece flanges)

MAOP = 5,960 psig

Design check: Preq = 5,821 psig < MAOP = 5,960 psig: OK

A.4 Shallow Section (12.75-inch x 0.900-inch) at El. (-) 299 ft

P = (2 x S x (t - ca) ÷ D) x F x E x T
ca = corrosion allowance = 0.10-inch
F = 0.72, E = 1.00, T = 1.00
P = (2 x 65,000 x (0.900-0.10) ÷ 12.75) x 0.72 x 1.00 x 1.00 = 5,873

P = 5,873 psig (design pressure)

P(80%) = 0.8 x (7,450) = 5,960 psig

P(components) = 10,000 psig (riser/spoolpiece flanges)

MAOP = 5,873 psig

Design check: Preq = 5,821 psig < MAOP = 5,873 psig: OK

A.5 Shallow Section (12.75-inch x 0.900-inch) at El. (-) 1,300 ft

MAOP = 5,873 psig (same calculation as above)

Design check: Preq = 5,473 psig < MAOP = 5,873 psig: OK

A.6 Intermediate Section (12.75-inch x 0.855-inch) at El. (-) 1,300 ft

P = (2 x S x (t - ca) ÷ D) x F x E x T
ca = corrosion allowance = 0.10-inch
F = 0.72, E = 1.00, T = 1.00
P = (2 x 65,000 x (0.855-0.10) ÷ 12.75) x 0.72 x 1.00 x 1.00

P = 5,543 psig (design pressure)

P(80%) = 0.8 x (7,450) = 5,960 psig

P(components) = not applicable, no components attached

MAOP = 5,543 psig

Design check: Preq = 5,473 psig < MAOP = 5,543 psig: OK

A.7 Intermediate Section (12.75-inch x 0.855-inch) at El. (-) 2,400 ft

MAOP = 5,543 psig (same calculation as above)

Design check: Preq = 5,091 psig < MAOP = 5,543 psig: OK

A.8 Deep Section (12.75-inch x 0.800-inch) at El. (-) 2,400 ft

P = (2 x S x (t - ca) ÷ D) x F x E x T
ca = corrosion allowance = 0.10-inch
F = 0.72, E = 1.00, T = 1.00
P = (2 x 65,000 x (0.800-0.10) ÷ 12.75) x 0.72 x 1.00 x 1.00

P = 5,139 psig (design pressure)

P(80%) = 0.8 x (7,450) = 5,960 psig

P(components) = 5,900 psig (11-inch connectors to the 12-inch pigging jumper at Camden Hills has the lowest pressure rating of all components attached to this section of the west flowline)

MAOP = 5,139 psig

Design check: Preq = 5,091 psig < MAOP = 5,139 psig: OK

A.9 Deep Section (12.75-inch x 0.800-inch) at El. (-) 7,210 ft

MAOP = 5,139 psig (same calculation as above)

Design check: Preq = 3,421 psig < MAOP = 5,139 psig: OK

A.10 Contingency: Deep Section with 12.75-inch x 0.900-inch Linepipe at El. (-) 7,280 ft

MAOP = 5,873 psig (same calculation as in Section A.4)

Design check: Preq = 3,397 psig < MAOP = 5,873 psig: OK

The calculation above shows that the thickest line pipe (WT = 0.900-inch) can be used in all water depths, in case of a contingency.

A.11 Contingency: Deep Section with 12.75-inch x 0.855-inch Linepipe at El. (-) 7,280 ft

MAOP = 5,543 psig (same calculation as in Section A.6)

Design check: Preq = 3,397 psig < MAOP = 5,543 psig: OK

The calculation above shows that the intermediate water line pipe (WT = 0.855-inch) can be used in deep water.

A.12 6-inch jumper (6.625-inch x 0.562-inch) at Various Elevations

P = (2 x S x (t - ca) ÷ D) x F x E x T
ca = corrosion allowance = 0.10-inch
F = 0.72, E = 1.00, T = 1.00
P = (2 x 65,000 x (0.562-0.10) ÷ 6.625) x 0.72 x 1.00 x 1.00

P = 6,527 psig (design pressure)

P(80%) = 0.8 x (7,450) = 5,960 psig

P(components) = 7,500 psig (jumper connectors have the lowest pressure rating when compared to MPFM and flanges)

MAOP = 5,960 psig

The required design pressure for the jumpers is calculated neglecting the packed gas weight, but taking into account the external pressure at each of the shallowest well of each field. The required design pressure for each field is calculated below.

At Camden Hills

Required design pressure, Preq = MSP – Ppacked gas – P_{ext}
Ppacked gas = 0 psig
Pext = External Hydrostatic Pressure = 64 pcf x 7,205 ft/144 = 3,202 psig
Preq = 6,625 – 0 - 3,202 = 3,423 psig

At Aconcagua

Required design pressure, Preq = MSP – Ppacked gas – Pext
Ppacked gas = 0 psig
Pext = External Hydrostatic Pressure = 64 pcf x 6,990 ft/144 = 3,107 psig
Preq = 5,846 – 0 - 3,202 = 2,739 psig

At King's Peak

Required design pressure, Preq = MSP – Ppacked gas – Pext
Ppacked gas = 0 psig
Pext = External Hydrostatic Pressure = 64 pcf x 6,370 ft/144 = 2,831 psig
Preq = 6,000 – 0 - 2,831 = 3,269 psig

Design check: Highest Preq = 3,423 psig < MAOP = 5,960 psig: OK

APPENDIX B: KING'S PEAK STABILITY ASSESSMENT SUMMARY

MARSCO

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gems@gemsinc.net
marsco@marsco.com

GEOSCIENCE EARTH & MARINE SERVICES, INC. GEMS

Intec Engineering
15600 JFK Boulevard
9th Floor
Houston TX 77032

Report No. 1000-341
January 31, 2001

Attention: Mr. Andre Nogueira

Canyon Express Project
Slope Stability Assessment of King's Peak Diapir
Based On
Geohazard Review of Deeptow Geophysical Data
Collected by FGSI during August to October 2000

Introduction

A previous integrated report (No. 20-010642) by GEMS/Marsco (2000) defined the shallow subsurface conditions along the proposed route of the Canyon Express pipeline and the area around the King's Peak Diapir. GEMS/Marsco presented a comprehensive description of the seafloor and near-surface sediments, as well as an assessment of the overall stability of the diapir slopes based on the results of a geotechnical/geologic testing program, and slope stability analyses.

This report presents our general findings relative to our assessment of geohazards primarily associated with slope stability of the King's Peak Diapir, in light of the deeptow data recently collected by Fugro Geo-Service Inc. (FGSI) for the proposed Canyon Express project.

Background

Since completion of the integrated report (GEMS, Marsco 2000), FGSI conducted a high-resolution, deep-tow geophysical survey along the Canyon Express pipeline route. The acquired data consists of chirp side-scan sonar, chirp subbottom profiler, and towbody-mounted multibeam bathymetry. Geoscience Earth and Marine Services, Inc. (GEMS), served as QA/QC supervisor during this program. As part of this study, GEMS reviewed the deep-tow data associated with the King's Peak Diapir as well as along the proposed route where 9 pipeline sleds are planned. The primary purpose of this study was to make a detailed interpretation of the high-resolution geophysical data, to verify that the geologic model used for the slope stability analyses is consistent in terms of observed geologic and stratigraphic conditions. GEMS also carefully reviewed the geophysical data on the flanks and at the base of the King Peak's Diapir to verify that the data did not reveal any new evidence of slope instabilities in recent times. The following sections will describe in more detail the geologic conditions identified with the high-resolution data, and present data examples of these conditions.

Geologic Interpretation

The King's Peak diapir is a prominent salt-cored structure located on the upper continental slope in the Mississippi Canyon Area, Gulf of Mexico (Figure 1). The diapir covers an approximate 20 square mile area encompassing all or portions of Mississippi Canyon blocks 128-129, 172-173, and Desoto Canyon blocks 89 and 133. Water depths range from 4800 ft on the crest of the diapir to 6250 ft at the diapir base (Figure 2a). Associated gradients range between 0 and 55 degrees (Figure 2b). The steepest gradients occur along the flanks of the diapir with shallower gradients at the diapir crest and base.

The side-scan sonar mosaic, collected and processed by FGSI, shows seafloor irregularities of varying magnitude associated with the diapir (Figure 3). On the diapir flanks the data shows large-magnitude NNE to SSW trending undulations (Figure 4). The number and magnitude of these features decreases as the seafloor transitions to a slightly irregular and undulating seafloor immediately south of the diapir (Figure 5). The overall low-amplitude of seafloor reflectance on the side-scan records indicate the seafloor sediments to be predominantly composed of clays. There are no observed changes in reflectance, fresh scarps, or any other features on the side-scan sonar that would indicate recent slope instabilities resulting in sediment evacuation, erosion, or downslope movement along the southern flank of the diapir. Likewise, there are no indications on the side-scan data of disturbed seafloor indicative of recent sediment run-out or deposition at the base and immediately south of the diapir.

The subbottom profiler data correlates with the side-scan sonar data. Subbottom profiles on the flanks of, and at the base of the diapir, show a relatively uniform drape of undisturbed, intact sediment. On the flanks of the diapir, this drape overlies what is interpreted to be uniformly deformed strata (Figure 6). Forces resulting from the upbuilding of the salt diapir likely deformed this strata. There is no indication of prevalent shallow faulting associated with the diapir although some deep-seated faults probably do exist. At the base of the diapir, the shallow subsurface stratigraphy is composed of uniform bedding, periodically interrupted by relict mass-transport deposits (MTD's), Figure 7. A uniform sediment drape of about 10 ft to 12 ft overlies the most recent of these deposits. Holocene sediments are present for the upper 4 ft to 7 ft of this drape, indicating the MTD's are at least older than Holocene in age. The youngest of these relict deposits likely occurred sometime during the last low-stand of sea-level, greater than 10,000 years before present (B.P.). Figure 7 also shows deep, larger-scale MTD's. The lobate features seen at the base of the King's Peak Diapir in block DC 133 (Figure 1) are probably the surface expression of these deeper MTD's. They are buried by approximately 75 ft to 100 ft of sediment and are possibly Pleistocene/Pliocene in age. Local variations in seafloor topography around these lobate features are probably the expression of the younger MTD's still buried by the 10 ft to 12 ft drape sequence (Figure 1 and Figure 7).

Slope Stability Assessment

Our interpretation of the high-resolution deep-tow data confirms our previous conclusions (GEMS/Marsco 2000) that the proposed pipeline route and sled locations along the southeastern perimeter of the diapir are considered safe from the standpoint of slope stability. There is evidence of numerous and ancient, relict slope failures. However, there was no change in seafloor reflectance, recent scarps, or any other features on the side-scan sonar data that would

indicate recent slope instabilities resulting in sediment evacuation, erosion, or downslope movement along the southern flank of the diapir. The side-scan sonar data also did not reveal any disturbed seafloor indicative of run-out or deposition from recent sediment flows, slides, or slumps at the base and south of the diapir.

The presence of an undisturbed, uniform Holocene drape blanketing the flanks and base of the diapir, based on sub-bottom profiler data, in combination with the age dating results, supports the conclusions of our original slope stability analyses presented in the integrated report. Thus, we conclude that the slopes have been geologically stable for at least the last 10,000 years and should remain stable for the operational life of the pipeline.

Conclusions

Marsco/GEMS conducted a geohazard assessment of the King's Peak Diapir using the recently acquired FGSI high-resolution deep-tow geophysical data. In particular, the study was directed towards evaluating past, present, and potentially future slope stability issues.

We conclude that the slopes along the perimeter of the King's Peak Diapir should remain stable during the operational life of the pipeline based on the following:

1) Geophysical data along with age dating of cores indicate an undisturbed, uniform Holocene/Pleistocene drape and no evidence of significant slope instability or failure during the last 10,000 to 17,000 years (GEMS/Marsco 2000).
2) The current depositional environment is significantly different and more benign than when the last slope failures are estimated to have occurred, greater than 10,000 years B.P.
3) Slope stability analyses indicated a factor of safety ranging from 1.12 to 1.40 against deep rotational failures along the flanks of the diapir (GEMS/Marsco 2000).

The integrated geologic/geotechnical data provides a comprehensive model for the understanding of seafloor and shallow sediment conditions (topography, geology, and soils). All these conditions indicate that the risk of slope instability on the King's Peak Diapir is negligible and the proposed Canyon Express pipeline route and sled locations are feasible for installation and operation of the pipeline.

We appreciate the opportunity to present the results of these analyses to the Canyon Express team. We look forward to working with the team on future projects associated with the Canyon Express Pipeline. Please contact us at 713-465-2700 if you have any questions or require additional information.

References

GEMS/Marsco (2000), Deepwater Geological/Geotechnical Investigation-Canyon Express Pipeline Route-Mississippi Canyon 348 to Viosca Knoll 823, Gulf of Mexico, Report No. 20-010642, November 14, 2000.

FUGRO Geoservices, Inc. (2000), "Phase 1 (Deep Water) Engineering and Hazard Study of Canyon Express Project, Proposed Routes for (2) 12-inch Gas Flowlines, Electrohydraulic Chemical Umbilicals, and Methanol Distribution Umbilicals from Block 348, Mississippi Canyon Area to Block 41, Mississippi Canyon Area."

Very truly yours,

Marsco, Inc.

Alan G. Young, P.E.
Vice President

Geoscience Earth and Marine Services, Inc.

John R. Brand
Marine Geologist

Distribution:
Andre Nogueira, Intec Engineering, Houston, TX (7)
James Collins, Marathon Oil Company, Houston, TX (1)

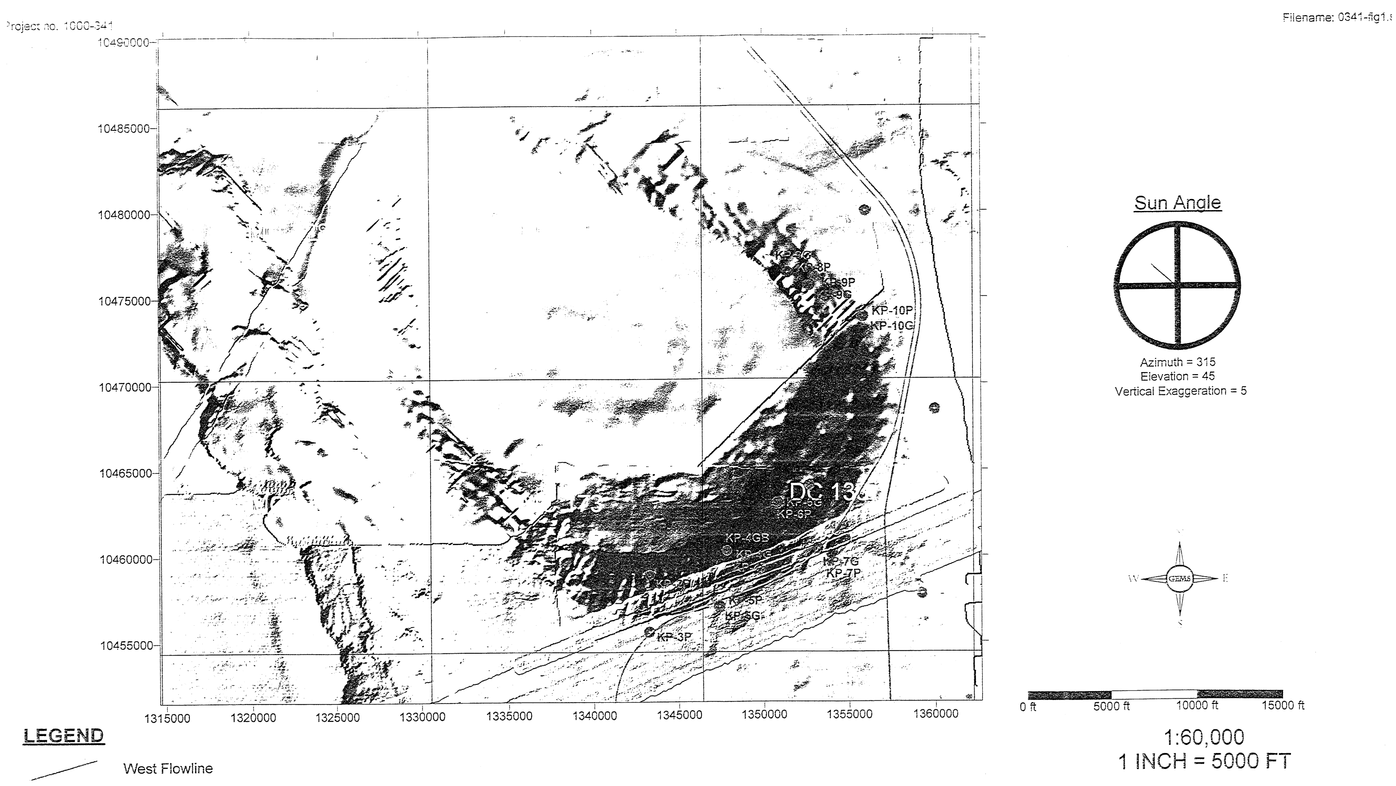
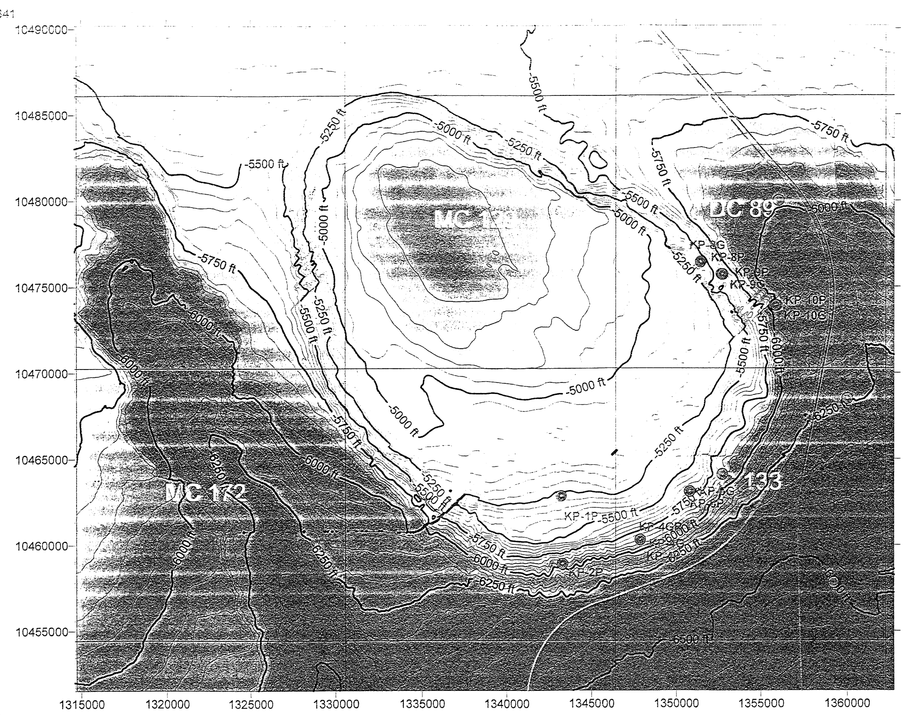
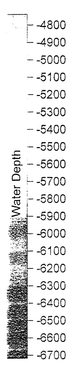


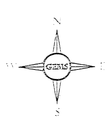
Figure 1: Seafloor Shaded Relief Map of the King's Peak Diapir

Project no. 1000-341

Filename: 0341-fg2a.







1:60,000
1 INCH = 5000 FT

LEGEND

- West Flowline
- East Flowline
- Piston Core Locations
- Existing Core Locations

Figure 2a: Bathymetry/Seafloor Image Map

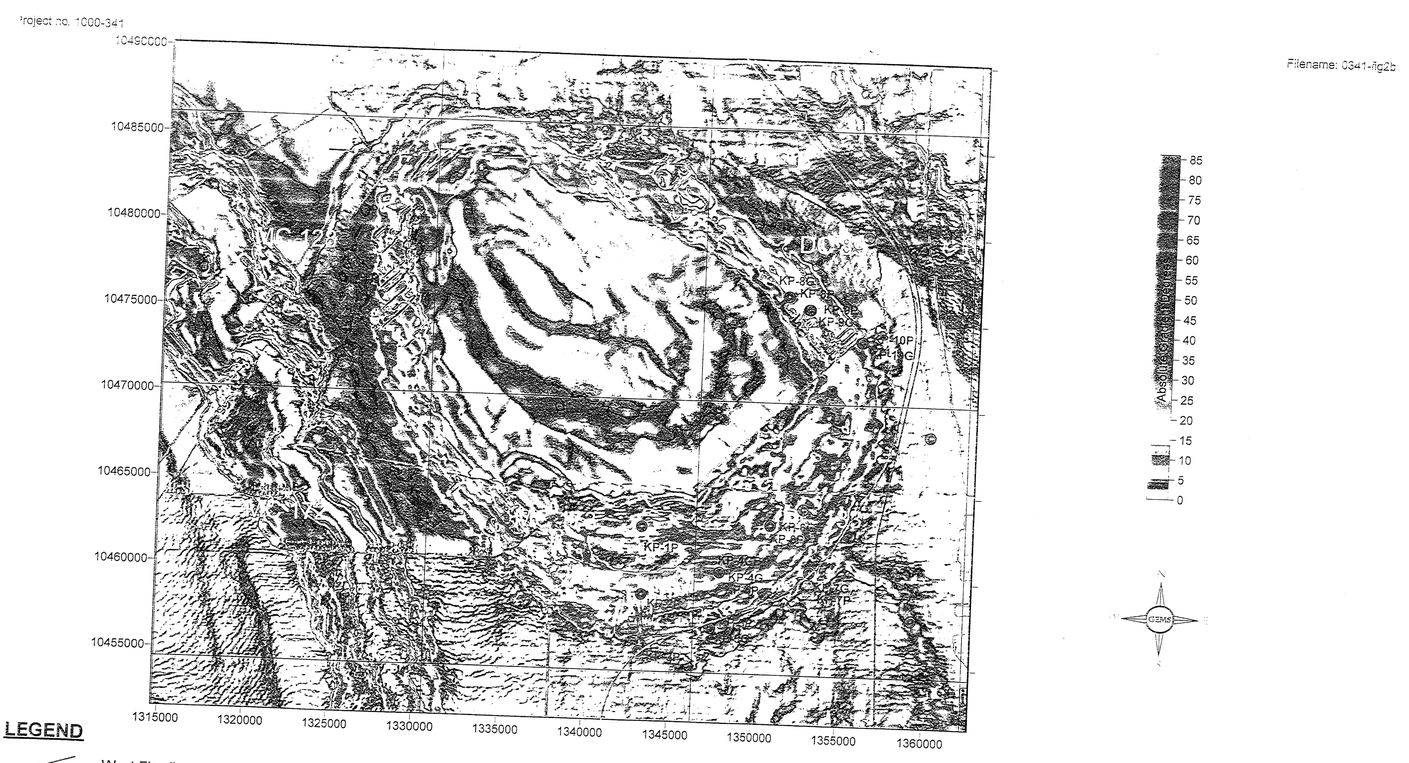


Figure 2b: Absolute Seafloor Gradient Map

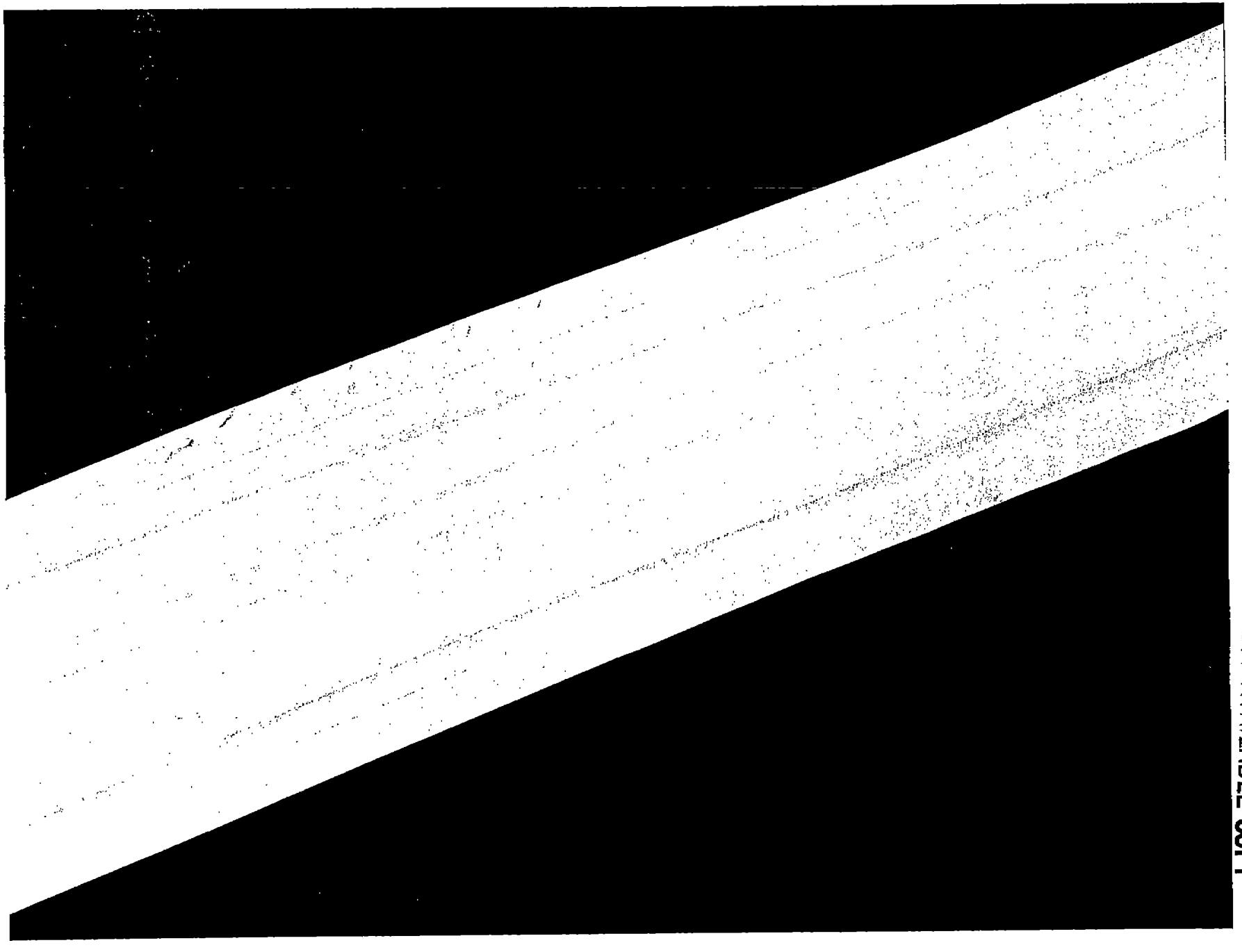


Figure 3. Side-Scan sonar mosaic of the southern flank of the King's Peak Diapir

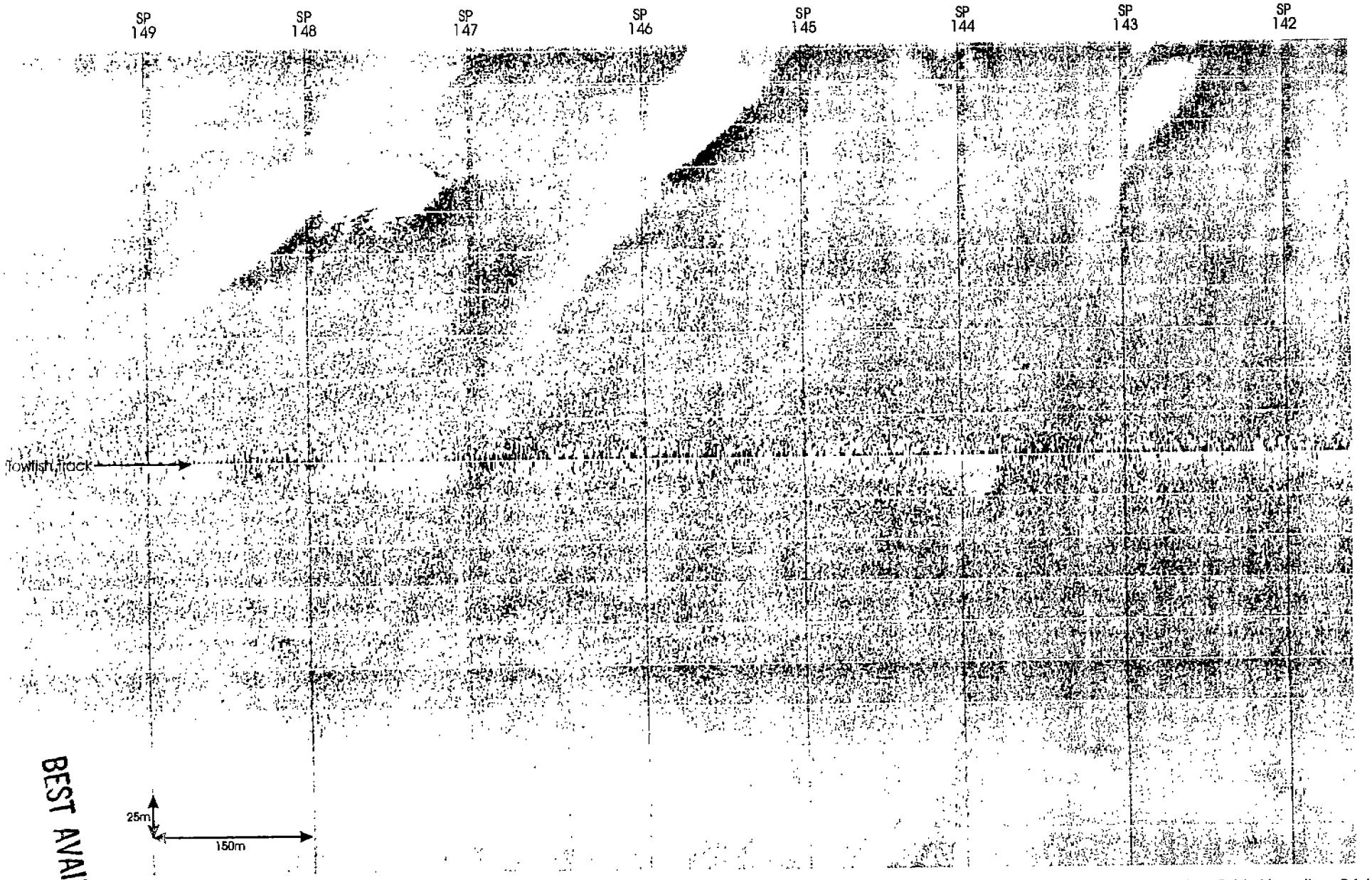


Figure 4. Side-scan sonar image of irregular topography on southern flank of the King's Peak salt diapir.

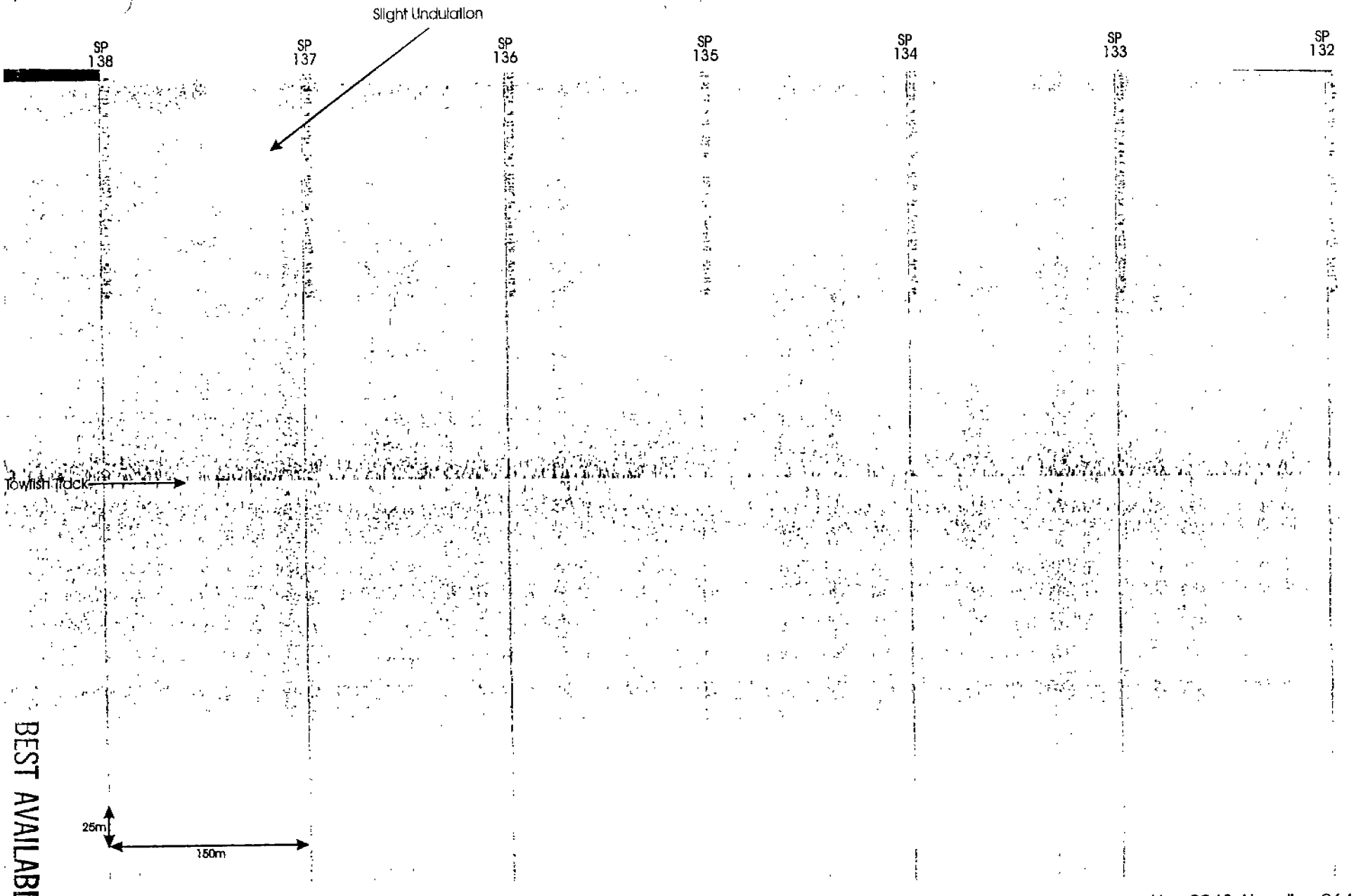


Figure 5. Side-scan sonar image of slightly undulating seafloor south of the King's Peak salt diapir.

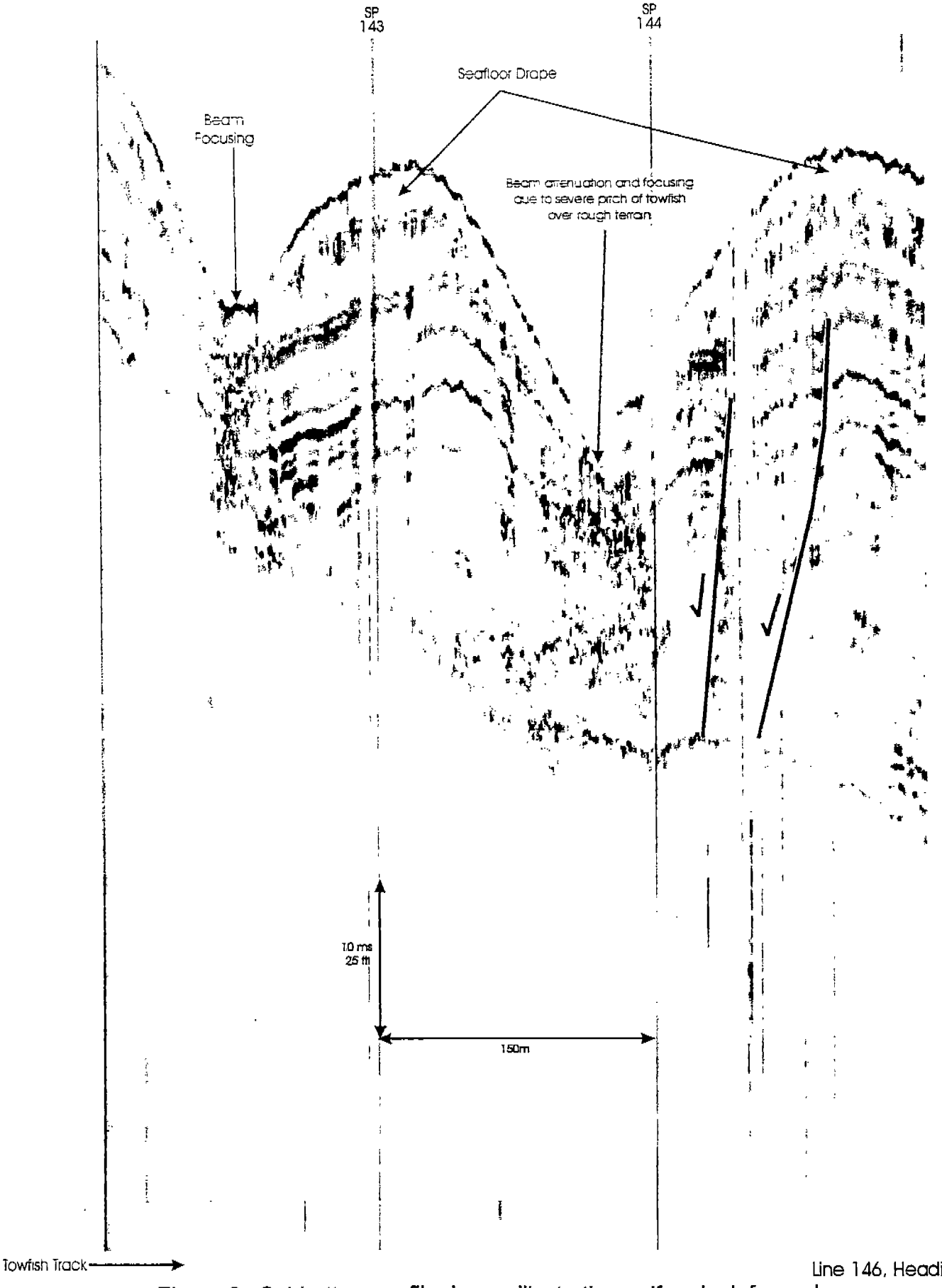


Figure 6. Subbottom profiler image illustrating uniformly deformed strata on the flanks of the King's Peak salt diapir.

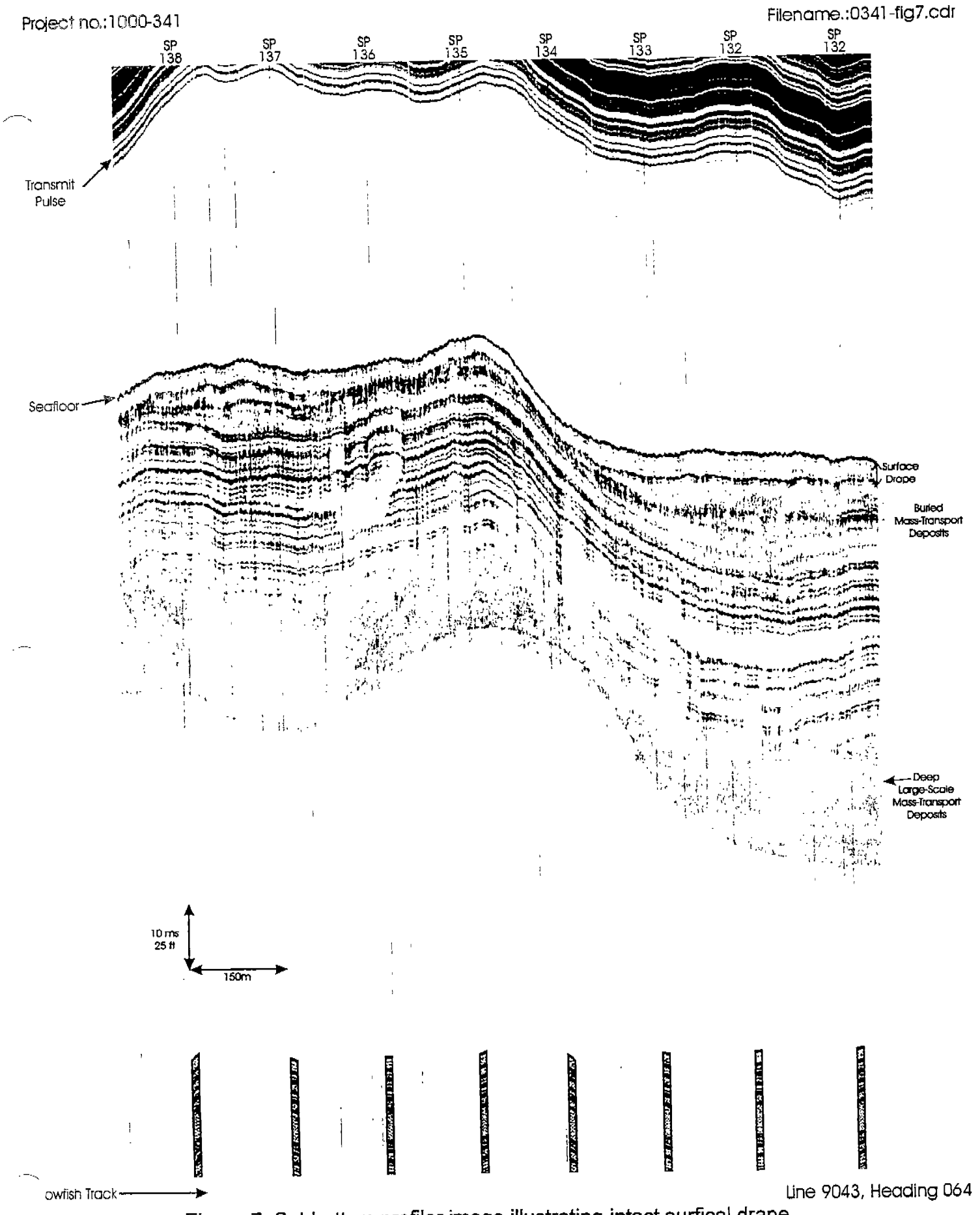


Figure 7. Subbottom profiler image illustrating intact surfical drape. Note uniform subsurface stratigraphy interrupted by periodic, now relict, mass-transport deposits.

REGIONAL OIL SPILL RESPONSE PLAN /
OIL SPILL FINANCIAL RESPONSIBILITY
RIGHT-OF-WAY PIPELINES

CALCULATION WORKSHEET FOR
WORST CASE DISCHARGE SCENARIO

Calculations for ROW Pipelines

		Actual Calculations (BBLS)
1.	Add the pipeline system detection time to the shutdown response time assuming automatic shutdown (enter HRS. in decimals).	6 Hours
2.	Multiply by the highest measured oil flow rate over the preceding 12 month period (for new pipelines used predicted oil flow rate).	126 bbls
3.	Add the total volume of oil that would leak from the pipeline after it is shut in (consider effects of hydrostatic pressure, gravity, frictional wall forces, length of pipeline segment, tie-ins with other pipelines, etc.).	300 bbls
	TOTAL	426 bbls

12-Inch Bulk Gas Right-of-Way (54.54 Miles) - East Flowline
Mississippi Canyon Block 348 to Main Pass Block 261
(Application No. 1)

MAIN PASS AREA

VIOSCA KNOLL AREA

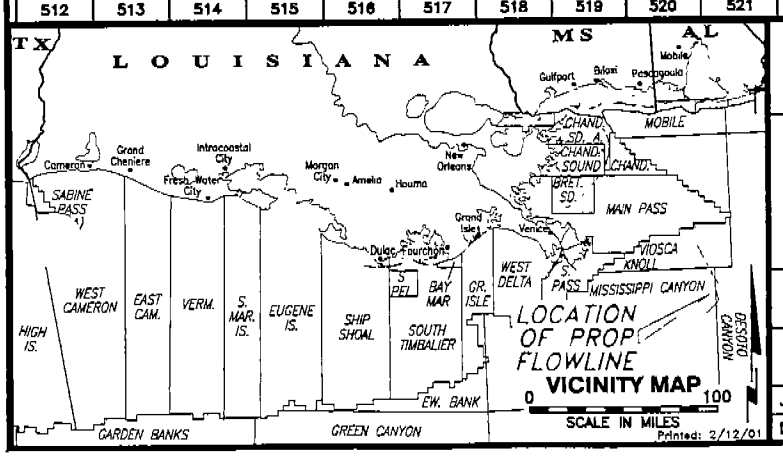
MISSISSIPPI CANYON AREA

DESOTO CANYON AREA

DESTIN DOME AREA

PROPOSED (EAST LINE)
12" GAS FLOWLINE

GRID NORTH



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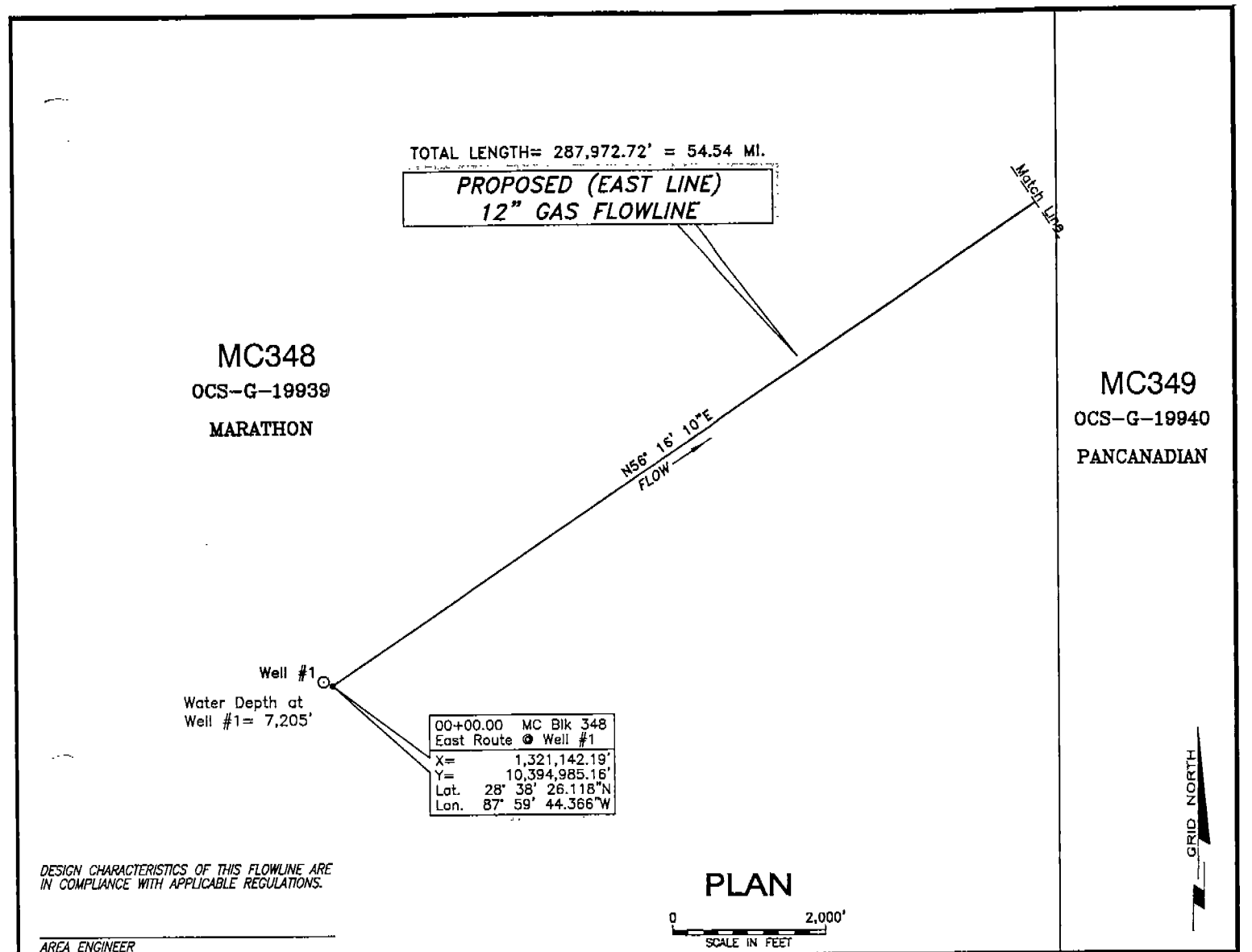
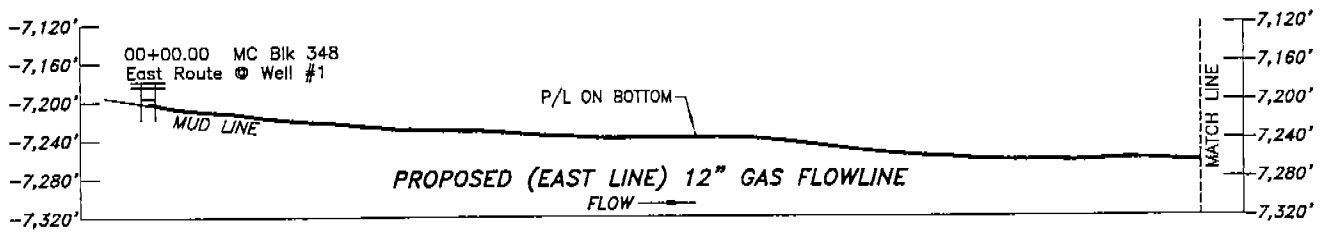
PROPOSED (EAST LINE)
12" GAS FLOWLINE

MISSISSIPPI CANYON BLK 348 @ WELL #1 TO
MAIN PASS BLK 261-PROP "JP" PLATFORM
GULF OF MEXICO

JOHN E. CHANCE & ASSOCIATES, INC. (UCRO)

GEODETIC DATUM: NAD 1927 PROJECTION: U.T.M. 16 GRID UNITS: US SURVEY FEET		SCALE IN FEET	0 — 40,000'
Job No.: 00-3516	Date: 02/11/01	Drwn: MGK	Chart: 1 Of: 27
Dwgfile: H:\2000\003516\CAD\MARINE\3516COVRPPEAST			

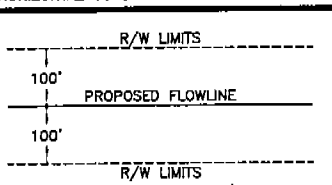




THE RIGHT OF WAY OF THE PROPOSED FLOWLINE IS ACCURATELY REPRESENTED.

STATE OF LOUISIANA
LIONEL J. CORMIER
REG. No. 4401
REGISTERED
PROFESSIONAL
LAND SURVEYOR

REG. PROFESSIONAL LAND SURVEYOR NO. 4401
STATE OF LOUISIANA



RIGHT-OF-WAY DETAIL

Printed: 2/11/01

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PROPOSED (EAST LINE) 12" GAS FLOWLINE

MISSISSIPPI CANYON BLK 348 @ WELL #1 TO
MAIN PASS BLK 261-PROP "JP" PLATFORM
GULF OF MEXICO

JOHN E. CHANCE & ASSOCIATES, INC. (LUCRO)

GEODETIC DATUM: NAD 1927 PROJECTION: U.T.M. 16 GRID UNITS: US SURVEY FEET	SCALE AS SHOWN
Job No.: 00-3516 | Date: 02/11/01 | Drwn: MGK	Chart: 2 Of: 27
Dwgfile: H:\2000\003516\CAD\MARINE\003516PPEAST	

MC304

MC305
OCS-G-19935
ELF

MC348
OCS-G-19939
MARATHON

MC349
OCS-G-19940
PANCANADIAN

Match Line

N34° 46' 35"E

PROPOSED (EAST LINE)
12" GAS FLOWLINE

P.T.1

P.C.1

201+56.22
Block Line Crossing
X= 1,337,246.36'
Y= 10,406,880.00'
Lat. 28° 40' 25.214"N
Lon. 87° 56' 44.648"W

N56° 16' 10"E
FLOW

Match Line

113+24.14
Block Line Crossing
X= 1,330,560.00'
Y= 10,401,273.32'
Lat. 28° 39' 29.158"N
Lon. 87° 57' 59.219"W

CURVE 1 DATA	
P.C.	166+36.72
X=	1,334,978.25'
Y=	10,404,223.33'
Lat.	28° 39' 58.725"N
Lon.	87° 57' 09.879"W
P.T.	185+12.34
X=	1,336,308.73'
Y=	10,405,529.75'
Lat.	28° 40' 11.768"N
Lon.	87° 56' 55.056"W
P.I.	1
X=	1,335,767.46'
Y=	10,404,750.28'
Radius	5,000.00'
Delta	21° 29' 35"
Tangent	948.97'
Length	1,875.62'

GRID NORTH

PLAN

0 2,000'
SCALE IN FEET

-7,000'
-7,040'
-7,080'
-7,120'
-7,160'
-7,200'
-7,240'
-7,280'
-7,320'

MATCH LINE

P/L ON BOTTOM

PROPOSED (EAST LINE) 12" GAS FLOWLINE
FLOW

MUD LINE

0 2,000'
HORIZONTAL SCALE IN FEET

PROFILE

0 200'
VERTICAL SCALE IN FEET

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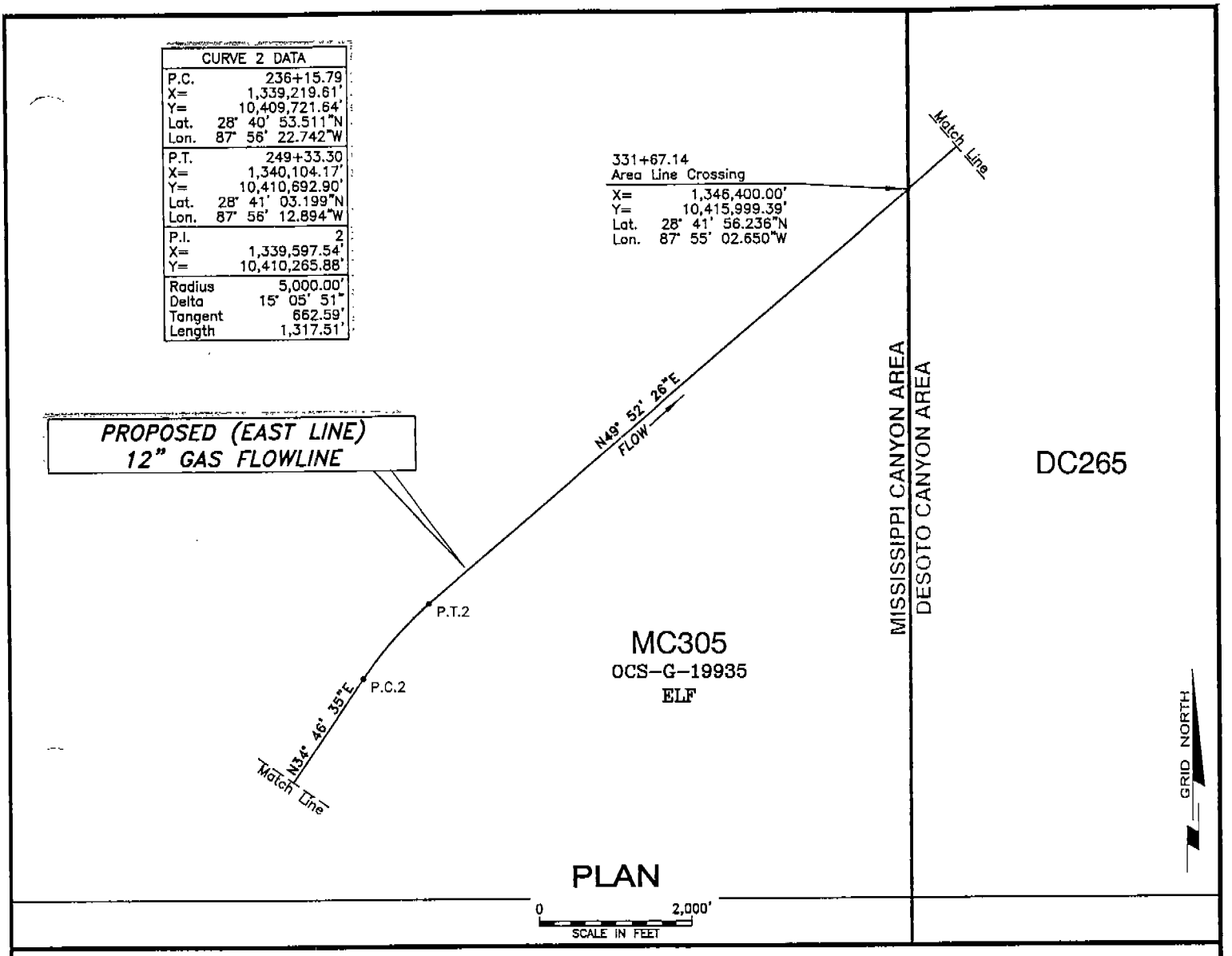
PROPOSED (EAST LINE) 12" GAS FLOWLINE

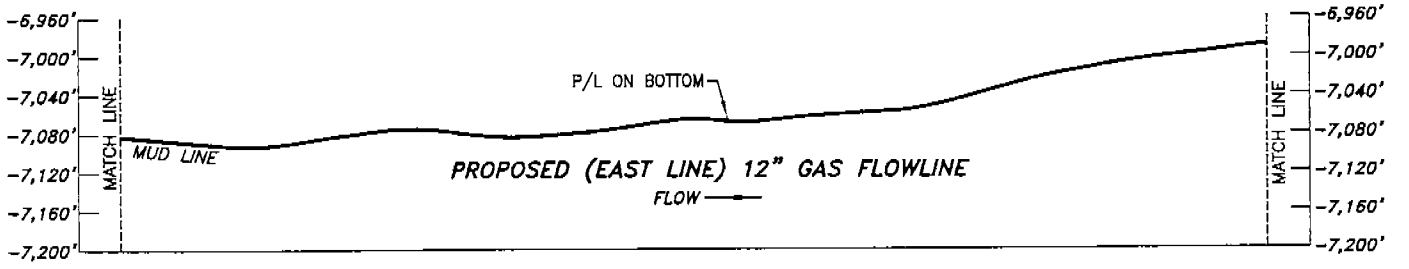
MISSISSIPPI CANYON BLK 348 @ WELL #1 TO
MAIN PASS BLK 261-PROP "JP" PLATFORM
GULF OF MEXICO

JOHN E. CHANCE & ASSOCIATES, INC. — fugro

GEODETIC DATUM: NAD 1927 PROJECTION: U.T.M. 16 GRID UNITS: US SURVEY FEET		SCALE AS SHOWN	
Job No.: 00-3516	Date: 02/11/01	Drwn: MGK	Chart: 3 Of: 27
Dwgfile: H:\2000\003516\CAD\MARINE\003516PPEAST			

Printed: 2/11/01





elf exploration inc

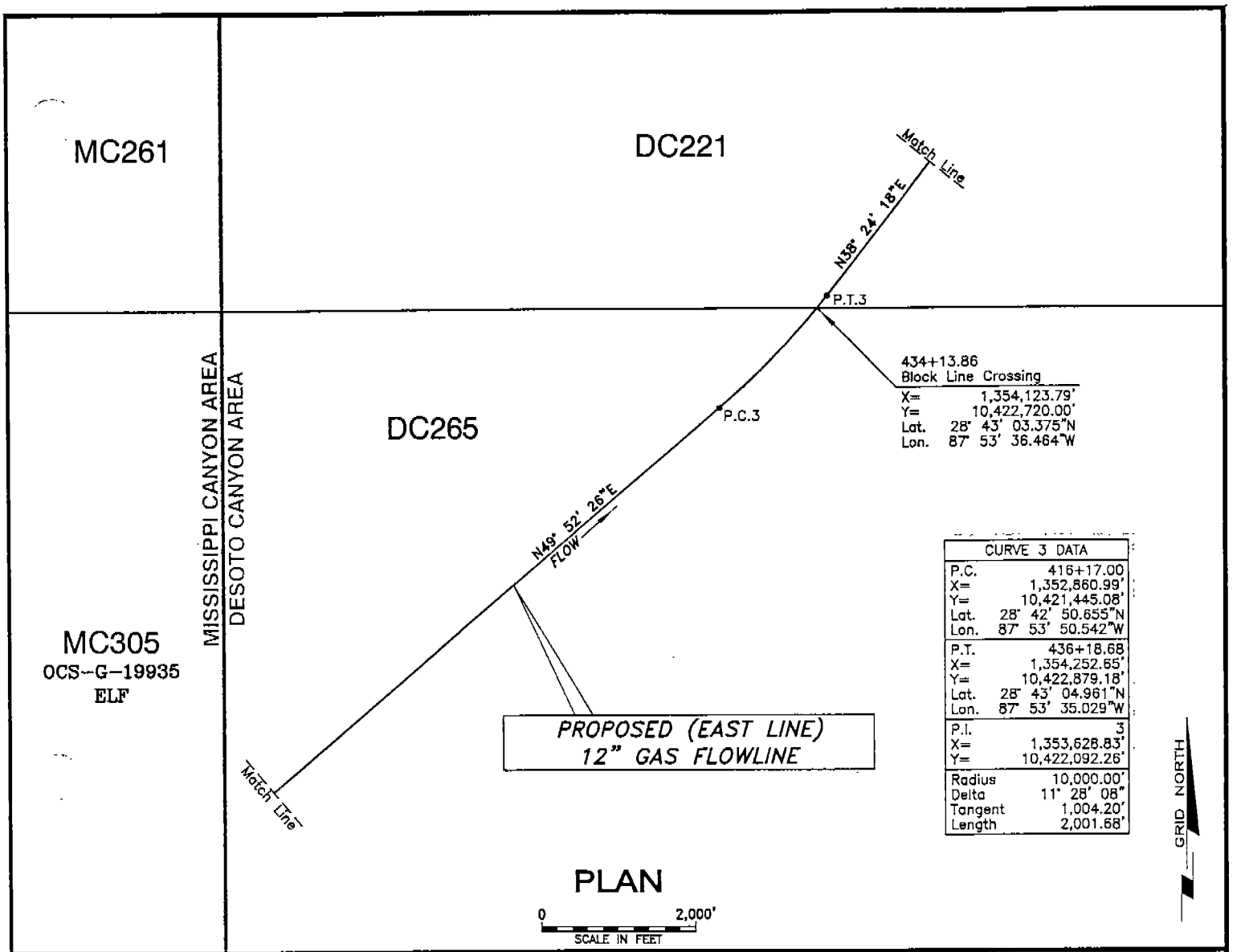
PROPOSED (EAST LINE) 12" GAS FLOWLINE

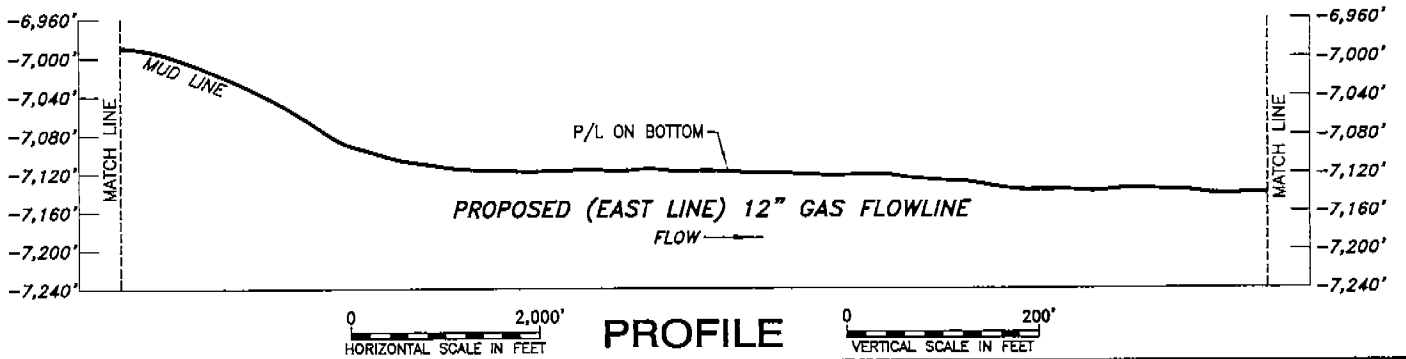
MISSISSIPPI CANYON BLK 348 @ WELL #1 TO
MAIN PASS BLK 261-PROP "JP" PLATFORM
GULF OF MEXICO

JOHN E. CHANCE & ASSOCIATES, INC. (a Fugro company)

GEODETIC DATUM: NAD 1927 PROJECTION: U.T.M. 16 GRID UNITS: US SURVEY FEET	SCALE AS SHOWN
Job No.: 00-3516 | Date: 02/11/01	Drwn: MGK | Chart: 4 Of: 27
Dwgfile: H:\2000\003516\CAD\MARINE\003516PPEAST	

Printed: 2/11/01





elf exploration inc

PROPOSED (EAST LINE) 12" GAS FLOWLINE

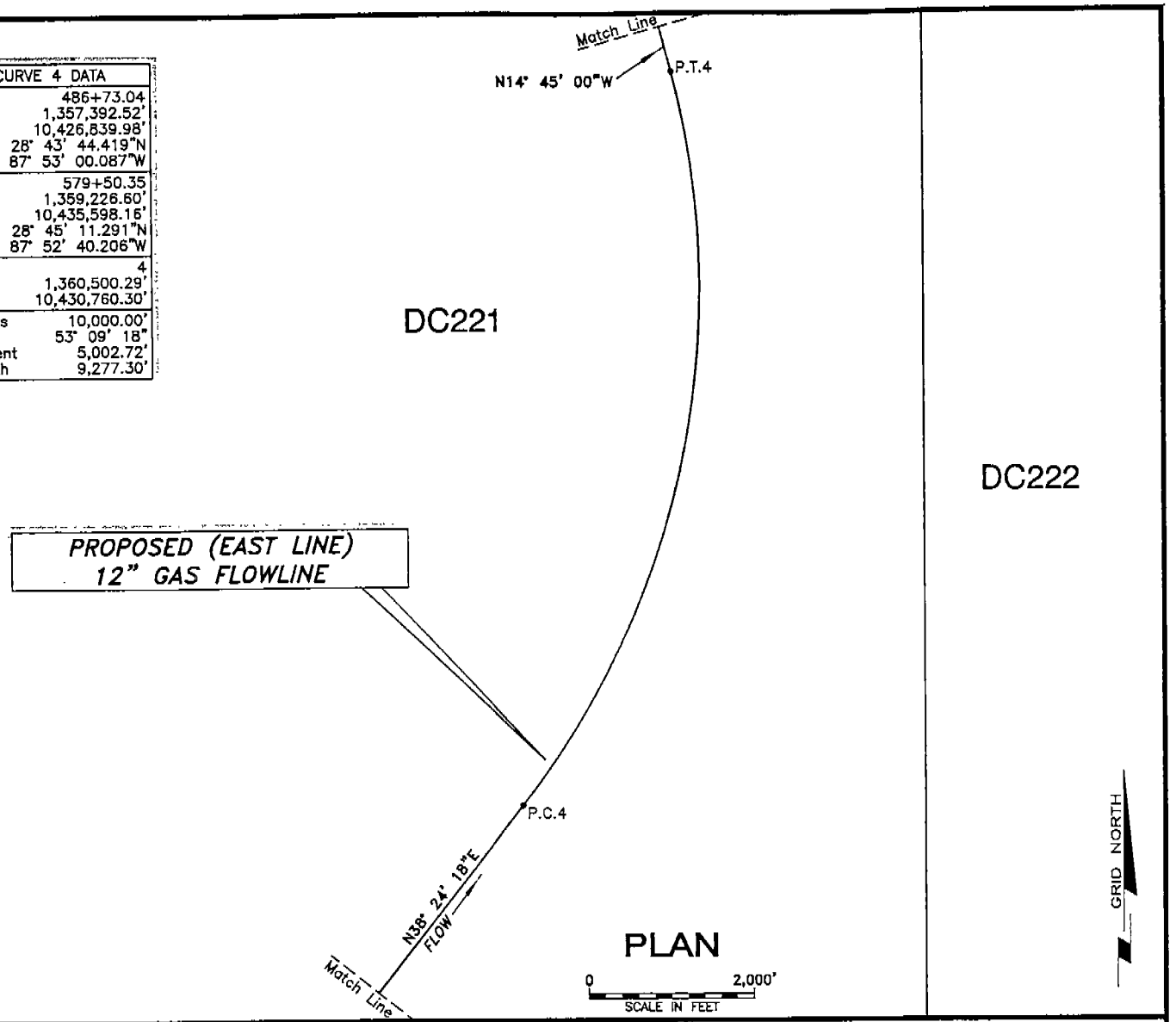
MISSISSIPPI CANYON BLK 348 @ WELL #1 TO
MAIN PASS BLK 261-PROP "JP" PLATFORM
GULF OF MEXICO

JOHN E. CHANCE & ASSOCIATES, INC. (UCRO)

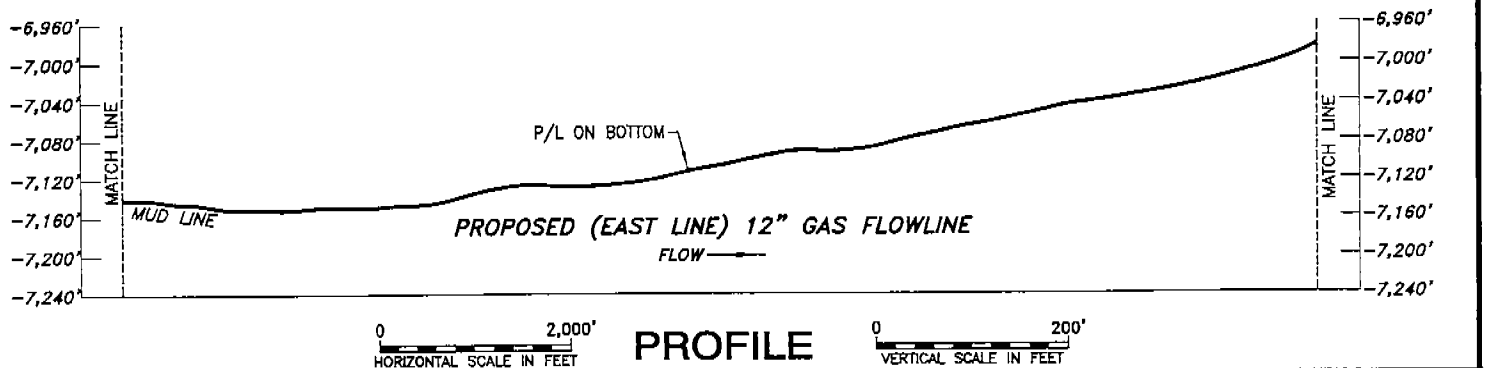
GEODETIC DATUM: NAD 1927 PROJECTION: U.T.M. 16 GRID UNITS: US SURVEY FEET		SCALE AS SHOWN	
Job No.: 00-3516	Date: 02/11/01	Drwn: MGK	Chart: 5 Of: 27
Dwgfile: H:\2000\003516\CAD\MARINE\003516PPEAST			

Printed: 2/11/01

CURVE 4 DATA	
P.C.	486+73.04
X=	1,357,392.52'
Y=	10,426,839.98'
Lat.	28° 43' 44.419"N
Lon.	87° 53' 00.087"W
P.T.	579+50.35
X=	1,359,226.60'
Y=	10,435,598.16'
Lat.	28° 45' 11.291"N
Lon.	87° 52' 40.206"W
P.I.	4
X=	1,360,500.29'
Y=	10,430,760.30'
Radius	10,000.00'
Delta	53° 09' 18"
Tangent	5,002.72'
Length	9,277.30'



PLAN



PROFILE

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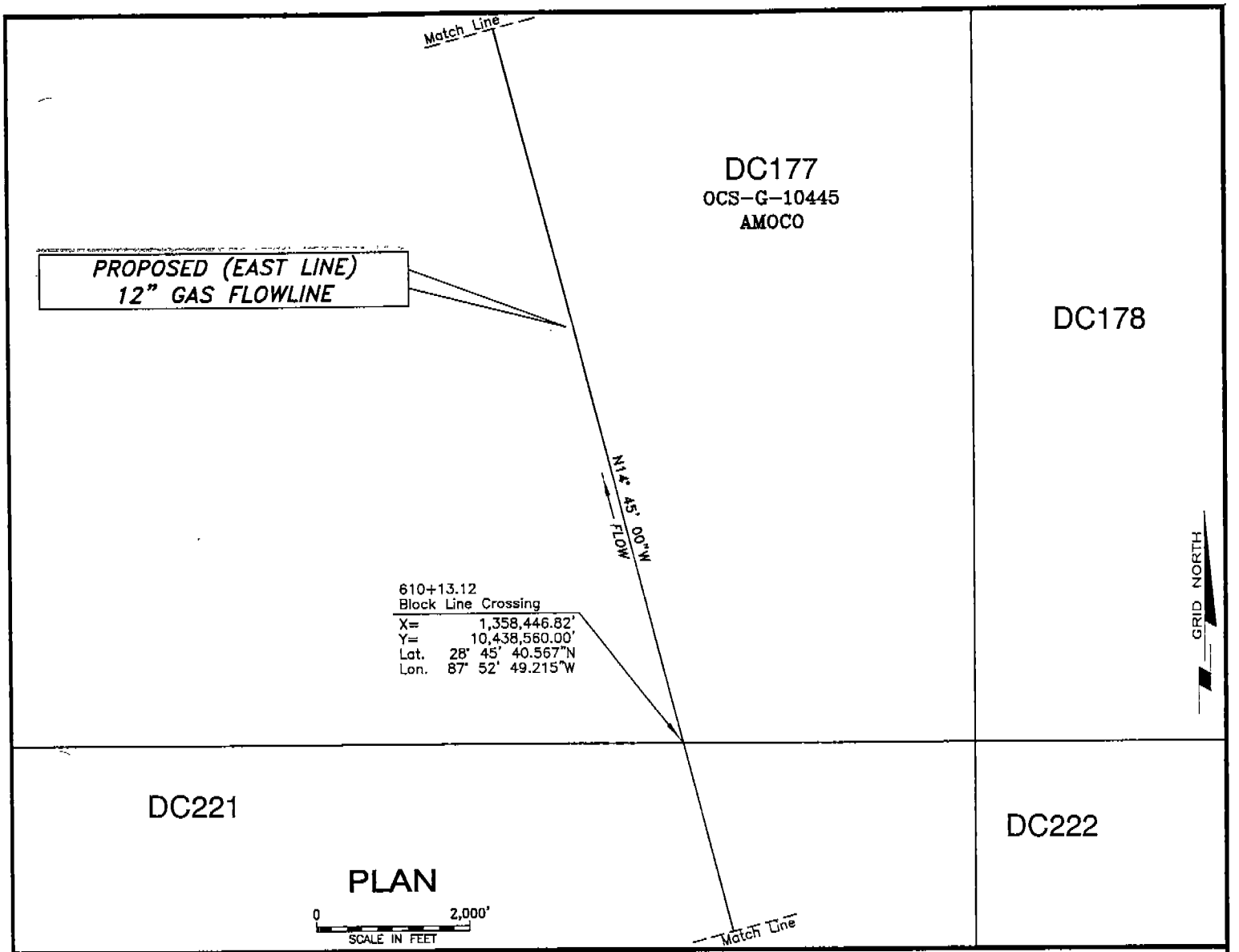
PROPOSED (EAST LINE) 12" GAS FLOWLINE

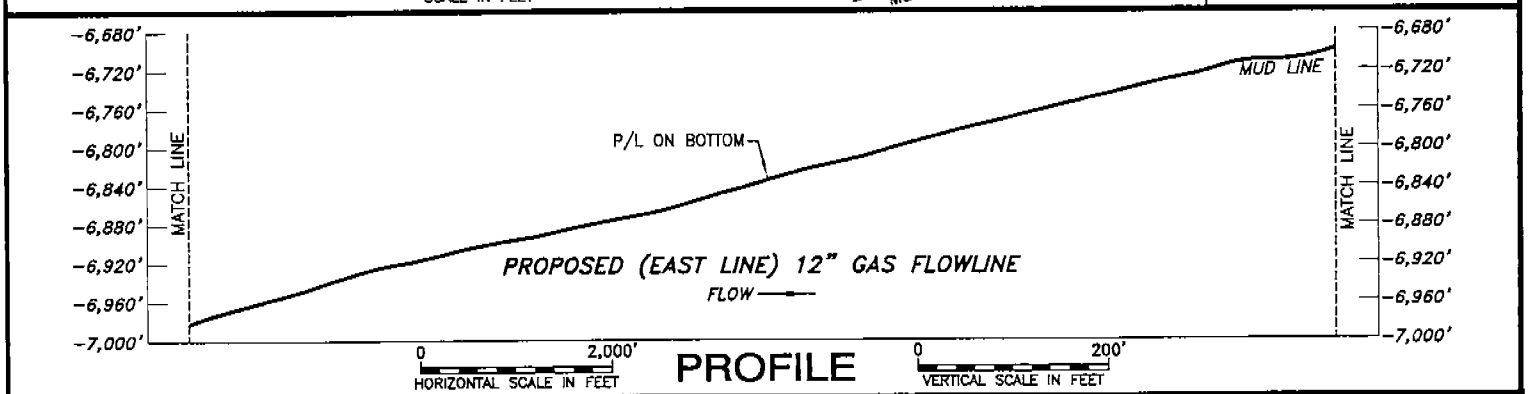
MISSISSIPPI CANYON BLK 348 @ WELL #1 TO
MAIN PASS BLK 261-PROP "JP" PLATFORM
GULF OF MEXICO

JOHN E. CHANCE & ASSOCIATES, INC. (UCRO)

GEODETIC DATUM: NAD 1927 PROJECTION: U.T.M. 16 GRID UNITS: US SURVEY FEET		SCALE AS SHOWN	
Job No.: 00-3516	Date: 02/11/01	Drwn: MGK	Chart: 6 Of: 27
Dwgfile: H:\2000\003516\CAD\MARINE\003516PPEAST			

Printed: 2/11/01





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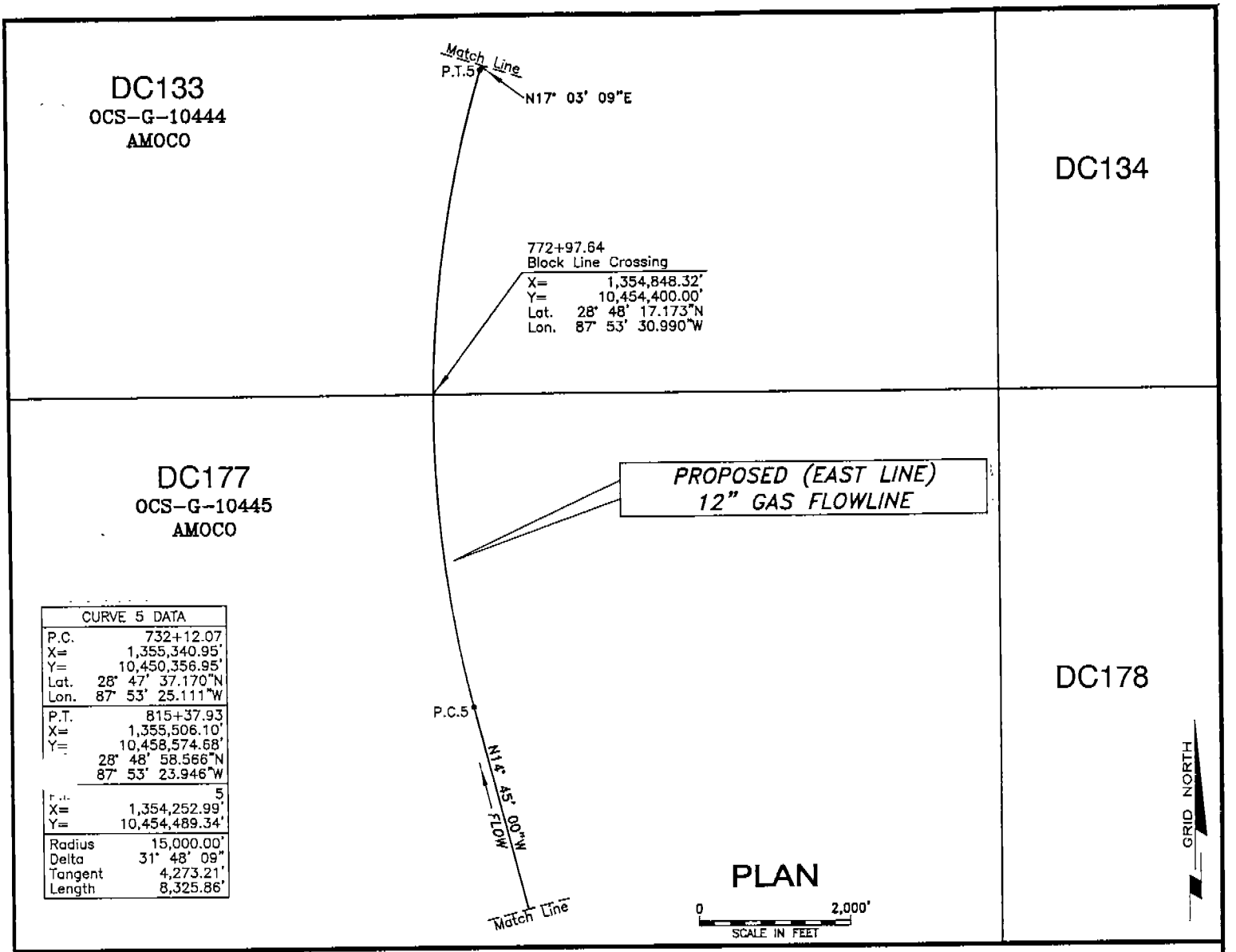
PROPOSED (EAST LINE) 12" GAS FLOWLINE

MISSISSIPPI CANYON BLK 348 @ WELL #1 TO
MAIN PASS BLK 261-PROP "JP" PLATFORM
GULF OF MEXICO

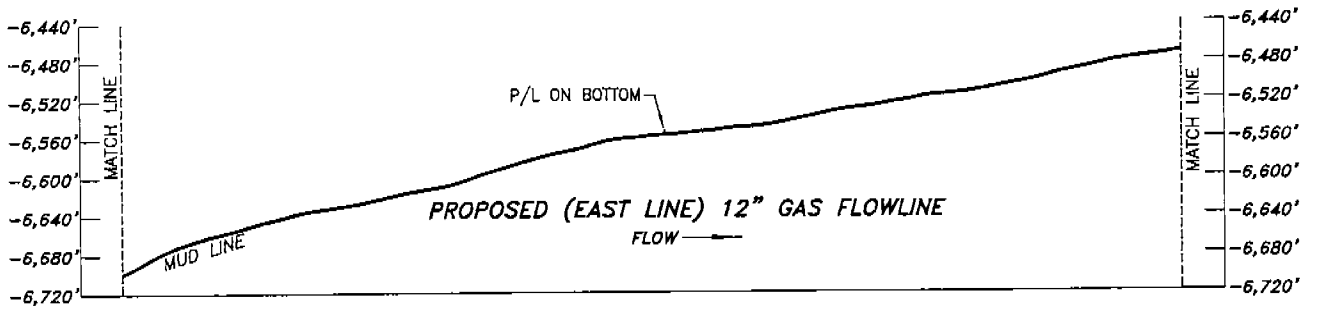
JOHN E. CHANCE & ASSOCIATES, INC. — a Fugro company

GEODETIC DATUM: NAD 1927 PROJECTION: U.T.M. 16 GRID UNITS: US SURVEY FEET		SCALE AS SHOWN	
Job No.: 00-3516	Date: 02/11/01	Drwn: MGK	Chart: 7 Of: 27
Dwgfile: H:\2000\0035 3\CAD\MARINE\003516PPEAST			

Printed: 2/11/01



CURVE 5 DATA	
P.C.	732+12.07
X=	1,355,340.95'
Y=	10,450,356.95'
Lat.	28° 47' 37.170"N
Lon.	87° 53' 25.111"W
P.T.	815+37.93
X=	1,355,506.10'
Y=	10,458,574.68'
	28° 48' 58.566"N
	87° 53' 23.946"W
[illegible]	5
X=	1,354,252.99'
Y=	10,454,489.34'
Radius	15,000.00'
Delta	31° 48' 09"
Tangent	4,273.21'
Length	8,325.86'



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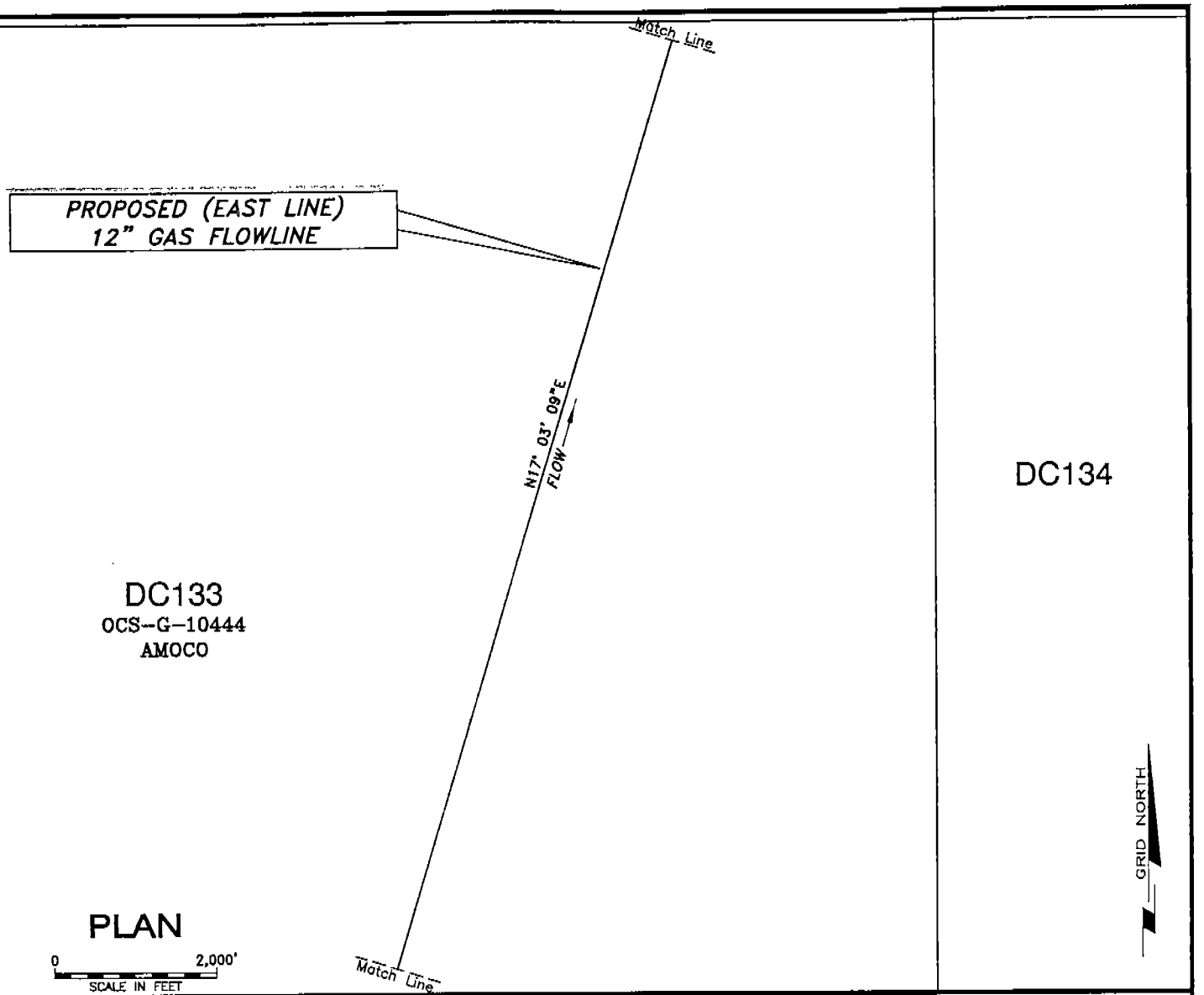
PROPOSED (EAST LINE) 12" GAS FLOWLINE

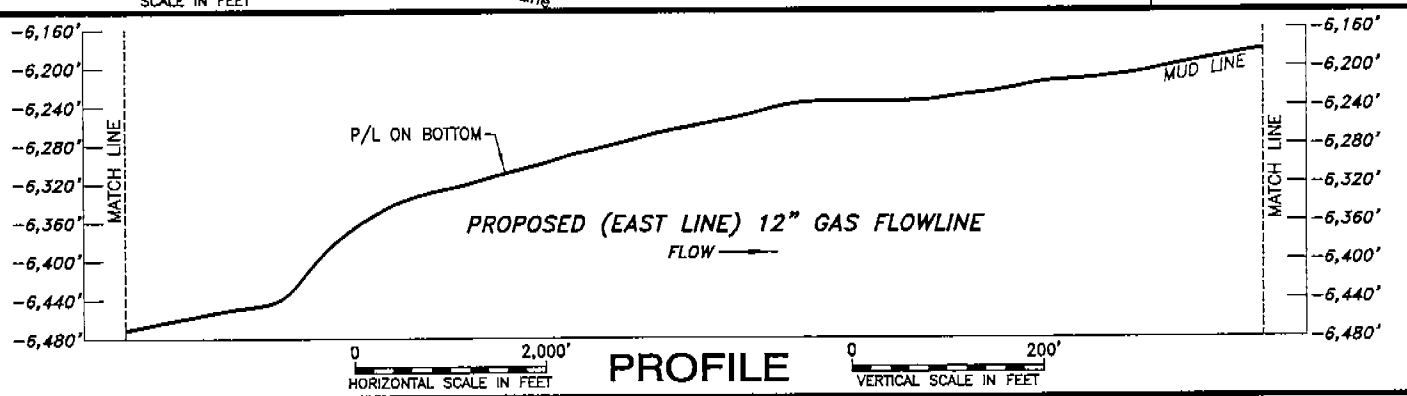
MISSISSIPPI CANYON BLK 348 @ WELL #1 TO
MAIN PASS BLK 261-PROP "JP" PLATFORM
GULF OF MEXICO

JOHN E. CHANCE & ASSOCIATES, INC. — fugro

GEODETIC DATUM: NAD 1927 PROJECTION: U.T.M. 16 GRID UNITS: US SURVEY FEET		SCALE AS SHOWN	
Job No.: 00-3516	Date: 02/11/01	Drwn: MGK	Chart: 8 Of: 27
Dwgfile: H:\2000\003516\CAD\MARINE\003516PPEAST			

Printed: 2/11/01





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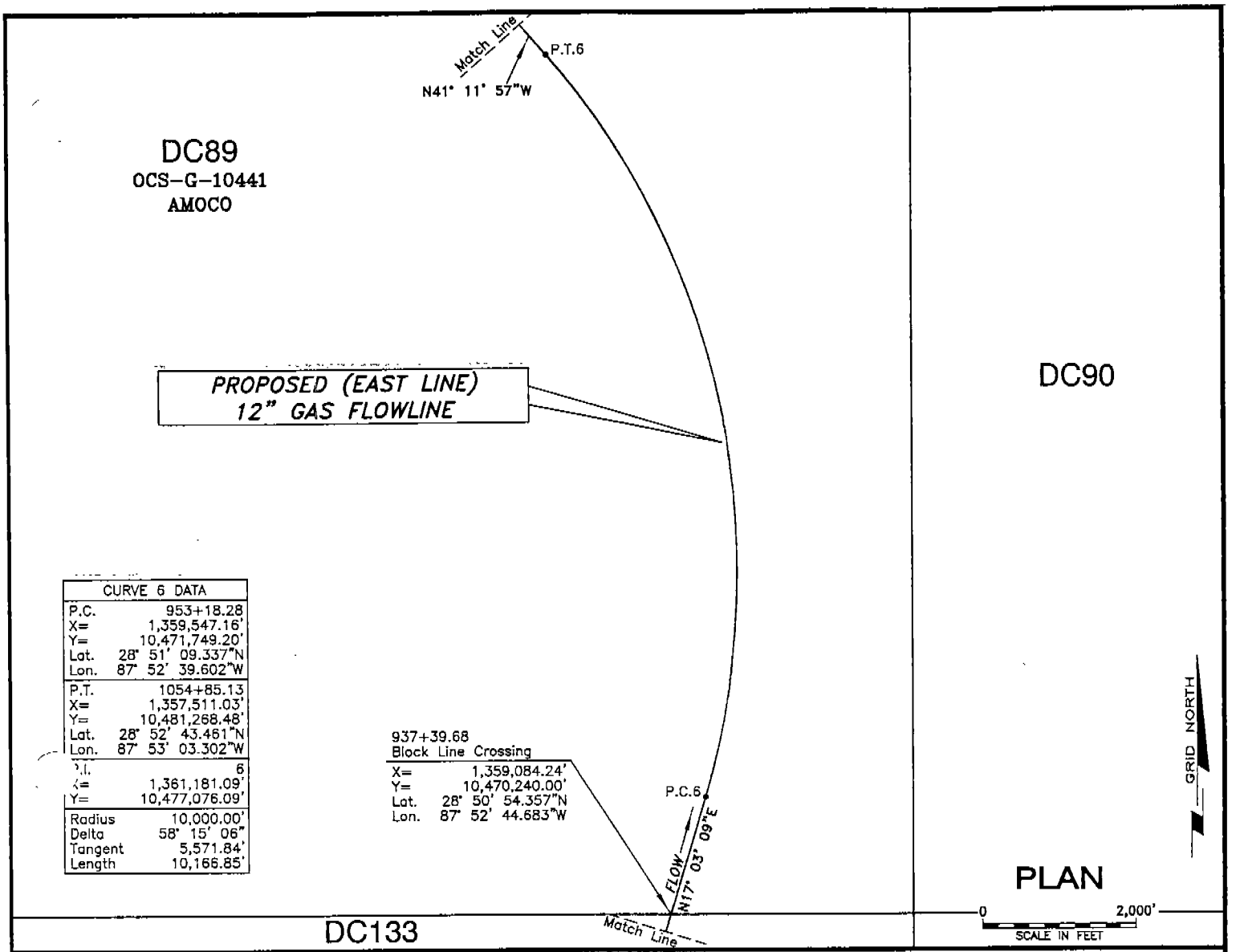
PROPOSED (EAST LINE) 12" GAS FLOWLINE

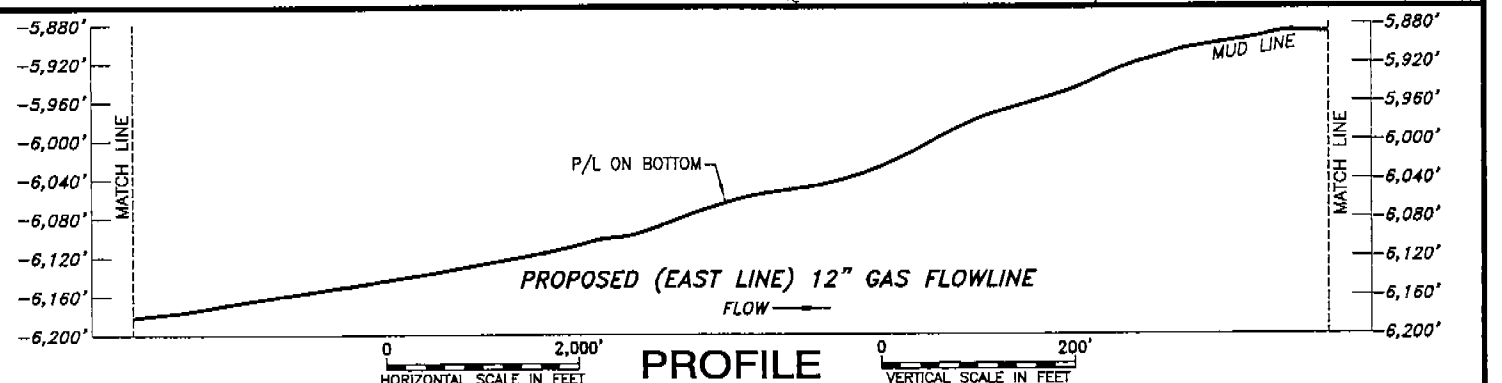
MISSISSIPPI CANYON BLK 348 @ WELL #1 TO
MAIN PASS BLK 261-PROP "JP" PLATFORM
GULF OF MEXICO

JOHN E. CHANCE & ASSOCIATES, INC. (FUGRO)

GEODETIC DATUM: NAD 1927 PROJECTION: U.T.M. 16 GRID UNITS: US SURVEY FEET		SCALE AS SHOWN	
Job No.: 00-3516	Date: 02/11/01	Drwn: MGK	Chart: 9 Of: 27
Dwgfile: H:\2000\003516\CAD\MARINE\003516PPEAST			

Printed: 2/11/01





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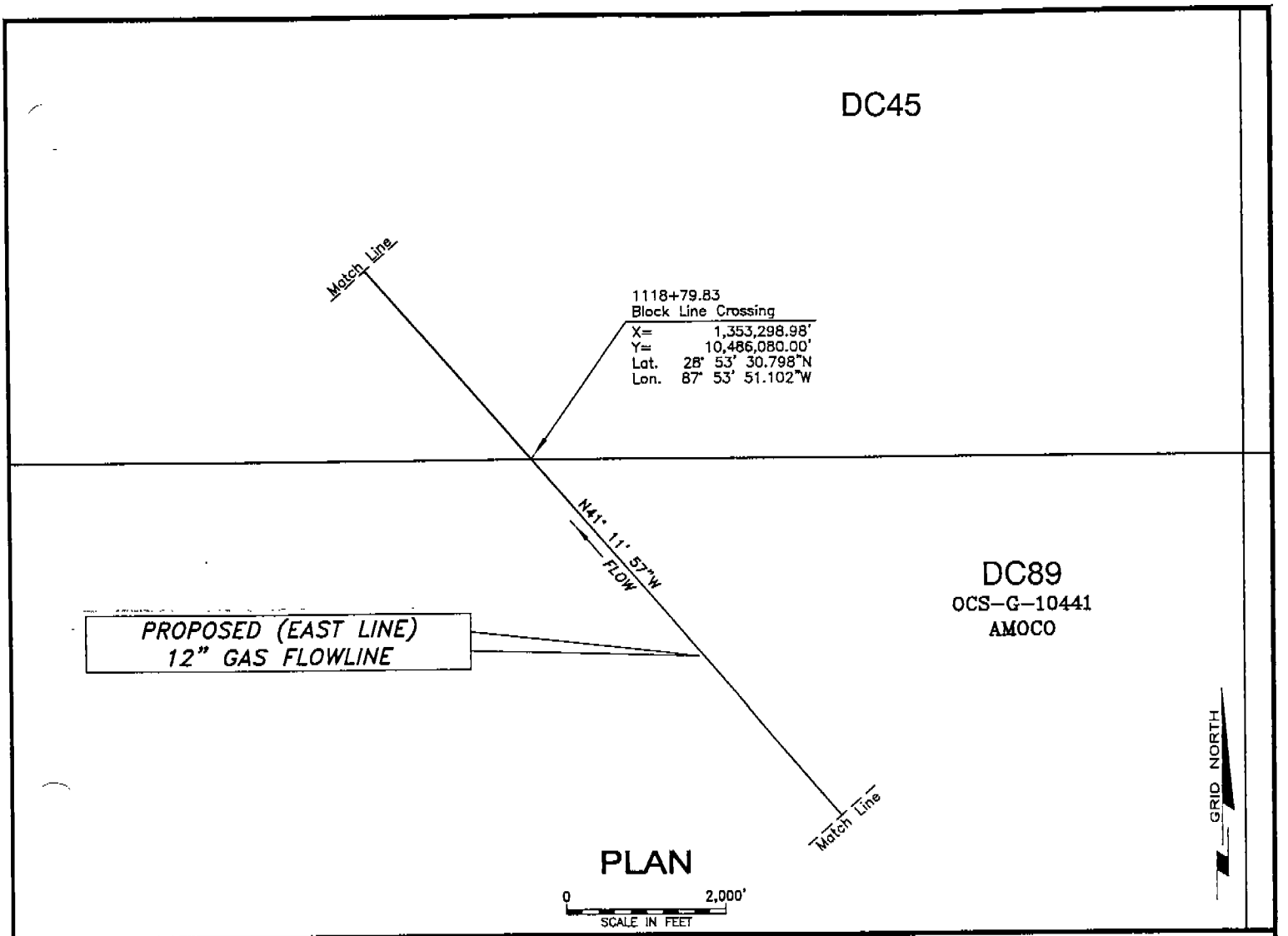
PROPOSED (EAST LINE) 12" GAS FLOWLINE

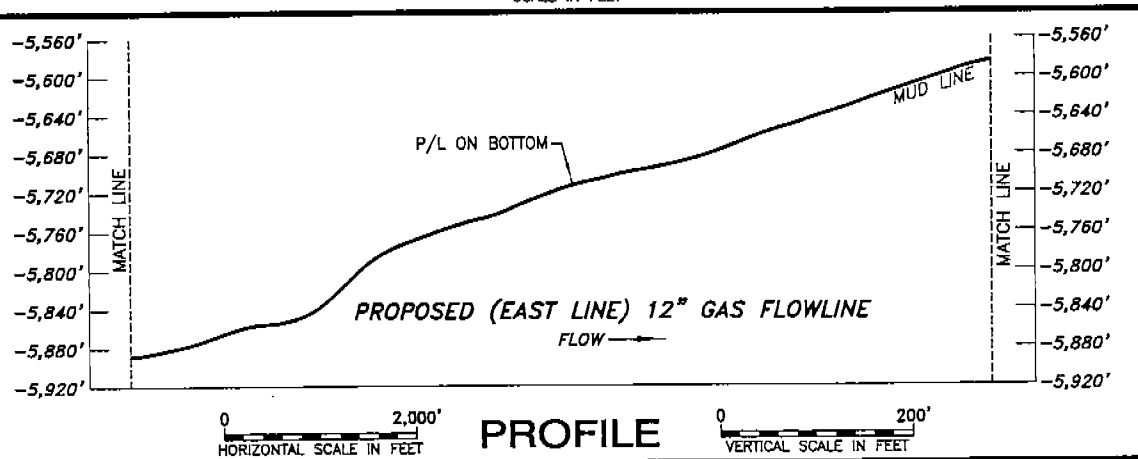
MISSISSIPPI CANYON BLK 348 @ WELL #1 TO
MAIN PASS BLK 261-PROP "JP" PLATFORM
GULF OF MEXICO

JOHN E. CHANCE & ASSOCIATES, INC. | FUGRO

GEODETIC DATUM: NAD 1927 PROJECTION: U.T.M. 16 GRID UNITS: US SURVEY FEET		SCALE AS SHOWN	
Job No.: 00-3516	Date: 02/11/01	Drwn: MGK	Chart: 10 Of: 27
Dwgfile: H:\2000\003516\CAD\MARINE\003516PPEAST			

Printed: 2/11/01





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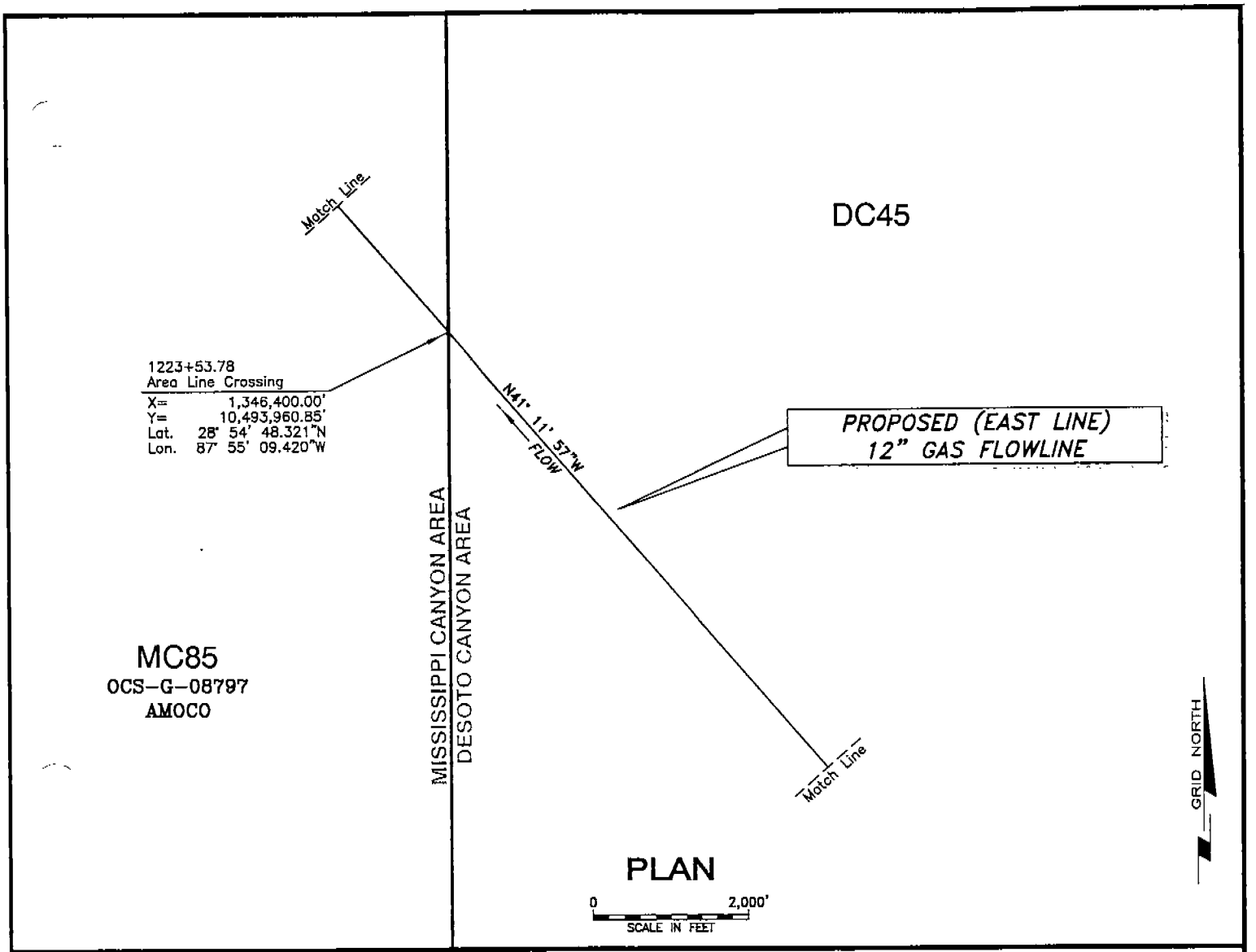
PROPOSED (EAST LINE) 12" GAS FLOWLINE

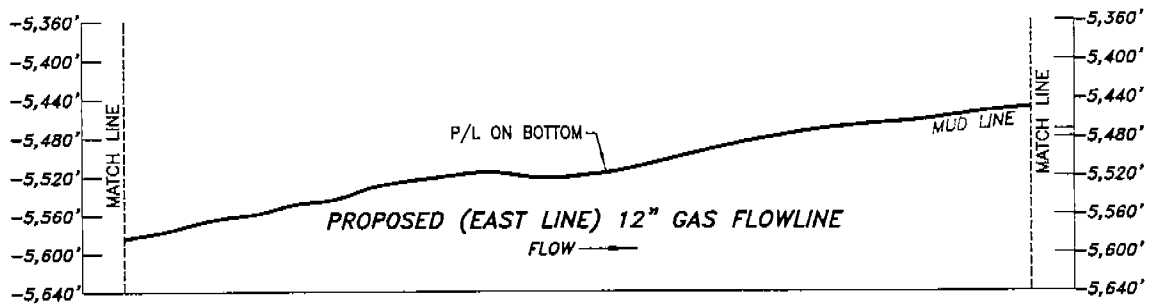
MISSISSIPPI CANYON BLK 348 @ WELL #1 TO
MAIN PASS BLK 261-PROP "JP" PLATFORM
GULF OF MEXICO

JOHN E. CHANCE & ASSOCIATES, INC. — Fugro

GEODETIC DATUM: NAD 1927 PROJECTION: U.T.M. 16 GRID UNITS: US SURVEY FEET		SCALE AS SHOWN	
Job No.: 00-3516	Date: 02/11/01	Drwn: MGK	Chart: 11 Of: 27
Dwgfile: H:\2000\003516\CAD\MARINE\003516PPEAST			

Printed: 2/11/01





elf exploration inc

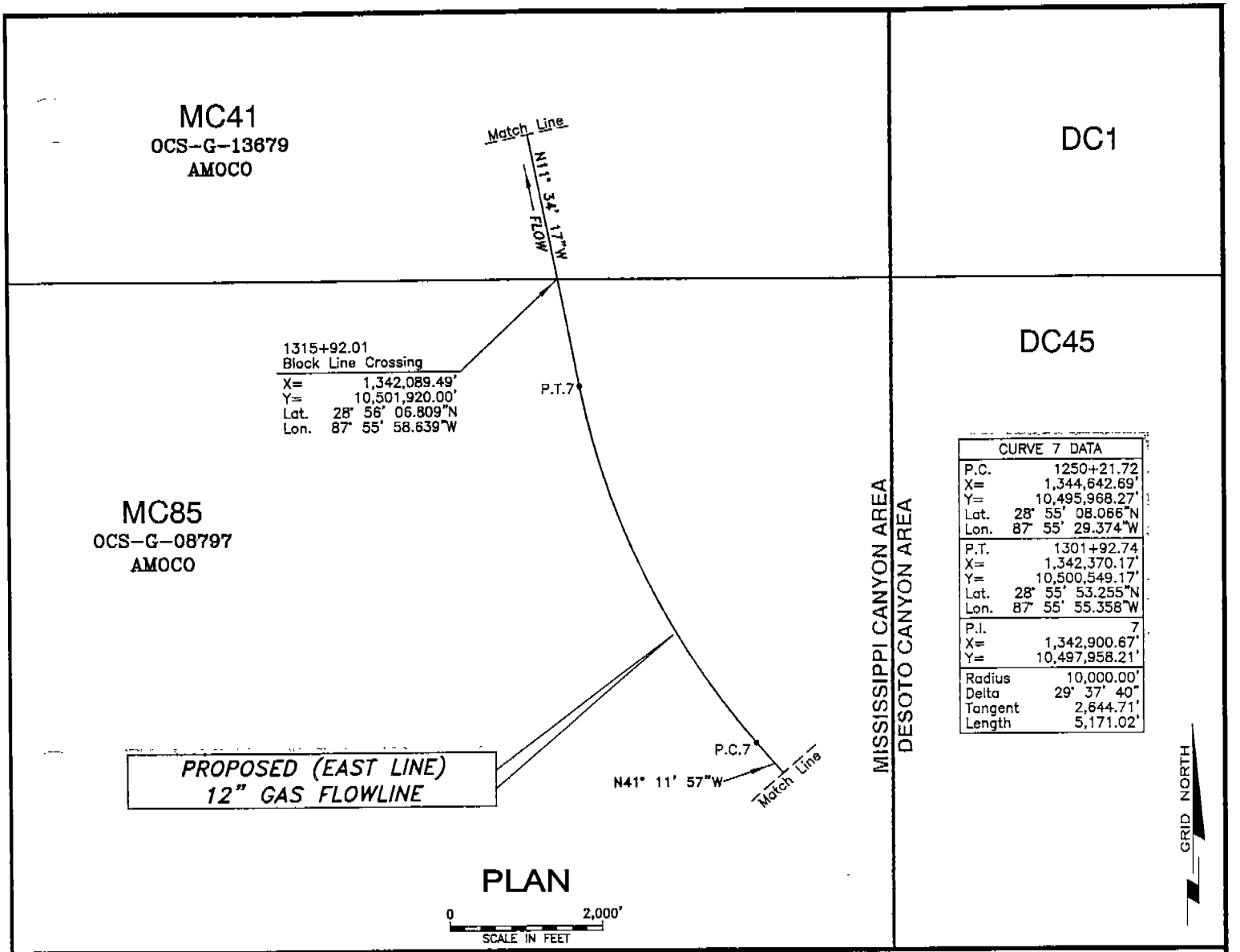
PROPOSED (EAST LINE) 12" GAS FLOWLINE

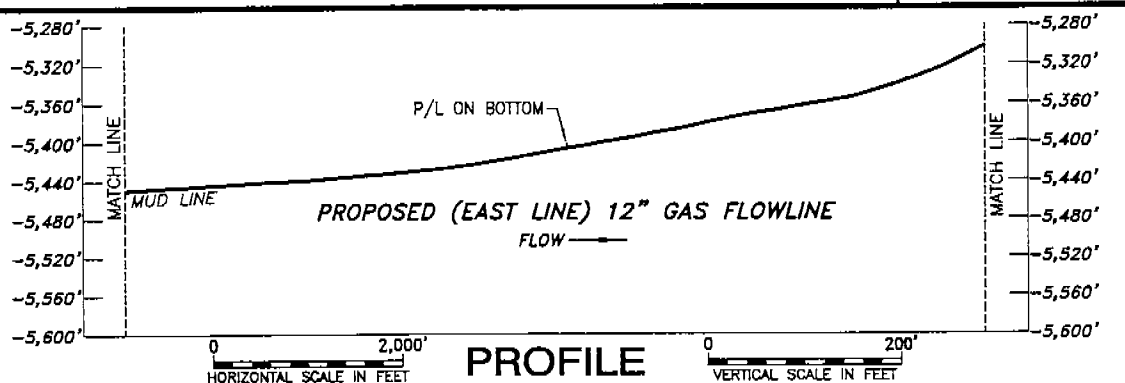
MISSISSIPPI CANYON BLK 348 @ WELL #1 TO
MAIN PASS BLK 261-PROP "JP" PLATFORM
GULF OF MEXICO

JOHN E. CHANCE & ASSOCIATES, INC. | UGRO

GEODETIC DATUM: NAD 1927 PROJECTION: U.T.M. 16 GRID UNITS: US SURVEY FEET	SCALE AS SHOWN
Job No.: 00-3516 | Date: 02/11/01 | Drwn: MGK	Chart: 12 Of: 27
Dwgfile: H:\2000\003516\CAD\MARINE\003516PPEAST	

Printed: 2/11/01





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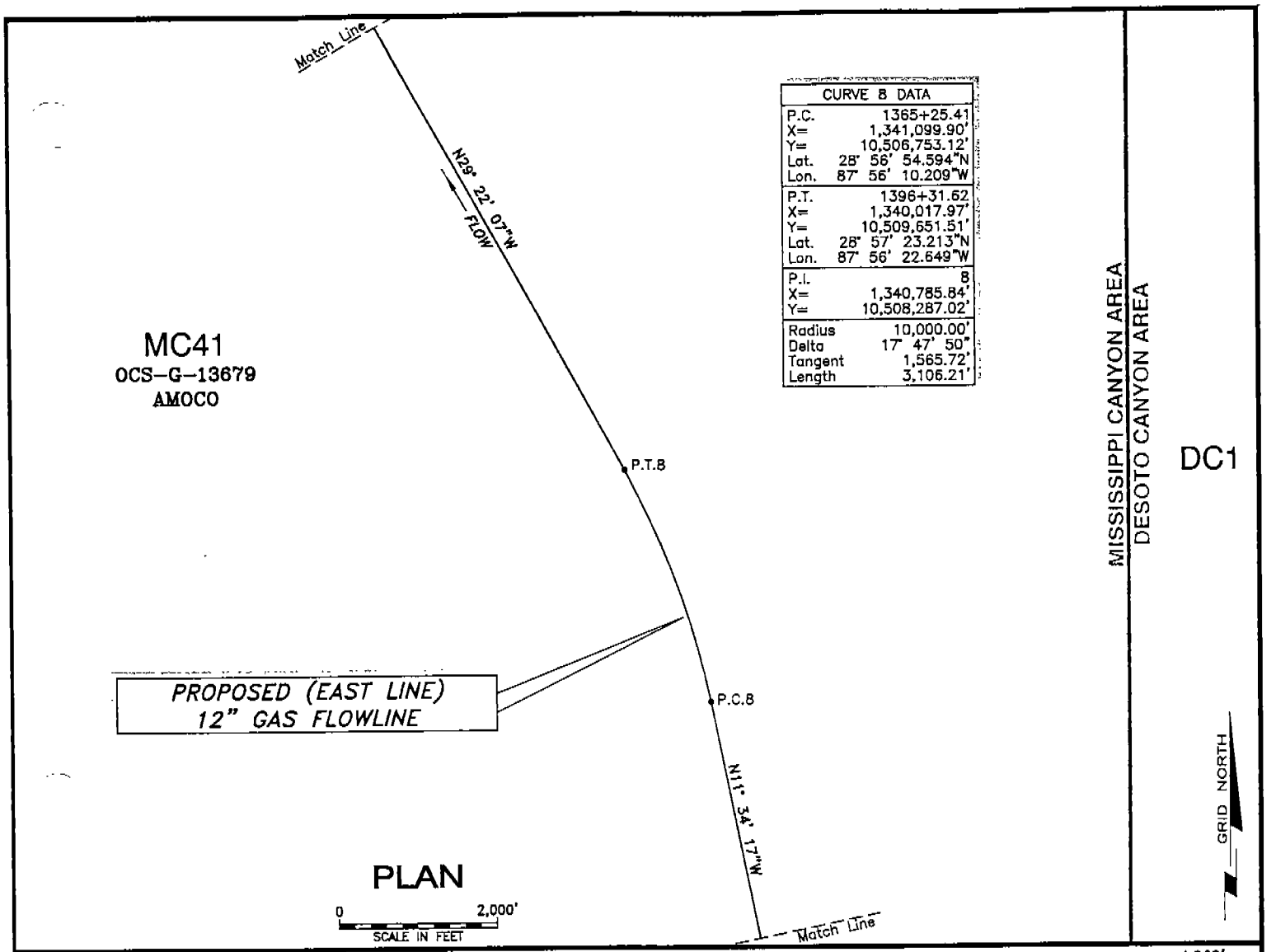
PROPOSED (EAST LINE) 12" GAS FLOWLINE

MISSISSIPPI CANYON BLK 348 @ WELL #1 TO
MAIN PASS BLK 261-PROP "JP" PLATFORM
GULF OF MEXICO

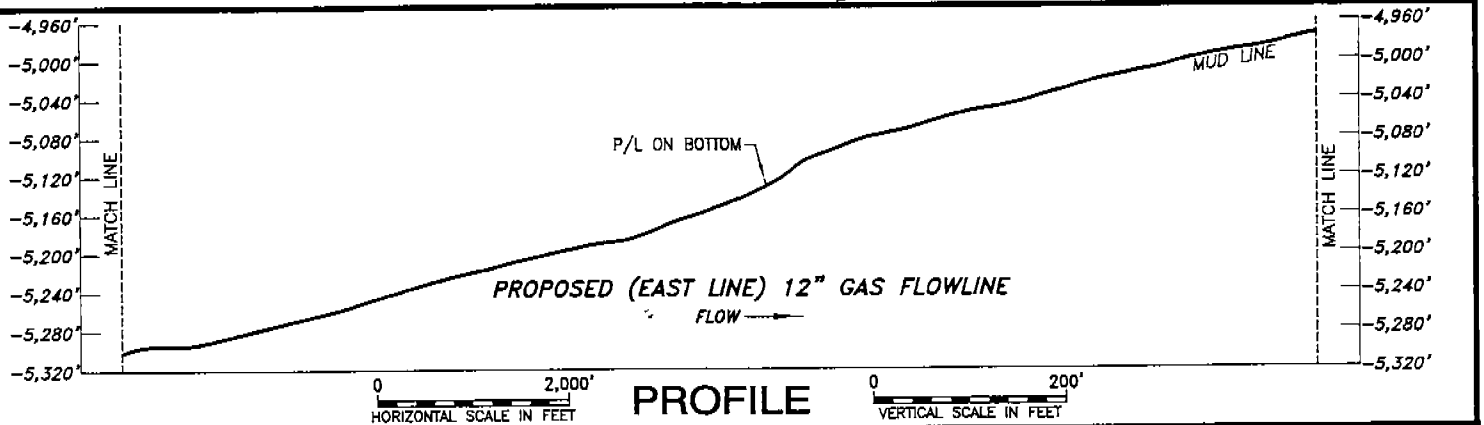
JOHN E. CHANCE & ASSOCIATES, INC. | UCRD

GEODETIC DATUM: NAD 1927 PROJECTION: U.T.M. 15 GRID UNITS: US SURVEY FEET	SCALE AS SHOWN
Job No.: 00-3516 | Date: 02/11/01 | Drwn: MGK	Chart: 13 Of: 27
Dwgfile: H:\2000\003516\CAD\MARINE\003516PPEAST	

Printed: 2/11/01



CURVE 8 DATA	
P.C.	1365+25.41
X=	1,341,099.90'
Y=	10,506,753.12'
Lat.	28° 56' 54.594"N
Lon.	87° 56' 10.209"W
P.T.	1396+31.62
X=	1,340,017.97'
Y=	10,509,651.51'
Lat.	28° 57' 23.213"N
Lon.	87° 56' 22.649"W
P.I.	8
X=	1,340,785.84'
Y=	10,508,287.02'
Radius	10,000.00'
Delta	17° 47' 50"
Tangent	1,565.72'
Length	3,106.21'



elf exploration inc

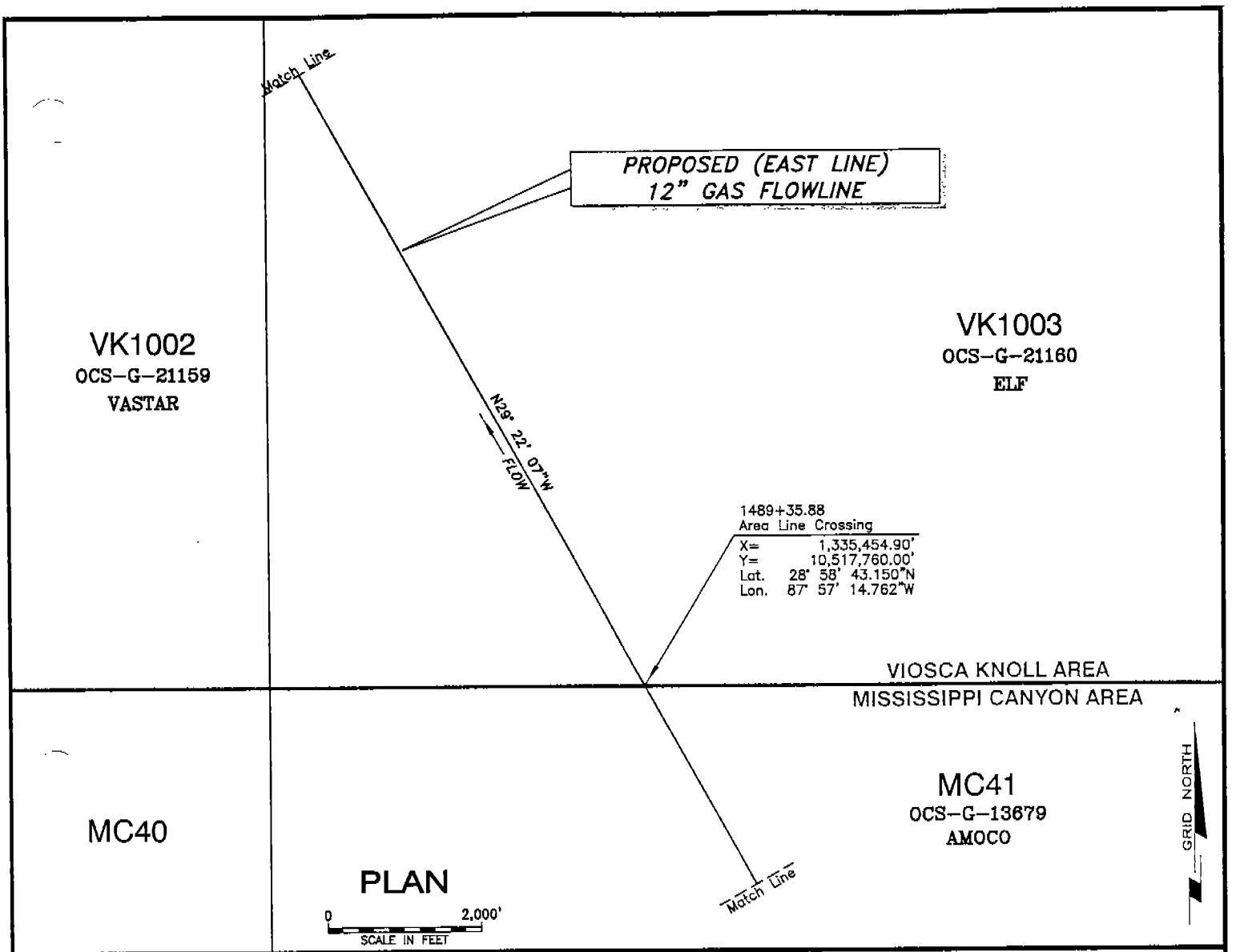
PROPOSED (EAST LINE) 12" GAS FLOWLINE

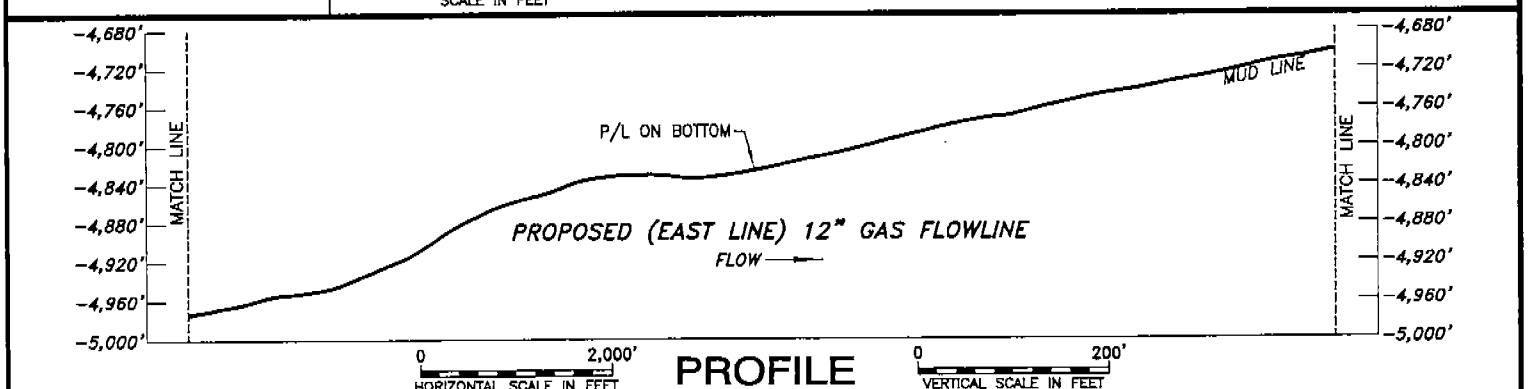
MISSISSIPPI CANYON BLK 348 @ WELL #1 TO
MAIN PASS BLK 261-PROP "JP" PLATFORM
GULF OF MEXICO

JOHN E. CHANCE & ASSOCIATES, INC. (UCRO)

GEODETIC DATUM: NAD 1927 PROJECTION: U.T.M. 16 GRID UNITS: US SURVEY FEET	SCALE AS SHOWN
Job No.: 00-3516 | Date: 02/11/01 | Drwn: MGK	Chart: 14 Of: 27
Dwgfile: H:\2000\003516\CAD\MARINE\003516PPEAST	

Printed: 2/11/01





elf exploration inc

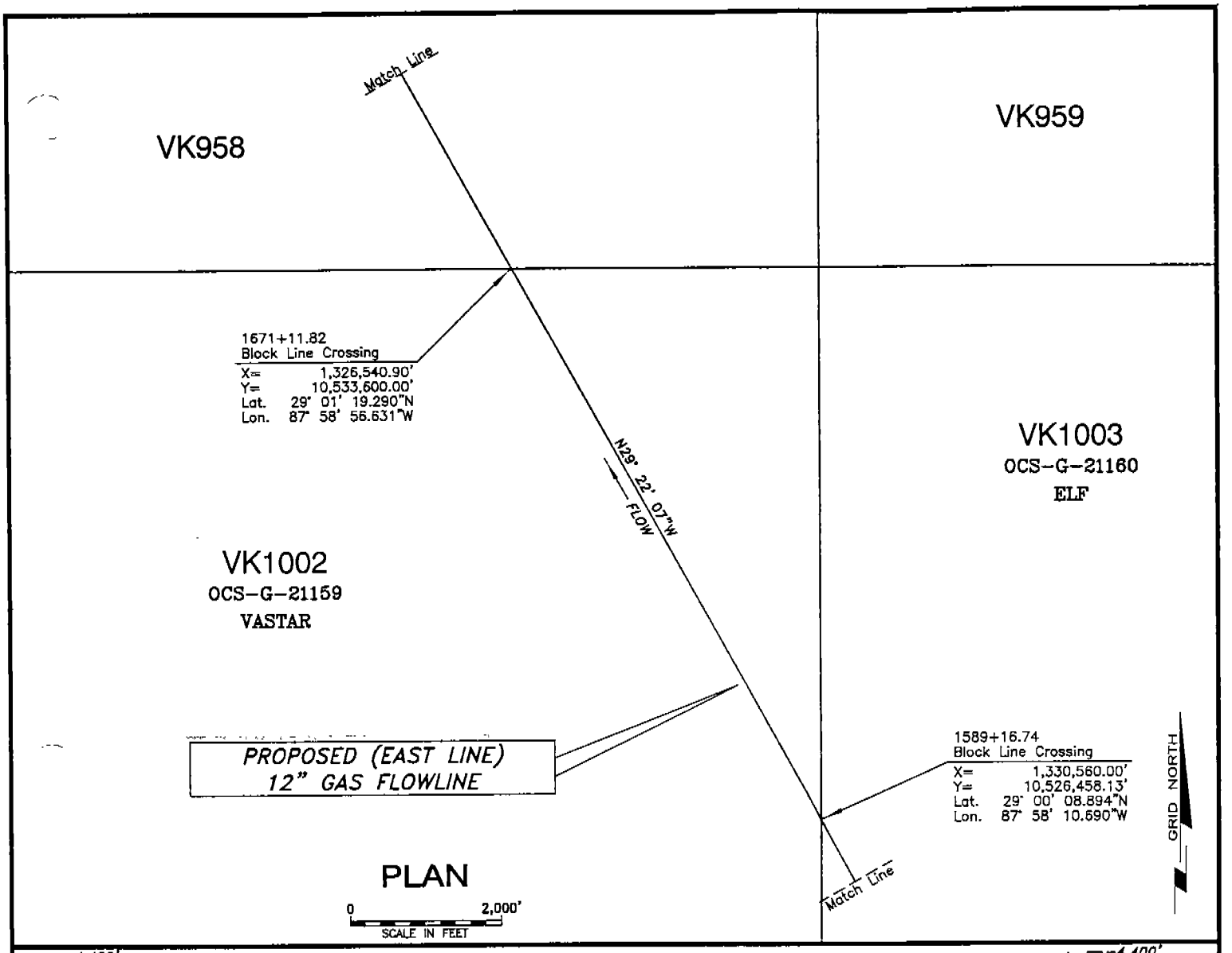
PROPOSED (EAST LINE) 12" GAS FLOWLINE

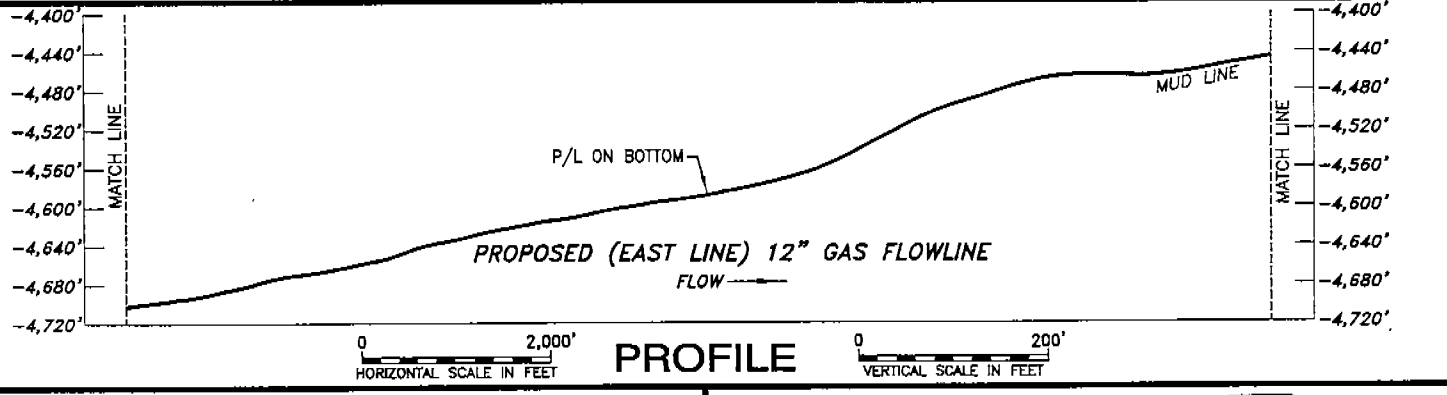
MISSISSIPPI CANYON BLK 348 @ WELL #1 TO
MAIN PASS BLK 261-PROP "JP" PLATFORM
GULF OF MEXICO

JOHN E. CHANCE & ASSOCIATES, INC. (Fugro)

GEODETIC DATUM: NAD 1927 PROJECTION: U.T.M. 16 GRID UNITS: US SURVEY FEET	SCALE AS SHOWN
Job No.: 00-3516 | Date: 02/11/01 | Drwn: MGK	Chart: 15 Of: 27
Dwgfile: H:\2000\003516\CAD\MARINE\003516PPEAST	

Printed: 2/11/01





Printed: 2/11/01

elf exploration inc

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GULF OF MEXICO

JOHN E. CHANCE & ASSOCIATES, INC. — FUGRO

GEODETIC DATUM: NAD 1927 PROJECTION: U.T.M. 16 GRID UNITS: US SURVEY FEET		SCALE AS SHOWN	
Job No.: 00-3516	Date: 02/11/01	Drwn: MGK	Chart: 16 Of: 27
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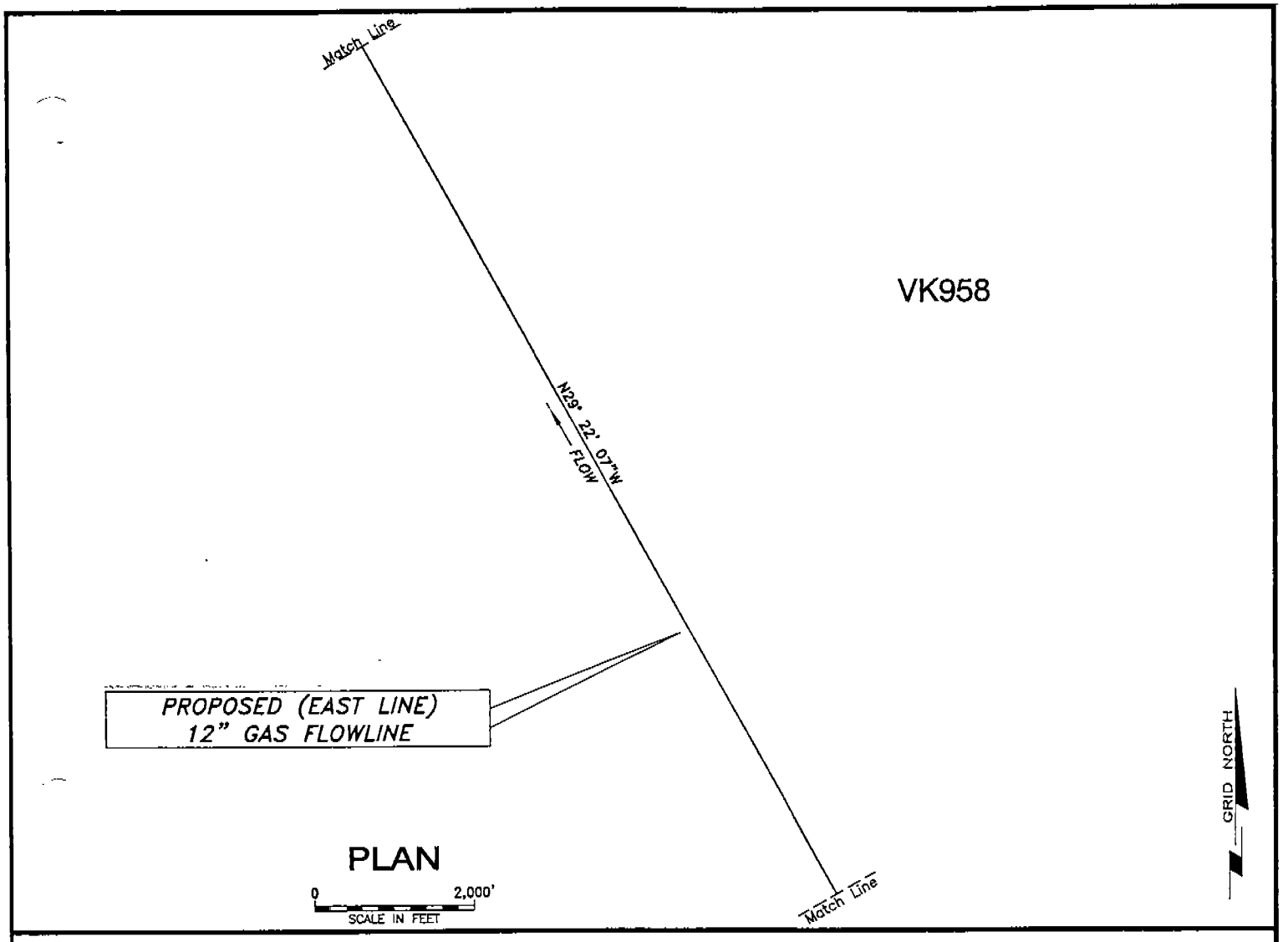

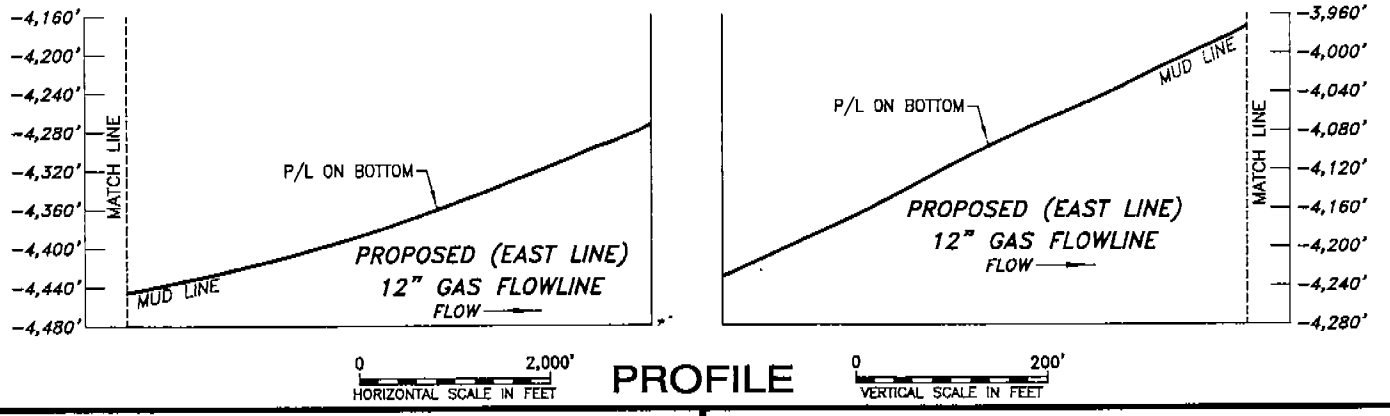

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Job No.: 00-3516	Date: 02/11/01	Drwn: MGK	Chart: 17 Of: 27
Dwgfile: H:\2000\003516\CAD\MARINE\003516PPEAST			

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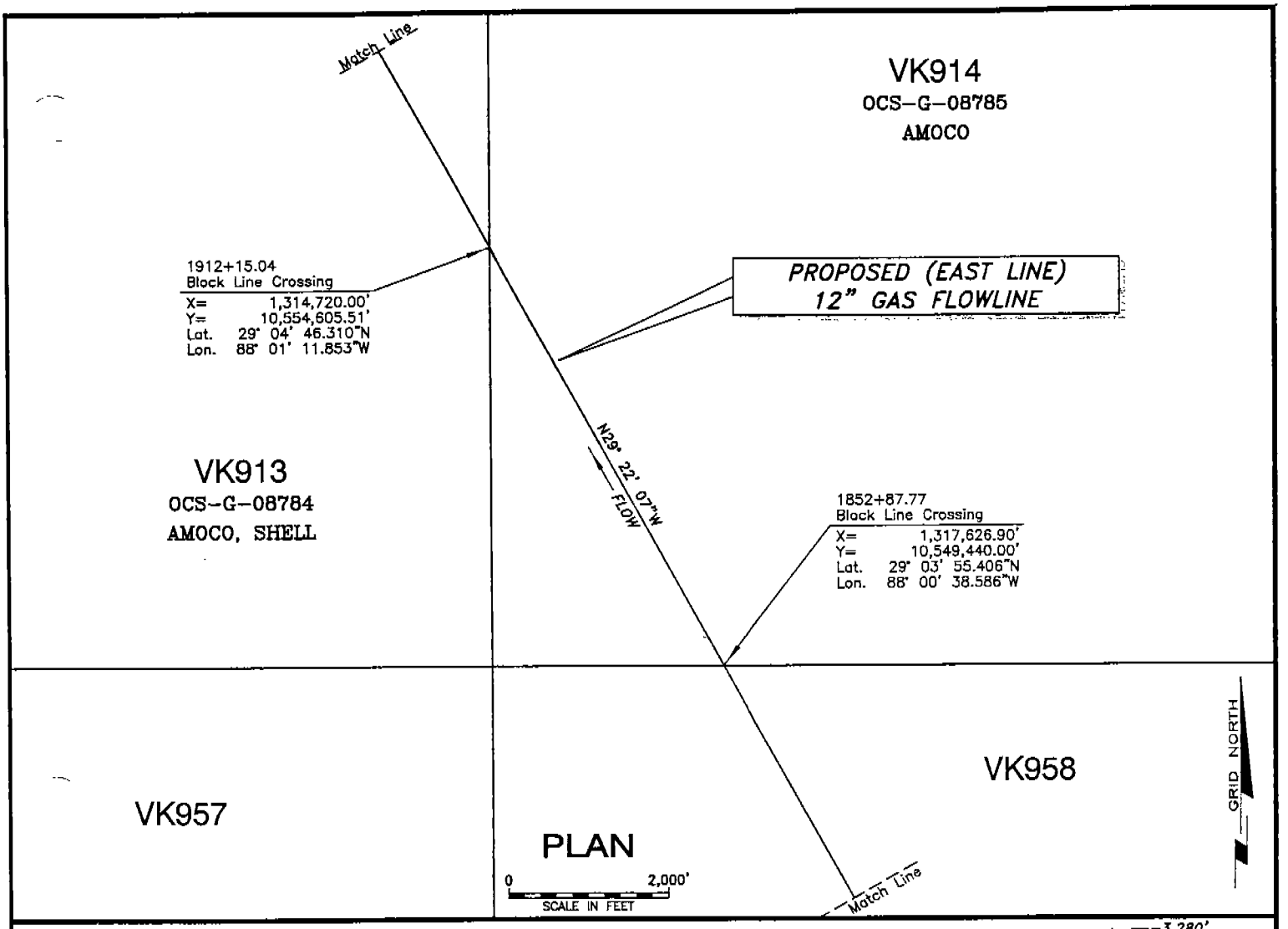

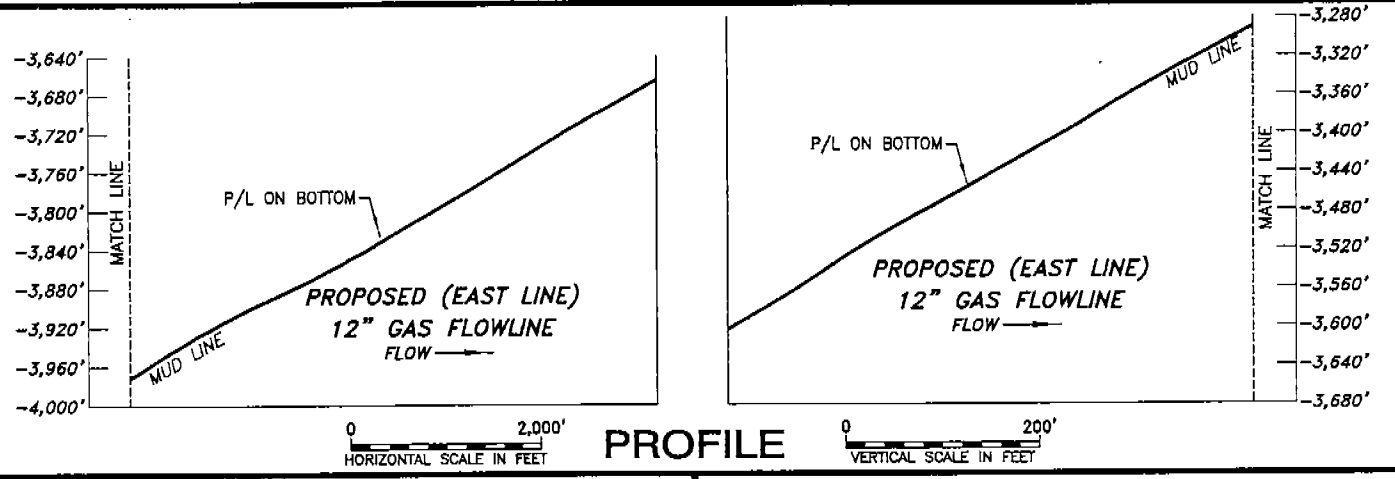

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PROPOSED (EAST LINE) 12" GAS FLOWLINE

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GULF OF MEXICO

JOHN E. CHANCE & ASSOCIATES, INC. (A Fugro Company)

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Job No.: 00-3516 | Date: 02/11/01 | Drwn: MGK	Chart: 18 Of: 27
Dwgfile: H:\2000\003516\CAD\MARINE\003516PPEAST	

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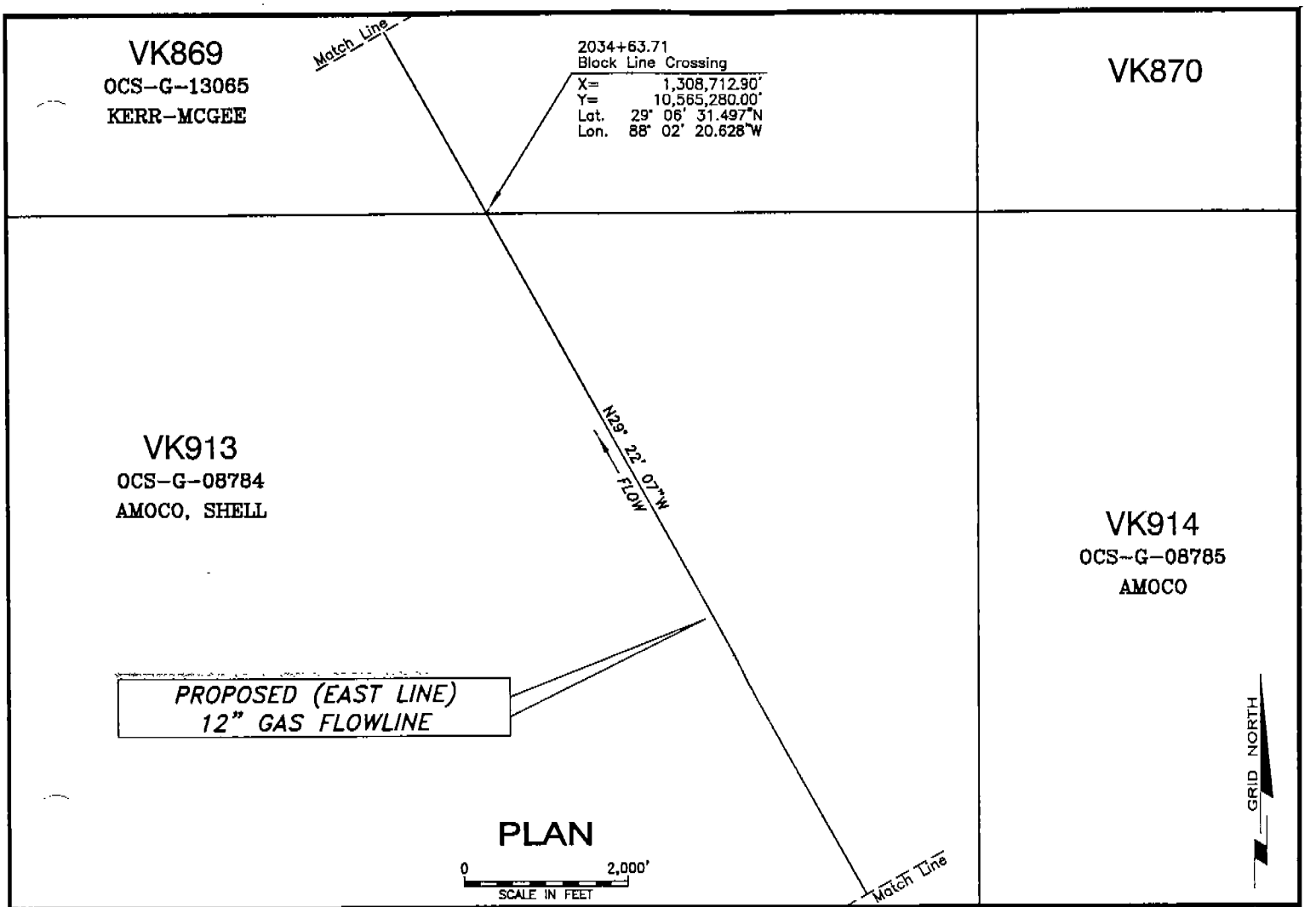

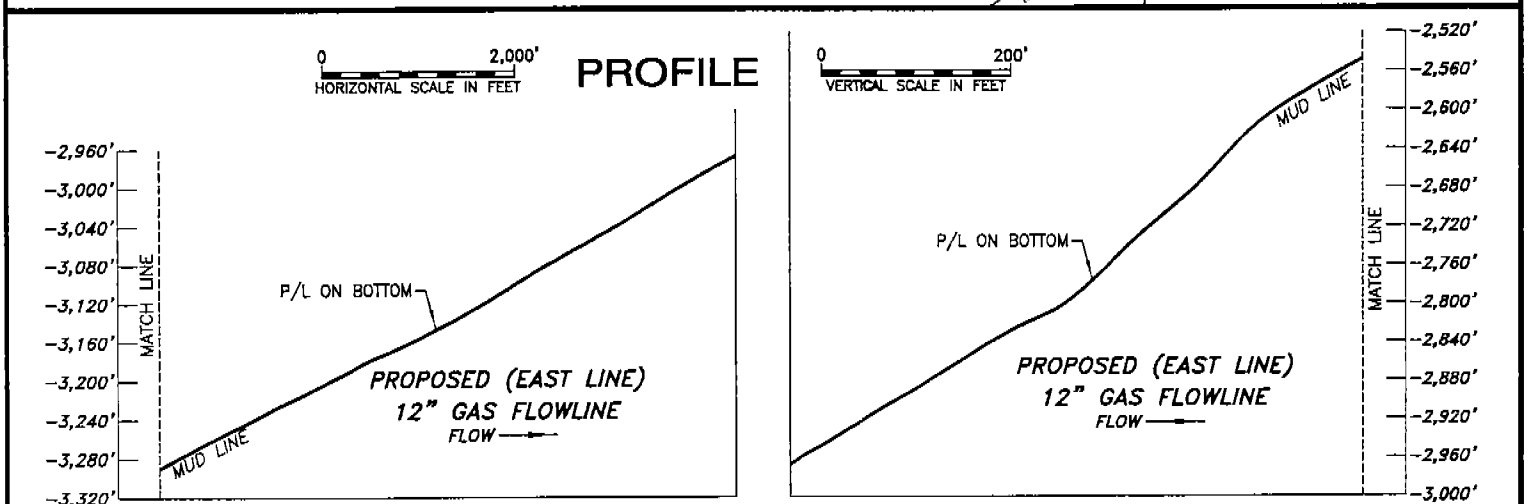

Printed: 2/11/01

elf exploration inc

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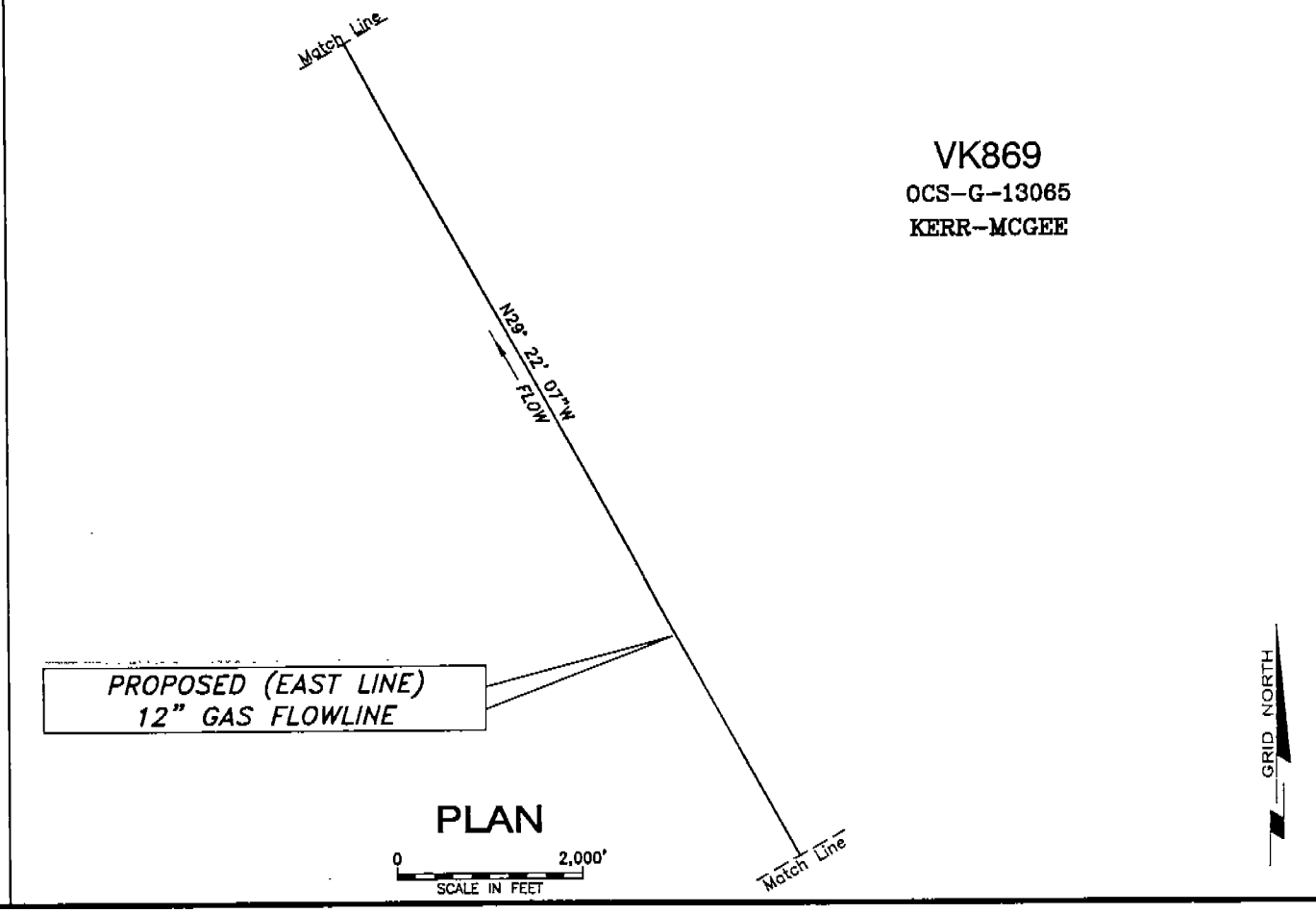
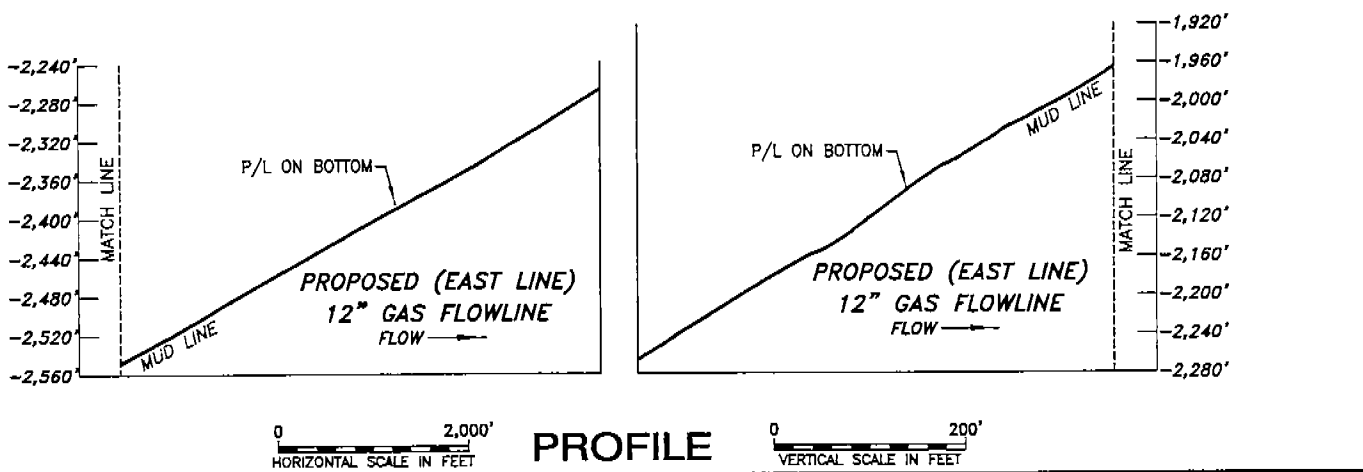
Job No.: 00-3516 | Date: 02/11/01 | Drwn: MGK	Chart: 19 Of: 27
Dwgfile: H:\2000\003516\CAD\MARINE\003516PPEAST	





elf exploration inc

PROPOSED (EAST LINE) 12" GAS FLOWLINE

MISSISSIPPI CANYON BLK 348 @ WELL #1 TO
MAIN PASS BLK 261-PROP "JP" PLATFORM
GULF OF MEXICO

JOHN E. CHANCE & ASSOCIATES, INC. — LUCRO

GEODETIC DATUM: NAD 1927 PROJECTION: U.T.M. 16 GRID UNITS: US SURVEY FEET		SCALE AS SHOWN	
Job No.: 00-3516	Date: 02/11/01	Drwn: MGK	Chart: 20 Of: 27
Dwgfile: H:\2000\003516\CAD\MARINE\003516PPEAST			

Printed: 2/11/01

VK824

CURVE 9 DATA	
P.C.	2161+67.61
X=	1,302,482.55'
Y=	10,576,351.21'
Lat.	29° 08' 20.580"N
Lon.	88° 03' 32.001"W
P.T.	2203+28.14
X=	1,301,243.92'
Y=	10,580,291.71'
Lat.	29° 08' 59.490"N
Lon.	88° 03' 46.372"W
P.I.	9
X=	1,301,447.36'
Y=	10,578,190.73'
Radius	10,000.00'
Delta	23° 50' 17"
Tangent	2,110.80'
Length	4,160.53'

Match Line

N05° 31' 50"W FLOW

VK825
OCS-G-05778
KERR-MCGEE

2211+60.30
Block Line Crossing
X= 1,301,163.72'
Y= 10,581,120.00'
Lat. 29° 09' 07.685"N
Lon. 88° 03' 47.361"W

P.T.9

PROPOSED (EAST LINE)
12" GAS FLOWLINE

VK868

VK869
OCS-G-13065
KERR-MCGEE

GRID NORTH

N29° 22' 07"W

P.C.9

Match Line

PLAN

0 2,000'
SCALE IN FEET

-1,600'
-1,640'
-1,680'
-1,720'
-1,760'
-1,800'
-1,840'
-1,880'
-1,920'
-1,960'
-2,000'

MATCH LINE

P/L ON BOTTOM

PROPOSED (EAST LINE) 12" GAS FLOWLINE FLOW

MUD LINE

MATCH LINE

0 2,000'
HORIZONTAL SCALE IN FEET

PROFILE

0 200'
VERTICAL SCALE IN FEET

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PROPOSED (EAST LINE) 12" GAS FLOWLINE

MISSISSIPPI CANYON BLK 348 @ WELL #1 TO
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GULF OF MEXICO

JOHN E. CHANCE & ASSOCIATES, INC. — FUGRO

GEODETIC DATUM: NAD 1927 PROJECTION: U.T.M. 16 GRID UNITS: US SURVEY FEET		SCALE AS SHOWN	
Job No.: 00-3516	Date: 02/11/01	Drwn: MGK	Chart: Of: 21 27
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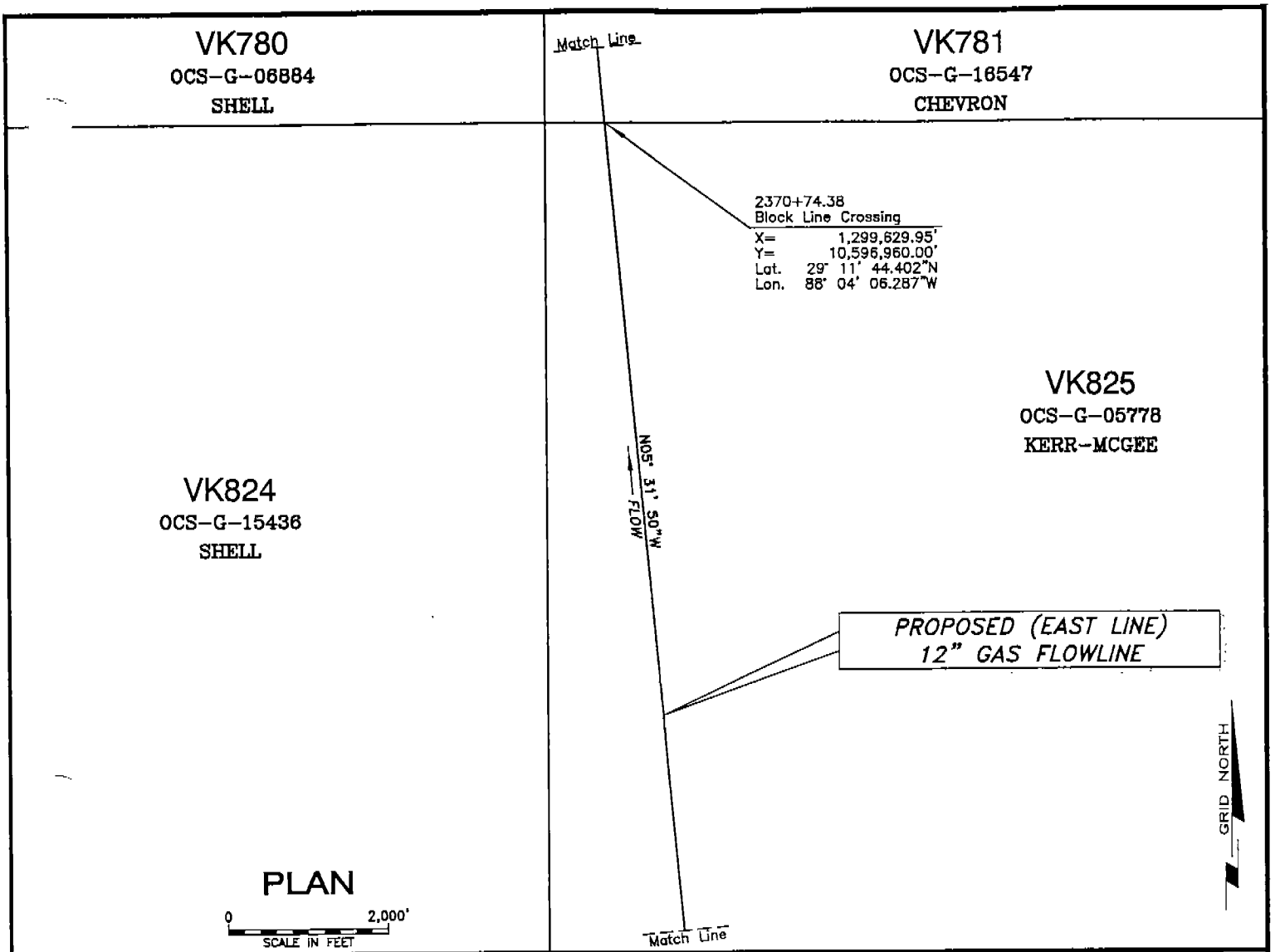

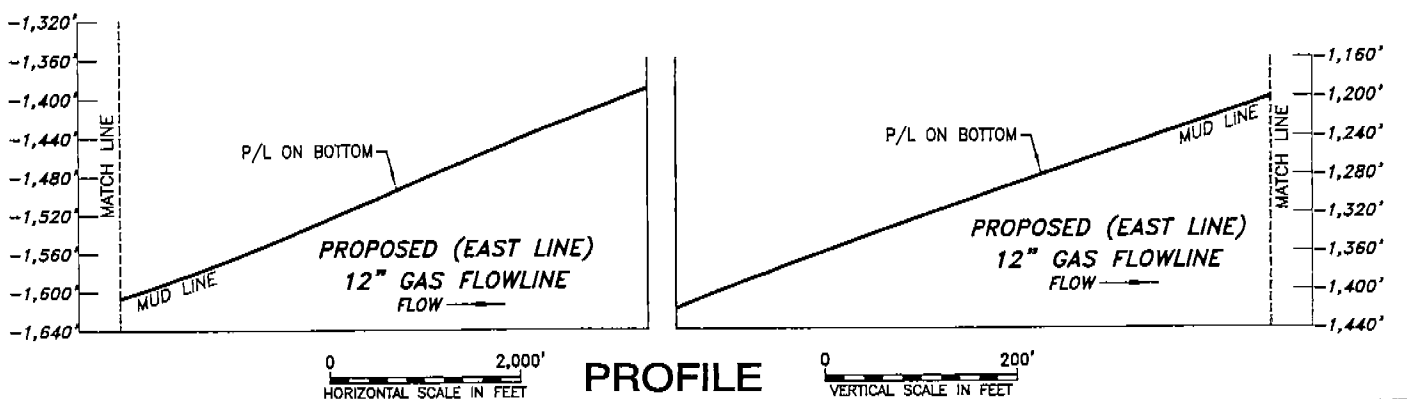

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JOHN E. CHANCE & ASSOCIATES, INC. (Fugro)

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Job No.: 00-3516	Date: 02/11/01	Drwn: MGK	Chart: 22 Of: 27
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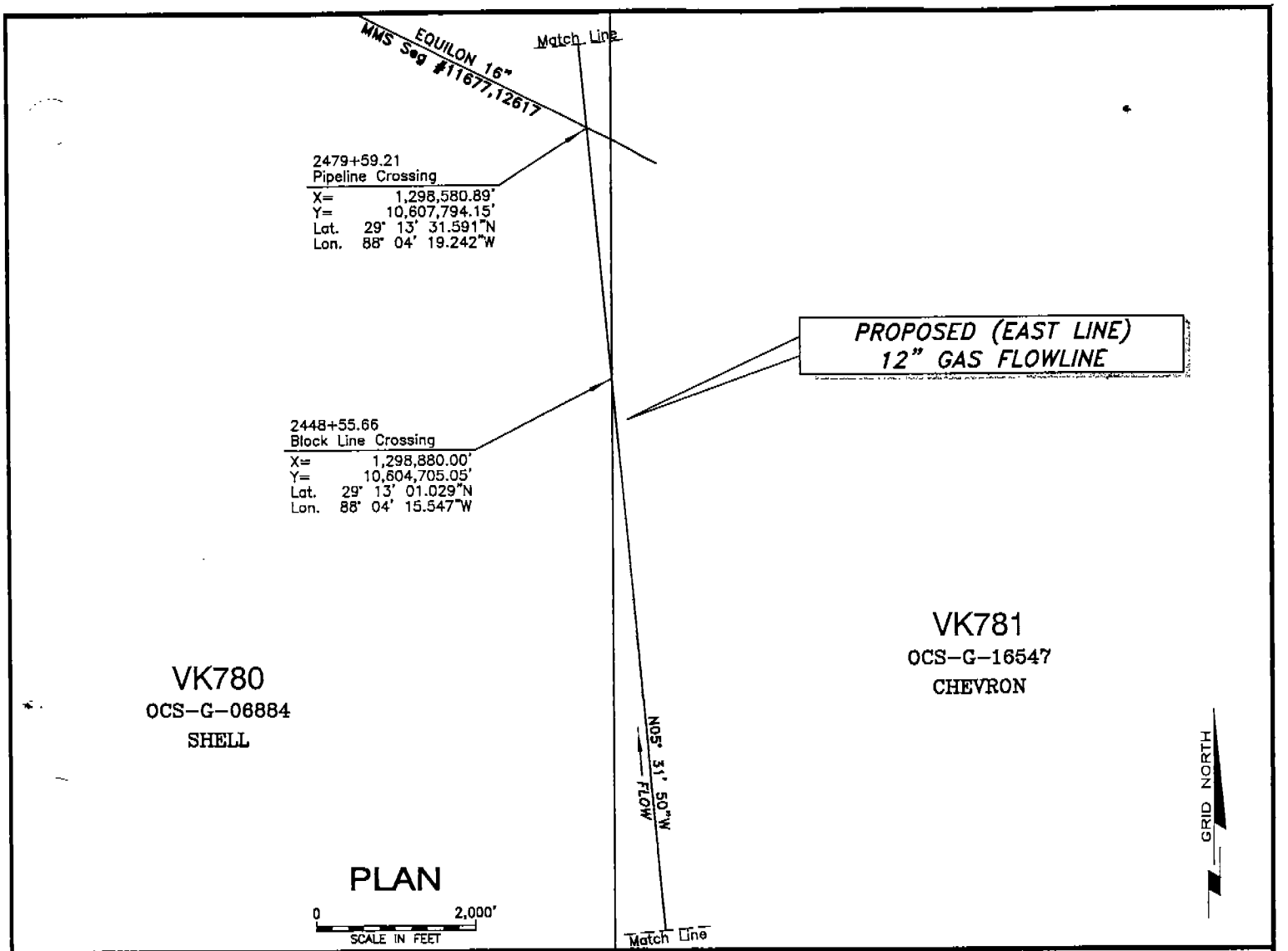

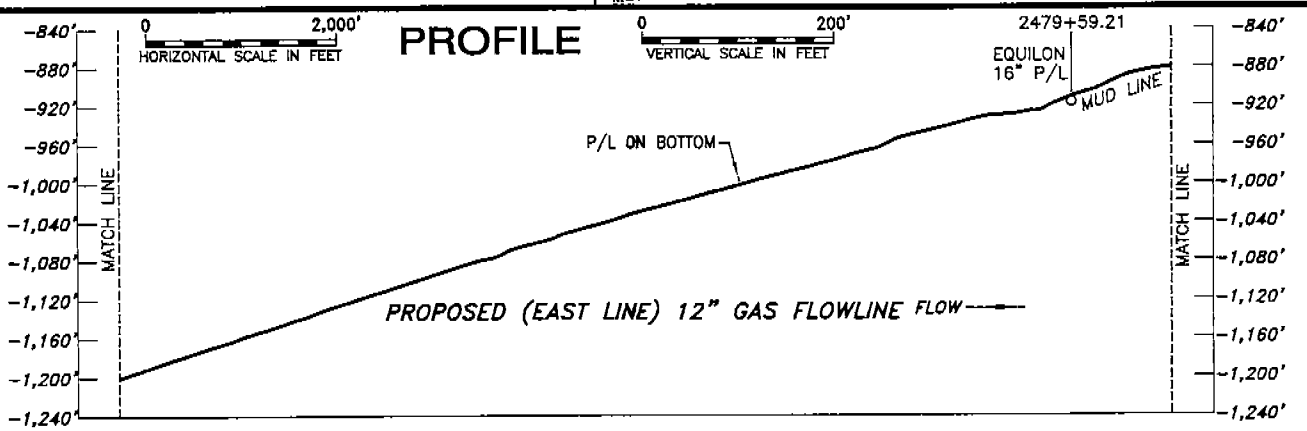

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GULF OF MEXICO

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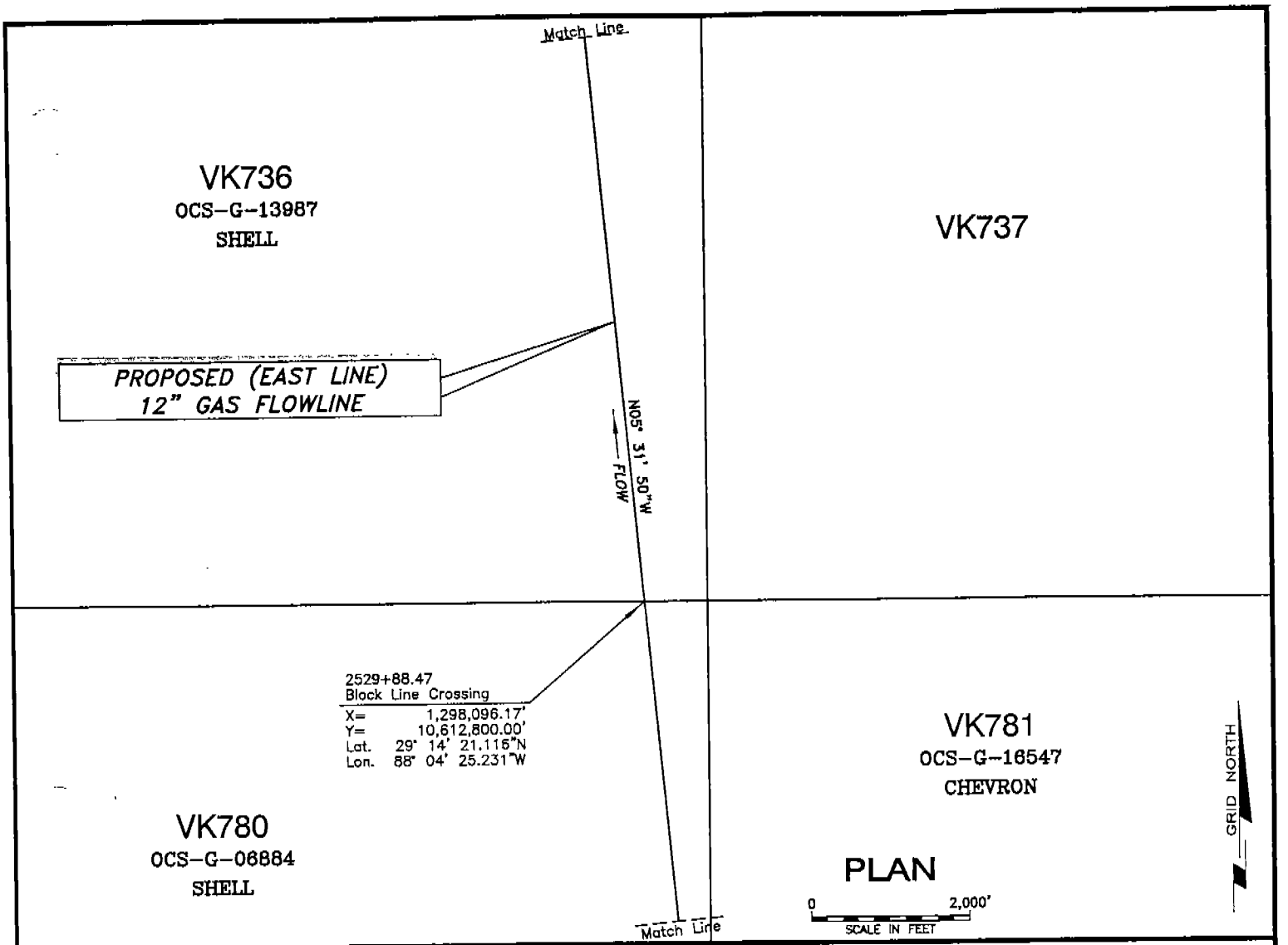
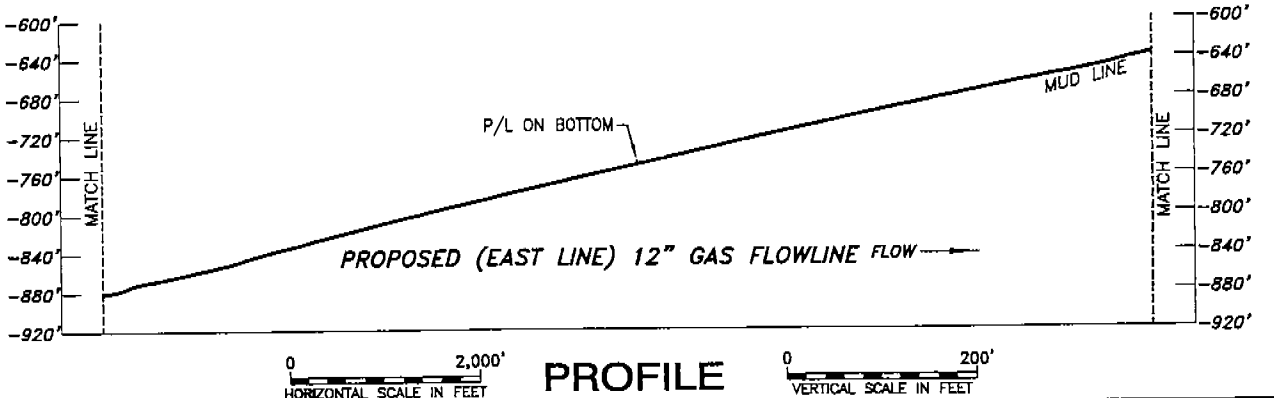
Job No.: 00-3516 | Date: 02/11/01 | Drwn: MGK	Chart: 23 Of: 27
Dwgfile: H:\2000\003516\CAD\MARINE\003516PPEAST	

Printed: 2/11/01





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PROPOSED (EAST LINE) 12" GAS FLOWLINE

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GULF OF MEXICO

JOHN E. CHANCE & ASSOCIATES, INC. (UCRO)

GEODETIC DATUM: NAD 1927 PROJECTION: U.T.M. 16 GRID UNITS: US SURVEY FEET	SCALE AS SHOWN
Job No.: 00-3516 | Date: 02/11/01 | Drwn: MGK	Chart: 24 Of: 27
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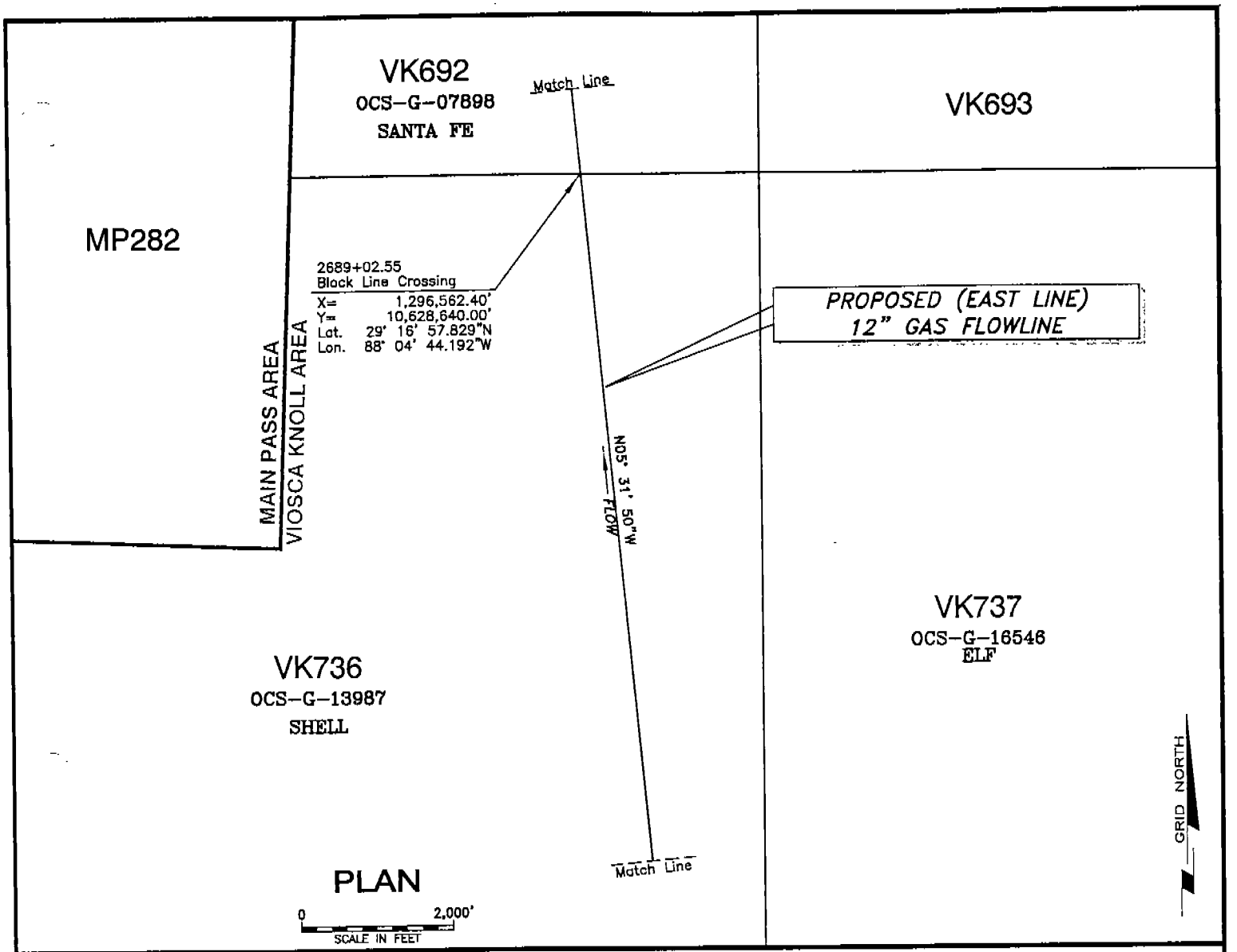

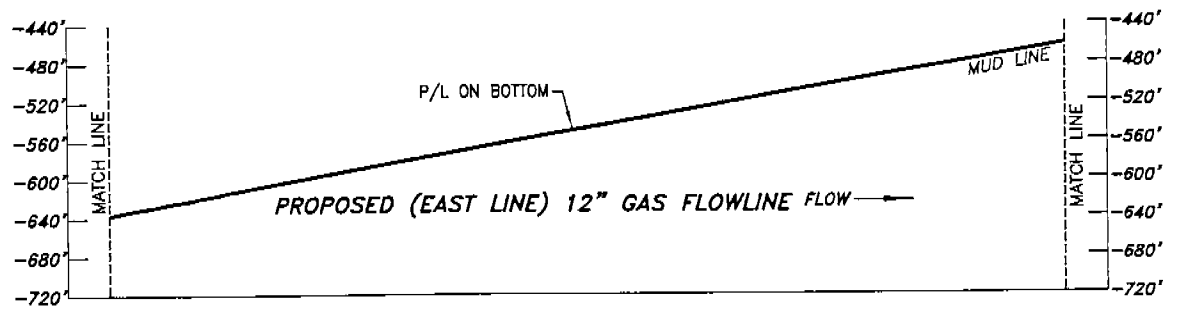

elf exploration inc

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GULF OF MEXICO

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GEODETIC DATUM: NAD 1927 PROJECTION: U.T.M. 16 GRID UNITS: US SURVEY FEET	SCALE AS SHOWN
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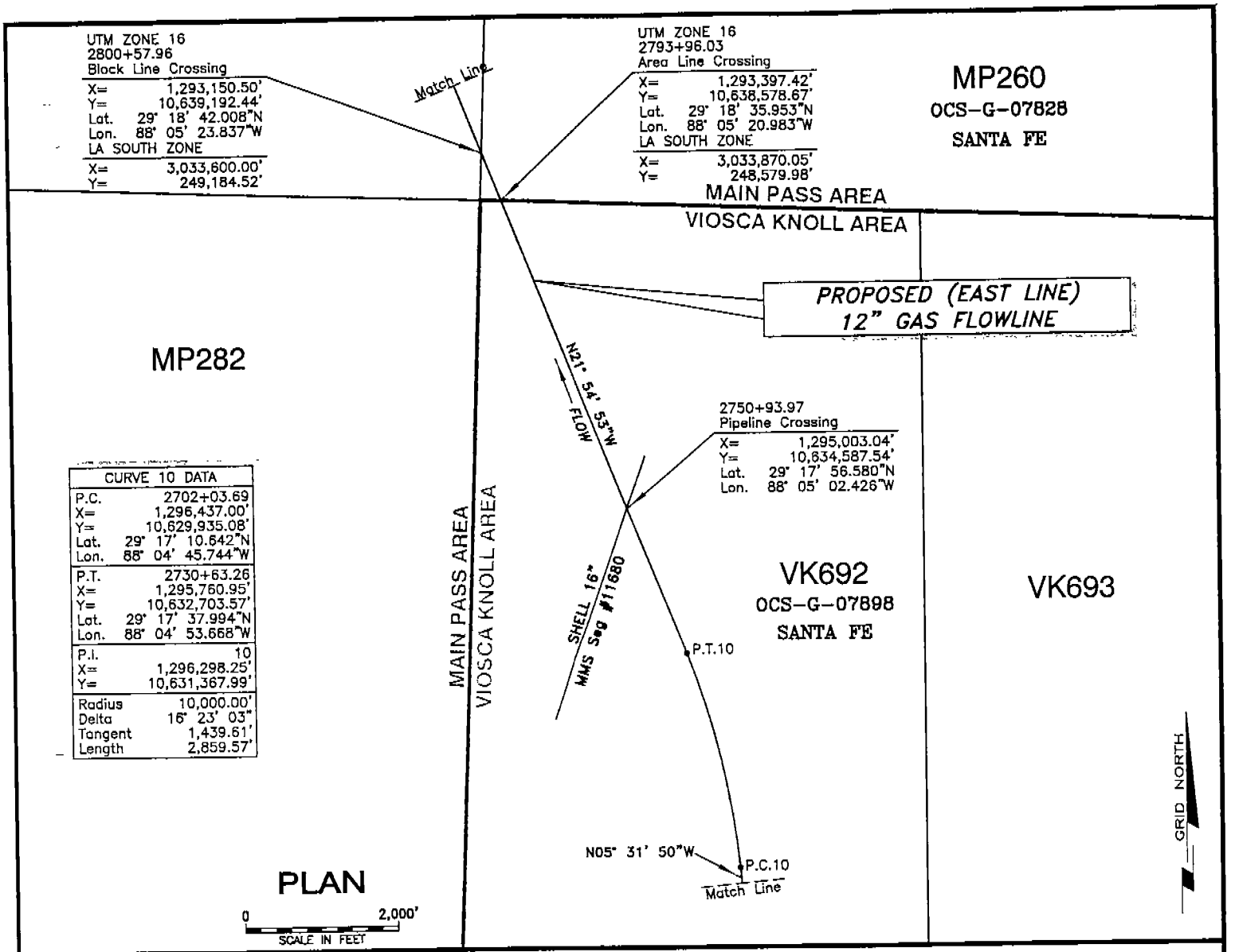

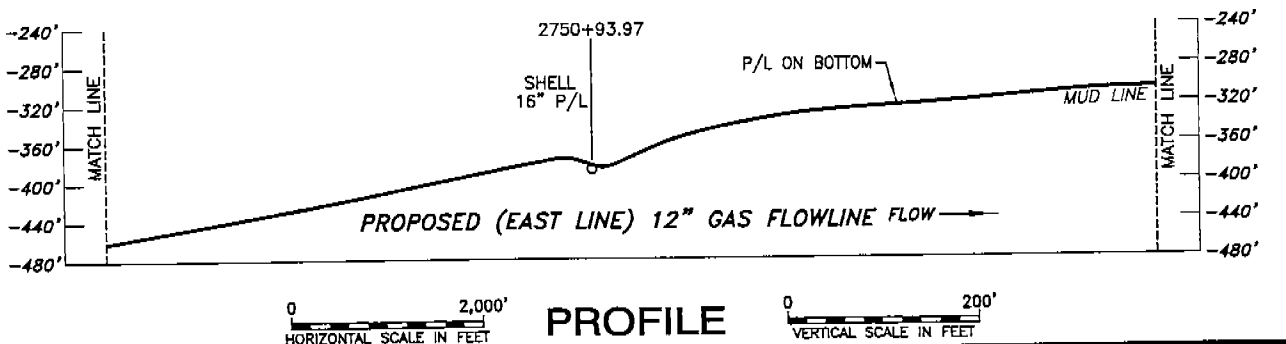

Printed: 2/11/01

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GEODETIC DATUM: NAD 1927 PROJECTION: U.T.M. 16 GRID UNITS: US SURVEY FEET	SCALE AS SHOWN
Job No.: 00-3516 Date: 02/11/01 Drwn: MGK	Chart: 26 Of: 27
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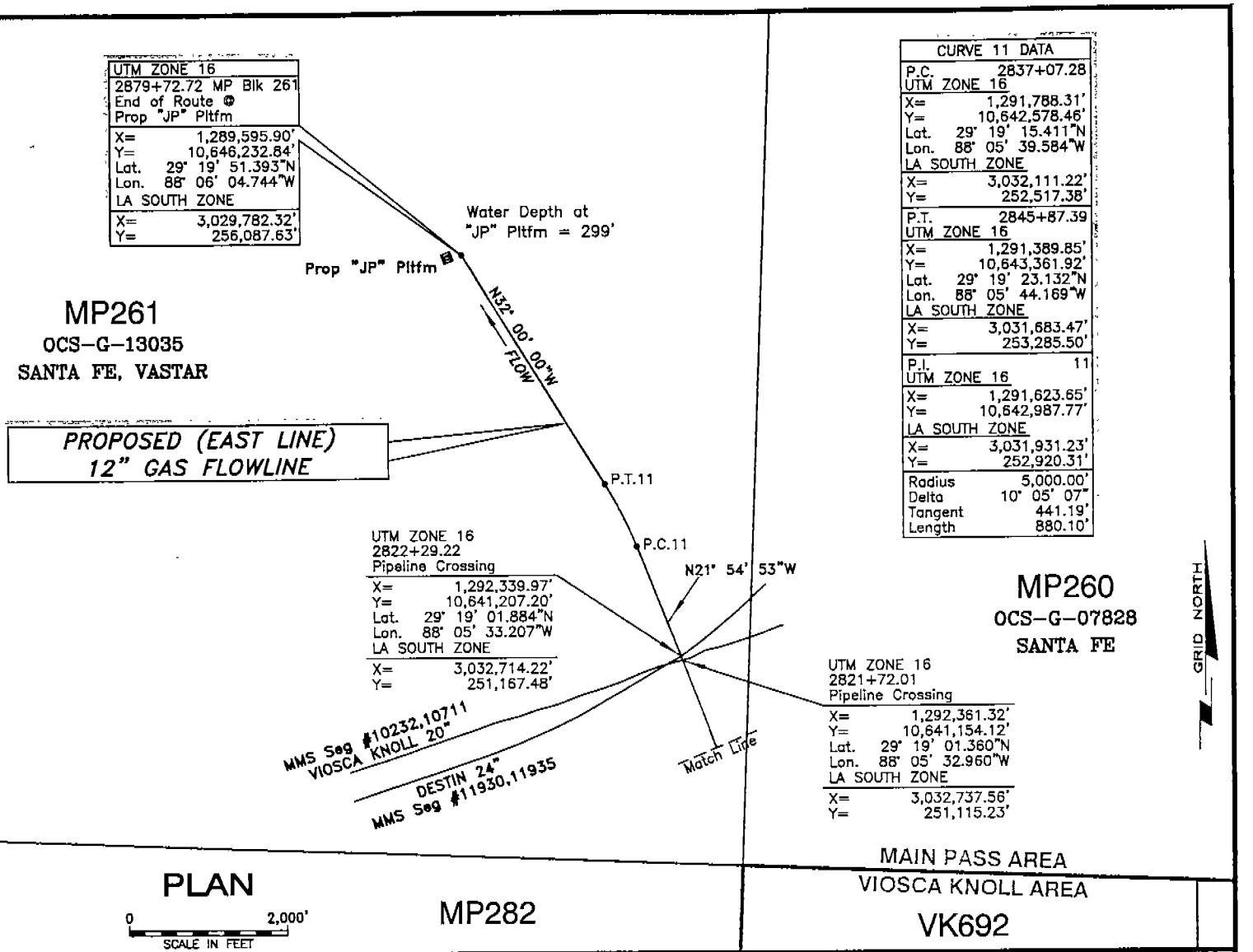

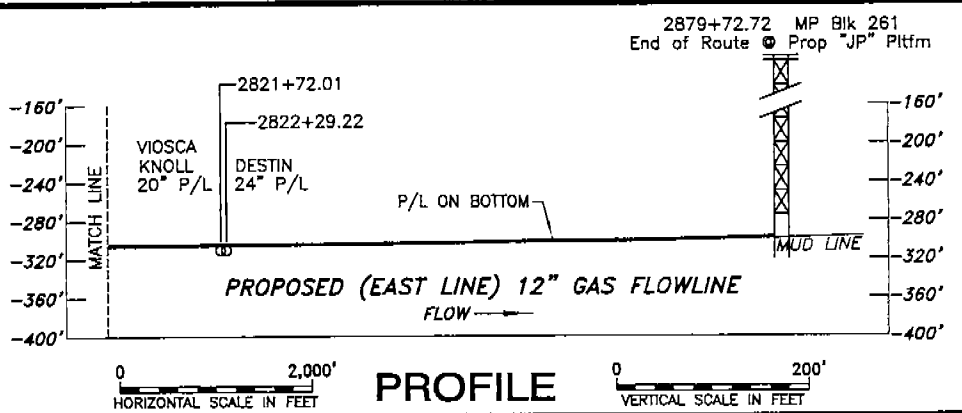

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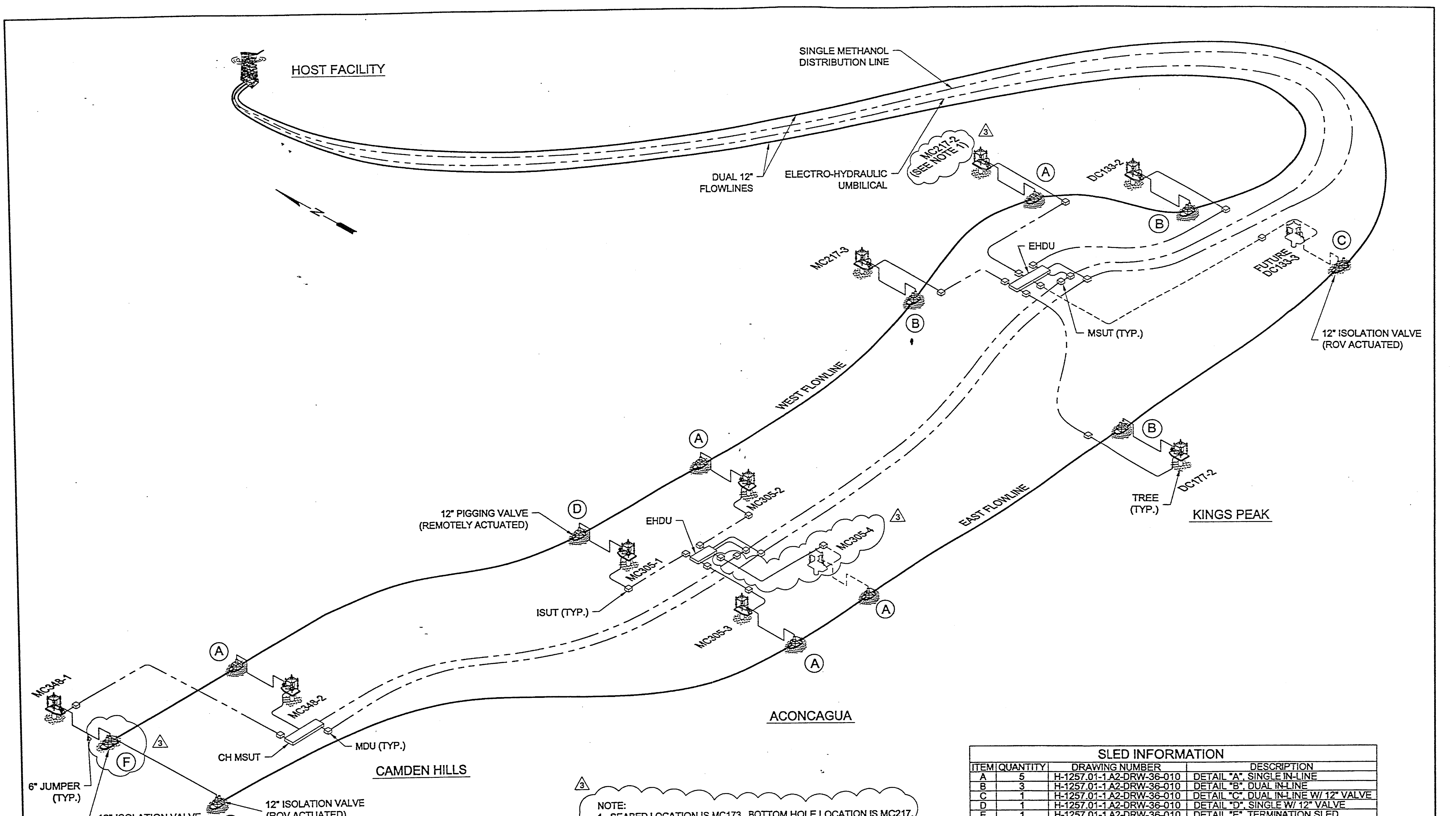
Dwgfile: H:\2000\003516\CAD\MARINE\003516PPEAST			

Printed: 2/11/01



NOTE:
1. SEABED LOCATION IS MC173. BOTTOM HOLE LOCATION IS MC217.

SLED INFORMATION

ITEM	QUANTITY	DRAWING NUMBER	DESCRIPTION
A	5	H-1257.01-1.A2-DRW-36-010	DETAIL "A", SINGLE IN-LINE
B	3	H-1257.01-1.A2-DRW-36-010	DETAIL "B", DUAL IN-LINE
C	1	H-1257.01-1.A2-DRW-36-010	DETAIL "C", DUAL IN-LINE W/ 12" VALVE
D	1	H-1257.01-1.A2-DRW-36-010	DETAIL "D", SINGLE W/ 12" VALVE
E	1	H-1257.01-1.A2-DRW-36-010	DETAIL "E", TERMINATION SLED
F	1	H-1257.01-1.A2-DRW-36-010	DETAIL "F", 2-WAY TERMINATION SLED

REF No	REFERENCE DRAWING TITLE	DRAWING No
1	FIELD ARRANGEMENT ALTERNATE CASE 9 CAMDEN HILLS/ACONCAGUA/ KINGS PEAK FLOWLINE SLED SCHEMATICS	H-1257.01-1.A2-DRW-36-010
2	SYSTEM P&ID CASE 9 KINGS PEAK FIELD SHEET 1 OF 3	H-1257.01-1.A2-DRW-36-013
3	SYSTEM P&ID CASE 9 ACONCAGUA FIELD SHEET 2 OF 3	H-1257.01-1.A2-DRW-36-014
4	SYSTEM P&ID CASE 9 CAMDEN HILS FIELD SHEET 3 OF 3	H-1257.01-1.A2-DRW-36-015

REV	DESCRIPTION	DATE OF ISSUE	REV'D BY	CHK'D BY	PROJ MGR	CLIENT APPROVAL
0	ISSUED FOR REFERENCE	11-02-00	HWS	ANC	JPS	
1	REVISED FOR NEW HOST/RELOCATED SMDL AND UMBILICAL/REMOVED MC 348-3	12-18-00	JAS	BGC	JPS	
2	REVISED EAST FLOWLINE SLEDS (AC/KP)	1-26-01	JLP	JPS	JPS	
3	REVISED SLED AT MC348-1 AND REFERENCE DRAWINGS	2-12-01	KGC			

INTEC ENGINEERING

	DRAWN	CHECKED	ENGINEER	CLIENT
BY	JAS	ANC	JPS	
DATE	9-27-00	9-27-00	9-27-00	
SCALE AT "B" SIZE	NONE	PRINTED FEB 13, 2001 10:40 AM KGC		

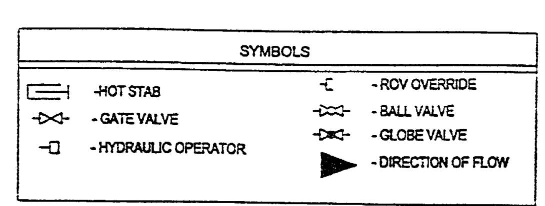
elf exploration inc

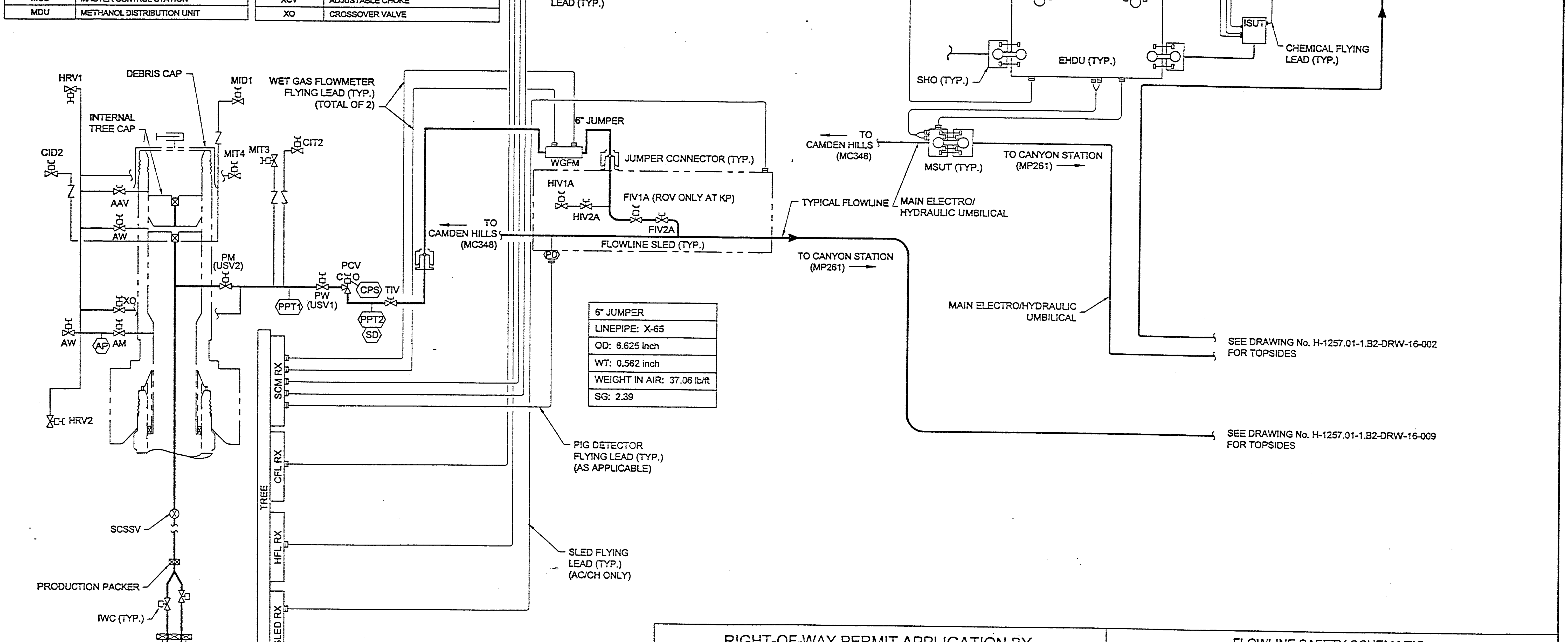
FIELD ARRANGEMENT ALTERNATE CASE 9
CAMDEN HILLS/ACONCAGUA/KINGS PEAK

H-1257.01 - 1.A2 - DRW - 36 - 008 - 3
PROJECT NUMBER CTR TYPE GROUP NUMBER REV

ABBV.	DEFINITION
AAV	ANNULUS ACCESS VALVE
AM	ANNULUS MASTER VALVE
AW	ANNULUS WING VALVE
CFL	CHEMICAL FLYING LEAD
CID2	CHEMICAL INJECTION VALVE DOWNHOLE
CIU	CHEMICAL INJECTION UNIT
CIT2	CHEMICAL INJECTION VALVE TREE
CPS	CHOKE POSITION SENSOR
EHDU	ELECTRO/HYDRAULIC DISTRIBUTION UNIT
EPU	ELECTRICAL POWER UNIT
FC	FAIL CLOSED
FIV1 & 2	FLOWLINE ISOLATION VALVE
HFL	HYDRAULIC FLYING LEAD
HIV1 & 2	HEADER ISOLATION VALVE
HOV	HYDRAULICALLY OPERATED VALVE
HPU	HYDRAULIC POWER UNIT
HRV1 & 2	HYDRATE REMEDIATION VALVE
ISUT	INFIELD SUBSEA UMBILICAL TERMINATION
IWC	INTELLIGENT WELL COMP
KAH	FLOWLINE (DEPARTING)
MCC	MOTOR CONTROL CENTER
MCS	MASTER CONTROL STATION
MDU	METHANOL DISTRIBUTION UNIT

ABBV.	DEFINITION
MID1	METHANOL INJECTION DOWNHOLE
MIT 3 & 4	METHANOL INJECTION TREE
MSUT	MAIN SUBSEA UMBILICAL TERMINATION
NC	NORMALLY CLOSED
PCS	PLATFORM CONTROL SYSTEM
PCV	PRODUCTION CHOKE VALVE
PD	PIG DETECTOR
PM	PRODUCTION MASTER VALVE
PPT	PRODUCTION PRESSURE & TEMP
PW	PRODUCTION WING VALVE
ROT	REMOTE OPERATOR TERMINAL
RX	RECEIVER PLATE
SCM	SUBSEA CONTROL MODULE
SD	SAND DETECTOR
SDV	SHUTDOWN VALVE
SHO	STAB AND HINGE-OVER
SMDL	SINGLE METHANOL DISTRIBUTION LINE
TIV	TREE ISOLATION VALVE
TUTB	TOPSIDE UMBILICAL TERMINATION BOX
UPS	UNINTERRUPTIBLE POWER SUPPLY
WGFM	WET GAS FLOWMETER
XCV	ADJUSTABLE CHOKE
XO	CROSSOVER VALVE





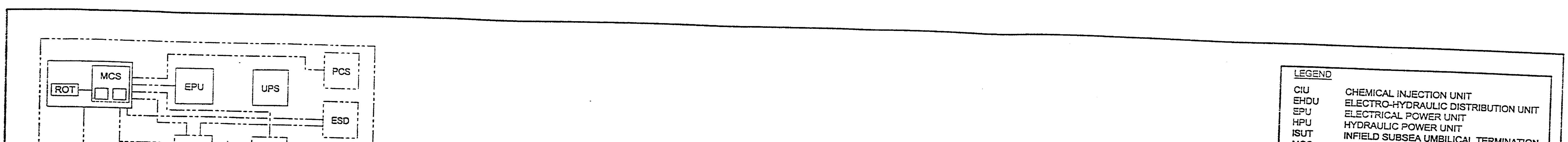
NOTES:
1. REFER TO H-1257.01-1.B1-PER-003 FOR ADDITIONAL DETAILS.

RIGHT-OF-WAY PERMIT APPLICATION BY
MARATHON OIL COMPANY
TOTALFINA ELF E&P USA, INC.
BP-AMOCO, INC.

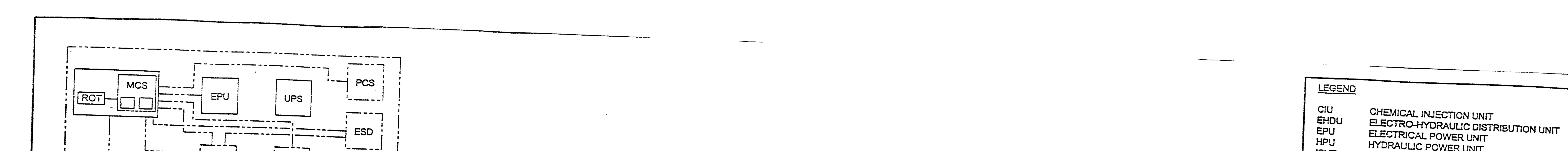
FLOWLINE SAFETY SCHEMATIC
ACONCAGUA/CAMDEN HILLS TYPICAL WELL
CANYON EXPRESS WEST FLOWLINE SYSTEM

MC-348 TO MP-261 — GULF OF MEXICO

DRAWN BY	AHG	CHECKED BY	GPS	DATE	2-14-01	SHEET	1 OF 1	DRAWING NO.	H-1257.01-1.B2-DRW-16-001	REV.	B



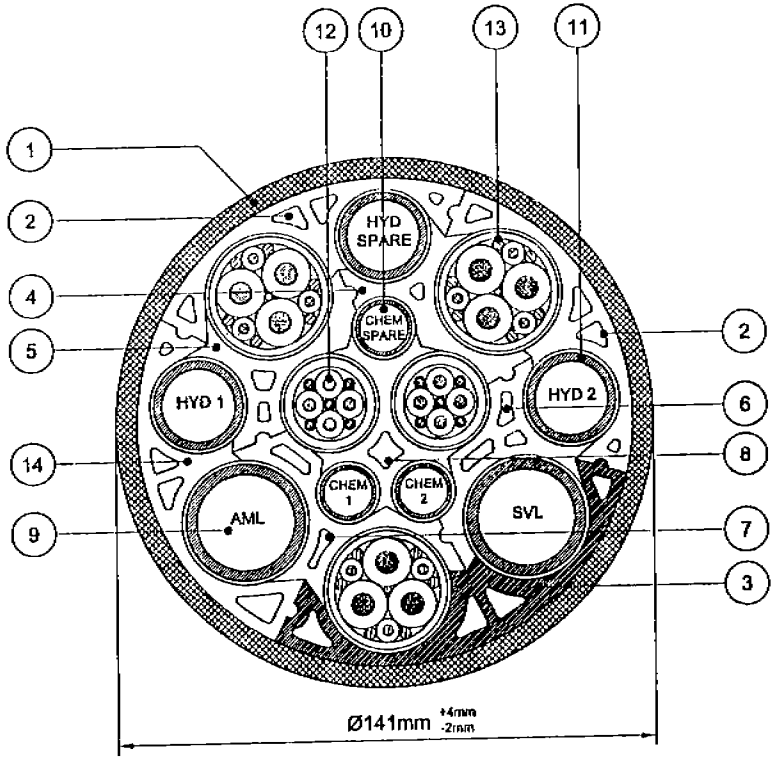
RIGHT-OF-WAY PERMIT APPLICATION BY MARATHON OIL COMPANY TOTALFINA ELF E&P USA, INC. BP-AMOCO, INC.				UMBILICAL DISTRIBUTION SYSTEM SCHEMATIC CANYON EXPRESS ELECTRO/HYDRAULIC CONTROL SYSTEM
				MC-348 TO MP-261 GULF OF MEXICO
DRAWN BY KGC	CHECKED BY JPS	DATE 2-14-01	SHEET 1 OF 1	DRAWING NO. H-1257.01-1.B2-DRW-16-002 REV. B

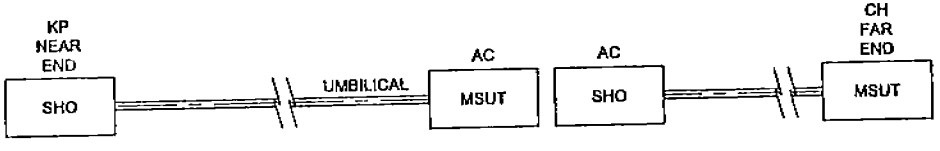

ROT
MCS
EPU
UPS
PCS
ESD
HPU
MCC
CIU
J-BOXES
TUTB
SMDL/
UMBILICAL
HANG-OFF
CANYON STATION
MP261 JP PLATFORM
MAIN ELECTRO/HYDRAULIC
UMBILICAL
SINGLE METHANOL
DISTRIBUTION LINE(SMDL)
KINGS PEAK FIELD DEVELOPMENT
VULCANIZED
RUBBER
COATING
J-TUBE
CHEMICAL FLYING
LEAD (TYP.)
HYDRAULIC
FLYING LEAD
(TYP.)
TREE MC217-2
TREE DC133-2
TREE MC217-3
TREE DC177-2
SCM
ISUT
FUTURE
SLOT
EHDU 1
INFIELD UMBILICAL (TYP.)
SEE DWG. No. H-1257.01-1.B2-DRW-16-006
MDU 1
SINGLE METHANOL DISTRIBUTION LINE
SEE DWG. No. H-1257.01-1.B2-DRW-16-014
ACONCAGUA FIELD DEVELOPMENT
HYDRULIC FLYING
LEAD (TYP.)
TREE MC305-1
TREE MC305-2
TREE MC305-3
TREE MC305-4
RX
PLATE
SHO (TYP.)
EHDU 2
METHANOL FLYING
LEAD (TYP.)
INFIELD UMBILICAL (TYP.)
SEE DWG. No. H-1257.01-1.B2-DRW-16-007
MDU 2
CHEMICAL FLYING
LEAD (TYP.)
CAMDEN HILLS FIELD DEVELOPMENT
TREE MC348-1
TREE MC348-2
MSUT 3
MDU 3
LEGEND
CIU CHEMICAL INJECTION UNIT
EHDU ELECTRO-HYDRAULIC DISTRIBUTION UNIT
EPU ELECTRICAL POWER UNIT
HPU HYDRAULIC POWER UNIT
ISUT INFIELD SUBSEA UMBILICAL TERMINATION
MCC MOTOR CONTROL CENTER
MCS MASTER CONTROL STATION
MDU METHANOL DISTRIBUTION UNIT
MSUT MAIN SUBSEA UMBILICAL TERMINATION
PCS PLATFORM CONTROL SYSTEM
ROT REMOTE OPERATOR TERMINAL
RX RECEIVER
SCM SUBSEA CONTROL MODULE
SHO STAB AND HINGE-OVER
TUTB TOPSIDE UMBILICAL TERMINATION BOX
UPS UNINTERRUPTIBLE POWER SUPPLY
DIRECTION OF FLOW

RIGHT-OF-WAY PERMIT APPLICATION BY
MARATHON OIL COMPANY
TOTALFINA ELF E&P USA, INC.
BP-AMOCO, INC.

METHANOL DELIVERY
SYSTEM SCHEMATIC
CANYON EXPRESS SYSTEM TO CANYON STATION PLATFORM
MC-348 TO MP-261
GULF OF MEXICO

DRAWN BY	KGC	CHECKED BY JPS	DATE	2-14-01	SHEET	1 OF 1	DRAWING NO.	H-1257.01-1.B2-DRW-16-003	REV.	B





BILL OF MATERIALS

ITEM	QTY.	PART DESCRIPTION	MATERIAL
1	1	OUTER SHEATHING	MDPE
2	2	FILLER; KVAERNER TYPE OU1	PVC
3	1	FILLER; KVAERNER TYPE OU2	PVC
4	1	FILLER; KVAERNER TYPE MI1	PVC
5	1	FILLER; KVAERNER TYPE MI2	PVC
6	1	FILLER; KVAERNER TYPE MI3	PVC
7	1	FILLER; KVAERNER TYPE MI4	PVC
8	1	FILLER; KVAERNER TYPE IN1	PVC
9	2	ANNULUS MONITORING LINE/SERVICE LINE; 6000 PSI WP; ODØ31.12 x 2.86mm	SUPER DUPLEX STAINLESS STEEL
10	3	CHEMICAL 1/CHEMICAL 2/CHEMICAL SPARE; 7500 PSI WP; ODØ14.8 x 1.05mm	SUPER DUPLEX STAINLESS STEEL
11	3	HYDRAULIC 1/HYDRAULIC 2; 5500 PSI WP; ODØ23.35 x 2.15mm	SUPER DUPLEX STAINLESS STEEL
12	2	ELECTRICAL CABLE; TSQ 6mm2; Ø24mm	
13	1	ELECTRICAL CABLE; TT 16mm2; Ø31.5mm	
14	1	FILLER; KVAERNER TYPE OU3	PVC

LEGEND

AC	ACONCAGUA FIELD
CH	CAMDEN HILLS FIELD
KP	KINGS PEAK FIELD
MDPE	MEDIUM DENSITY POLYETHYLENE
MSUT	MAIN SUBSEA UMBILICAL TERMINATION
OD	OUTSIDE DIAMETER
PVC	POLYVINYL CHLORIDE
SHO	STAB AND HINGE-OVER
TSQ	TWISTED SHIELDED QUAD
TT	TWISTED TRIAD
WP	WORKING PRESSURE

TECHNICAL DATA

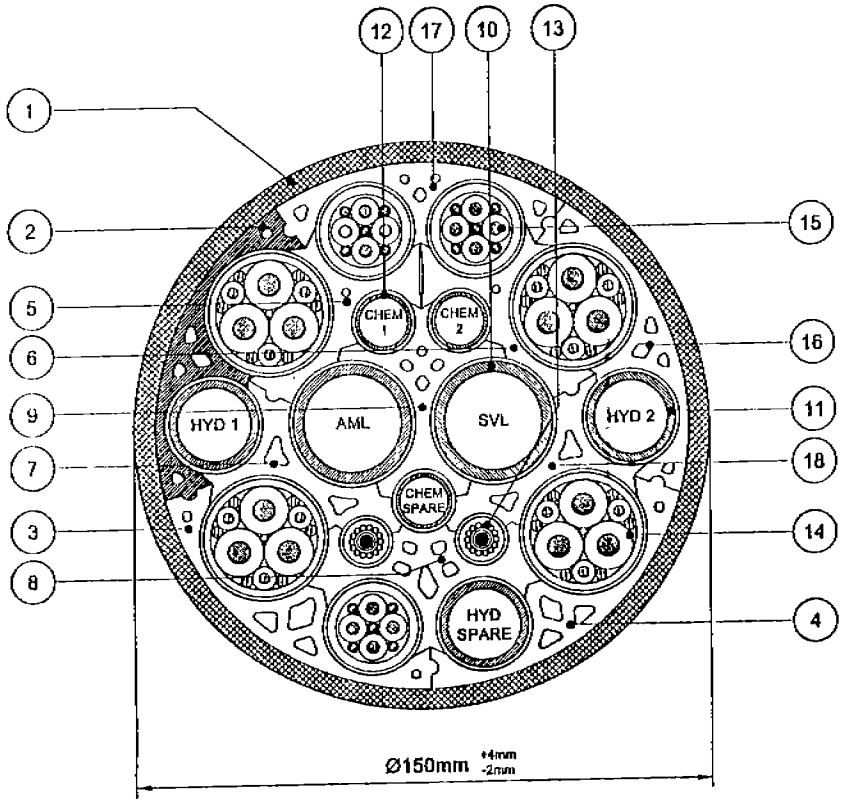
UMBILICAL WEIGHT IN AIR, EMPTY	217 N/m
UMBILICAL WEIGHT IN AIR, FLUID FILLED	237 N/m
UMBILICAL WEIGHT IN WATER, FLUID FILLED	80 N/m
DESIGN TENSION CAPACITY OF UMBILICAL	487 kN
TENSILE STRENGTH OF UMBILICAL	859 kN
MIN. BENDING RADIUS OPERATION (MBR): n = 0.72	MBR = 6.9 m
MIN. BENDING RADIUS INSTALLATION (MBR): n = 1.0	MBR = 4.9 m

REFERENCE KOPN DWG. 32-NU4024-16 REV. 0

RIGHT-OF-WAY PERMIT APPLICATION BY
MARATHON OIL COMPANY
TOTALFINA ELF E&P USA, INC.
BP-AMOCO, INC.

MAIN ELECTRO / HYDRAULIC UMBILICAL
KINGS PEAK TO CAMDEN HILLS
CANYON EXPRESS SYSTEM
MC-348 TO MP-261
GULF OF MEXICO

DRAWN BY	AHG	CHECKED BY	JPS	DATE	2-14-01	SHEET 1 OF 4	DRAWING NO. H-1257.01-1.B2-DRW-16-004	REV. B



BILL OF MATERIALS

ITEM	QTY.	PART DESCRIPTION	MATERIAL
1	1	OUTER SHEATHING	MDPE
2	1	FILLER; KVAERNER TYPE OU1	PVC
3	1	FILLER; KVAERNER TYPE OU2	PVC
4	1	FILLER; KVAERNER TYPE OU3	PVC
5	1	FILLER; KVAERNER TYPE MI1	PVC
6	1	FILLER; KVAERNER TYPE MI2	PVC
7	1	FILLER; KVAERNER TYPE MI3	PVC
8	1	FILLER; KVAERNER TYPE MI4	PVC
9	1	FILLER; KVAERNER TYPE IN1	PVC
10	2	ANNULUS MONITORING LINE/SERVICE LINE; 8000 PSI WP; ODØ31.12 x 2.86mm	SUPER DUPLEX STAINLESS STEEL
11	3	HYDRAULIC 1/HYDRAULIC 2; 5500 PSI WP; ODØ23.35 x 2.15mm	SUPER DUPLEX STAINLESS STEEL
12	3	CHEMICAL 1/CHEMICAL 2/ CHEMICAL SPARE; 7500 PSI WP; ODØ14.8 x 1.05mm	SUPER DUPLEX STAINLESS STEEL
13	2	FIBER OPTIC CABLE; RANGE CABLE; Ø12	
14	4	ELECTRICAL CABLE; TT 16mm2; Ø31.5mm	
15	3	ELECTRICAL CABLE; TSQ 6mm2; Ø24mm	
16	1	FILLER; KVAERNER TYPE OU4	PVC
17	1	FILLER; KVAERNER TYPE OU5	PVC
18	1	FILLER; KVAERNER TYPE MI5	PVC

LEGEND

KP	KINGS PEAK FIELD
MDPE	MEDIUM DENSITY POLYETHYLENE
OD	OUTSIDE DIAMETER
PVC	POLYVINYL CHLORIDE
SHO	STAB AND HINGE-OVER
TSQ	TWISTED SHIELDED QUAD
TT	TWISTED TRIAD
WP	WORKING PRESSURE

TECHNICAL DATA

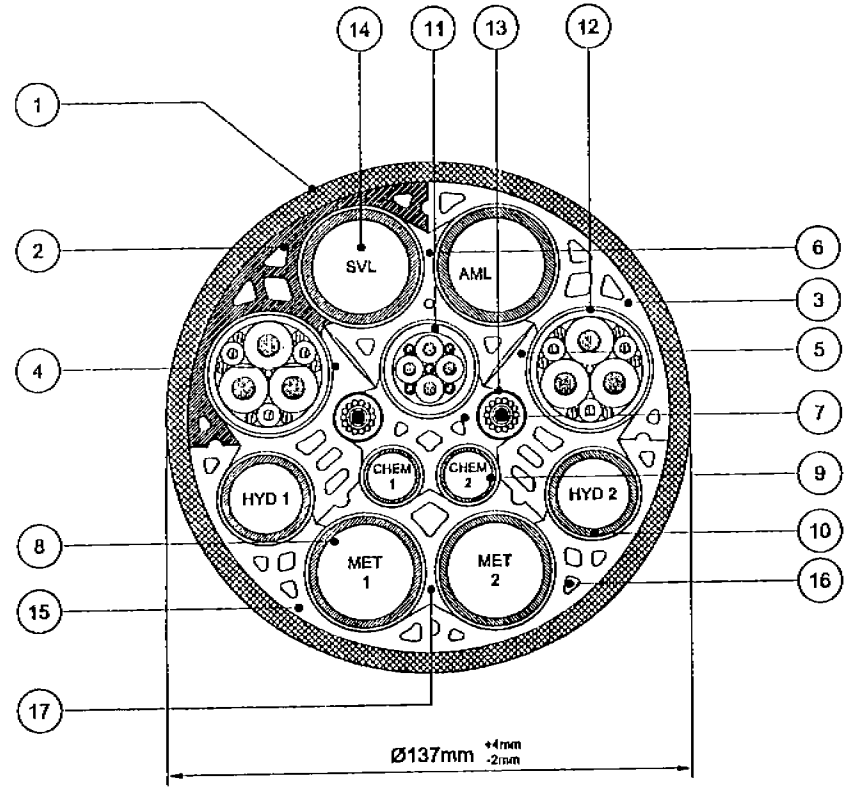
UMBILICAL WEIGHT IN AIR, EMPTY	246 N/m
UMBILICAL WEIGHT IN AIR, FLUID FILLED	266 N/m
UMBILICAL WEIGHT IN WATER, FLUID FILLED	88 N/m
DESIGN TENSION CAPACITY OF UMBILICAL	487 kN
TENSILE STRENGTH OF UMBILICAL	859 kN
MIN. BENDING RADIUS OPERATION (MBR): n = 0.72	MBR = 6.9 m
MIN. BENDING RADIUS INSTALLATION (MBR): n = 1.0	MBR = 4.9 m

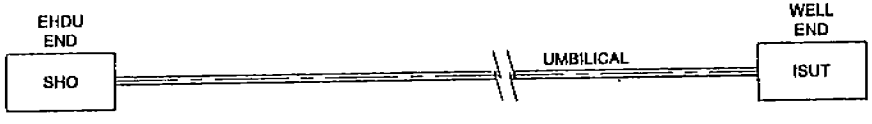
REFERENCE KOPN DWG. 32-NU4027-16 REV. 0

RIGHT-OF-WAY PERMIT APPLICATION BY
MARATHON OIL COMPANY
TOTALFINA ELF E&P USA, INC.
BP-AMOCO, INC.

MAIN ELECTRO / HYDRAULIC UMBILICAL
CANYON STATION TO KINGS PEAK
CANYON EXPRESS SYSTEM
MC-348 TO MP-261
GULF OF MEXICO

DRAWN BY	AHG	CHECKED BY	JPS	DATE	2-14-01	SHEET 2 OF 4	DRAWING NO. H-1257.01-1.B2-DRW-16-005	REV. B





BILL OF MATERIALS

ITEM	QTY.	PART DESCRIPTION	MATERIAL
1	1	OUTER SHEATHING	MDPE
2	1	FILLER; KVAERNER TYPE OU1	PVC
3	1	FILLER; KVAERNER TYPE OU2	PVC
4	1	FILLER; KVAERNER TYPE MI1	PVC
5	1	FILLER; KVAERNER TYPE MI2	PVC
6	1	FILLER; KVAERNER TYPE MI3	PVC
7	1	FILLER; KVAERNER TYPE IN1	PVC
8	2	METHANOL1/METHANOL 2; 7500 PSI WP; ODØ29.56 x 2.08mm	SUPER DUPLEX STAINLESS STEEL
9	2	CHEMICAL 1/CHEMICAL 2; 7500 PSI WP; ODØ14.8 x 1.05mm	SUPER DUPLEX STAINLESS STEEL
10	2	HYDRAULIC 1/HYDRAULIC 2; 6500 PSI WP; ODØ23.35 x 2.15mm	SUPER DUPLEX STAINLESS STEEL
11	1	ELECTRICAL CABLE; TSQ 6mm2; Ø24mm	
12	2	ELECTRICAL CABLE; TT 16mm2; Ø31.5mm	
13	2	FIBER OPTIC CABLE; RANGE CABLE; Ø12	
14	2	ANNULUS MONITORING LINE/ SERVCE LINE; 8000 PSI WP; ODØ31.12 x 2.86mm	SUPER DUPLEX STAINLESS STEEL
15	1	FILLER; KVAERNER TYPE OU3	PVC
16	1	FILLER; KVAERNER TYPE OU4	PVC
17	1	FILLER; KVAERNER TYPE MI4	PVC

LEGEND

EHDU	ELECTRO-HYDRAULIC DISTRIBUTION UNIT
ISUT	INFIELD SUBSEA UMBILICAL TERMINATION
MDPE	MEDIUM DENSITY POLYETHYLENE
OD	OUTSIDE DIAMETER
PVC	POLYVINYL CHLORIDE
SHO	STAB AND HINGE-OVER
TSQ	TWISTED SHIELDED QUAD
TT	TWISTED TRIAD
WP	WORKING PRESSURE

TECHNICAL DATA

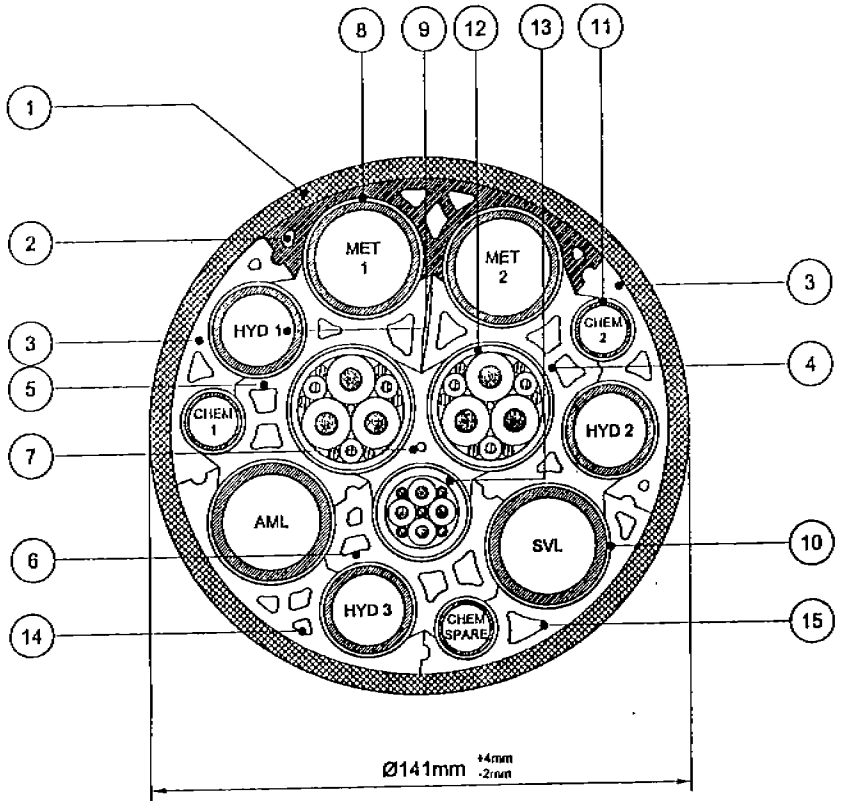
UMBILICAL WEIGHT IN AIR, EMPTY	223 N/m
UMBILICAL WEIGHT IN AIR, FLUID FILLED	249 N/m
UMBILICAL WEIGHT IN WATER, FLUID FILLED	101 N/m
DESIGN TENSION CAPACITY OF UMBILICAL	564 kN
TENSILE STRENGTH OF UMBILICAL	995 kN
MIN. BENDING RADIUS OPERATION (MBR): n = 0.72	MBR = 6.9 m
MIN. BENDING RADIUS INSTALLATION (MBR): n = 1.0	MBR = 4.9 m

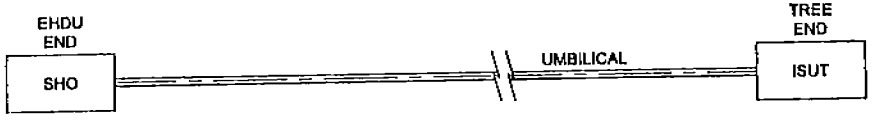
REFERENCE KOPN DWG. 32-NU4026-16 REV. 0

RIGHT-OF-WAY PERMIT APPLICATION BY
MARATHON OIL COMPANY
TOTALFINA ELF E&P USA, INC.
BP-AMOCO, INC.

KINGS PEAK INFIELD ELECTRO / HYDRAULIC UMBILICAL
KINGS PEAK FIELD
CANYON EXPRESS SYSTEM
MC-348 TO MP-261
GULF OF MEXICO

DRAWN BY	AHG	CHECKED BY JPS	DATE	2-14-01	SHEET 3 OF 4	DRAWING NO. H-1257.01-1.B2-DRW-16-006	REV. B





BILL OF MATERIALS

ITEM	QTY.	PART DESCRIPTION	MATERIAL
1	1	OUTER SHEATHING	MDPE
2	1	FILLER; KVAERNER TYPE OU1	PVC
3	2	FILLER; KVAERNER TYPE OU2	PVC
4	1	FILLER; KVAERNER TYPE MI1	PVC
5	1	FILLER; KVAERNER TYPE MI2	PVC
6	1	FILLER; KVAERNER TYPE MI3	PVC
7	1	FILLER; KVAERNER TYPE IN1	PVC
8	2	METHANOL 1/METHANOL 2; 7500 PSI WP; ODØ29.56 x 2.08mm	SUPER DUPLEX STAINLESS STEEL
9	3	HYDRAULIC 1/HYDRAULIC 2; 5500 PSI WP; ODØ23.35 x 2.15mm	SUPER DUPLEX STAINLESS STEEL
10	2	ANNULUS MONITORING LINE/SERVICE LINE; 8000 PSI WP; ODØ31.12 x 2.86mm	SUPER DUPLEX STAINLESS STEEL
11	3	CHEMICAL 1/CHEMICAL 2/CHEMICAL SPARE; 7500 PSI WP; ODØ14.8 x 1.05mm	SUPER DUPLEX STAINLESS STEEL
12	2	ELECTRICAL CABLE; TT 16mm2; Ø31.5mm	
13	1	ELECTRICAL CABLE; TSQ 6mm2; Ø24mm	
14	1	FILLER; KVAERNER TYPE OU3	PVC
15	1	FILLER; KVAERNER TYPE OU4	PVC

LEGEND

EHDU	ELECTRO-HYDRAULIC DISTRIBUTION UNIT
ISUT	INFIELD SUBSEA UMBILICAL TERMINATION
MDPE	MEDIUM DENSITY POLYETHYLENE
OD	OUTSIDE DIAMETER
PVC	POLYVINYL CHLORIDE
SHO	STAB AND HINGE-OVER
TSQ	TWISTED SHIELDED QUAD
TT	TWISTED TRIAD
WP	WORKING PRESSURE

TECHNICAL DATA

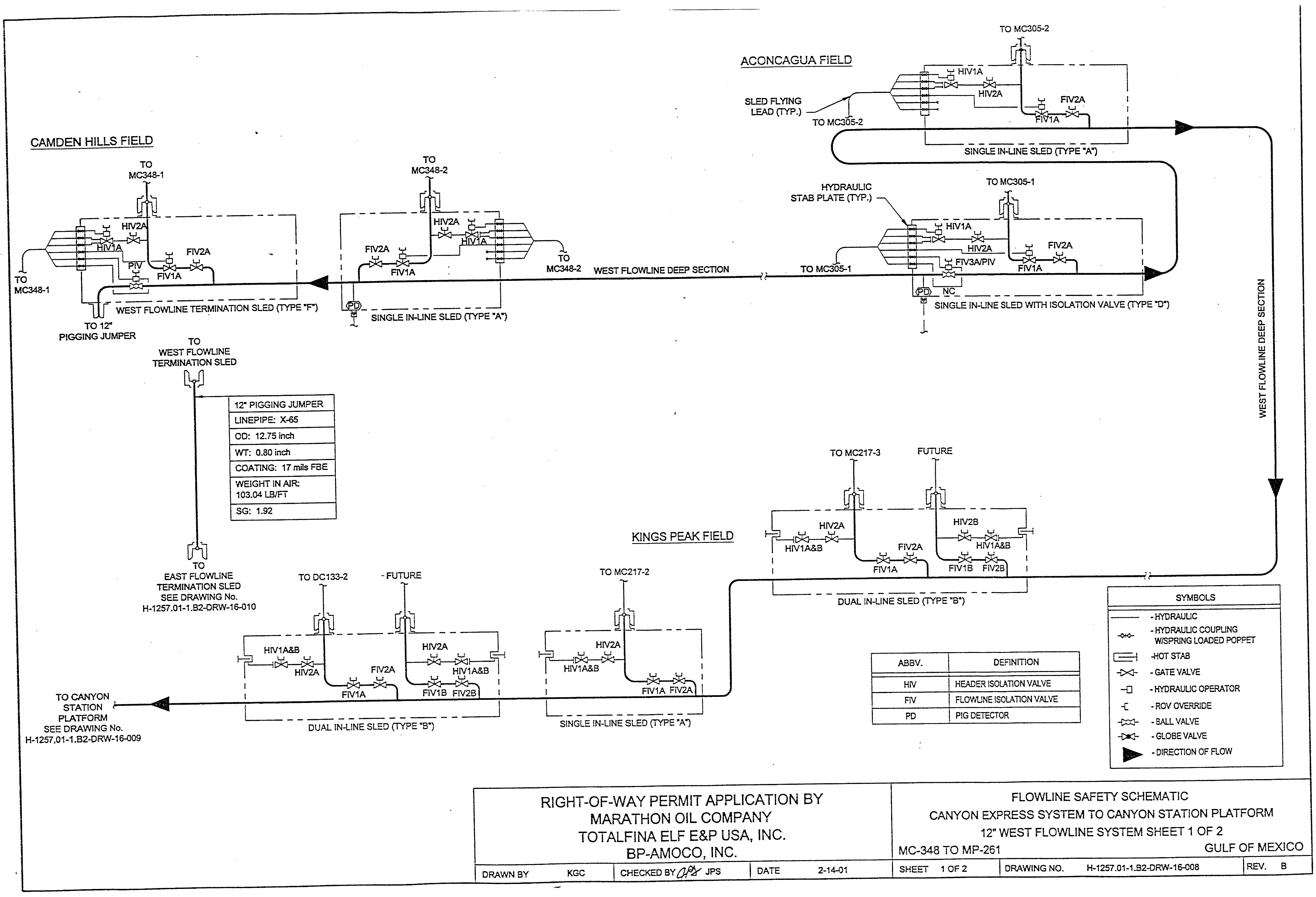
UMBILICAL WEIGHT IN AIR, EMPTY	226 N/m
UMBILICAL WEIGHT IN AIR, FLUID FILLED	255 N/m
UMBILICAL WEIGHT IN WATER, FLUID FILLED	98 N/m
DESIGN TENSION CAPACITY OF UMBILICAL	650 kN
TENSILE STRENGTH OF UMBILICAL	1150 kN
MIN. BENDING RADIUS OPERATION (MBR): n = 0.72	MBR = 6.9 m
MIN. BENDING RADIUS INSTALLATION (MBR): n = 1.0	MBR = 4.9 m

REFERENCE KOPN DWG. 32-NU4025-16 REV. 0

RIGHT-OF-WAY PERMIT APPLICATION BY
MARATHON OIL COMPANY
TOTALFINA ELF E&P USA, INC.
BP-AMOCO, INC.

ACONCAGUA AND CAMDEN HILLS INFIELD
ELECTRO / HYDRAULIC UMBILICAL
CANYON EXPRESS SYSTEM
MC-348 TO MP-261
GULF OF MEXICO

DRAWN BY	AHG	CHECKED BY JPS	DATE	2-14-01	SHEET 4 OF 4	DRAWING NO. H-1257.01-1.B2-DRW-16-007	REV. B



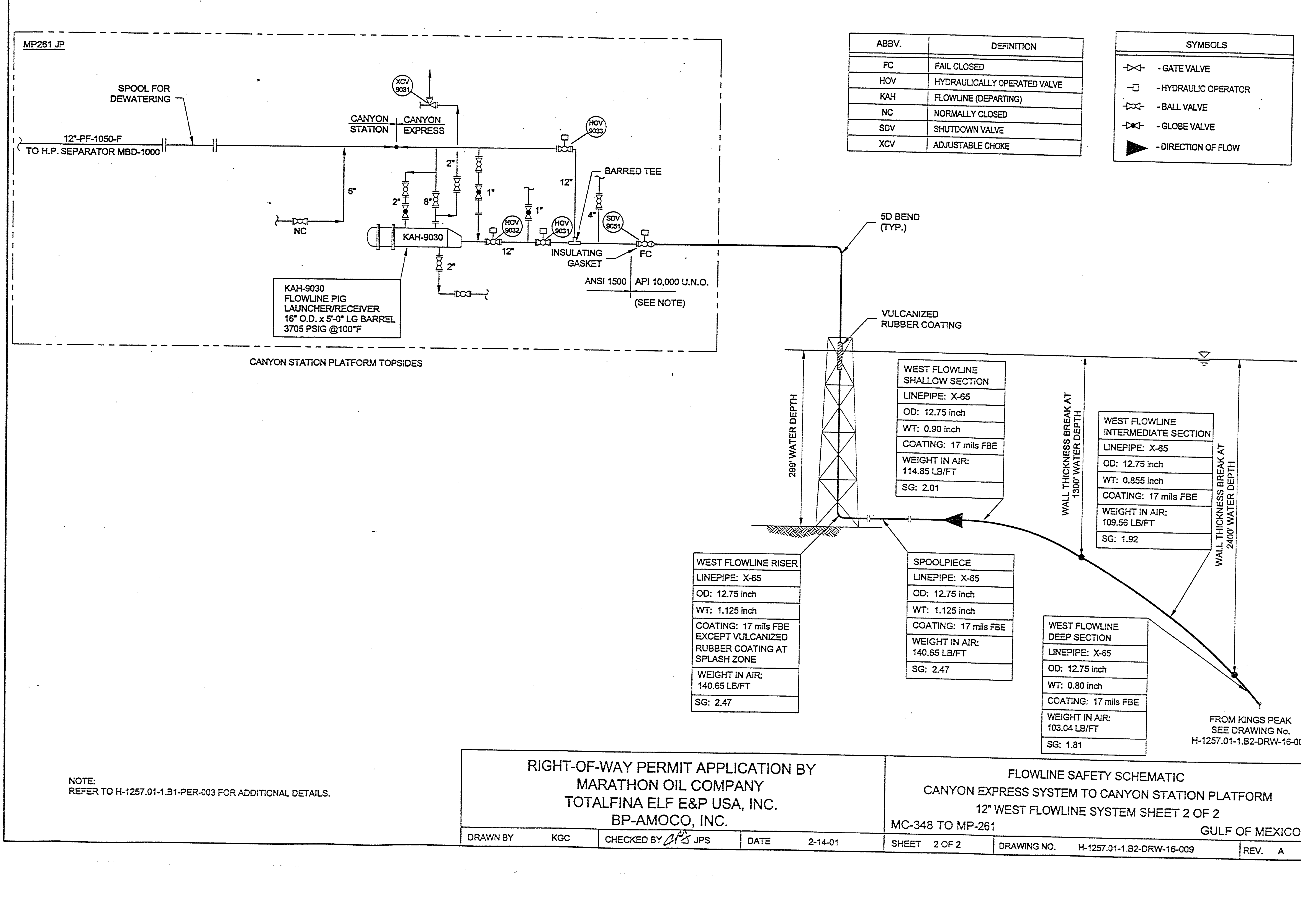
12" PIGGING JUMPER
LINEPIPE: X-65
OD: 12.75 inch
WT: 0.80 inch
COATING: 17 mils FBE
WEIGHT IN AIR: 103.04 LB/FT
SG: 1.92

ABBV.	DEFINITION
HIV	HEADER ISOLATION VALVE
FIV	FLOWLINE ISOLATION VALVE
PD	PIG DETECTOR

RIGHT-OF-WAY PERMIT APPLICATION BY
MARATHON OIL COMPANY
TOTALFINA ELF E&P USA, INC.
BP-AMOCO, INC.

FLOWLINE SAFETY SCHEMATIC
CANYON EXPRESS SYSTEM TO CANYON STATION PLATFORM
12" WEST FLOWLINE SYSTEM SHEET 1 OF 2
MC-348 TO MP-261 GULF OF MEXICO

DRAWN BY	KGC	CHECKED BY JPS	DATE	2-14-01	SHEET 1 OF 2	DRAWING NO.	H-1257.01-1.B2-DRW-16-008	REV. B



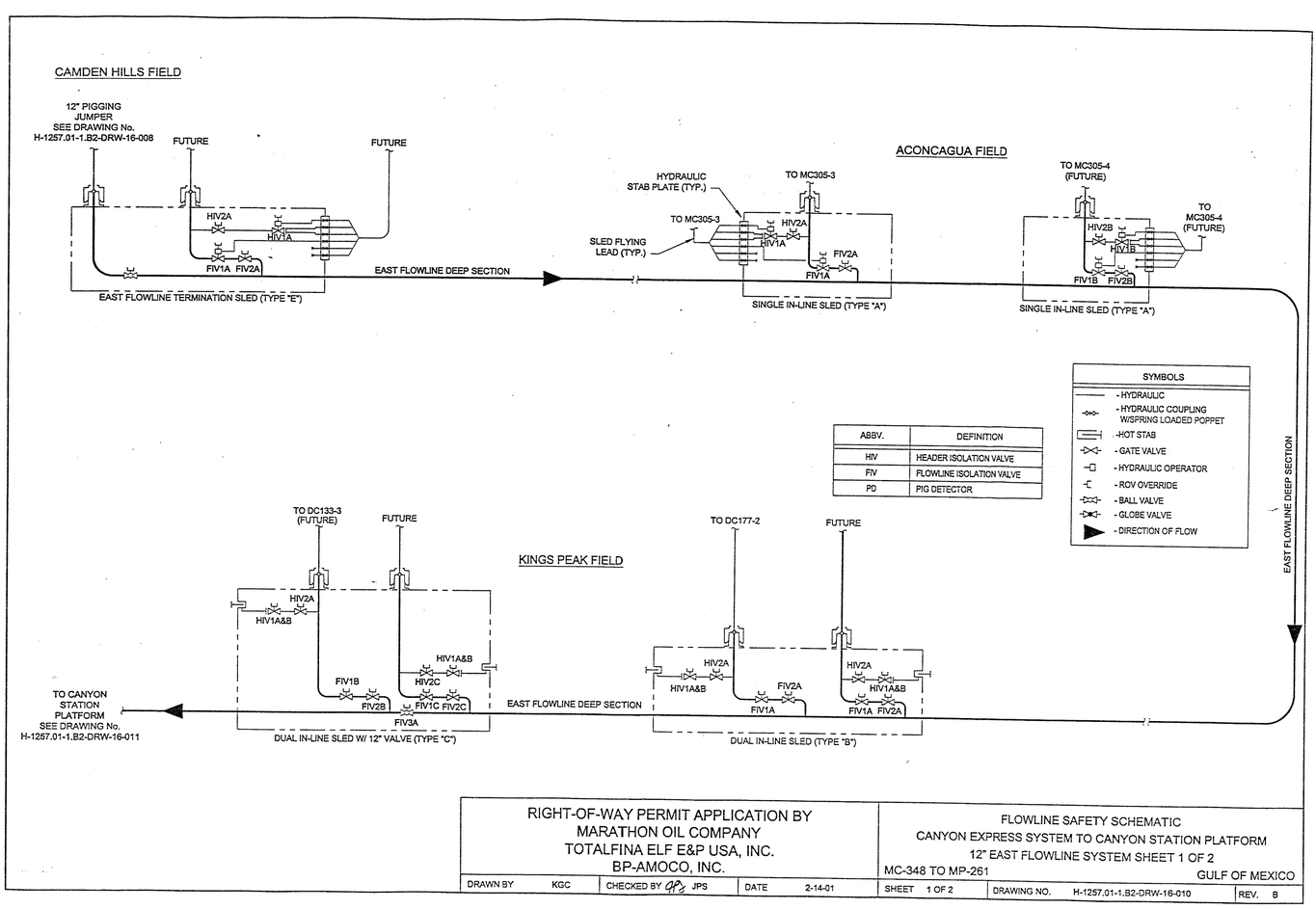
ABBV.	DEFINITION
FC	FAIL CLOSED
HOV	HYDRAULICALLY OPERATED VALVE
KAH	FLOWLINE (DEPARTING)
NC	NORMALLY CLOSED
SDV	SHUTDOWN VALVE
XCV	ADJUSTABLE CHOKE

NOTE:
REFER TO H-1257.01-1.B1-PER-003 FOR ADDITIONAL DETAILS.

RIGHT-OF-WAY PERMIT APPLICATION BY
MARATHON OIL COMPANY
TOTALFINA ELF E&P USA, INC.
BP-AMOCO, INC.

FLOWLINE SAFETY SCHEMATIC
CANYON EXPRESS SYSTEM TO CANYON STATION PLATFORM
12" WEST FLOWLINE SYSTEM SHEET 2 OF 2
MC-348 TO MP-261
GULF OF MEXICO

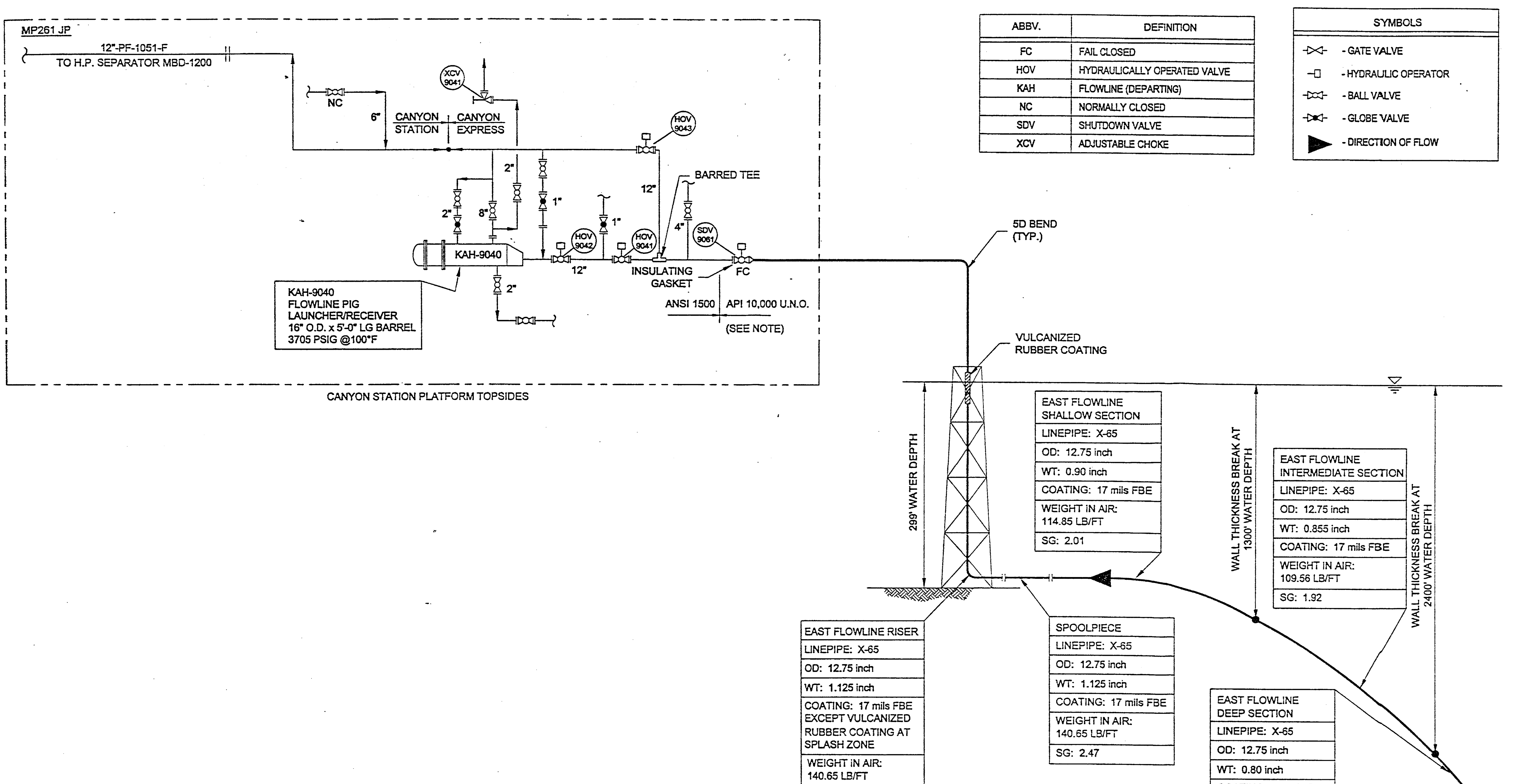
DRAWN BY	KGC	CHECKED BY JPS	DATE	2-14-01	SHEET 2 OF 2	DRAWING NO.	H-1257.01-1.B2-DRW-16-009	REV. A



RIGHT-OF-WAY PERMIT APPLICATION BY
MARATHON OIL COMPANY
TOTALFINA ELF E&P USA, INC.
BP-AMOCO, INC.

FLOWLINE SAFETY SCHEMATIC
CANYON EXPRESS SYSTEM TO CANYON STATION PLATFORM
12" EAST FLOWLINE SYSTEM SHEET 1 OF 2
MC-348 TO MP-261
GULF OF MEXICO

DRAWN BY	CHECKED BY	DATE	SHEET	DRAWING NO.	REV.
KGC	JPS	2-14-01	1 OF 2	H-1257.01-1.B2-DRW-16-010	B



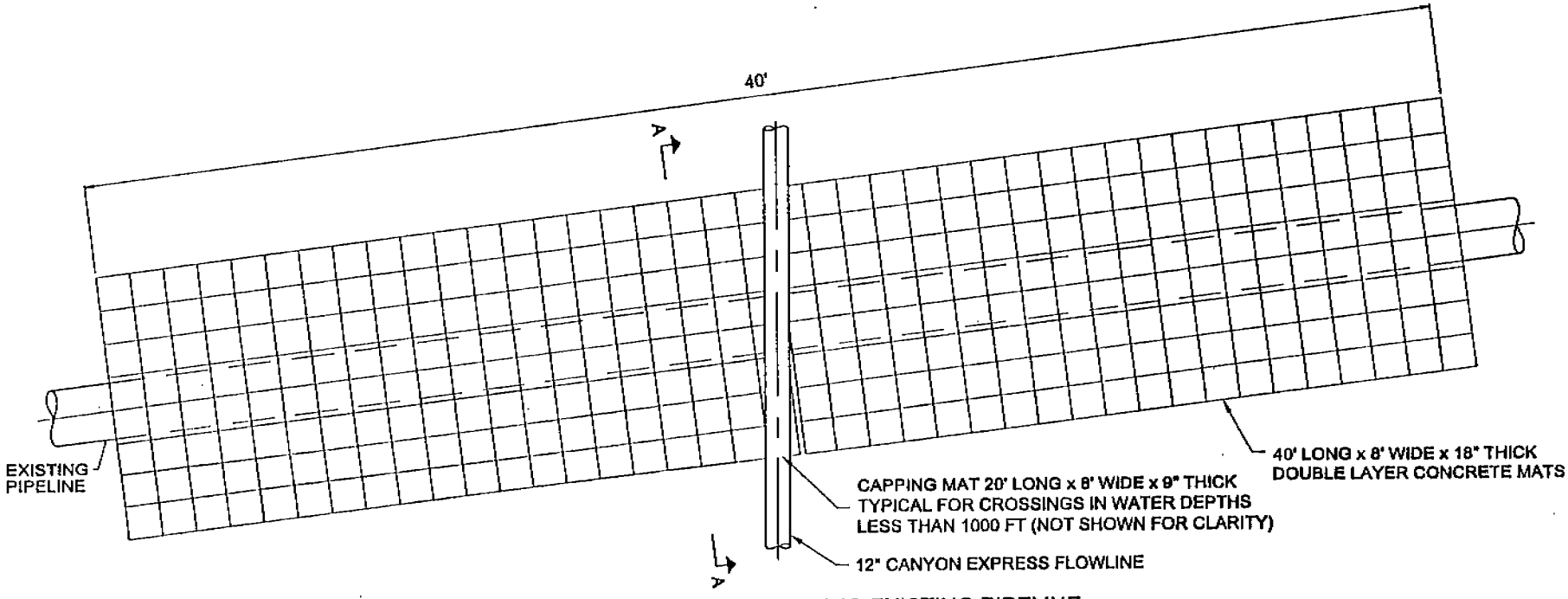
ABBV.	DEFINITION
FC	FAIL CLOSED
HOV	HYDRAULICALLY OPERATED VALVE
KAH	FLOWLINE (DEPARTING)
NC	NORMALLY CLOSED
SDV	SHUTDOWN VALVE
XCV	ADJUSTABLE CHOKE

NOTE:
REFER TO H-1257.01-1.B1-PER-003 FOR ADDITIONAL DETAILS.

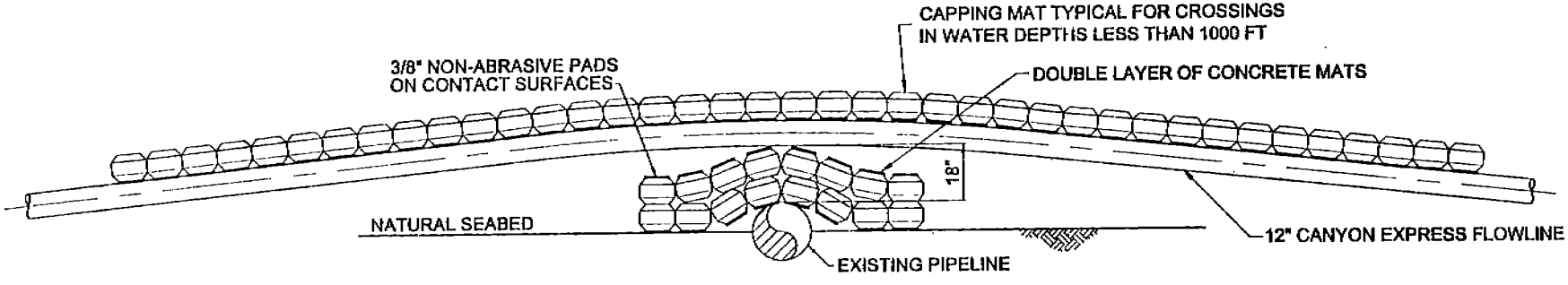
RIGHT-OF-WAY PERMIT APPLICATION BY
MARATHON OIL COMPANY
TOTALFINA ELF E&P USA, INC.
BP-AMOCO, INC.

FLOWLINE SAFETY SCHEMATIC
CANYON EXPRESS SYSTEM TO CANYON STATION PLATFORM
12" EAST FLOWLINE SYSTEM SHEET 2 OF 2
MC-348 TO MP-261 GULF OF MEXICO

DRAWN BY	KGC	CHECKED BY	JPS	DATE	2-14-01	SHEET	2 OF 2	DRAWING NO.	H-1257.01-1.B2-DRW-16-011	REV.	B



PLAN VIEW - FLOWLINE CROSSING EXISTING PIPELINE



SECTION A-A - FLOWLINE CROSSING EXISTING PIPELINE

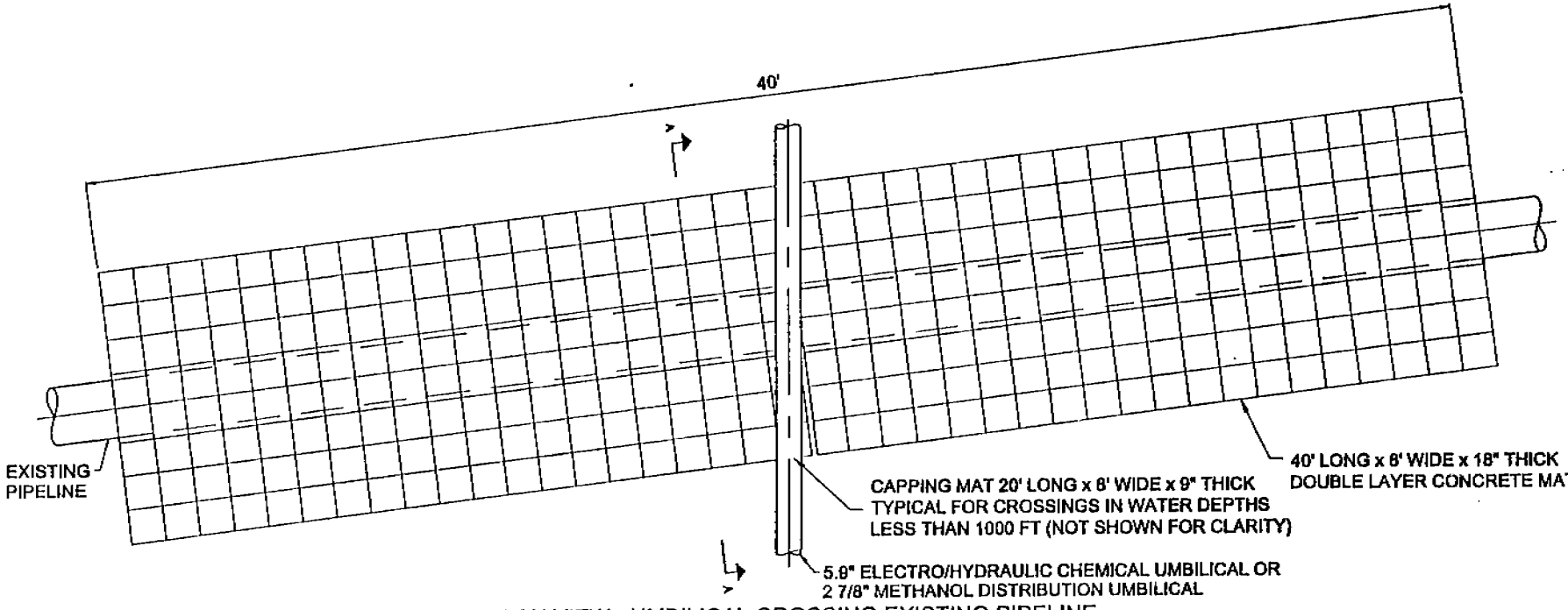
RIGHT-OF-WAY PERMIT APPLICATION BY
MARATHON OIL COMPANY
TOTALFINA ELF E&P USA, INC.
BP-AMOCO, INC.

TYPICAL FLOWLINE/PIPELINE CROSSING
CANYON EXPRESS PROJECT

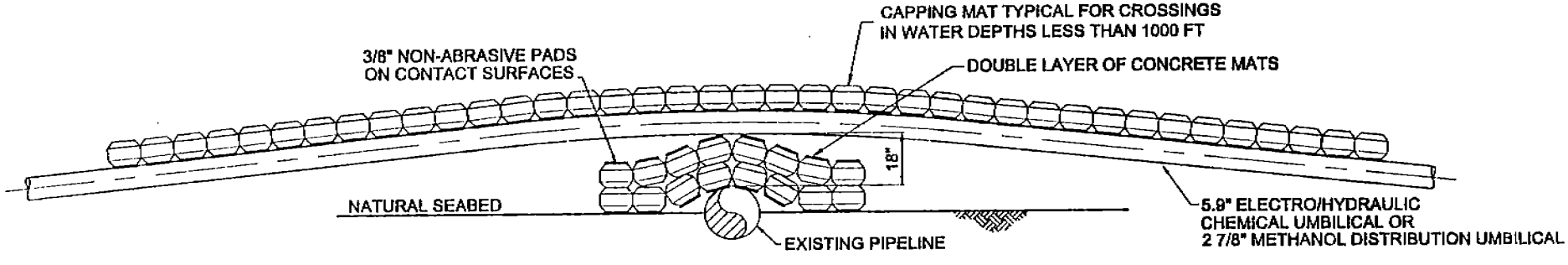
MC-348 TO MP-261

GULF OF MEXICO

DRAWN BY	KGC	CHECKED BY	JPS	DATE	2-14-01	SHEET	1 OF 1	DRAWING NO.	H-1257.01-1.B2-DRW-16-012	REV.	B



PLAN VIEW - UMBILICAL CROSSING EXISTING PIPELINE



SECTION A-A - UMBILICAL CROSSING EXISTING PIPELINE

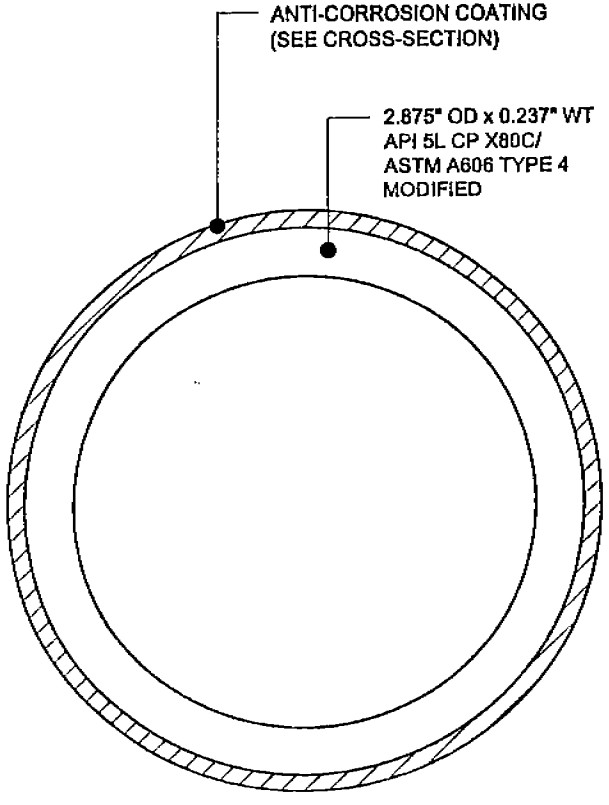
RIGHT-OF-WAY PERMIT APPLICATION BY
MARATHON OIL COMPANY
TOTALFINA ELF E&P USA, INC.
BP-AMOCO, INC.

TYPICAL UMBILICAL/PIPELINE CROSSING
CANYON EXPRESS PROJECT

MC-348 TO MP-261

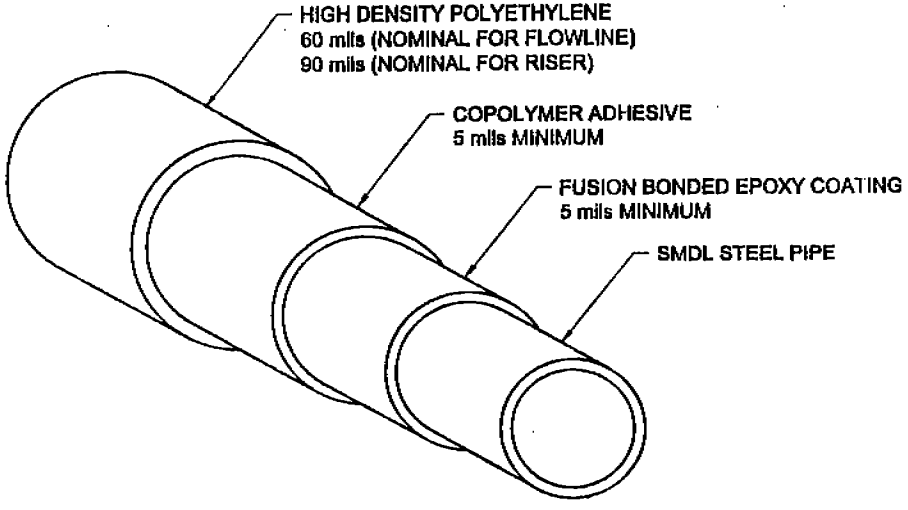
GULF OF MEXICO

DRAWN BY	KGC	CHECKED BY JPS	DATE	2-14-01	SHEET	1 OF 1	DRAWING NO.	H-1257.01-1.B2-DRW-16-013	REV.	B



SINGLE METHANOL DISTRIBUTION LINE (SMDL)

MINIMUM YIELD STRENGTH:	80,000 PSI
MINIMUM TENSILE STRENGTH:	88,000 PSI
APPROXIMATE COATED FLOWLINE WEIGHT IN AIR:	7.09 LB/FT
APPROXIMATE COATED FLOWLINE WEIGHT IN SEAWATER:	3.92 LB/FT
APPROXIMATE COATED FLOWLINE SG:	2.23
APPROXIMATE COATED RISER WEIGHT IN AIR:	7.27 LB/FT
APPROXIMATE COATED RISER WEIGHT IN SEAWATER:	3.97 LB/FT
APPROXIMATE COATED RISER SG:	2.20
RECOMMENDED MINIMUM DRUM DIAMETER:	9.58 FEET
SERVICE LINE:	20 YEARS
APPROXIMATE LENGTH:	5.26 MILES
MAXIMUM WATER DEPTH:	7250 FEET
MINIMUM WATER DEPTH:	299 FEET
BURIAL REQUIREMENTS:	NONE



COATING CROSS-SECTION

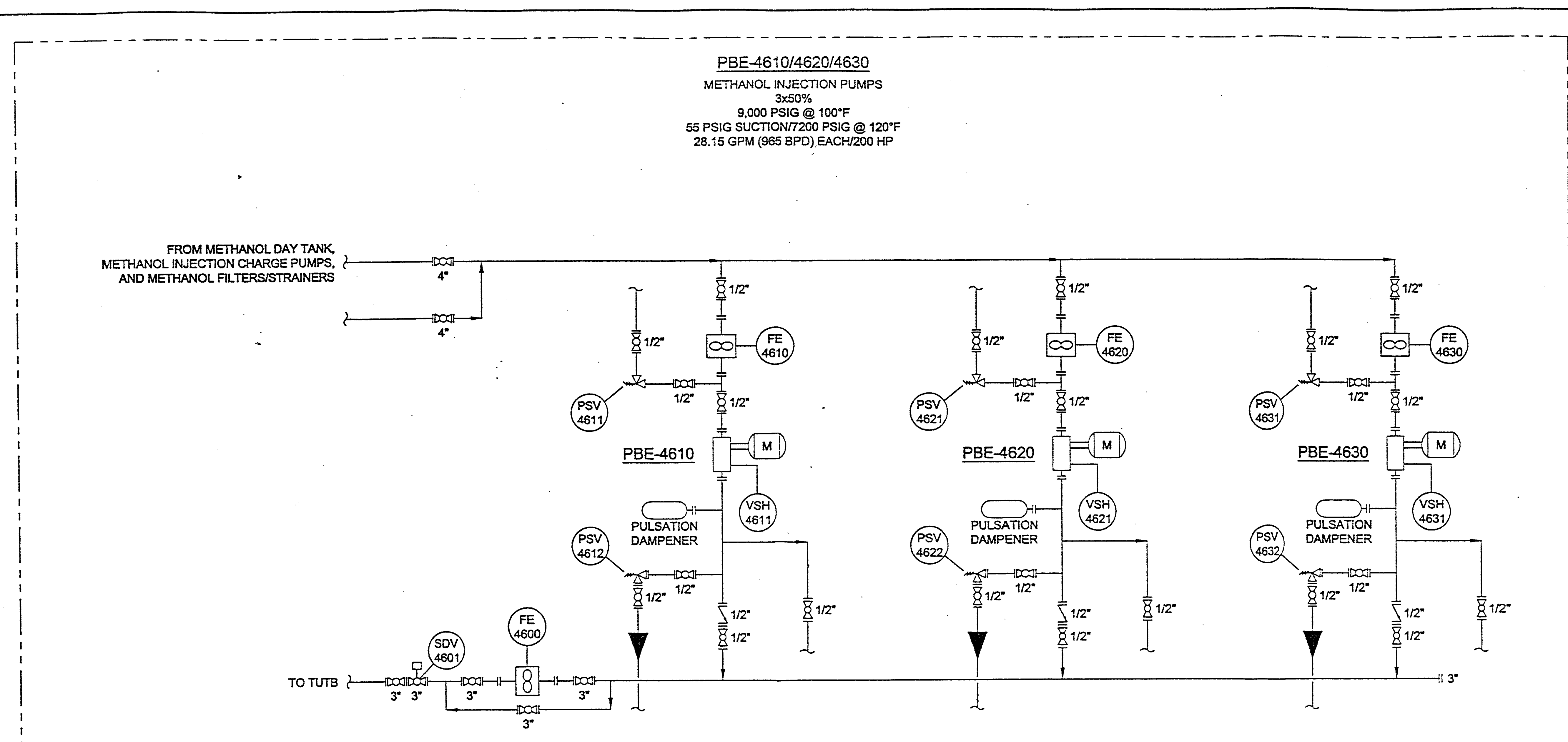
RIGHT-OF-WAY PERMIT APPLICATION BY
MARATHON OIL COMPANY
TOTALFINA ELF E&P USA, INC.
BP-AMOCO, INC.

SINGLE METHANOL DISTRIBUTION LINE
CANYON EXPRESS SYSTEM

MC-348 TO MP-261

GULF OF MEXICO

DRAWN BY	AHG	CHECKED BY	JPS	DATE	2-14-01	SHEET 1 OF 1	DRAWING NO. H-1257.01-1.B2-DRW-16-014	REV. B



SYMBOLS
- GATE VALVE
- HYDRAULIC OPERATOR
- BALL VALVE
- CHECK VALVE
- DIRECTION OF FLOW

ABBV.	DEFINITION
F	BASKET FILTER
FE	FLOW ELEMENT
M	MOTOR
PBA	CHEMICAL INJECTION PUMP
PSH	PRESSURE SAFETY HIGH
PSV	PRESSURE SAFETY VALVE
S	BASKET STRAINER
SDV	SHUTDOWN VALVE
VSH	VIBRATION SWITCH HIGH

RIGHT-OF-WAY PERMIT APPLICATION BY
MARATHON OIL COMPANY
TOTALFINA ELF E&P USA, INC.
BP-AMOCO, INC.

METHANOL INJECTION DELIVERY SYSTEM
TOPSIDES SCHEMATIC
CANYON STATION PLATFORM
MC-348 TO MP-261 GULF OF MEXICO

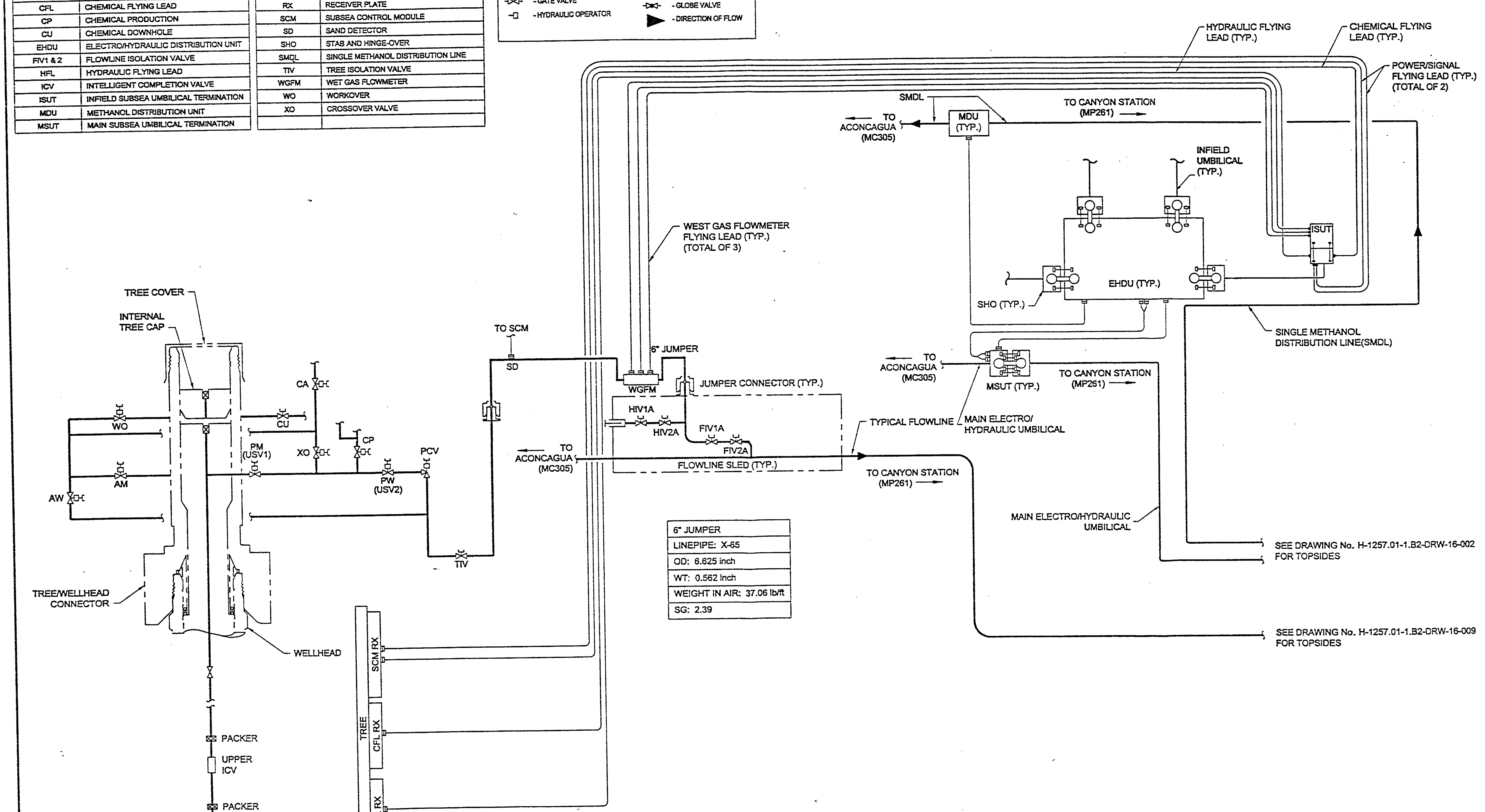
DRAWN BY	JAS	CHECKED BY	JPS	DATE	2-19-01	SHEET	1 OF 1	DRAWING NO.	H-1257.01-1.B2-DRW-16-017	REV.	B

ABBV.	DEFINITION
AM	ANNULUS MASTER VALVE
AW	ANNULUS WING VALVE
CA	CHEMICAL ANNULUS
CFL	CHEMICAL FLYING LEAD
CP	CHEMICAL PRODUCTION
CU	CHEMICAL DOWNHOLE
EHDU	ELECTRO/HYDRAULIC DISTRIBUTION UNIT
FIV1 & 2	FLOWLINE ISOLATION VALVE
HFL	HYDRAULIC FLYING LEAD
ICV	INTELLIGENT COMPLETION VALVE
ISUT	INFIELD SUBSEA UMBILICAL TERMINATION
MDU	METHANOL DISTRIBUTION UNIT
MSUT	MAIN SUBSEA UMBILICAL TERMINATION

ABBV.	DEFINITION
PCV	PRODUCTION CHOKE VALVE
PM	PRODUCTION MASTER VALVE
PW	PRODUCTION WING VALVE
RX	RECEIVER PLATE
SCM	SUBSEA CONTROL MODULE
SD	SAND DETECTOR
SHO	STAB AND HINGE-OVER
SMDL	SINGLE METHANOL DISTRIBUTION LINE
TIV	TREE ISOLATION VALVE
WGFM	WET GAS FLOWMETER
WO	WORKOVER
XO	CROSSOVER VALVE

SYMBOLS

- -HOT STAB
- -GATE VALVE
- -HYDRAULIC OPERATOR
- -ROV OVERRIDE
- -BALL VALVE
- -GLOBE VALVE
- -DIRECTION OF FLOW



6" JUMPER
LINEPIPE: X-65
OD: 6.625 inch
WT: 0.562 inch
WEIGHT IN AIR: 37.06 lb/ft
SG: 2.39

KINGS PEAK TYPICAL WELL

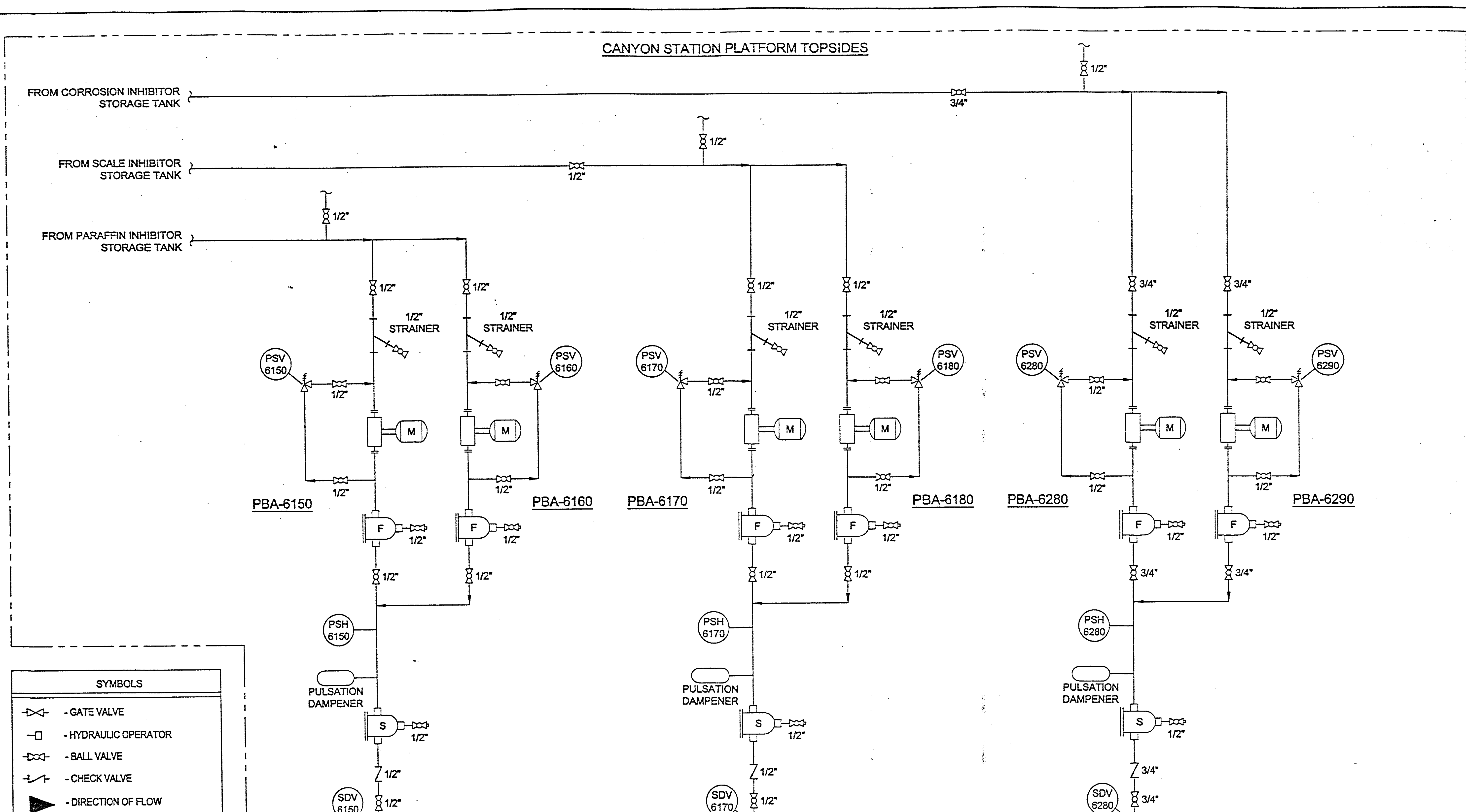
NOTES:
1. REFER TO H-1257.01-1.B1-PER-003 FOR ADDITIONAL DETAILS.

RIGHT-OF-WAY PERMIT APPLICATION BY
MARATHON OIL COMPANY
TOTALFINA ELF E&P USA, INC.
BP-AMOCO, INC.

FLOWLINE SAFETY SCHEMATIC
KINGS PEAK TYPICAL WELL
CANYON EXPRESS WEST FLOWLINE SYSTEM

MC-348 TO MP-261 GULF OF MEXICO

DRAWN BY	JAS	CHECKED BY	JPS	DATE	2-19-01	SHEET	1 OF 1	DRAWING NO.	H-1257.01-1.B2-DRW-16-015	REV.	B



ABBV.	DEFINITION
F	BASKET FILTER
M	MOTOR
PBA	CHEMICAL INJECTION PUMP
PSH	PRESSURE SAFETY HIGH
PSV	PRESSURE SAFETY VALVE
S	BASKET STRAINER
SDV	SHUTDOWN VALVE

RIGHT-OF-WAY PERMIT APPLICATION BY
MARATHON OIL COMPANY
TOTALFINA ELF E&P USA, INC.
BP-AMOCO, INC.

CHEMICAL INJECTION DELIVERY SYSTEM
TOPSIDES SCHEMATIC
CANYON STATION PLATFORM

MC-348 TO MP-261 GULF OF MEXICO

DRAWN BY	JAS	CHECKED BY [signature] JPS	DATE	2-19-01	SHEET 1 OF 1	DRAWING NO.	H-1257.01-1.B2-DRW-16-016	REV. B

RESULTS AND CONCLUSIONS

Overall, water depths across the survey limits range from -7205 feet at Well No. 1 in MC-348, to -299 feet at the proposed "JP" Platform in MP-261. The seafloor exhibits a regional slope to the south and the gradient varies from 15 feet per mile (0.16°) in MP-261 to 290 feet per mile (3.17°) in VK-869 and VK-913. For a more diagrammatic representation of the slope along the proposed routes, refer to the profile views presented on the Subbottom Profile Maps.

Numerous outcrops/pinnacles were observed within the northern portion of the survey area. These outcrops occur as small individual isolated features, small clusters, and large irregular patches. During placement of the "JP" Platform and construction of the planned pipelines, any bottom disturbing activities, including anchors, chains or cables should avoid any pinnacle trend feature with vertical relief equal to or greater than 8 feet by a distance of 100 feet.

Seafloor soils range from sandy clay to clay. Thirty-seven cores were collected and analyzed by MARSCO, Inc. and GEMS. The results of this coring program are presented in a report submitted in November of 2000.

The sonar and pinger data recorded several natural geological features throughout the survey area. These features include: areas of hummocky seafloor, areas of irregular seafloor, buried mass movement deposits, and faults. These features will not affect normal pipeline installation activities.

The potential for chemosynthetic communities along the proposed pipeline route is considered to be low.

The location of the man-made features and the twenty-two sonar contacts should be noted and/or avoided during pipeline construction activities.

ARCHEOLOGICAL ASSESSMENT

Introduction

This report presents the evaluation of the high resolution geophysical data from a survey of proposed routes for two gas flowlines and umbilicals from Block 348, Mississippi Canyon Area, to Block 261, Main Pass Area, offshore Louisiana. A portion of the survey crosses Blocks 781, 825, 869, 913, 914, 957, 958, and 1002, Viosca Knoll Area, which are included in nine-block polygons designated high probability areas for historic shipwrecks (U.S. Department of the Interior, Minerals Management Service [USDI MMS] 1998). Regional and vicinity maps in the hazard report show the survey location in relation to the Louisiana coast.

The high resolution geophysical survey data was conducted by Fugro GeoServices, Inc., for Elf Exploration, Inc. The proposed eastern and western gas flowline routes will originate near the Mississippi Canyon Block 348 (OCS-G-19939) No. 1 well. The proposed electrohydraulic chemical umbilical route and the proposed methanol umbilical route will originate at the Mississippi Canyon Block 348 (OCS-G-19939) No. 2 well. All of the proposed routes will terminate at the proposed "JP" platform in Main Pass Area Block 261 (OCS-G-13035).

The survey was conducted from the *M/V Geodetic Surveyor* between August, 2000 and January, 2001. Seas were variable from one to five and six to ten feet. *The R/V Aloha*, was the chase boat used to track the DeepTow fish system, utilizing the Sonardyne Ultra Short Baseline (USBL) acoustic array system. The geophysical instrumentation included a Simrad EA500 echo sounder and the Fugro DeepTow 2 System, which consists of the EdgeTech Dual Frequency Chirp Side Scan Sonar, the EdgeTech Full Spectrum Chirp Subbottom Profiler, and the Simrad SM2000 Multibeam Swath Bathymetry System. Water column velocity data were gathered with a Seabird SBE 19-01 Conductivity, Temperature, and Depth Recorder. The Fugro Starfix® satellite positioning system provided horizontal control. The application of a magnetometer was waived by the USDI MMS because of water depths greater than 500 feet, which preclude the effectiveness of that instrument.

Survey line spacing varied from 150 to 300 meters. Portions of DeepTow Lines 1 through 39 cover the blocks addressed in this report. A number of lines and line segments were rerun to assure data quality. Navigation fixes (shot points) that correspond with the antenna position are

ARCHEOLOGICAL ASSESSMENT

marked at 125-meter intervals along each track. The sonar and multibeam systems provide complete coverage of the seafloor, at 200 percent and 100 percent, respectively, with a representative sampling of the area by the other geophysical instrumentation.

The data are of good quality. The latest specifications published for hazard and cultural resources surveys by the USDI MMS were met.

In January, 2001, a conventional high resolution geophysical survey was conducted aboard the *M/V Geodetic Surveyor* over portions of the survey area not addressed in this report. The instrumentation included the Simrad EA 500 Echo Sounder, an EdgeTech SMS-260TH Side Scan sonar and a GeoMetrics 801/03 proton precession magnetometer. Water conductivity, temperature and depths were recorded with the Seabird SBE 19-01 recorder. The Fugro Starfix® satellite positioning system provided horizontal control. The Sonardyne Ultra Short Baseline (USBL) Acoustic Array System was utilized to track the sonar fish. Survey coverage consisted of nine primary tracklines spaced 300 meters apart, with a navigational fix interval of 125 meters. Investigation lines were run parallel to four existing pipelines. Several lines were rerun; these are numbered in a 100 or 200 series.

The figures, maps, and appendices of the hazard report are referenced in the following archeological discussion. Selected examples of the geophysical data are presented as figures in Appendix A. Appendix B is comprised of the list of geophysical equipment and instrument settings, a diagram of the survey vessel showing the sensor towing configuration, and equipment descriptions. The water column velocity data referenced for the bathymetry are in Appendix C. A list of the project personnel and a copy of the daily operations logs, which provide descriptions of the weather, sea state, and other commentary by the operators, are included in Appendix D. In Appendix E are the table of magnetic anomalies, along with a user's guide and nomogram, and the table of side scan sonar contacts. The bathymetry, seafloor features, and subbottom interpretation results of the survey area addressed in this report may be viewed on the Archeological, Engineering, and Hazard Maps, constructed at a scale of 1 inch equals 1,000 feet (1:12,000). Map 1 of 1 is an index map of the project. Maps 1 through 7 are the plan views of the survey route. Maps 8 through 12 show the subbottom

profiles along the proposed routes, with a horizontal scale of 1 inch equals 1,000 feet (1:12000) and a vertical scale of one inch equals 50 feet (1:600). A seafloor mosaic map (Map 1 of 1) across MP-261 is also included.

Previously Recorded Cultural Features

A number of wells and pipelines are within the survey area. The identities and locations of these features are shown on the Archeological, Engineering and Hazard Maps.

Because colonial and historic shipping routes have traditionally bypassed this area, the general probability for shipwreck occurrence in this portion of the northern Gulf of Mexico is considered to be low; preservation of a wreck site should be moderate to good (Garrison, Giammonna, Kelly, Tripp and Wolff 1989).

Charts and lists published by the U.S. Department of Transportation (1984 to Present), the National Ocean Service (1991, 1992), and CEI (1977), files maintained by the USDI MMS and previous archeological and hazard survey reports conducted in the vicinity of the proposed routes were reviewed. While no shipwrecks were noted in these previous reports, the files indicate that several shipwrecks have been reported in the area. Blocks 826 and 957 are the centroids for two nine-block polygons designating high probability areas for shipwrecks. The *Bradford C. French*, listed with Lloyd's register of ships, was reported lost in the vicinity of Block 957 in 1916. The 968-ton schooner built in 1884, foundered in this area "about 60 miles east of South Pass, Mississippi" (Berman 1972). Its position was noted as 88° 3' 6" West Longitude and 29° 1' 32" North Latitude. The wreck of the *Elmer E. Randall*, a 56-ton schooner built in 1893, reportedly sunk in the area of Block 826 in 1906 (Government Printing Office 1892, USDI MMS).

Previous geophysical surveys over identified wrecks using magnetometer and side scan sonar have shown that shipwrecks may be found intact or the debris may be scattered over an area greater than 100,000 square feet. Such scattering generally occurs with wooden hulled vessels in a nearshore environment where the vessel may be broken up and debris distributed by storm waves and currents (Arnold 1982; Saltus 1982; CEI 1977). Metal hulled vessels and vessels

which sink in deeper water may remain intact, although they can settle into and below unconsolidated seafloor sediments, occasionally leaving only a depression or scour zone to mark the site (Garrison, Giammona, Jobling, Tripp, Weinstein and Wolff 1989). Irregular anomalous bottom textures or debris fields may be the only indication of a wreck when magnetometry is not available.

Where sonar and magnetometry are not utilized, or water depths preclude their effectiveness, a wreck may be evident in the echo sounder and subbottom profiles if exposed above the seafloor sediments and in the beam range of the survey instrument. It may be detected as a diffraction anomaly at the surface, similar to those noted over buried pipelines and well sites, as well as an irregularity in the surface topography. At the 150 and 200-meter line spacing of this survey, which provide a sampling coverage of the area by the single beam echo sounder and subbottom profiler, the wreck exposed as a surface feature may be missed entirely if situated parallel to and midway between the lines. In the case of this survey, the side scan sonar and multibeam data provide complete coverage of the seafloor, and any anomalous features missed by the subbottom profiler or single beam echo sounder could be evident in the side scan sonar data or the multibeam data.

Bathymetry and Seafloor Features

The SeaBeam 1050 Multibeam Bathymetric System and Simrad single beam echosounder data were referenced for the bathymetry. These data show that water depths range from about 299 feet below local sea level (BLSL) at the Block 261 Main Pass Area proposed "JP structure to about 7,205 feet BLSL at the No. 1 well location in Block 348, Mississippi Canyon (see Appendix A:Figure 1). For specific water depths within the archeological high probability blocks, see Maps 4 through 6. The seafloor slopes to the south.

The digital echo sounder data were adjusted to compensate for the transducer depth. The soundings were converted from two-way traveltime to depths in feet by application of the harmonic mean velocities calculated from the Sea-Bird Velocity measurements (see Appendix C).

ARCHEOLOGICAL ASSESSMENT

Deep Tow Side Scan Sonar Interpretation

Seafloor sediments in this area are reported to be clays (USDI MMS 1983:Visual 3) which are largely derived from the settling of suspended particles in a low energy environment. Geotechnical investigations of 37 cores collected within the area indicate that soils are generally highly plastic clays.

The sonograms record a smooth, acoustically uniform, moderately reflecting seafloor over the project area, with a few textural variations noted (Appendix A:Figure 2). These appear to correspond with acoustic voids and fault scarps at the seafloor that were observed in the pinger data. In Block 781, pockmarks formed by the venting at the seafloor of subsurface gas or fluids were noted. The pipelines and well sites were well delineated.

There are 22 sonar contacts recorded within the project area, five of which, Contacts 12 through 16, are in the shipwreck high probability blocks. All of the contacts are listed and described in the Side Scan Sonar Contact Table in Appendix E. Also included in the table are one-to-one scanned images from the original data.

Sonar target 12 is about 250 feet north of the east flowline in Block 924; its coordinates are X=1,315,230.96', Y=10,554,259.17'. It measures 25 feet long and seven feet wide, with no relief above the seafloor.

Target 13 is about 400 feet north of the west flowline in Block 913; X=1,311,355.60', Y=10,557,905.25'. It measures three feet by ten feet with no relief.

Target 14 in Block 869 is about 5,700 feet north of the east flowline; X=1,309,055.86', Y=10,576,295.90'. It is a zone of disturbed seafloor about 29 feet by ten feet with a relief of about 6 feet.

Target 15 is about 3,700 feet north of the east flowline in Block 825; its coordinates are X=1,304,494.91', Y=10,585,485.90'. It measures ten feet long and six feet wide, with no relief above the seafloor.

ARCHEOLOGICAL ASSESSMENT

Target 16 is in Block 781 about 100 feet north of the east flowline; its coordinates are X=1,299,434.79'; Y=10,600,297.97'. It measures 23 feet by seven feet with no relief.

The dimensions and configurations of these contacts suggests that they may represent modern debris. However, none can be reliably identified from these data and should be avoided.

No other anomalous bottom features such as scour zones, reflectivity variations, relief changes or unidentified targets were observed that could be interpreted as possible shipwreck remains.

DeepTow Subbottom Profiler Interpretation

The subbottom profiler data record several units of unevenly layered parallel strata (see Figure Nos. 4, 5, and 6). Acoustic penetrations were achieved up to 110 feet below the seafloor. No anomalous diffraction hyperbolas or evidence of other significant variations in surface density occur at the seafloor which could indicate an object on or embedded in the shallow subsurface sediments.

Summary and Recommendations

In summary, the evaluation of the high resolution geophysical data from a survey for two proposed flowlines and two umbilical rights-of-way in Blocks 781, 825, 869, 913, 914, 957, 958, and 1002, Viosca Knoll Area, offshore Louisiana, indicates that no anomalous seafloor features that could be interpreted as possible shipwreck remains are recorded in the echo sounder, multibeam or subbottom profiler data sets. There are five unidentified linear contacts recorded in Blocks 781, 825, 869, 913, and 924. These contacts cannot be reliably identified and should be avoided.