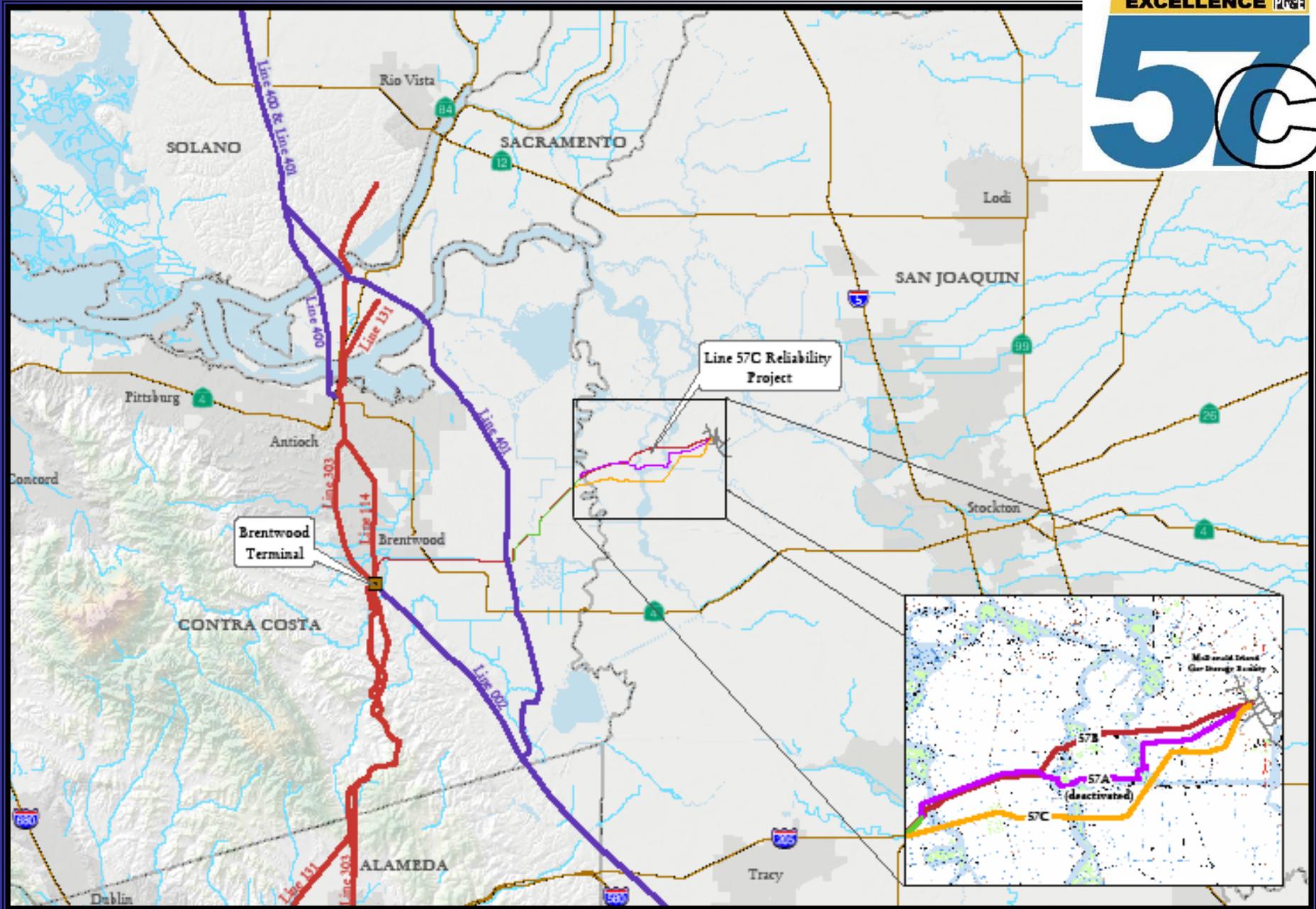
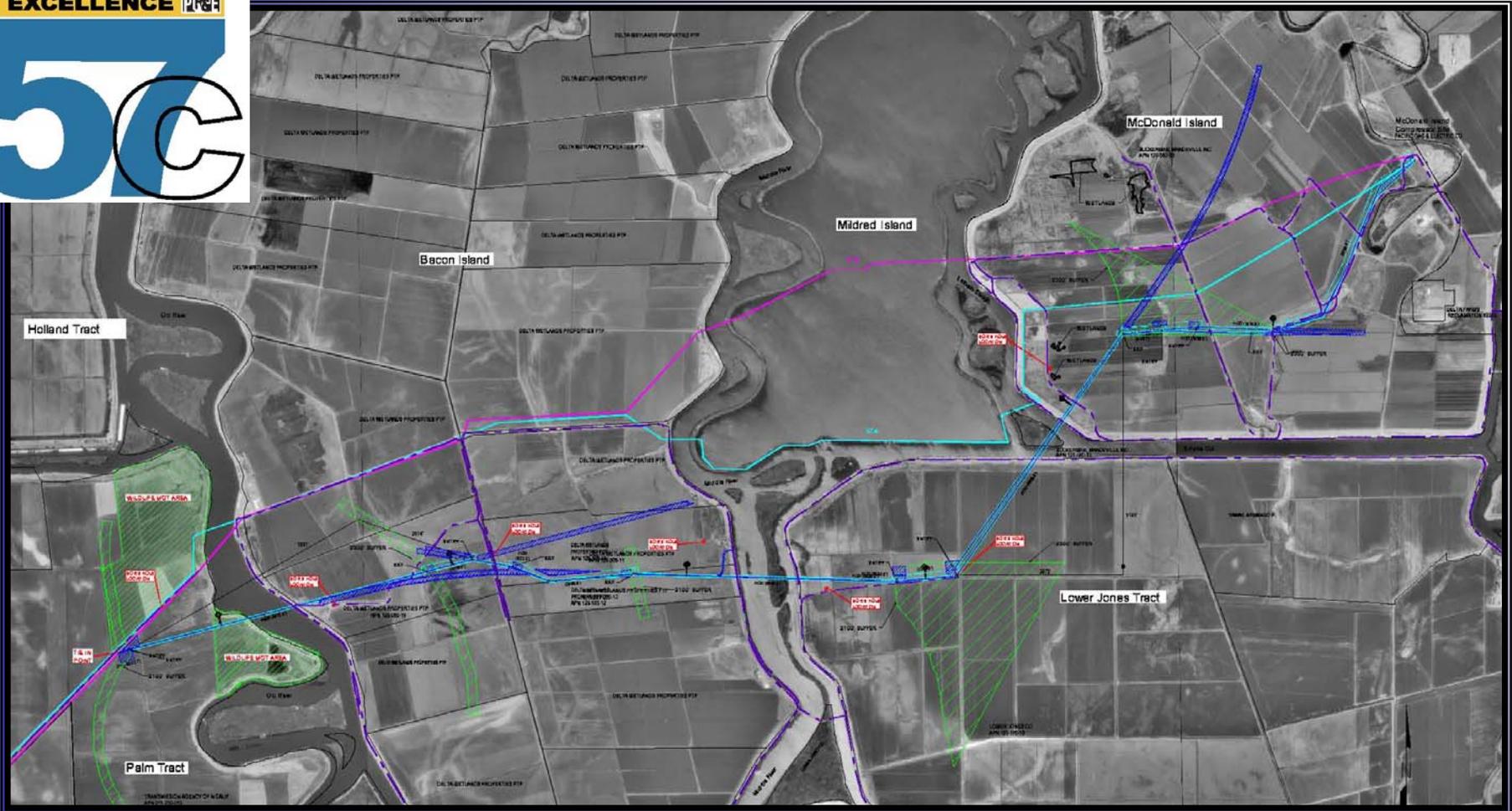




**Pipeline Installation by  
the Hole Intersect Method  
to Protect Facilities  
Crossing Under  
Navigable Waterways**

# 57C





- L-57A (18") installed 1949 by Standard Oil. Floated during flooding of Mildred Island, and is partially decommissioned.
- L-57B (22") installed 1974 through the levy cross sections.
- 25% of PG&E's daily peak winter demand is supplied by Mc Donald Island.



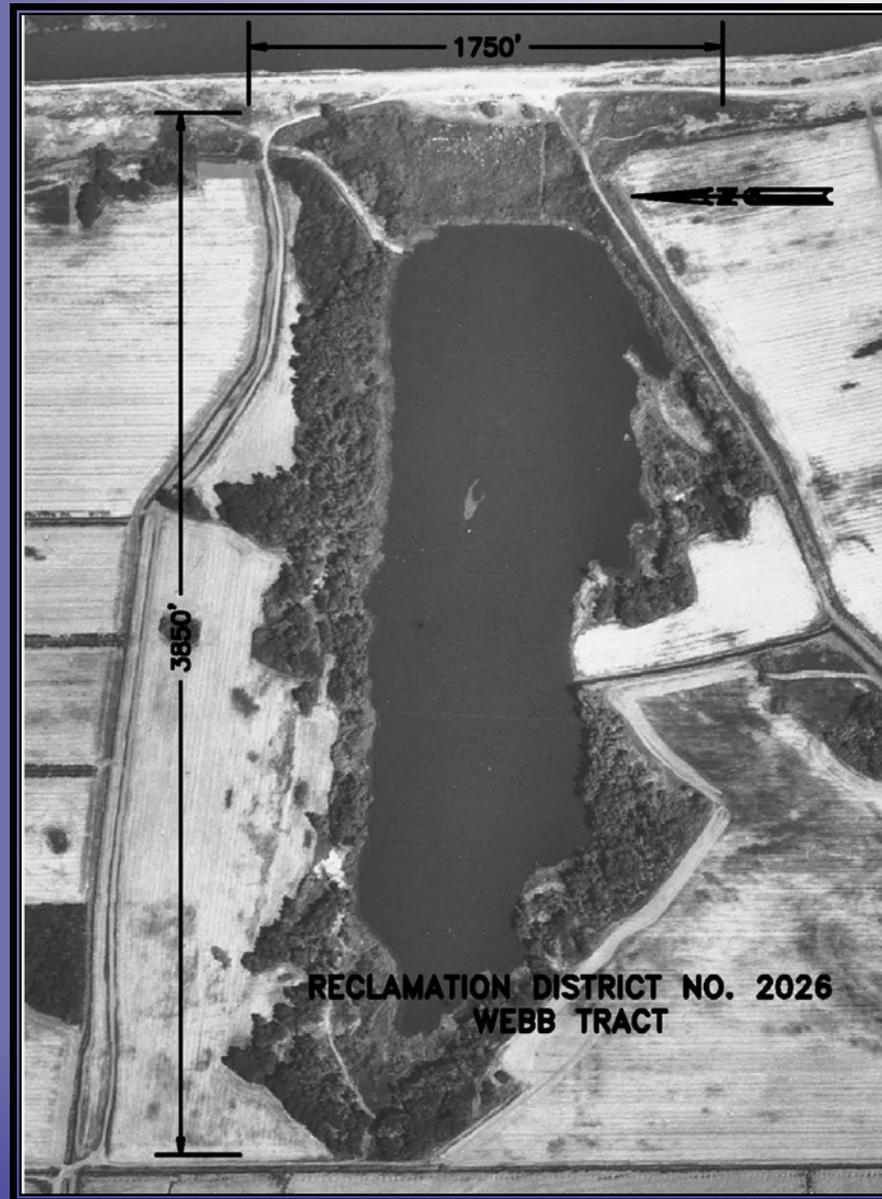
The loss of supply from Mc Donald Island would cost between \$200 million to \$1 billion.



McDonald Island levy breach



Levee Breach = Scour



Scour is bad for buried structures!



Island	Date of Flood	Probable Cause of Levee Failure	Levee Break Dimensions		
			Width	Max. Scour Depth	Scour Length
Lower Jones Tract	1980	Levee Failure - Rodents?			
Webb Tract	1980	High Water Failure	800 ft.		3800 ft.
Holland Tract	1980	High Water Failure	300 ft.		2600 ft.
McDonald Island	August 23, 1982	Levee Failure - Rodents?	650 ft.	-70 ft.	1200 ft.
Venice Island	November 1982	High Water Failure	510 ft.	-35 ft.	2200 ft.
Mildred Island	November 1982	High Water Failure	450 ft.	-90 ft.	550 ft.
Bradford Island	1983	High Water Failure			
New Hope Tract	February 1986	High Water Failure			
McCormick-Williams Tract	February 1986	Overtopping			
Deadhorse Island	February 1986	Overtopping	190 ft.	None	None
Glanville Tract	February 1986	Overtopping		None	None
Little Mandeville Island	February 1986	High Water Failure	190 ft.	-25 ft.	200 ft.
Tyler Island	February 21, 1986	Overtopping	375 ft.	-45 ft.	1900 ft.
Upper Jones Tract	June 3, 2004	Levee Failure - Rodents?	260 ft.	-50 ft.	

But How Deep?



- Pipe Spec: 24" DSAW, 0.750 WT, Gr. X-70, w/ 16 mils FBE (Mfg: Nippon Steel)
- Open Cut Coating: 1" concrete added over FBE for buoyancy control
- HDD Coating: 40 mils Powercrete over FBE

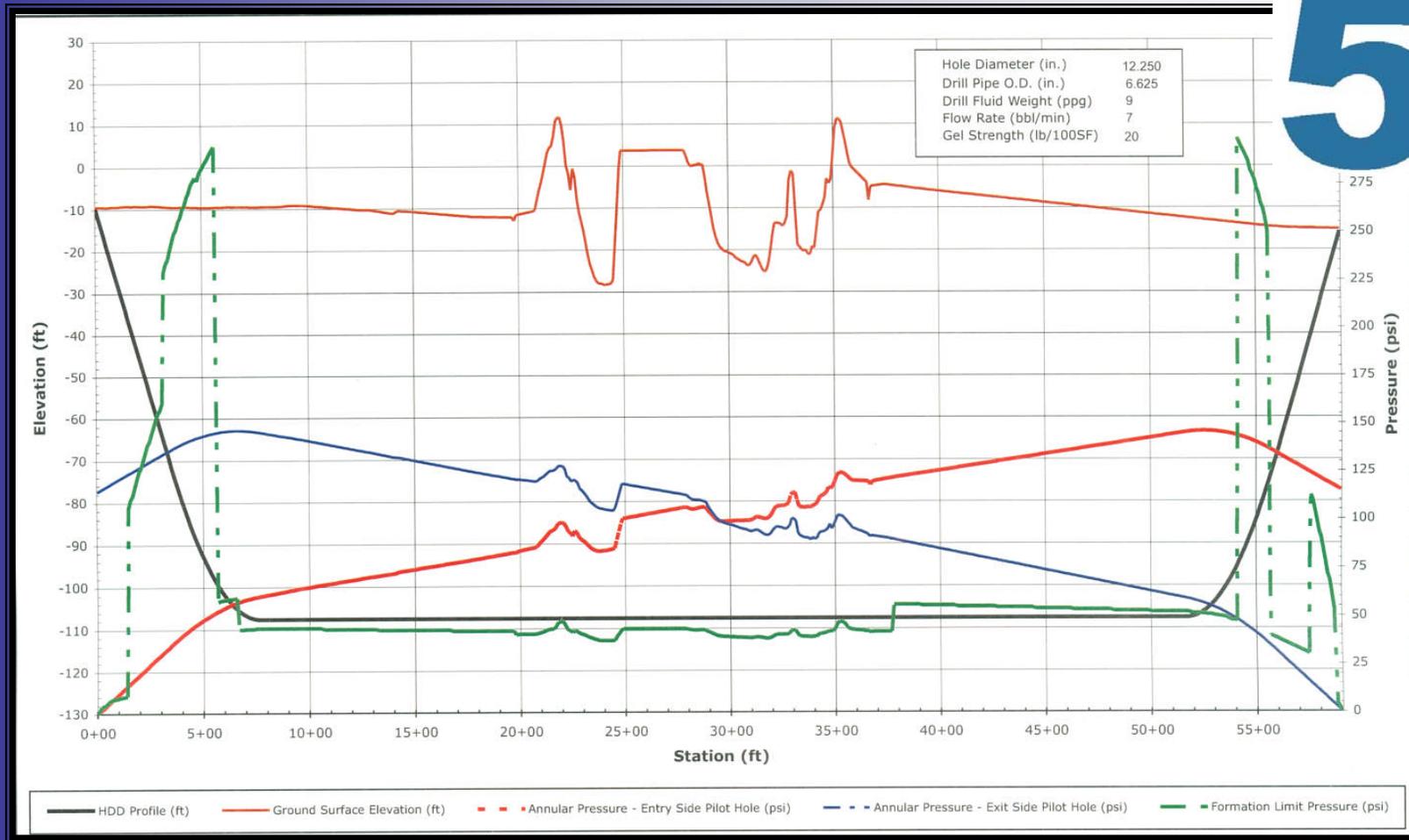
# HDD Design



- Pipeline outside of modeled scour zone.
- Entry / Exit min. 300' from levee toe and min.
- Depth > 60' below bottom of channel.
- All bending radii produce acceptable combined stresses during hydrotesting.
- Avoid fracture of the formation.

<u>Crossing</u>	<u>Length</u>
Empire Cut	6,420'
Middle River	5,820'
Old River	6,800'





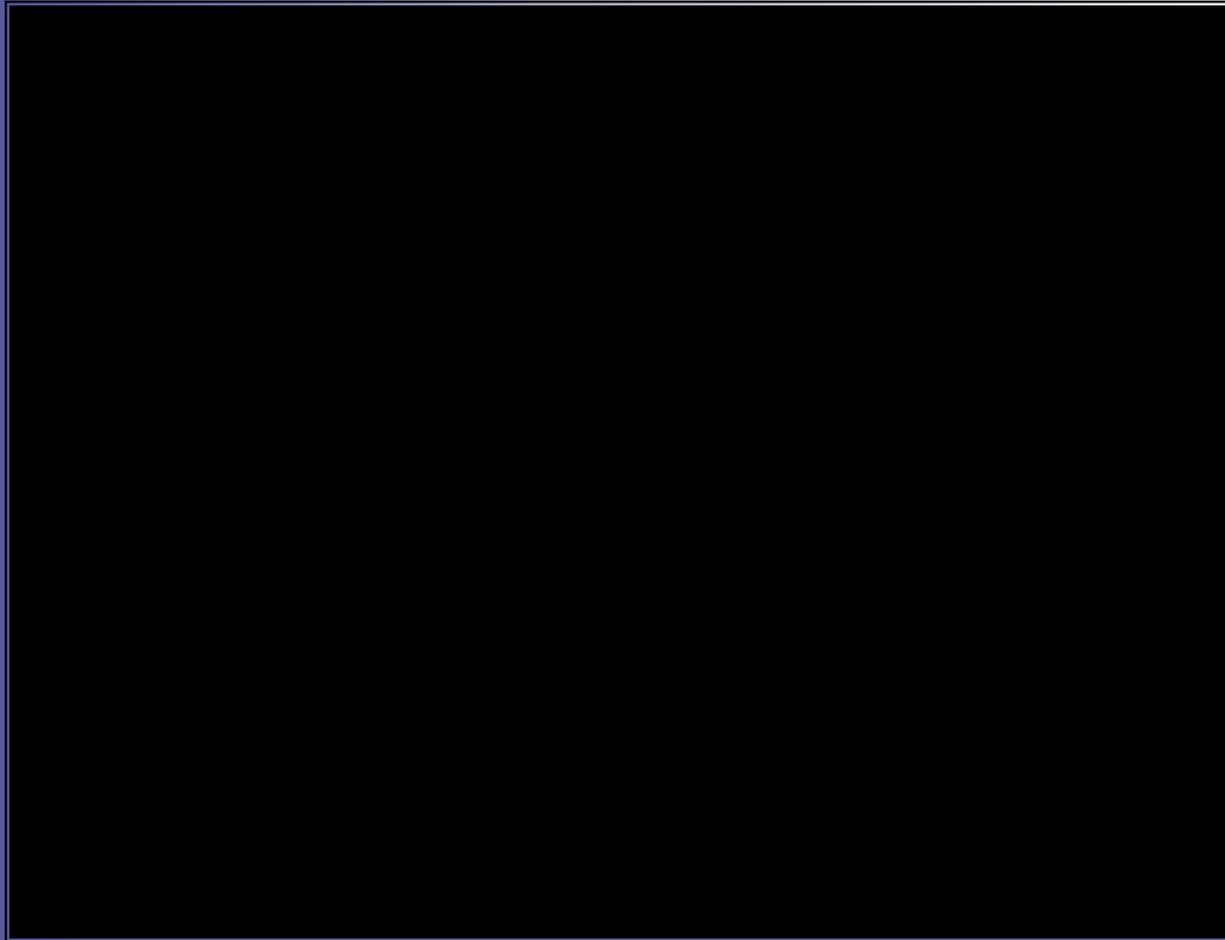
- To avoid “Frac-Out”: Keep downhole pressures below the “*theoretical*” limit pressure of the formation.
- Hire an experienced Driller!



Equipment		Rotary wash											
Depth (feet)	Sample Type	Sample No.	FIELD				LABORATORY					Lithography	DESCRIPTION
			Blows/ft	Pocket Penetrometer (tsf)	Dry Density (pcf)	Moisture Content (%)	Liquid Limit	Plasticity Index	Passing #4 Sieve (%)	Passing #200 Sieve (%)	Other Tests		
4-2.5-1	0	<0.25										(PT) PEAT - Dark brown, very soft, low plasticity	
4-5-1	0	<0.25	20	264									
4-10-1	0	<0.25	22	249								Gray	
	0												
4-20-1	3	0.75	88	34						UC = 0.7 ksf		(ML) SILT - Gray, soft, low plasticity	
4-25-1	10											(SM) SILTY SAND - Gray, loose, fine grained	
												(ML) CLAYEY SILT - Gray, stiff, low plasticity	
												(SM) SILTY SAND - Gray, loose, fine grained	

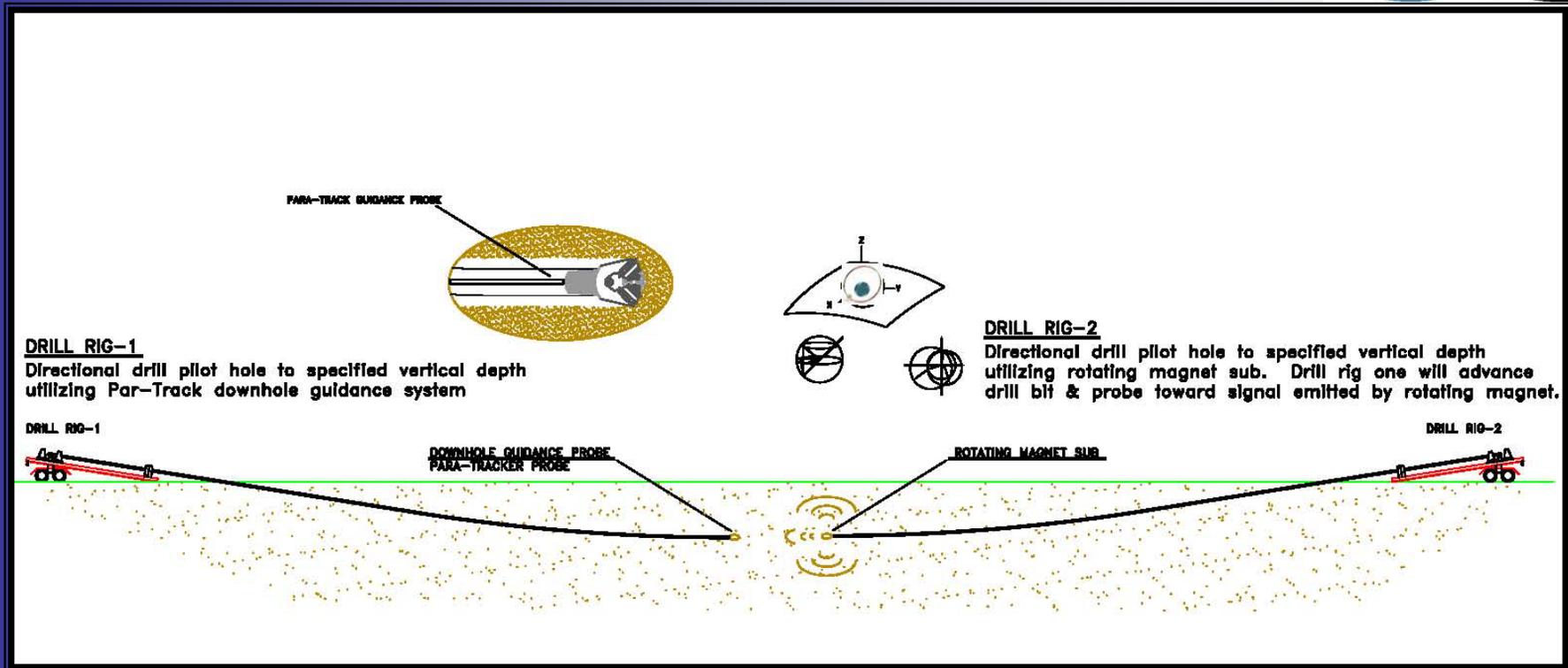
Geotechnical data to surmise formation limits.

## The Answers!



- Utilize hole intersect method of HDD to keep downhole pressures low.
- Use Conductor Casing

# The Answers



- Utilize hole intersect Method of HDD to keep downhole pressures low.
- Use Conductor Casing



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 Fax: (920) 583-3429  
[www.michels-usa.com](http://www.michels-usa.com)



**HERCULES  
 (3) RIGS OWNED & OPERATED**

**DRILL RIG SPECIFICATIONS**

Height: 13' 6"  
 Length: 53'  
 Width: 8' 6"  
 Horsepower: 1500+ HP (750 HP ea)

**DRILL RIG CAPACITY**

Torque Capacity: 160,000 Ft/Lbs  
 Max Spindle Speed: 90 RPM  
 Thrust/Pull: 1,260,000 Lbs

**DRILLING SPECIFICATIONS (DIRT)**

MAXIMUM RECOMMENDED  
 Back Ream: 96"  
 Drilling Distance: 8,000'

**DRILLING SPECIFICATIONS (ROCK)**

MAXIMUM RECOMMENDED  
 Back Ream: 60"  
 Drilling Distance: 8,000'

**SURVEY SYSTEM SPECIFICATIONS**

Type: Downhole probe transmits tool face, three dimensional coordinate data to surface  
 Accuracy: +/- 0.1° All Angles  
 Max Locating Depth: Unlimited



The Big Boy



Digging in the Delta

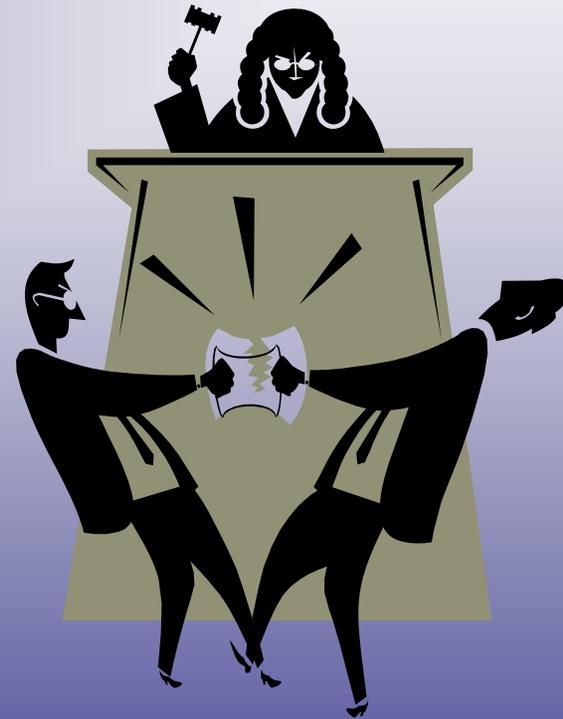


Why the gap???

Q: How many lawyers does it take to ruin a good project?

A: Just One

- Litigation over MND
- Condemnation
- Challenge at CPUC
- \$1.4 Million spent on Lawyers



## Let's Drill!!!



# Conductor Casing



# Drill Stem

OPERATIONAL  
EXCELLENCE



# 57C



Hydrotested & Ready to Pull

OPERATIONAL  
EXCELLENCE



57C

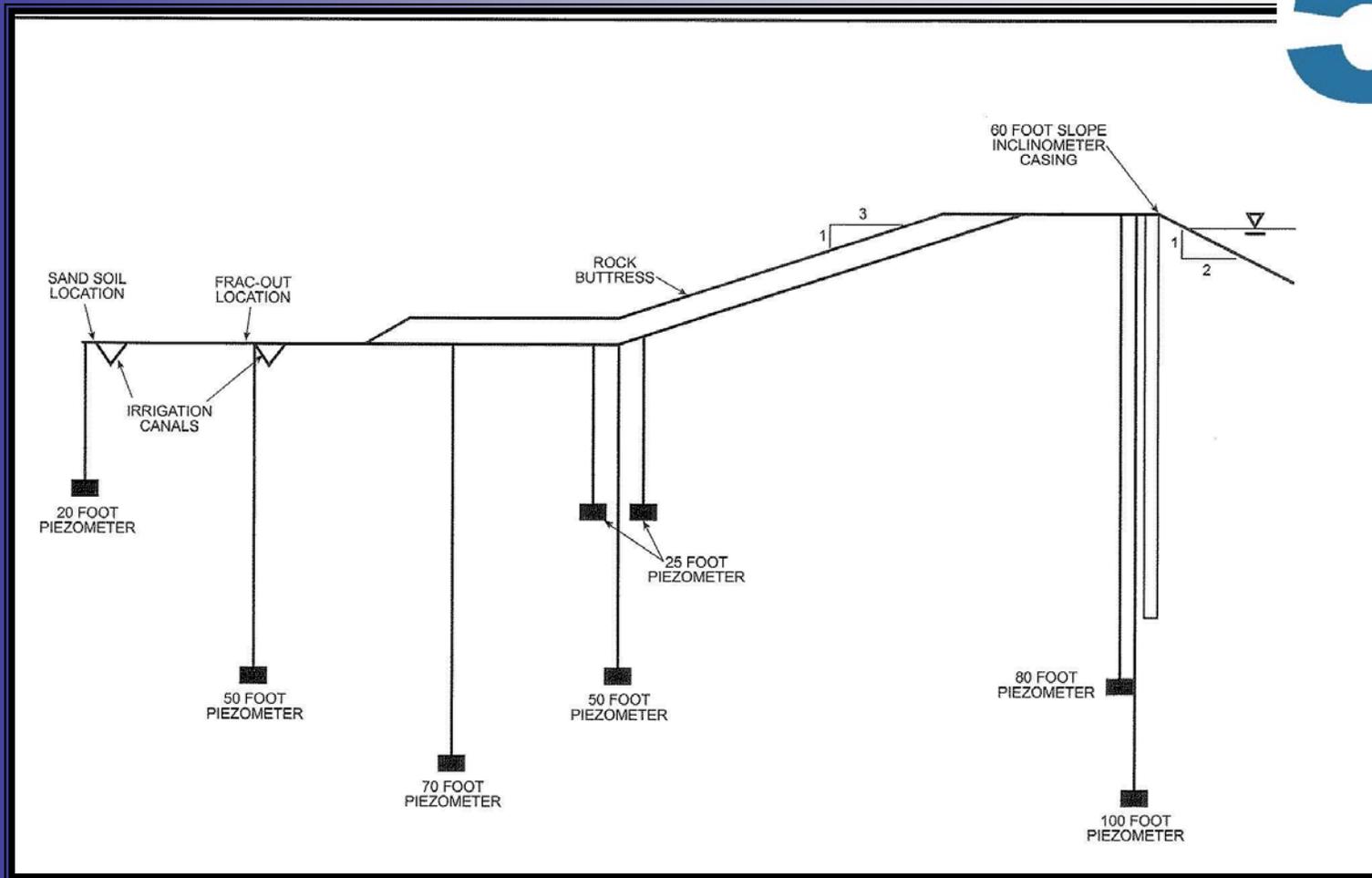


# The Pull

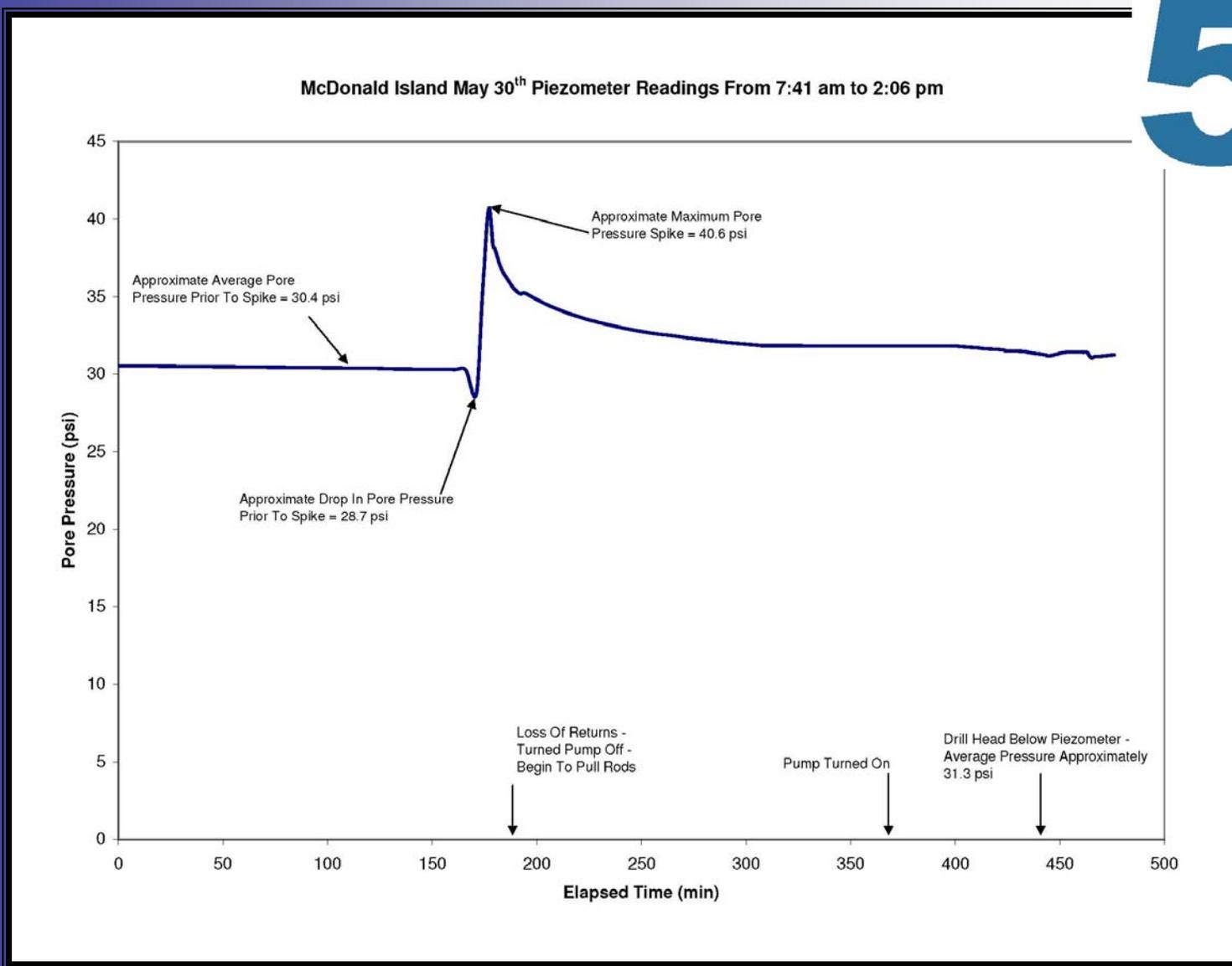


## Gently Cradled Into the Hole

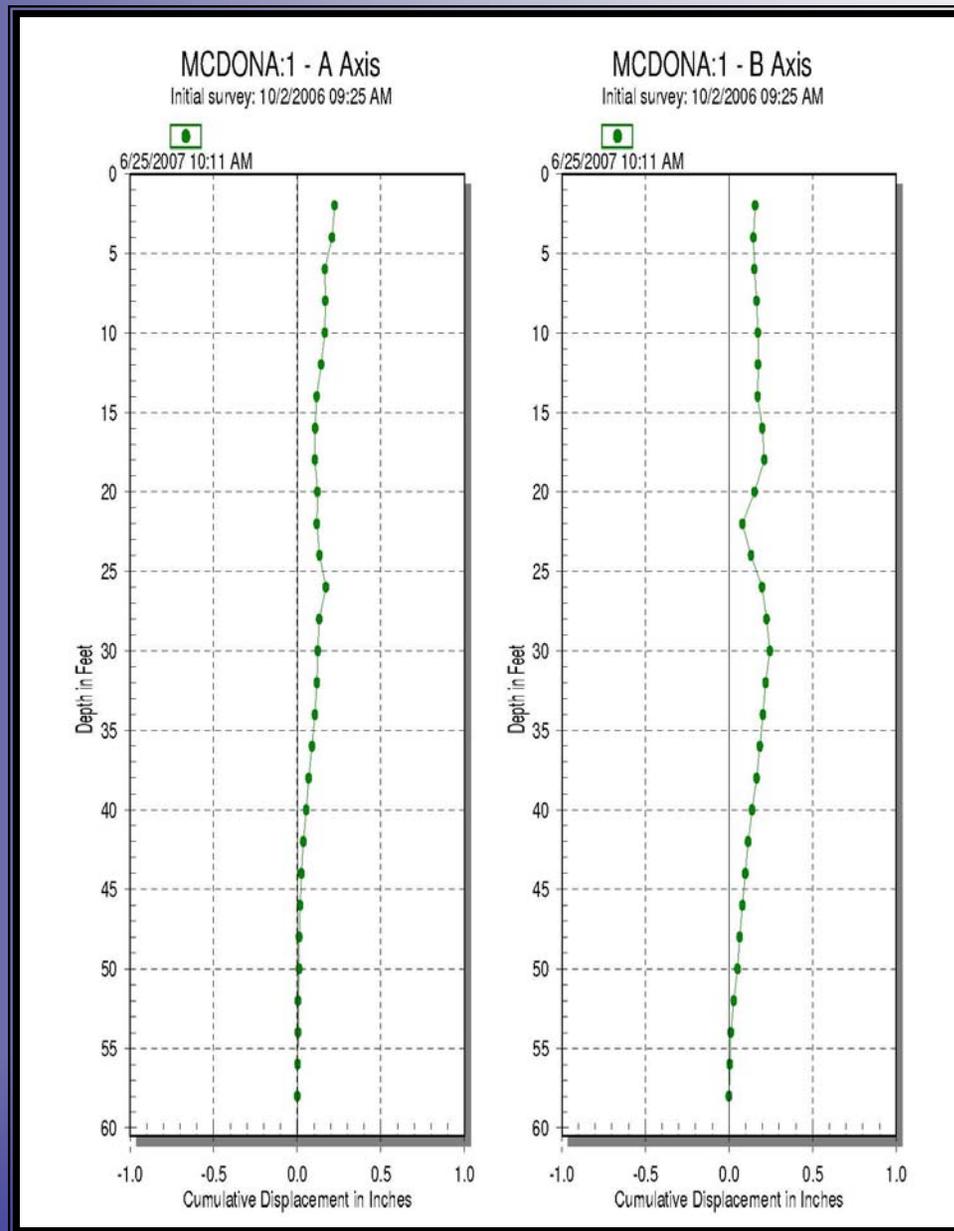




## Instrumentation to Monitor Drilling Operations



## Anatomy of a Frac-Out



Slope Inclinometer Data

OPERATIONAL  
EXCELLENCE



57C



We Done Good !!!!