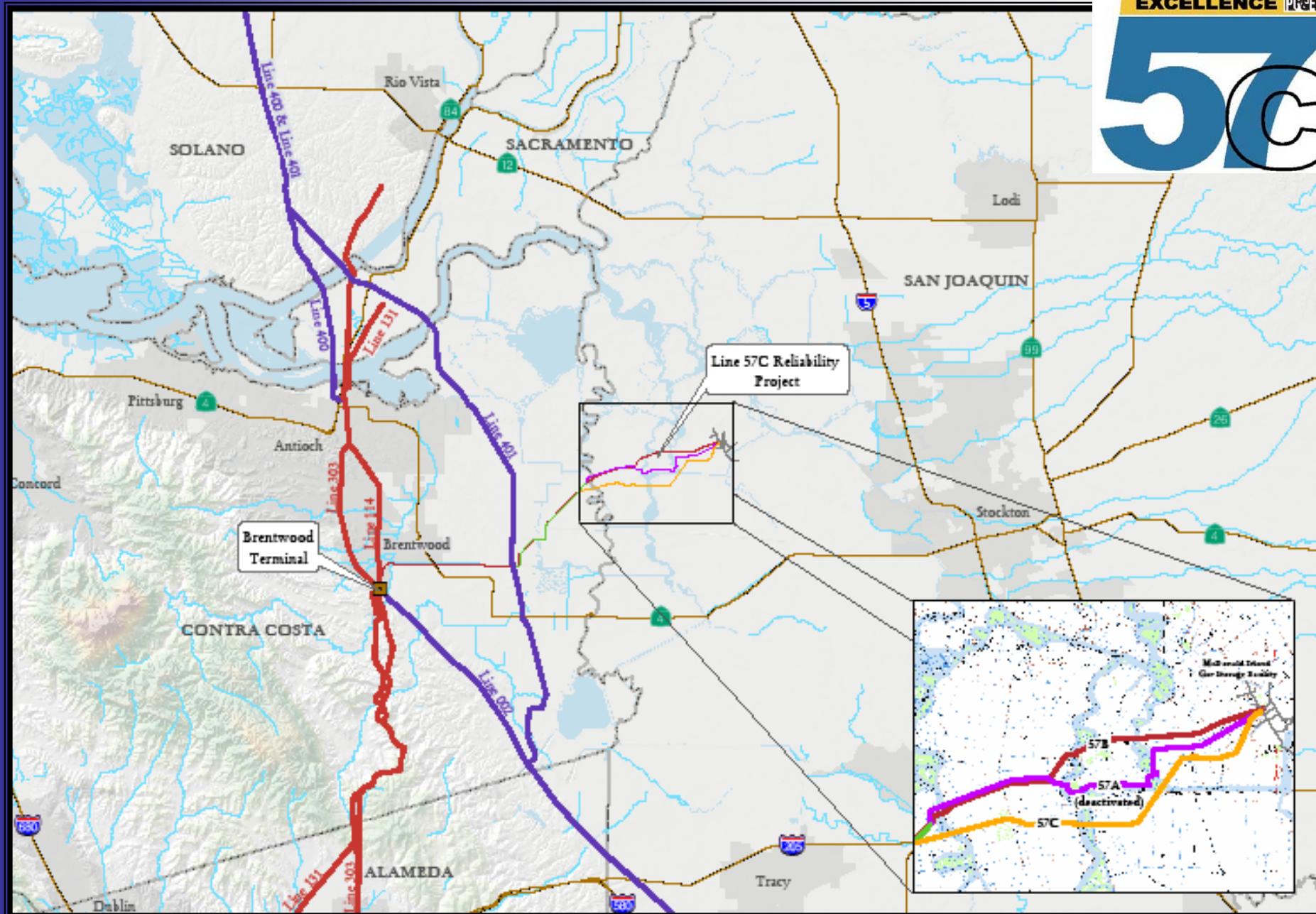
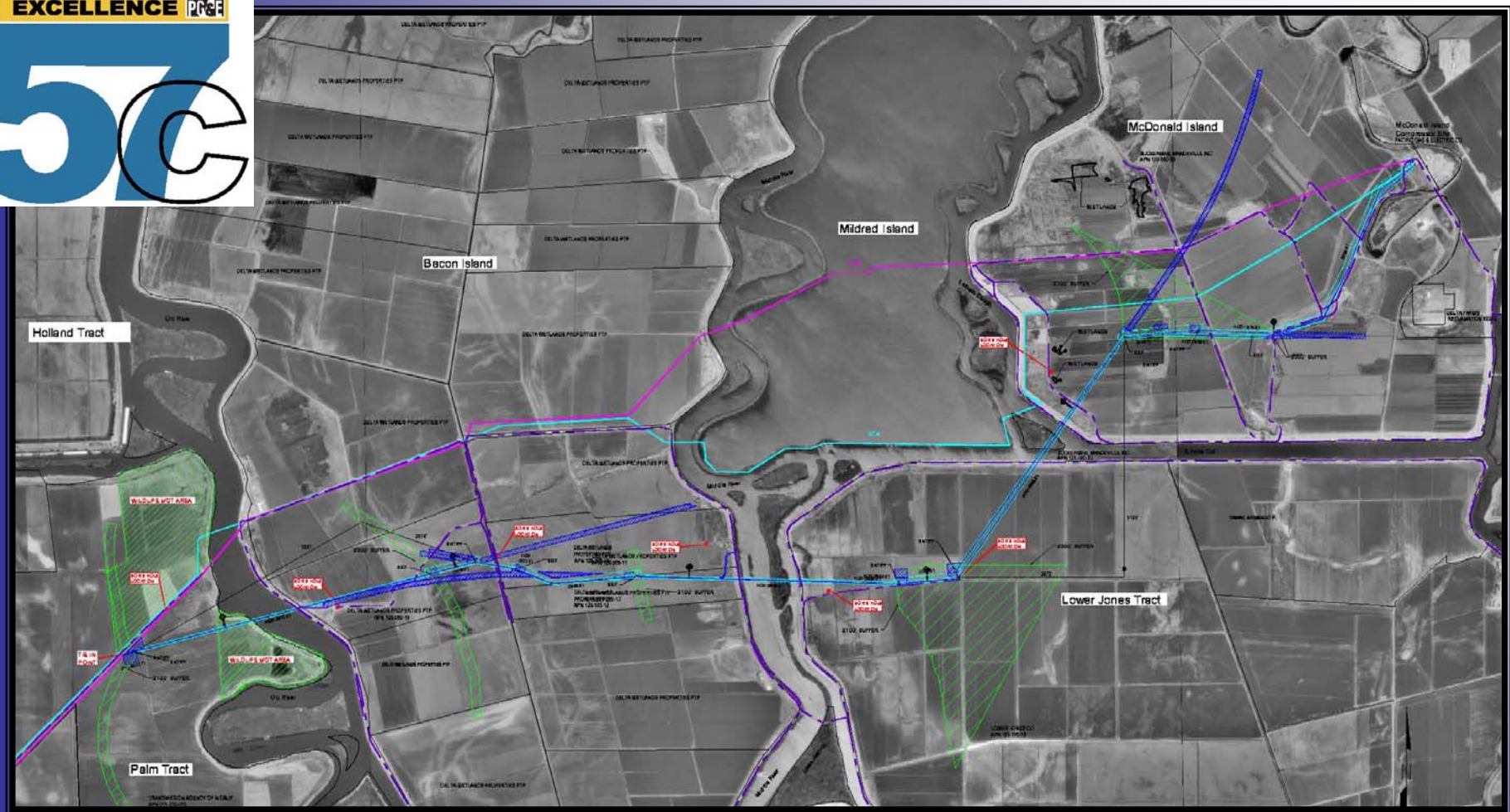




Pipeline Installation by the Hole Intersect Method to Protect Facilities Crossing Under Navigable Waterways

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.



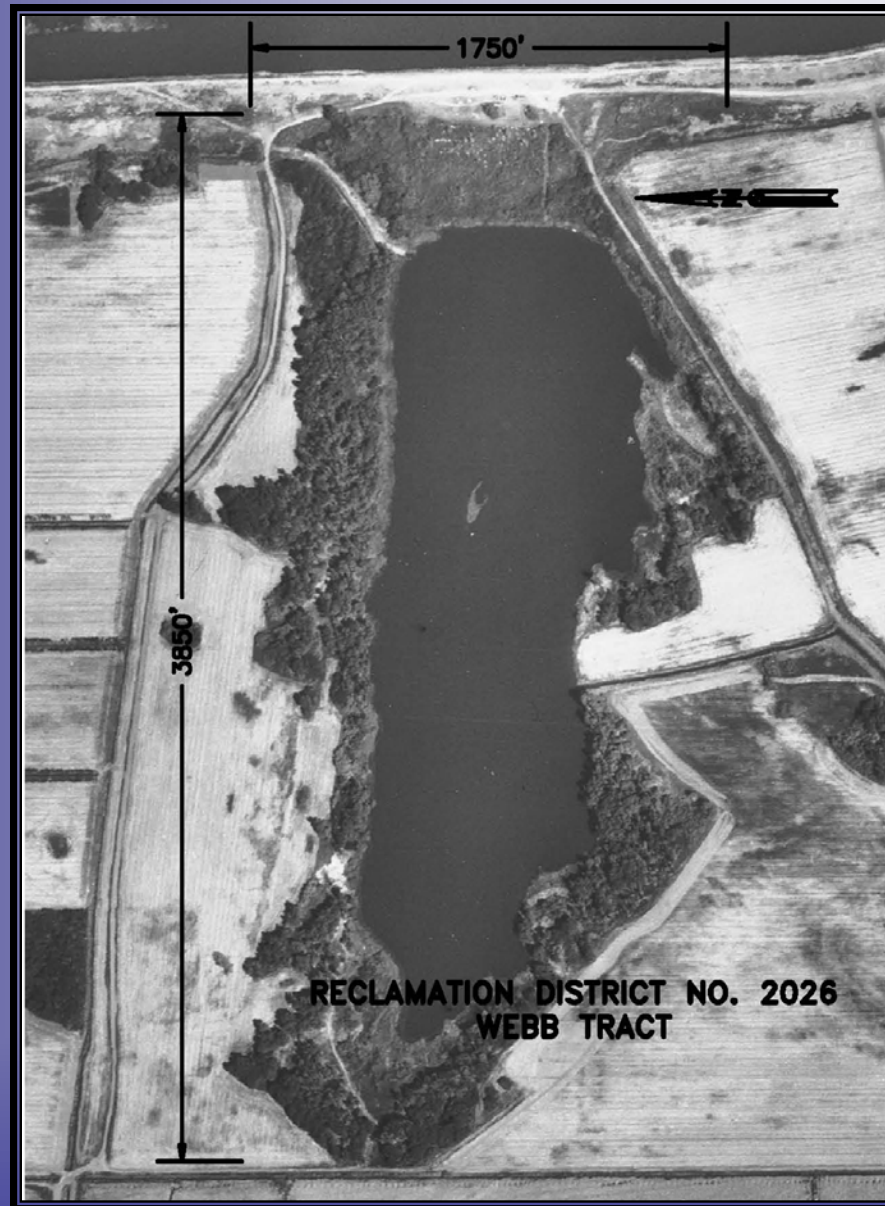
The loss of supply from Mc Donald Island would cost between \$200 million to \$1 billion.



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?

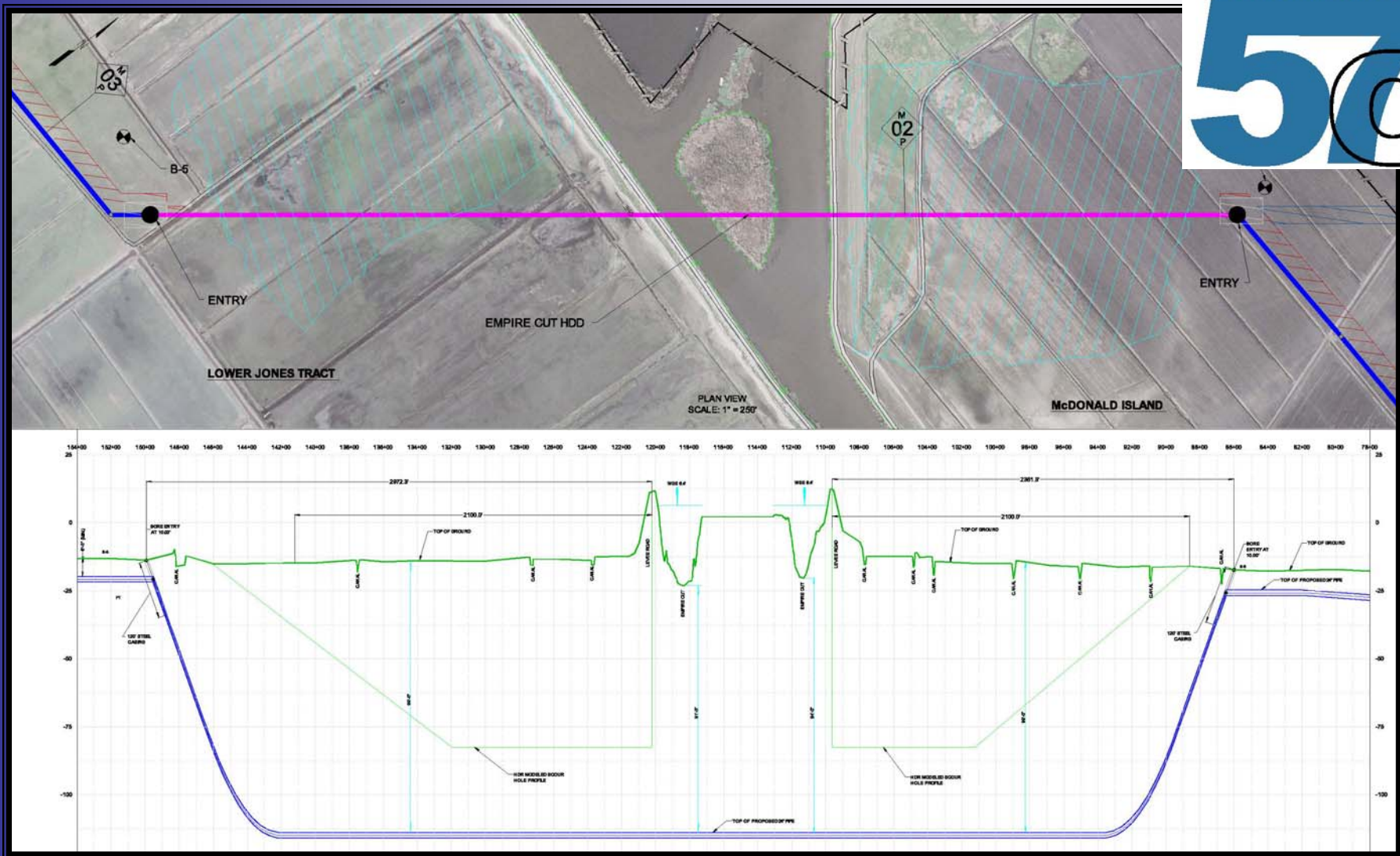


- Pipe Spec: 24" DSAW, 0.750 WT, Gr. X-70, w/ 16 mils FBE (Mfg: Nippon Steel)
- Open Cut Coating: 1" concrete added over FBE for buoyancy control
- HDD Coating: 40 mils Powercrete over FBE

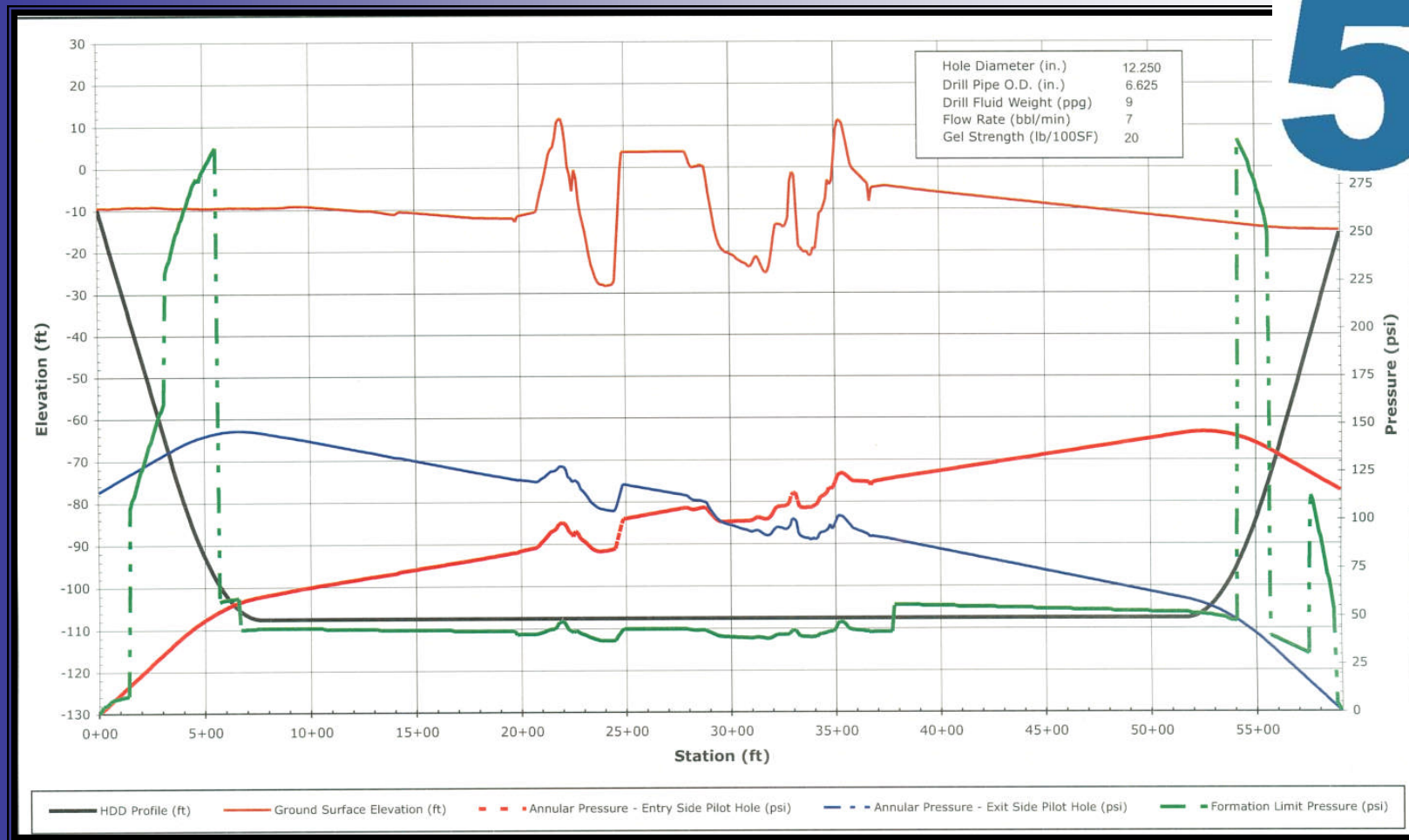
HDD Design

- 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'



Empire Cut HDD



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

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

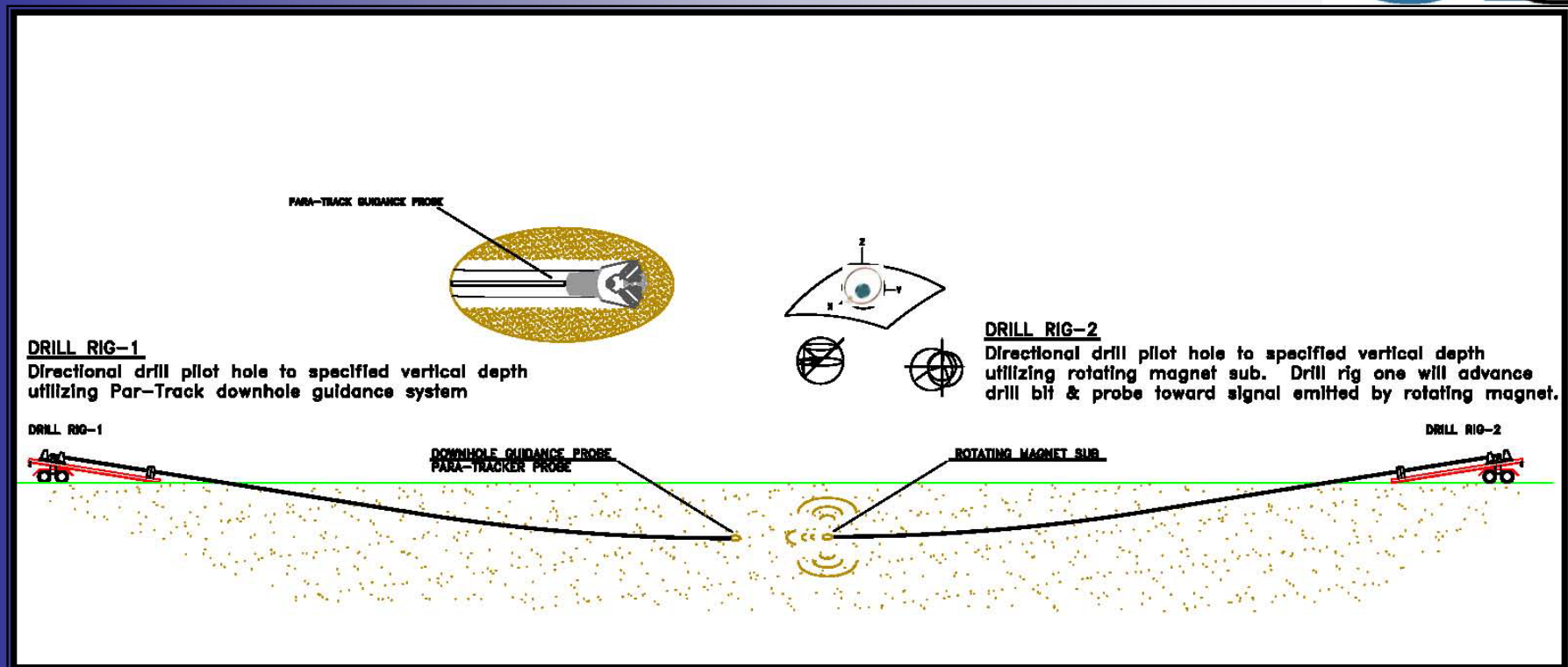
Geotechnical data to surmise formation limits.

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



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

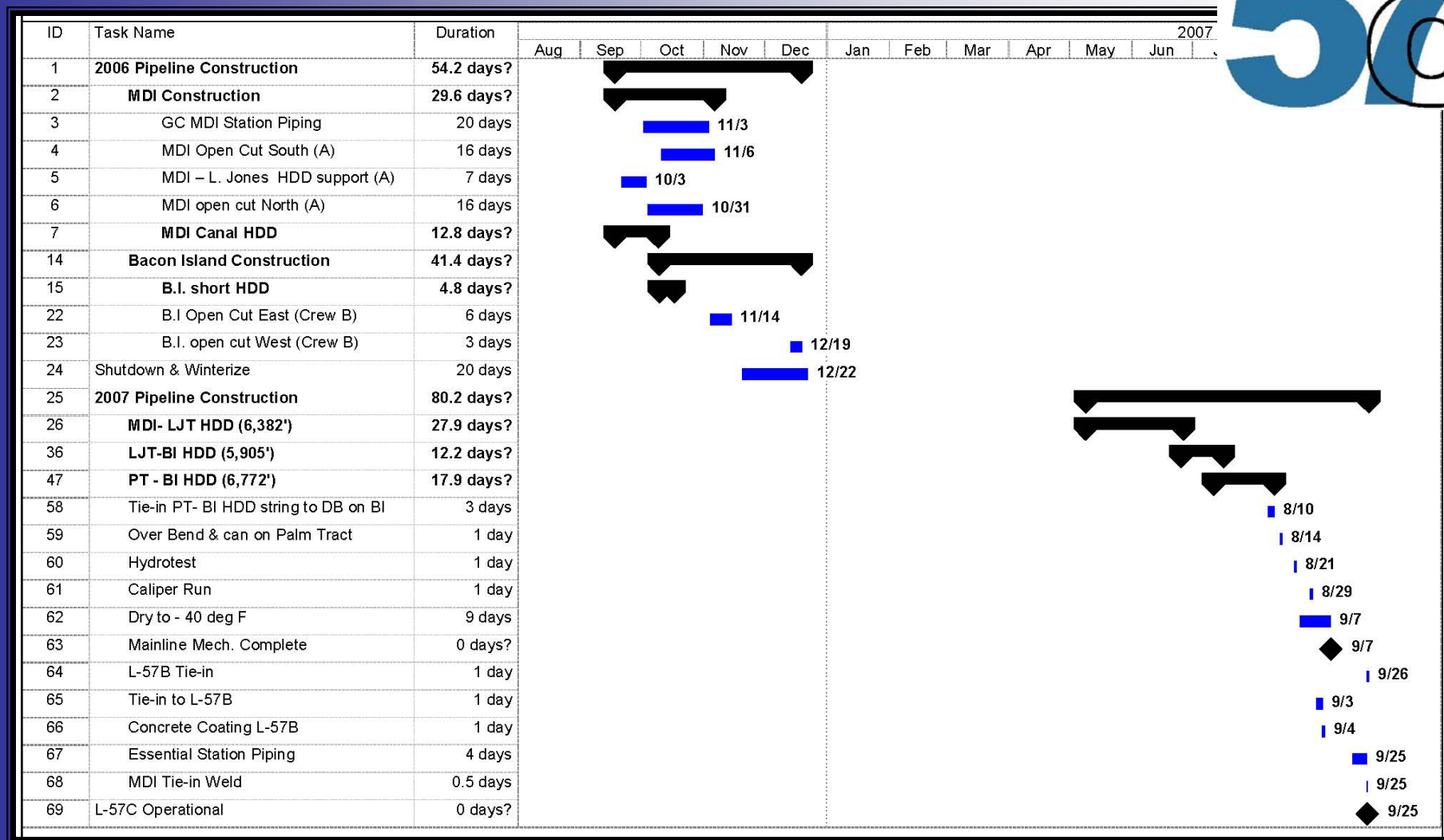
Type: Downhole probe transmits tool face, three dimensional coordinate data to surface
 Accuracy: $\pm 0.1^\circ$ All Angles
 Max Locating Depth: Unlimited



The Big Boy



Digging in the Delta

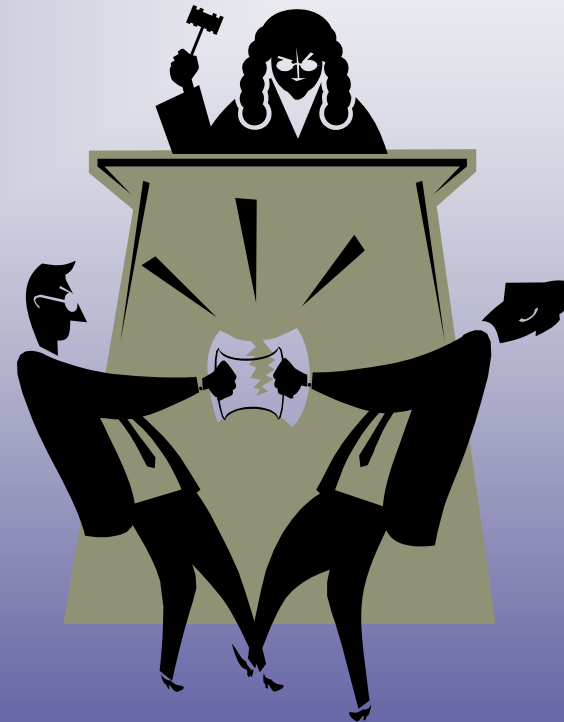


Why the gap???

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

OPERATIONAL
EXCELLENCE



57C



Drill Stem



Hydrotested & Ready to Pull

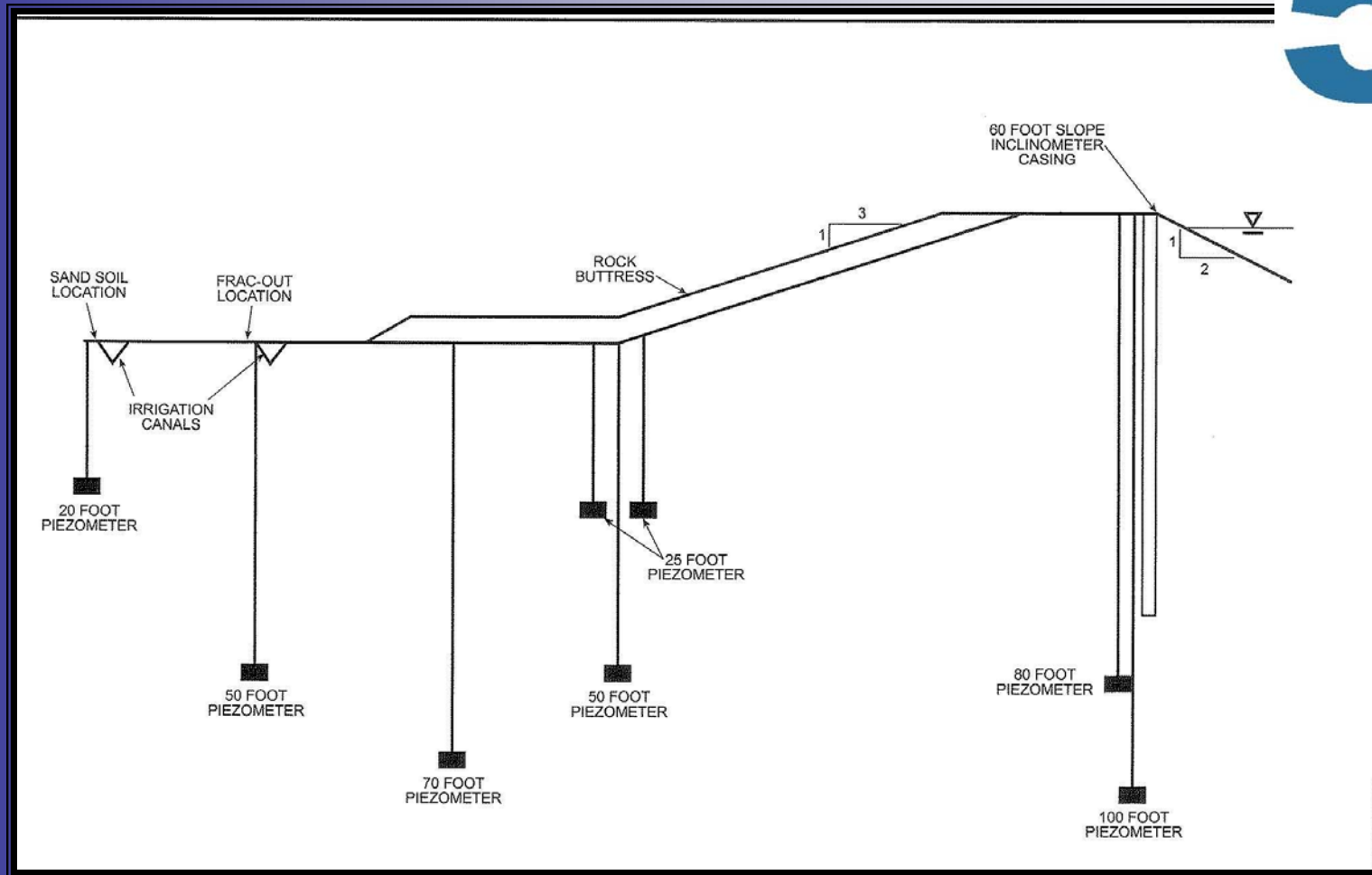


The Pull



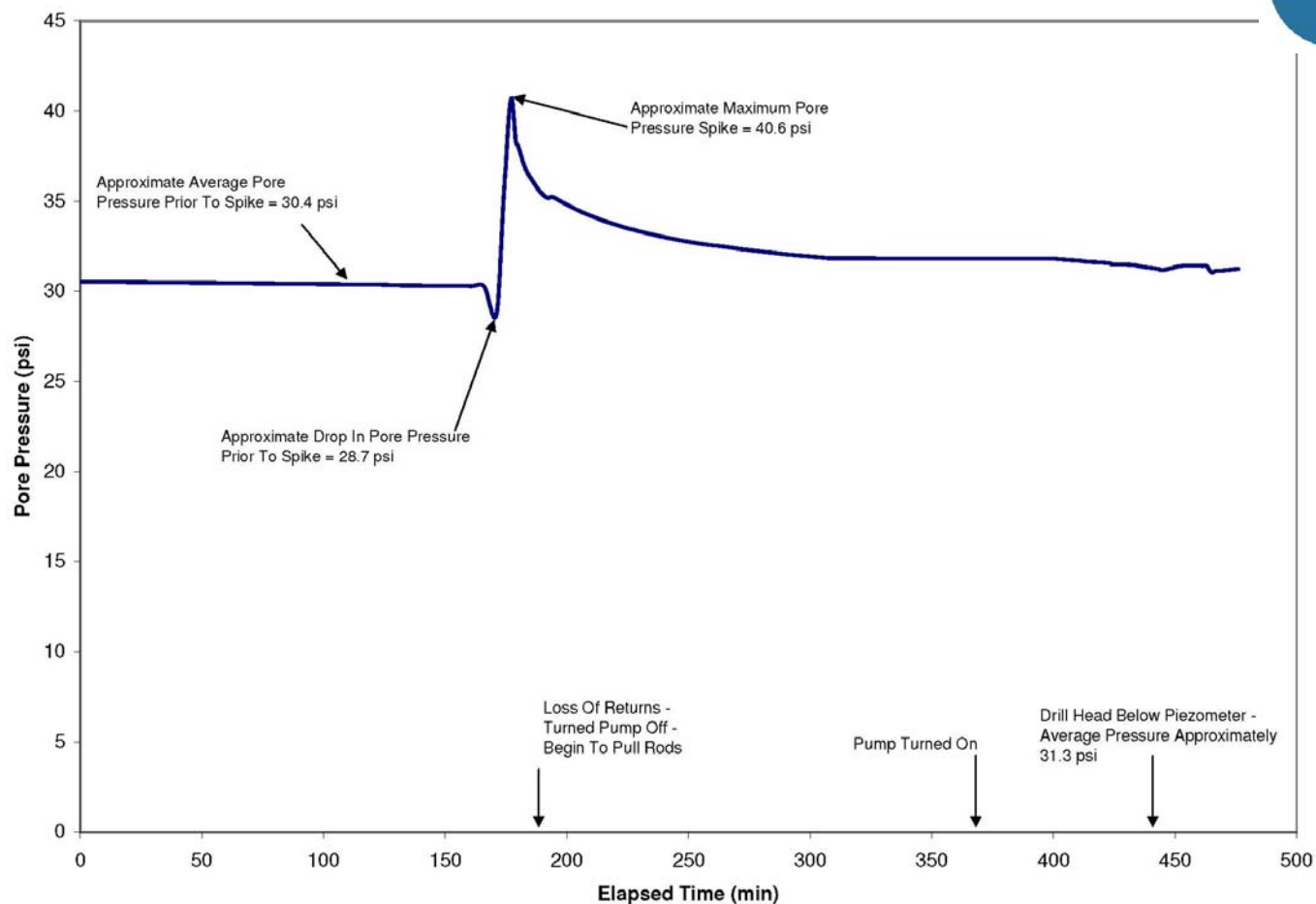
Gently Cradled Into the Hole



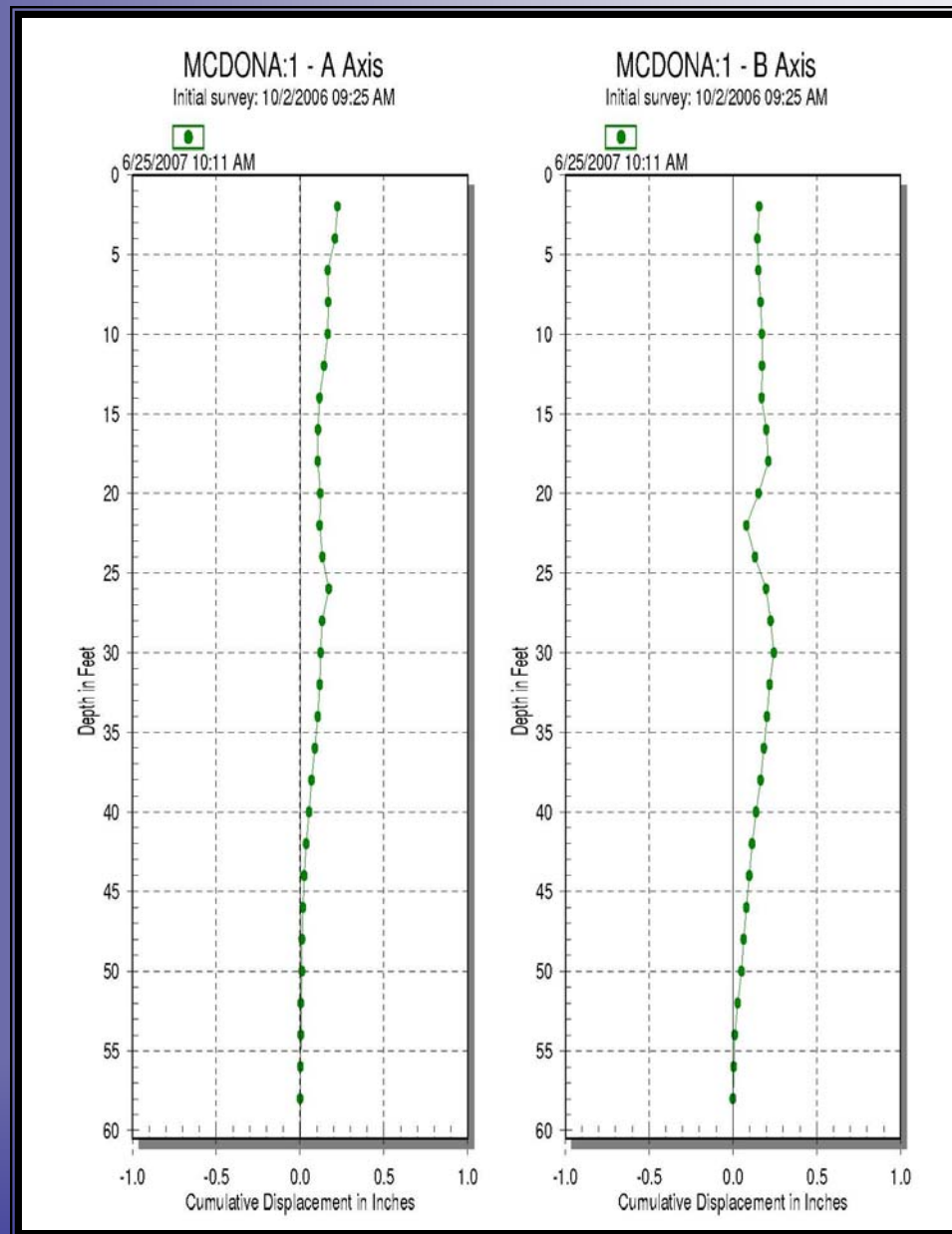


Instrumentation to Monitor Drilling Operations

McDonald Island May 30th Piezometer Readings From 7:41 am to 2:06 pm



Anatomy of a Frac-Out



Slope Inclinometer Data



We Done Good !!!!