



X INGPET  
2022



# PRACTICAS OPERATIVAS EN LA PERFORACION DE LA SECCION HORIZONTAL DE 6 1/8" CON MÁS DE 1000 m, CAMPO BRETAÑA – LOTE 95, PERU

MANUEL CASIANO / JAVIER DIAZ / HERNAN MELENDEZ  
PETROTAL

Perú

CIP

Construcción e intervenciones de pozos



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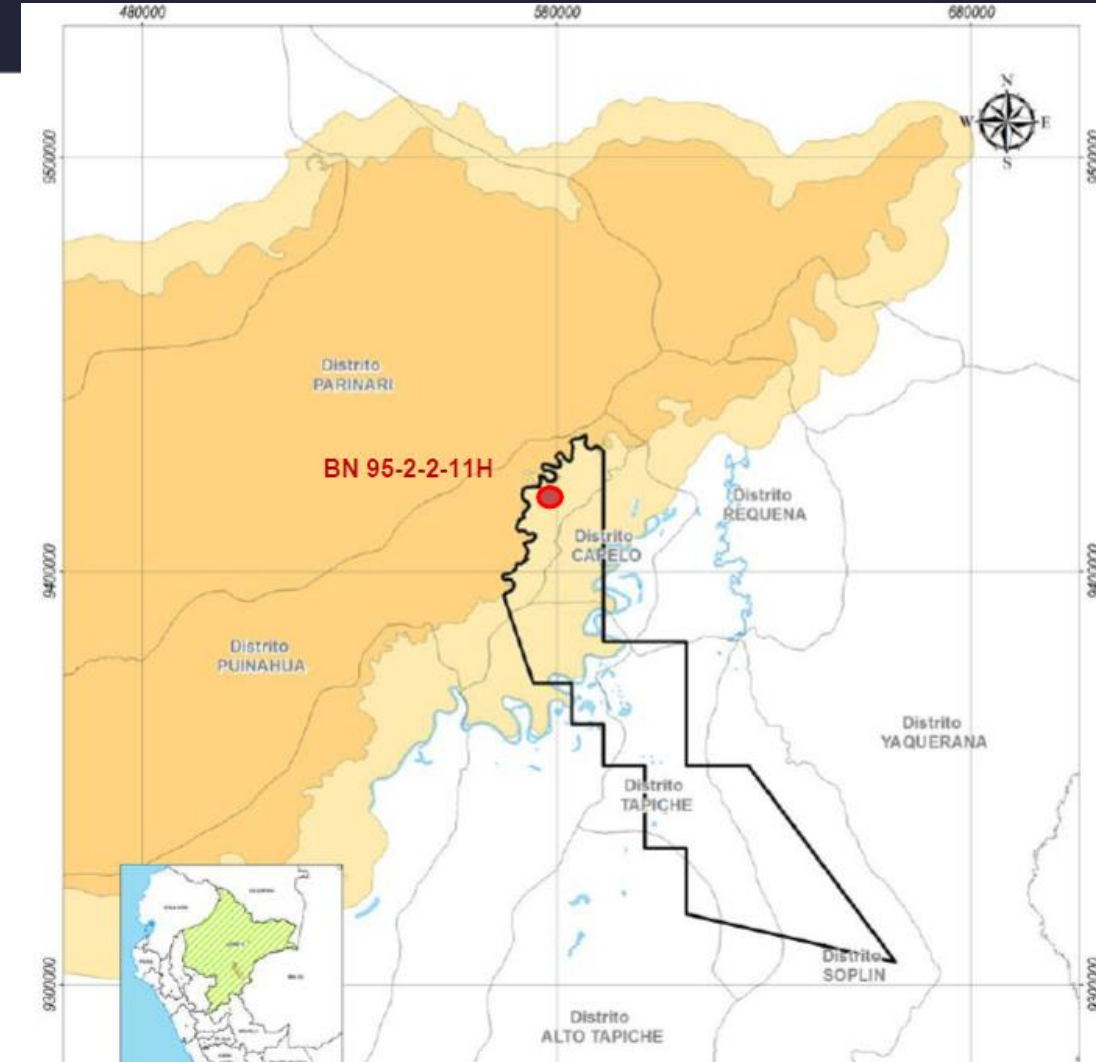
# CONTENIDO

- I. Ubicación
- II. Estructura y desarrollo de campo
- III.- Planificación
- IV.- Objetivos
- V.- Simulaciones
- VI. Monitoreo & resultados
- VII. Conclusiones



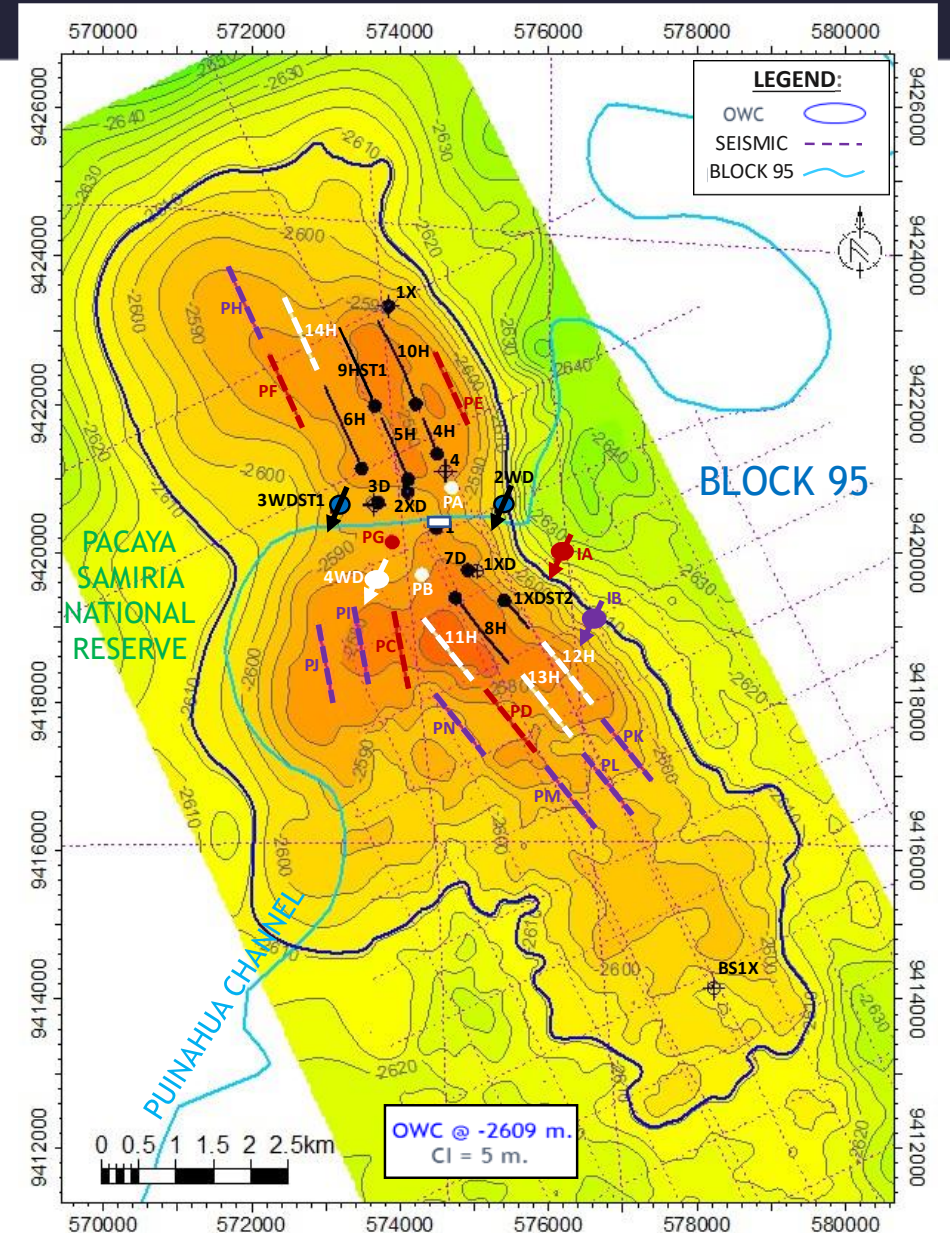
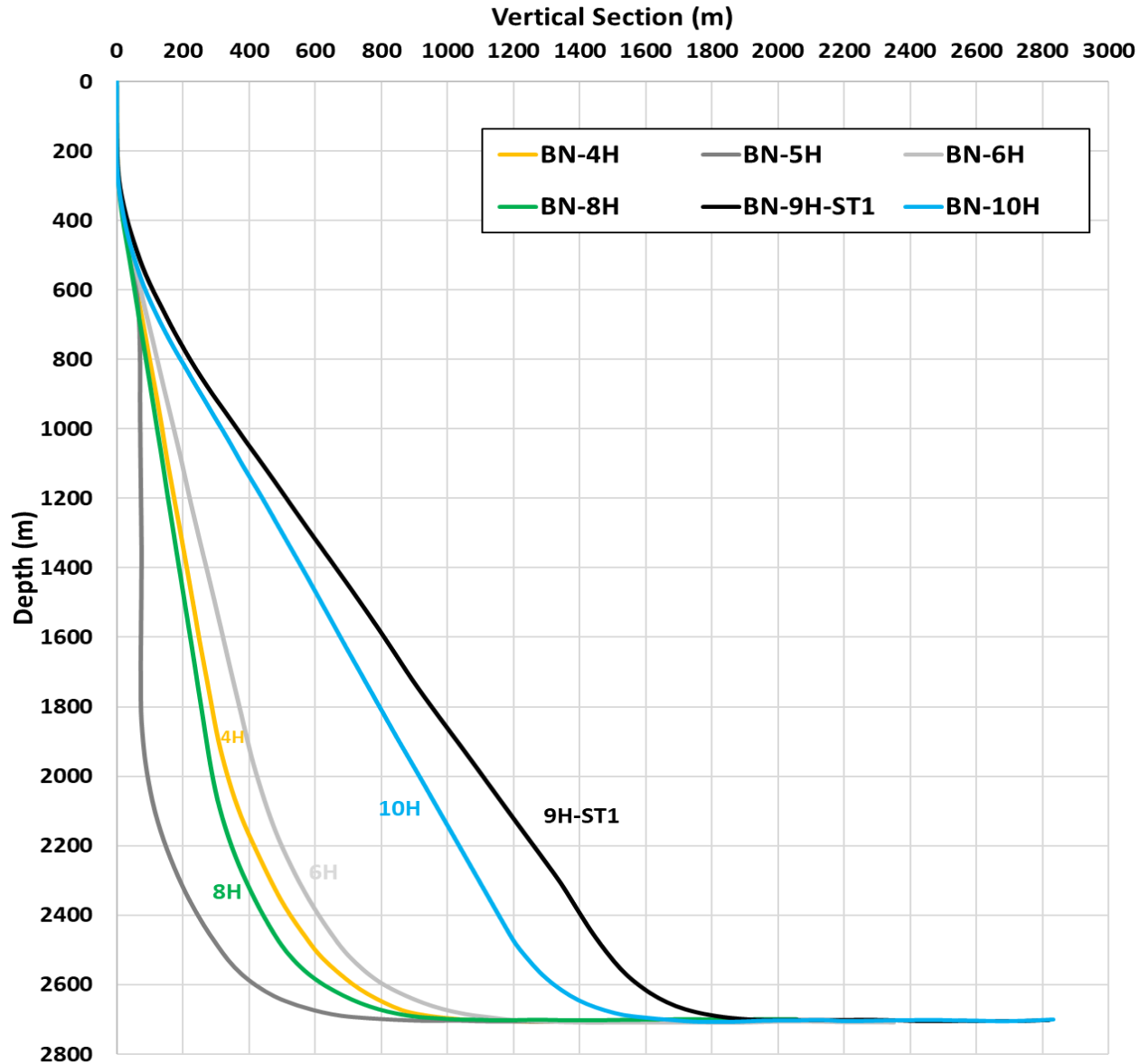
# UBICACION

- Lote 95 – Petrotal (Dic 2017)
- Campo Bretaña - Loreto
- Acceso vía fluvial y aérea
- 14 pozos perforados (PetroTal)
- 65% horizontales & 35% direccionales
- Producción actual 18,000 bls/día
- Desarrollo de campo con pozos horizontales y dirigidos (productores e inyectores) cuidando el medio ambiente.



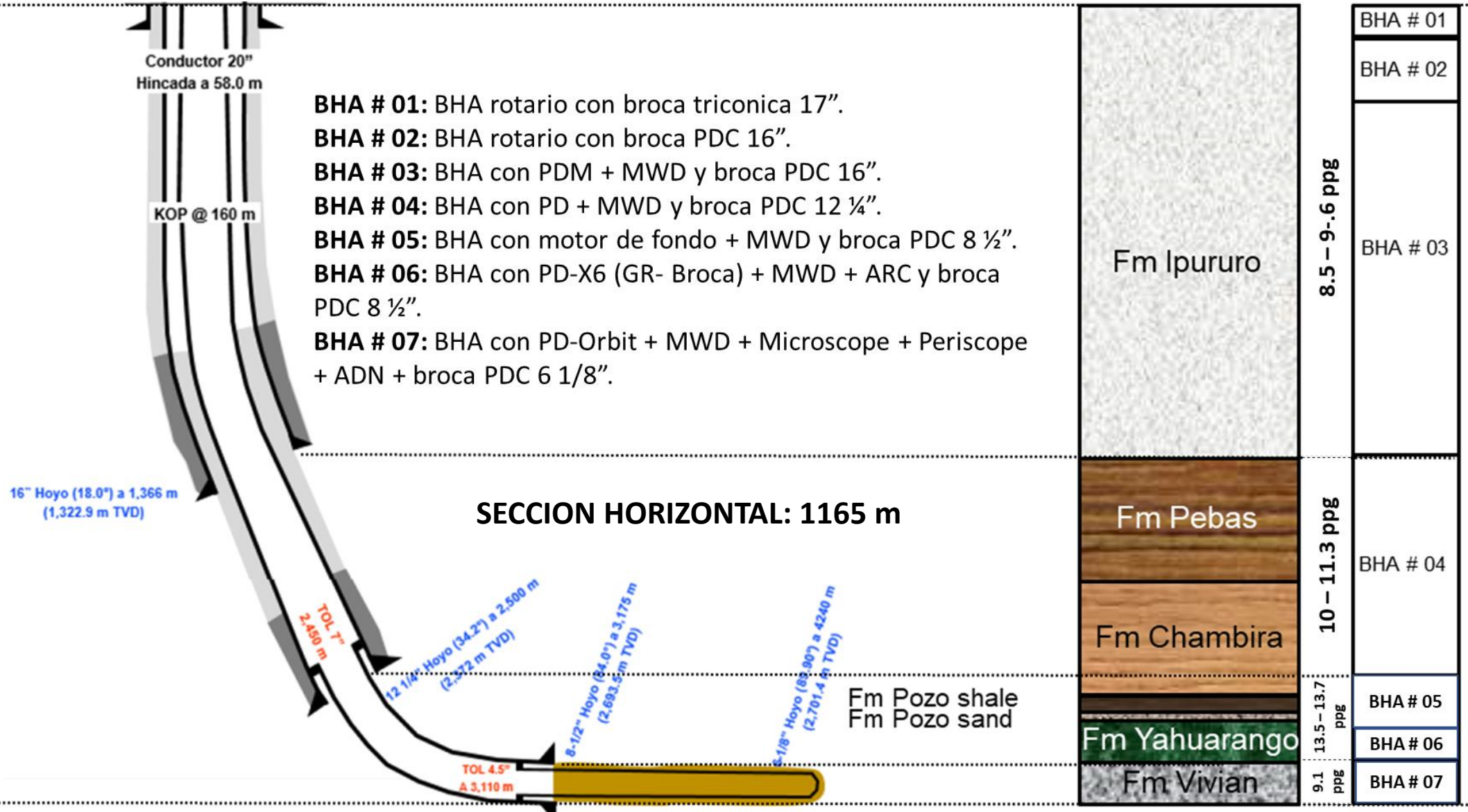


# ESTRUCTURA Y DESARROLLO DE CAMPO





# PLANIFICACION





# PLANIFICACION

## SECCION HORIZONTAL 6 1/8"

- Molienda accesorios de liner de 7" se realiza con BHA con motor de fondo.
- Trayectoria del pozo en base a criterios de geo navegación.
- Intervalo de perforación de 600 – 650 m o 60 hrs de perforación (Inicial 400 m)
- Viaje de calibración al zapato de liner de 7".
- Píldoras de limpieza no están programadas.
- Puenteo constante a la formación productora.

## CONTINGENCIAS

- Reductores de torque
- Lubricante para el sistema de lodo.



# PLANIFICACION

	Desc.	Manu.	OD (in)	Btm	Length (m)	Cum. Length (m)	Cum. Weight (1000 lbm)	Bot Type
			ID (in)	Top				Top Type
1	6-1/8" PDC Bit (Reparada); Model: R613-C; IADC M333	Schlumberger	3.875		0.20	0.20	0.0	
			1.250	Pin				3-1/2 REG
2	PD 475 Orbit (Slick CC) (FR=18)	Schlumberger	4.980	Box	4.56	4.76	0.8	3-1/2 REG
			3.640	Box				NC38
3	Receiver w- 5 7/8" Sleeve Stabiizer (w-Float Valve ported)	Schlumberger	4.625	Pin	2.22	6.98	1.1	NC38
			2.813	Pin				NC35
4	PeriScope HD 475	Schlumberger	4.750	Box	7.15	14.13	2.3	NC35
			1.430	Box				NC38
5	Upper Crossover	Schlumberger	4.750	Pin	0.47	14.60	2.4	NC38
			2.125	Pin				NC35
6	IMPulse (MWD)	Schlumberger	4.750	Box	9.84	24.44	4.0	NC35
			2.250	Box				NC38
7	Upper Crossover (MWD)	Schlumberger	4.563	Pin	0.40	24.84	4.0	NC38
			2.125	Pin				NC35
8	MicroScope 475 (Slick)	Schlumberger	4.750	Box	5.46	30.30	4.9	NC35
			1.430	Box				NC38
9	Upper Saver Sub	Schlumberger	4.750	Pin	0.43	30.73	5.0	NC38
			2.125	Pin				NC38
10	ADN-4 (Slick)	Schlumberger	4.875	Box	7.19	37.92	6.2	NC38
			2.250	Box				NC38
11	Upper Saver Sub	Schlumberger	4.750	Pin	0.46	38.38	6.3	NC38
			2.125	Box				NC38
12	6 x 3 1/2" HWDP (6 joints)	PTX-12	3.500	Pin	55.60	93.98	11.0	NC38
			2.063	Box				NC38
13	4-3/4" Hydraulic Jar	Schlumberger	4.750	Pin	8.92	102.90	12.1	NC38
			2.125	Box				NC38
14	9 x 3 1/2" HWDP (9 joints)	PTX-12	3.500	Pin	83.53	186.43	19.1	NC38
			2.063	Box				NC38
15	XO (NC38 Pin x XT39 Box)	PTX-12	4.750	Pin	0.67	187.10	19.2	NC38
			2.813	Box				XT39
16	201 x 4" 14.00 DPS, Premium (201 joints)	PTX-12	3.868	Pin	1919.08	2106.18	122.1	XT39
			3.340	Box				XT39
17	XO (XT39 Pin x XT57 Box)	Alpha	5.000	Pin	0.95	2107.13	122.2	XT39
			2.500	Box				XT57
18	5-7/8 " 23.40 (0.361wt) DPV, Premium	Alpha	5.731	Pin	9.45	2116.58	123.1	XT57
			5.153	Box				XT57

## DESCRIPCION DE HERRAMIENTAS

### Power drive orbit 4 3/4"

- Herramienta direccional.
- Inclinación en la broca
- Comunicación electromagnética

### MWD (Impulse)

- Herramienta de medición (Inclinación & dirección)
- Transmisión de datos hacia superficie (Telemetría)
- Comunicación física (Herramientas de navegación).

### PERISCOPE

- Herramienta de medición resistividad (tope y base)

### MICROSCOPE

- Imágenes

### ADN

- Densidad – Neutrón
- Fuente radioactiva



# PLANIFICACION

Size in.	Type	OD in.	Bore of Drill Collar, inches								
			1 3/4	2	2 1/4	2 1/2	2 13/16	3	3 1/4	3 1/2	3 3/4
API	NC35	4 1/2	9,038	9,038	9,038	7,411					
		4 3/4	12,273	10,826	9,202	7,411					
		5	12,273	10,826	9,202	7,411					
3 1/2	API IF	4 3/4	9,986	9,986	9,986	9,986	8,315				
API	NC 38	5	13,949	13,949	12,907	10,977	8,315				
4 1/2	Slim Hole	5 1/4	16,207	14,643	12,907	10,977	8,315				
		5 1/2	16,207	14,643	12,907	10,977	8,315				

Size and Weight: 4.000" 14.00 ppf 0.330" wall IU

Grade: S-135

Range: 2

Tool Joint: 4.875" x 2.688" XT39

	Pipe Body:				Tubular Assembly:	
	Nominal 100% RBW	95% RBW	Ultra Class 90% RBW	Premium 80% RBW	Adjusted Weight (lbs/ft): 16.34	Fluid Displacement (gal/ft): 0.25
OD (in):	4.000	3.967	3.934	3.868	Approximate Length (ft): 31.9	Fluid Displacement (bbls/ft): 0.0059
Wall Thickness (in):	0.330	0.314	0.297	0.264	Box TJ Length (in): 15	Fluid Capacity w/IPC (gal/ft): 0.43
Nominal ID (in):	3.340	3.340	3.340	3.340	Pin TJ Length (in): 12	Fluid Capacity w/IPC (bbls/ft): 0.0102
Tensile Strength (lbs):	513,645	485,769	458,124	403,526	Upset Type: IU	Fluid Capacity w/o IPC (gal/ft): 0.43
Torsional Strength (ft-lbs):	41,918	39,586	37,281	32,752	Max Upset OD (in): 4.188	Fluid Capacity w/o IPC (bbls/ft): 0.0103
Burst Capacity (psi):	19,491	21,161	20,048	17,820	Drift Size (in): 2.563	
Collapse Capacity (psi):	20,141	18,604	17,042	13,836		

Notes: Body properties are calculated based on uniform OD and wall thickness. Burst capacity for Nominal (100% RBW) based on 87.5% RBW per API.

Note: These are OEM values that may vary with actual values due to mill tolerances, IPC tolerances, OEM rounding, and other factors. Pipe is purchased at a guaranteed 95% RBW. IPC is applied to a nominal thickness of 0.009". Pipe will have an ID of 3.285", which is smaller than pipe purchased at 87.5%.

Connection: XT39	1.0 FF	1.1 FF	1.15 FF	Elevator Shoulder:
	TJ OD (in): 4.875 TJ ID (in): 2.688 MYS (ksi): 120			
Maximum MUT is recommended based on thread compound friction factor (unless stated). Lower than maximum MUT should only be used when MUT is limited by rig equipment or connection tensile. Lower than minimum MUT should never be used.	Maximum MUT (ft-lbs): 21,200	23,320	24,360	Nominal TJ OD (in): 4.875 Nominal TJ OD Elevator Shoulder Capacity (lbs): 470,200 Assumed Elevator Bore (in): 4.281
Tension at Shoulder Separation @ Max MUT (lbs): Tensile Limited	553,300	553,300	553,300	
Tension at Connection Yield @ Max MUT (lbs):	662,200	662,200	662,200	
Minimum MUT (ft-lbs):	17,700	19,470	20,355	
Tension at Shoulder Separation @ Min MUT (lbs):	647,200	647,200	647,200	
Tension at Connection Yield @ Min MUT (lbs):	662,200	662,200	662,200	
Tool Joint Torsional Strength (ft-lbs):	35,300	38,830	40,595	
Tool Joint Tensile Strength (lbs):	662,200	662,200	662,200	

XT39 is a trademark of NOV Grant Prideco.

Note: There is no published pressure rating for this connection.

ADJUST makeup torque according to thread compound friction factor (FF) greater than 1.0 up to 1.15 FF. Not to exceed 1.15 regardless of dope FF. Reference Page 3.

Note: Elevator capacity based on assumed elevator bore, no wear factor, and contact stress of 110, 100 psi. An increased elevator shoulder OD increases elevator capacity without affecting make-up torque.





## OBJETIVO

- Perforar sección horizontal de 6 1/8" en longitud programada manteniendo integridad de herramientas direccionales sin afectar productividad de la formación objetivo sin tener eventos de pérdidas de herramientas.



# SIMULACIONES

## 3712m

## 4000m

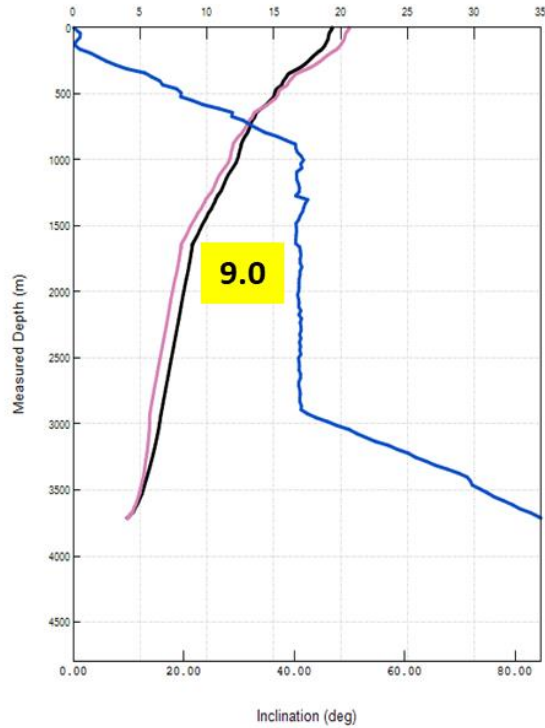
## 4400m

## 4800m

### Torque (1000 ft.lbf)

Single Depth Analysis @ 3712m

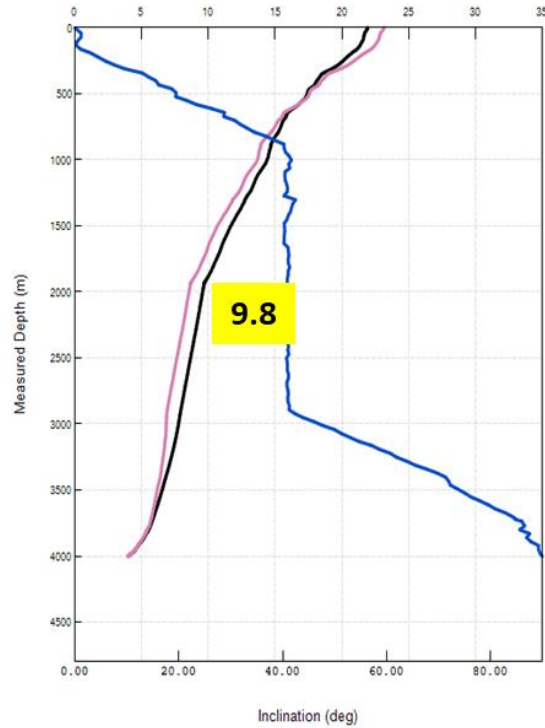
Well: BN-13H Borehole: BN-13H WBG: WBG\_BN-13H\_Plan Rev A8  
Trajectory: BN-13H\_Navegacion\_V2 BHA: BHA#07\_6.125in\_PD Orbit+PERI+SHORTPULSE+MICRO+ADN4  
Mud wt: 9.7(lbm/gal) DiWOB: 8 (1000 lbf) DTOR: 4 (1000 ft.lbf)  
Overpull: 10 (1000 lbf) Block wt: 45(1000 lbf)  
FF: Slide CH/OH = 0.3/0.42, Rotational CH/OH = 0.3/0.42, Translational FF while Backreaming CH/OH = 0.07/0.07  
Group Scenario: 6.125D Torque & Drag Load Cases 22-Sep-2022 11:58:50



### Torque (1000 ft.lbf)

Single Depth Analysis @ 4000m

Well: BN-13H Borehole: BN-13H WBG: WBG\_BN-13H\_Plan Rev A8  
Trajectory: BN-13H\_Navegacion\_V2 BHA: BHA#07\_6.125in\_PD Orbit+PERI+SHORTPULSE+MICRO+ADN4  
Mud wt: 9.7(lbm/gal) DiWOB: 8 (1000 lbf) DTOR: 4 (1000 ft.lbf)  
Overpull: 10 (1000 lbf) Block wt: 45(1000 lbf)  
FF: Slide CH/OH = 0.3/0.42, Rotational CH/OH = 0.3/0.42, Translational FF while Backreaming CH/OH = 0.07/0.07  
Group Scenario: 6.125D Torque & Drag Load Cases 22-Sep-2022 12:00:23



### Torque (1000 ft.lbf)

Single Depth Analysis @ 4400m

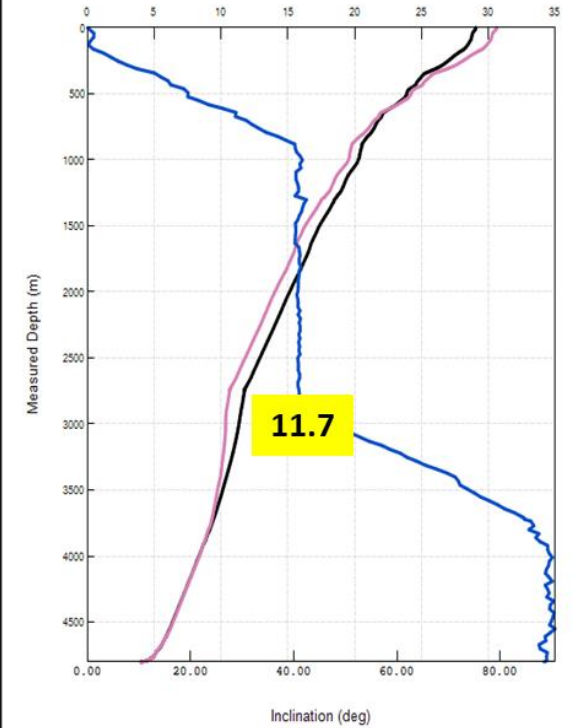
Well: BN-13H Borehole: BN-13H WBG: WBG\_BN-13H\_Plan Rev A8  
Trajectory: BN-13H\_Navegacion\_V2 BHA: BHA#07\_6.125in\_PD Orbit+PERI+SHORTPULSE+MICRO+ADN4  
Mud wt: 9.7(lbm/gal) DiWOB: 8 (1000 lbf) DTOR: 4 (1000 ft.lbf)  
Overpull: 10 (1000 lbf) Block wt: 45(1000 lbf)  
FF: Slide CH/OH = 0.3/0.42, Rotational CH/OH = 0.3/0.42, Translational FF while Backreaming CH/OH = 0.07/0.07  
Group Scenario: 6.125D Torque & Drag Load Cases 22-Sep-2022 12:20:53



### Torque (1000 ft.lbf)

Single Depth Analysis @ 4800m

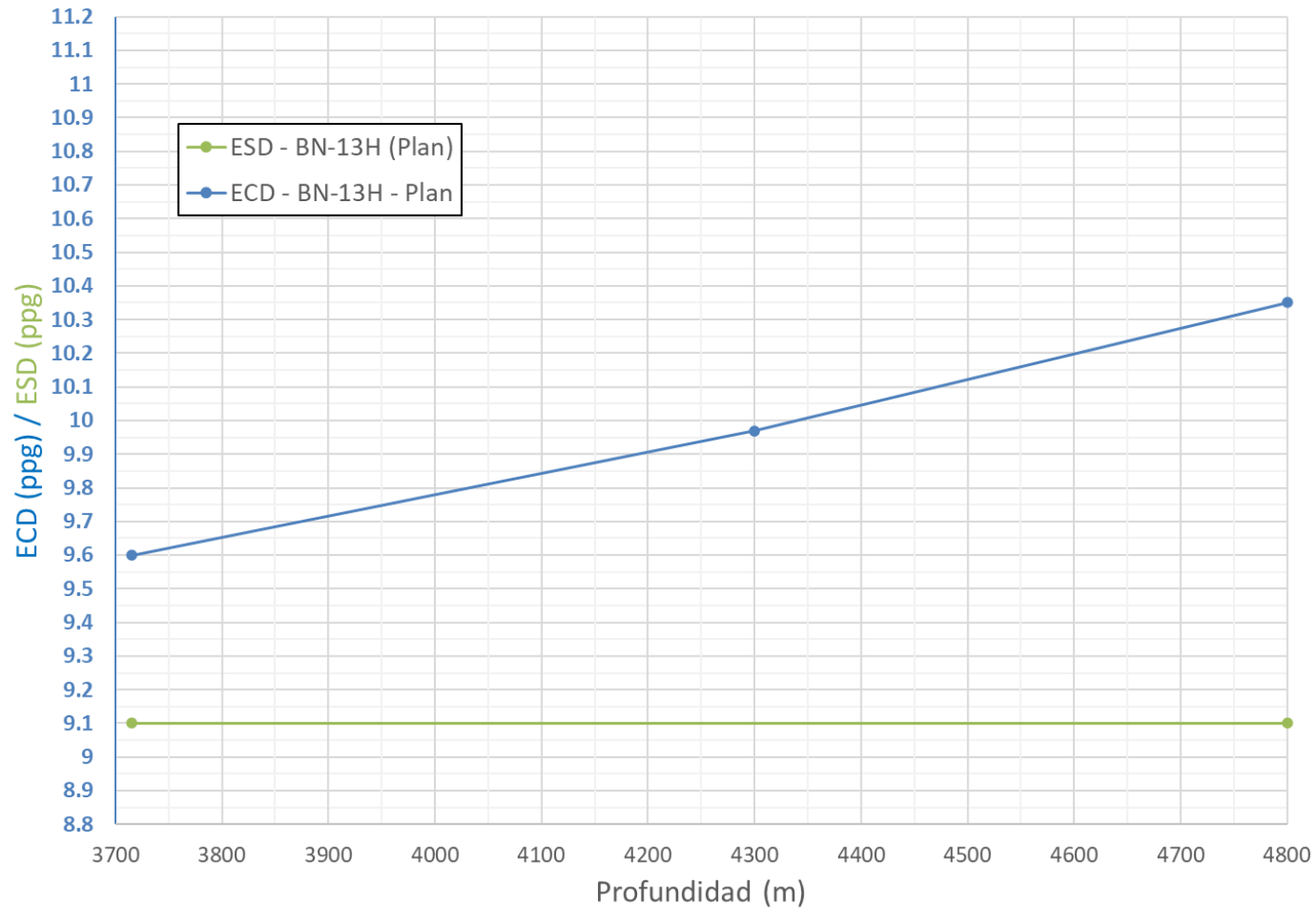
Well: BN-13H Borehole: BN-13H WBG: WBG\_BN-13H\_Plan Rev A8  
Trajectory: BN-13H\_Navegacion\_V2 BHA: BHA#07\_6.125in\_PD Orbit+PERI+SHORTPULSE+MICRO+ADN4  
Mud wt: 9.7(lbm/gal) DiWOB: 8 (1000 lbf) DTOR: 4 (1000 ft.lbf)  
Overpull: 10 (1000 lbf) Block wt: 45(1000 lbf)  
FF: Slide CH/OH = 0.3/0.42, Rotational CH/OH = 0.3/0.42, Translational FF while Backreaming CH/OH = 0.07/0.07  
Group Scenario: 6.125D Torque & Drag Load Cases 22-Sep-2022 12:22:32



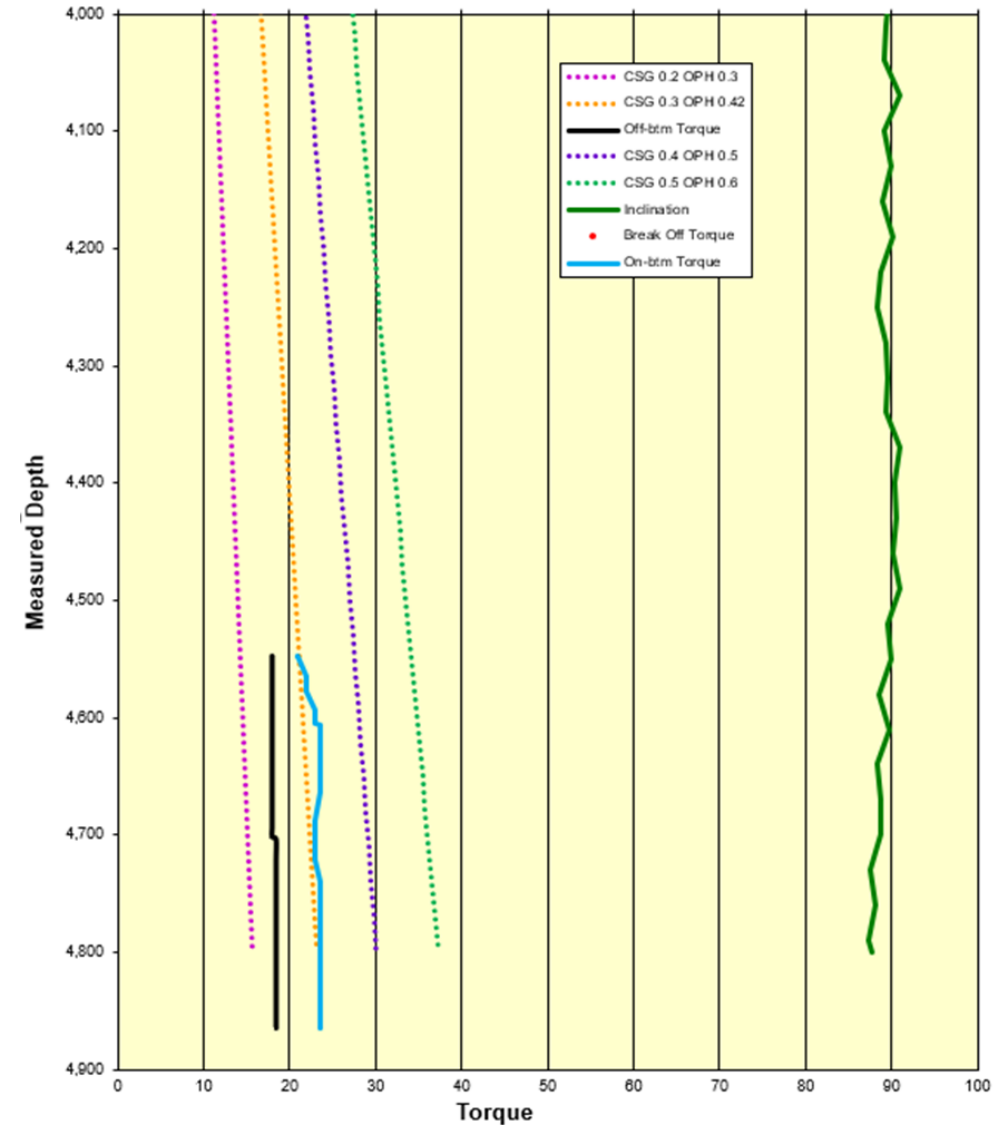


# SIMULACIONES

## ECD/ESD vs PROFUNDIDAD - BN-13H



## Torque Load

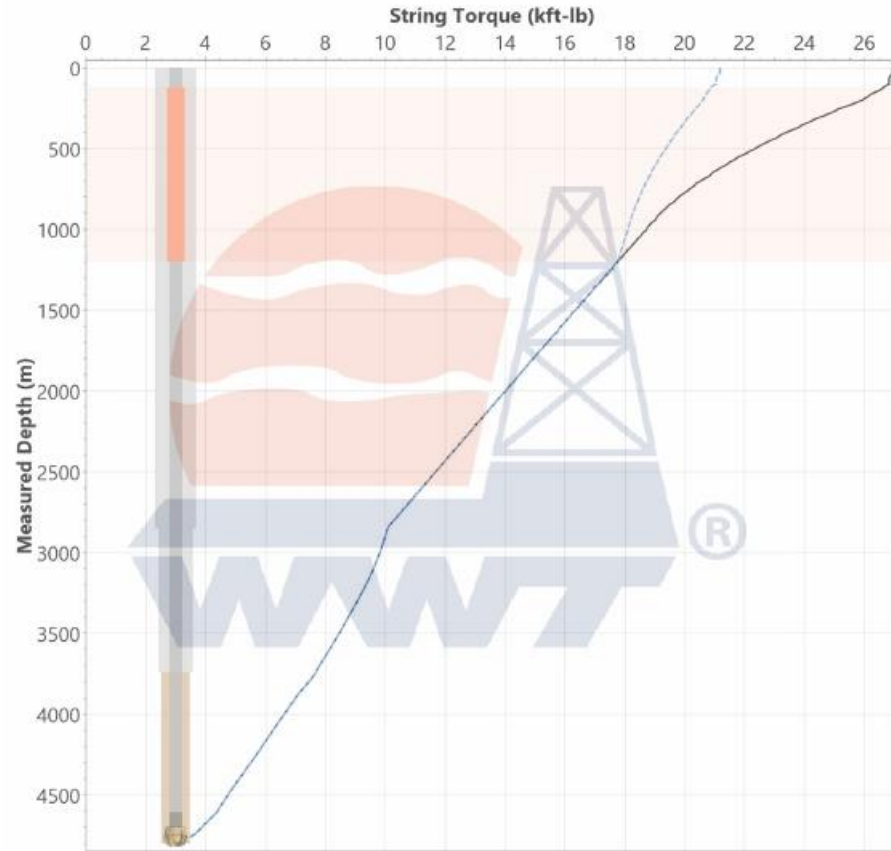




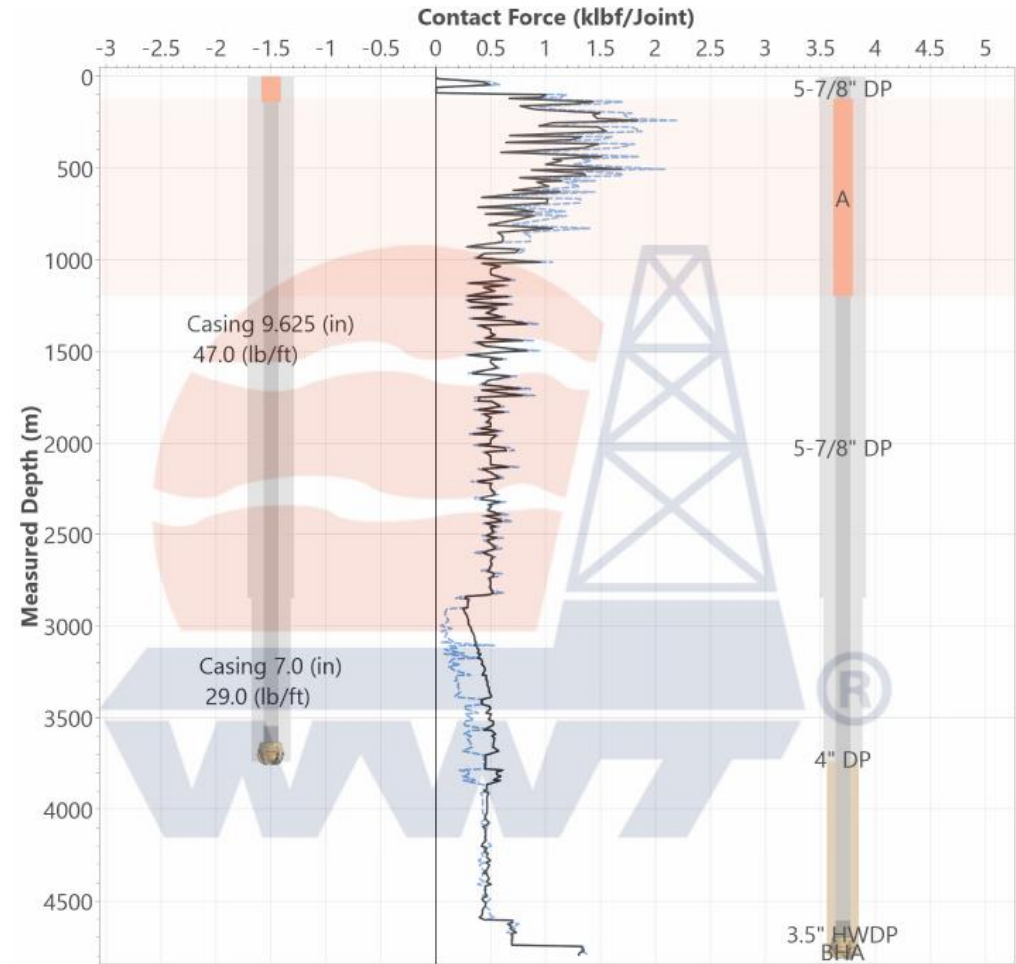
# SIMULACIONES

CONDITION	TORQUE NO NRP (kft-lb)	TORQUE WITH NRP (kft-lb)	% TORQUE BENEFIT
DRILLING	27	21.2	21
BACKREAMING	27.5	20.6	25

Protector benefits often include reduced torque, prevention of casing wear, reduced stick-slip and vibration.



Torque, No Protectors — Torque, With Protectors --- 65% FF Reduction ■



Backream --- Rotary Drilling —

Area of Concern	Placement MD: Start of Run			Placement MD: End Of Run			Protectors Per Joint	Protector Quantity	Model
	Zone	Top	Bottom	Joints	Top	Bottom			
A	0	139	15	122	1199	114	1	114	SS3-578



# LIMPIEZA – SECCION HORIZONTAL 6 1/8”

## LIMPIEZA (MONITOREO DEL ECD)

### - **Peso y reología del lodo.**

- 1.- Optimiza peso de lodo de 9.4 a 9.1 ppg.
- 2.- Monitoreo en superficie c/30 min & valores de ESD.
- 3.- Lecturas R3/R6: 12/13 & VP(cP)/YP(Lbf/100ft<sup>2</sup>): 10 - 12/40 – 44
- 4.- Agentes puenteantes.

### - **Píldoras de limpieza**

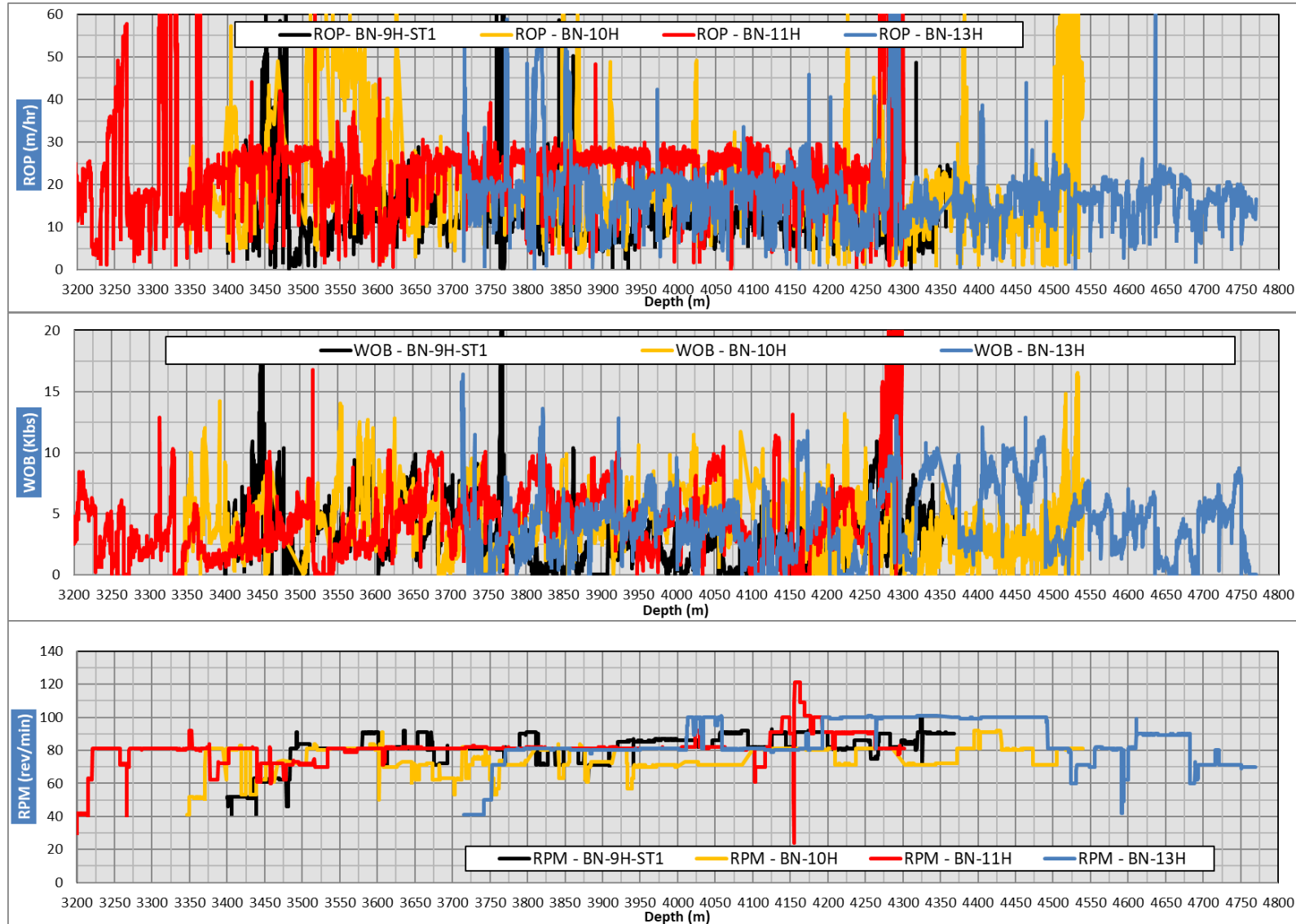
- 1.- 25 bls píldora viscosa.
- 2.- Monitoreo en superficie retorno de píldoras (% adicional).
- 3.- No hay un régimen de bombeo.

### - **ROP, Caudal & RPM**

- 1.- ROP entre 20 – 25 m/hr.
- 2.- Caudal promedio de 250 gpm
- 3.- 100 RPM (Mínimo 80).

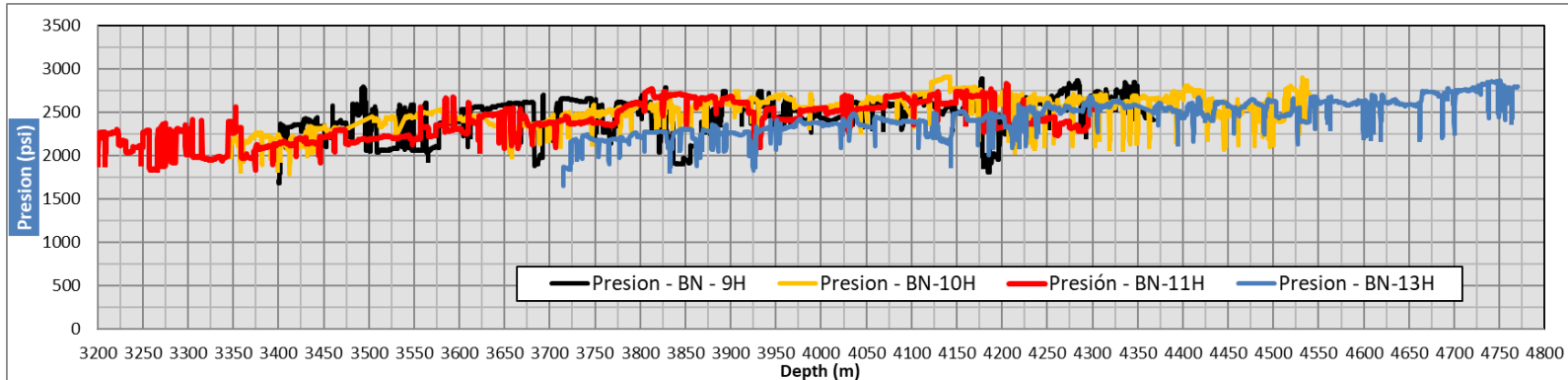
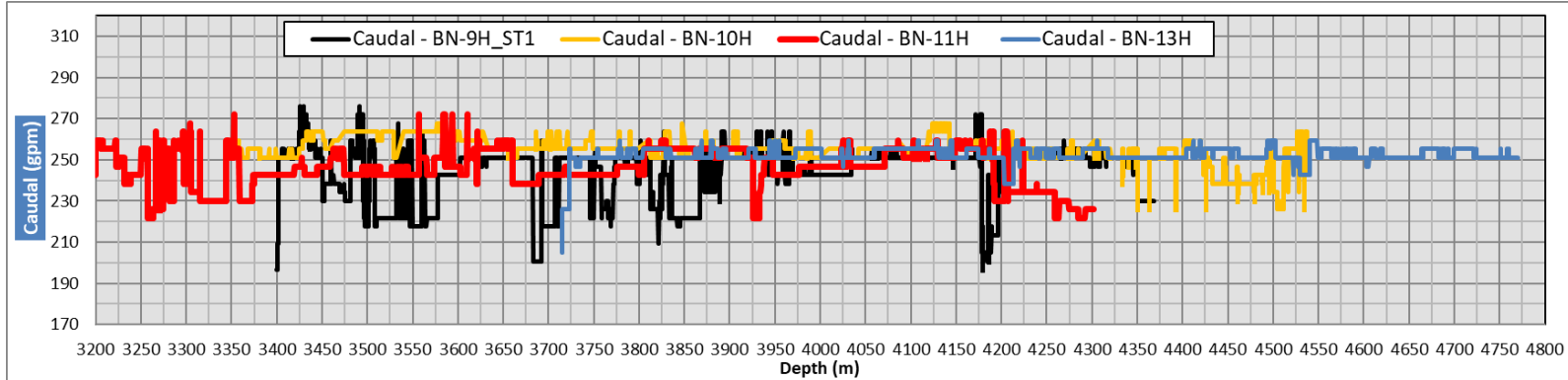
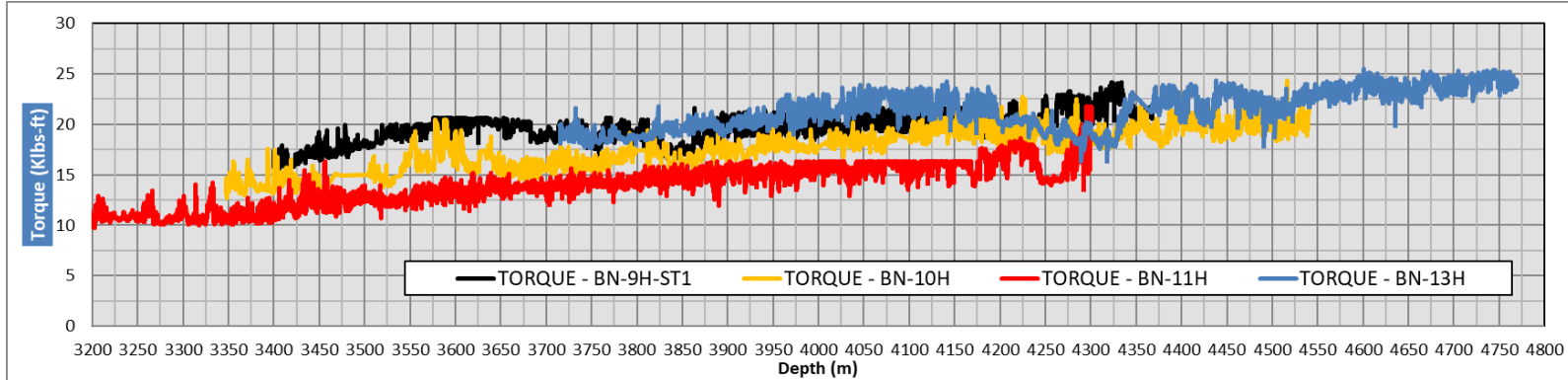


# MONITOREO – SECCION HORIZONTAL 6 1/8”



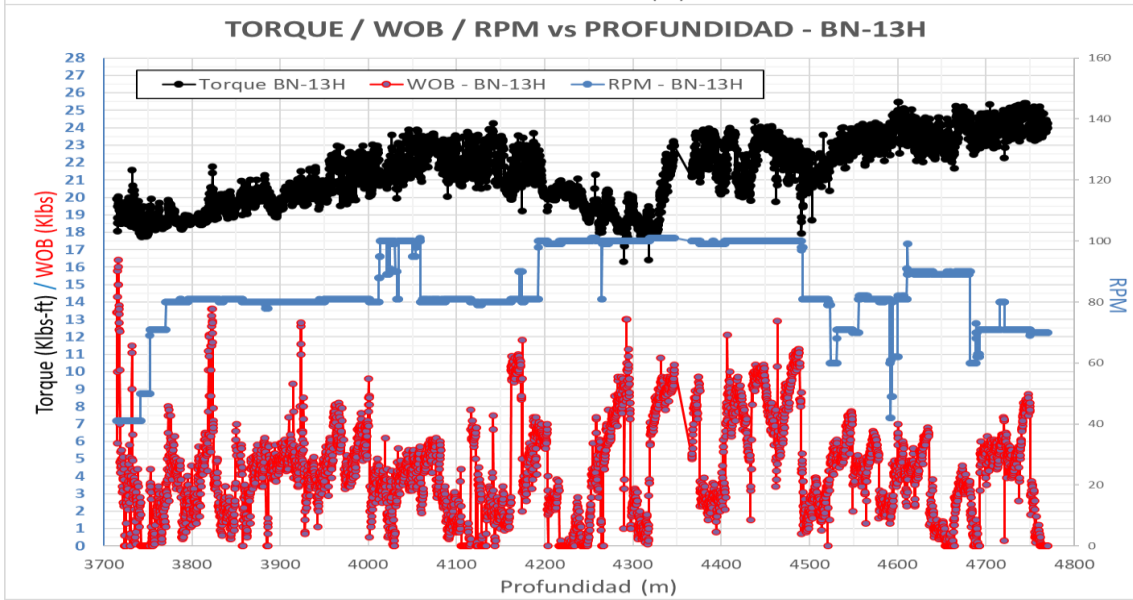
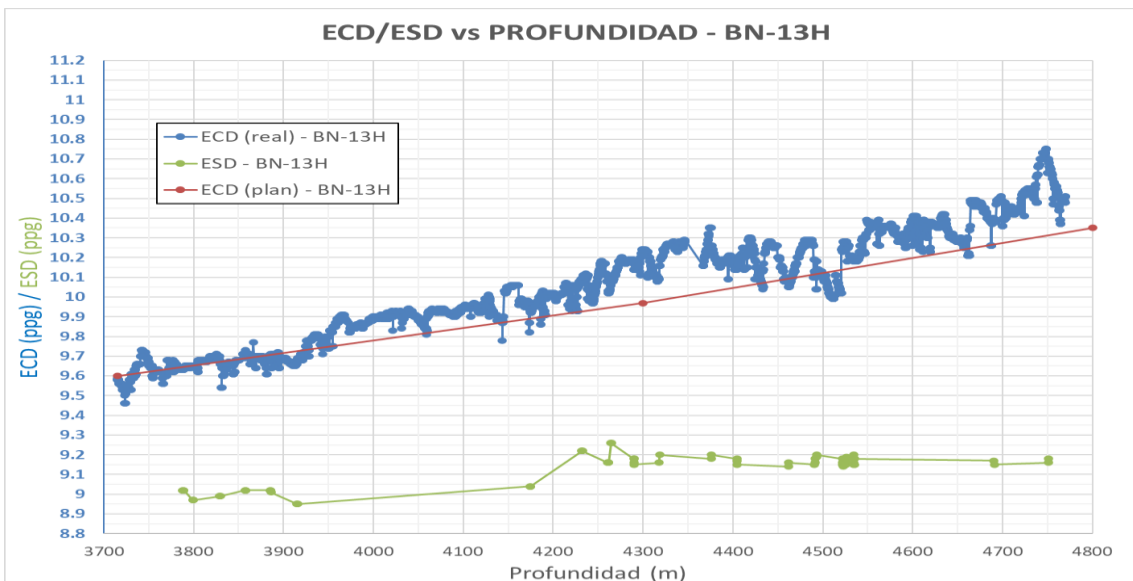


# MONITOREO – SECCION HORIZONTAL 6 1/8”





# MONITOREO – SECCION HORIZONTAL 6 1/8”

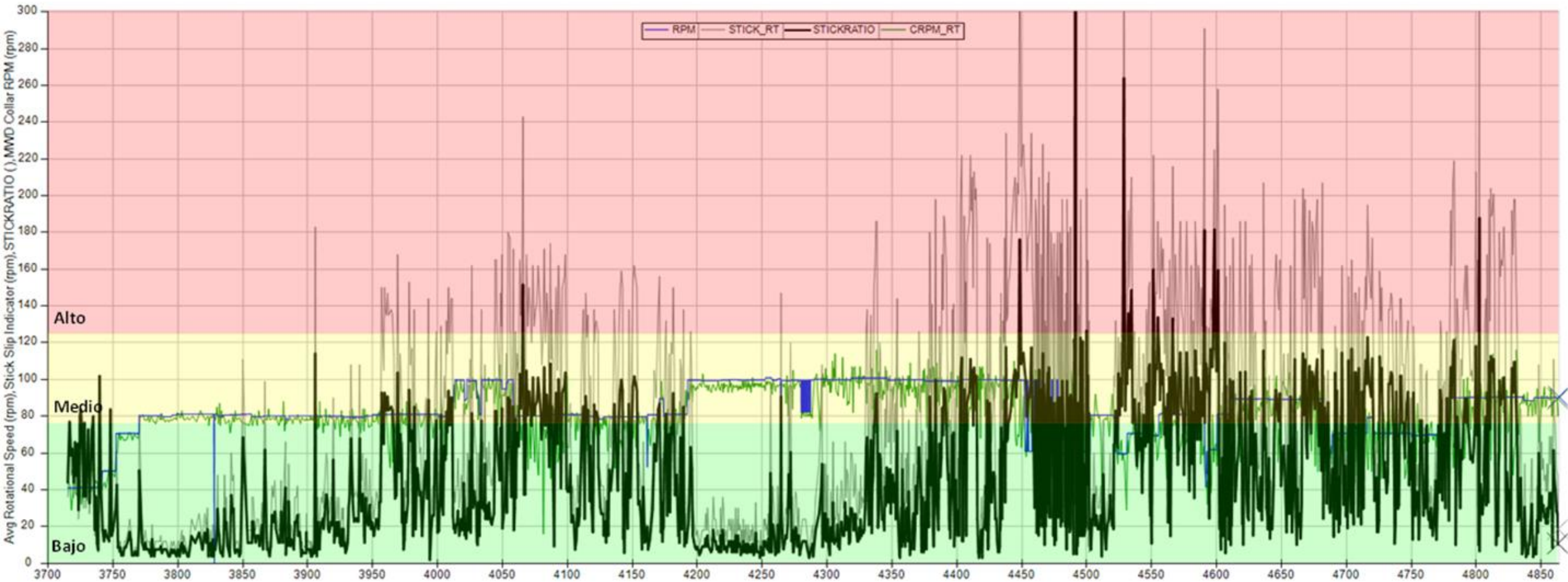


- Mientras menos sólidos haya en el sistema, menor es el torque.
- Sólidos deseados a no deseados.
- Menor uso de carbonato (densidad) & puenteantes.
- Mayor RPM, mayor remoción e ECD más bajo.
- ECD más bajo, menor valor de Torque.
- Incremento de WOB, intensifica el valor de torque.





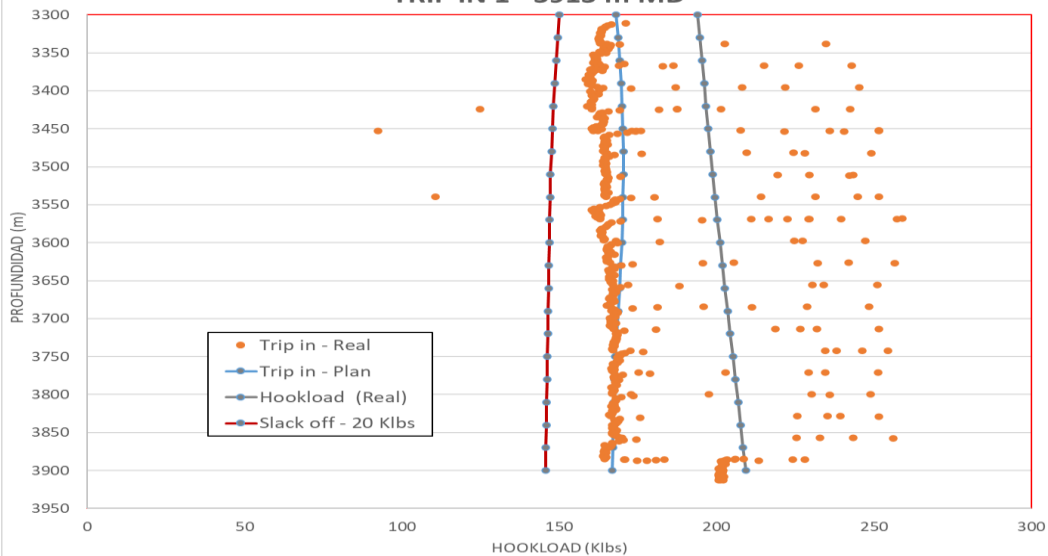
# MONITOREO – SECCION HORIZONTAL 6 1/8”



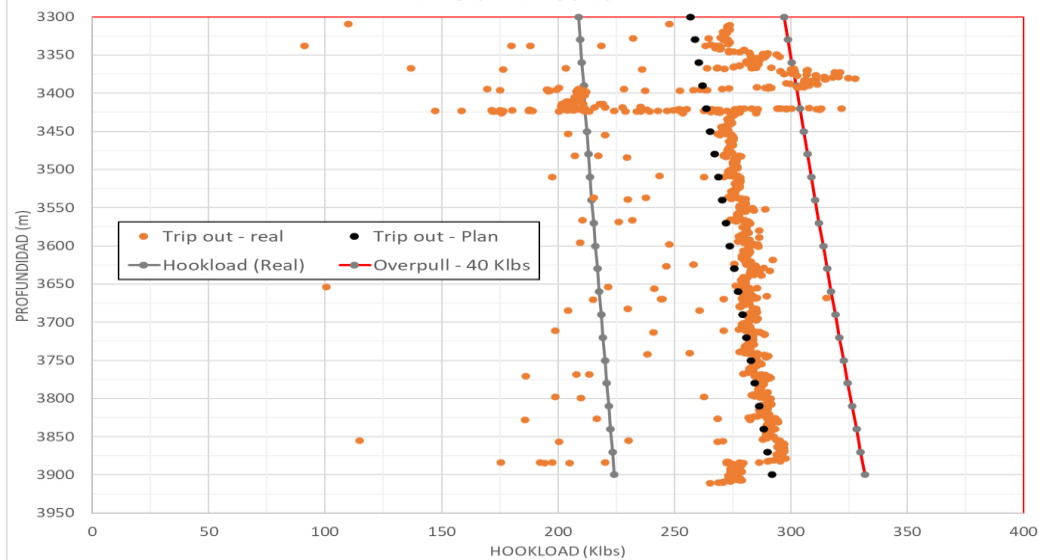


# MONITOREO – SECCION HORIZONTAL 6 1/8”

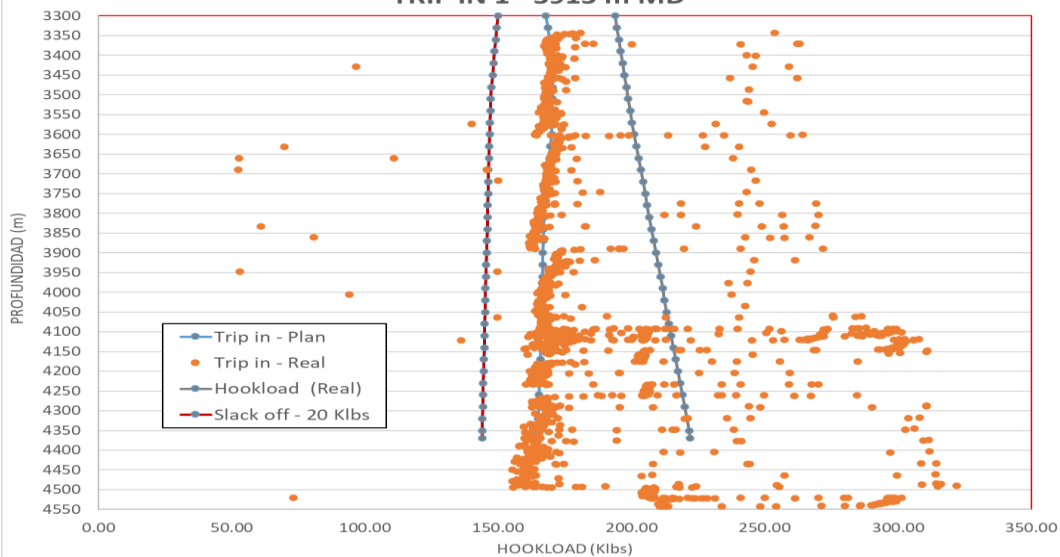
### TRIP IN 1 - 3913 m MD



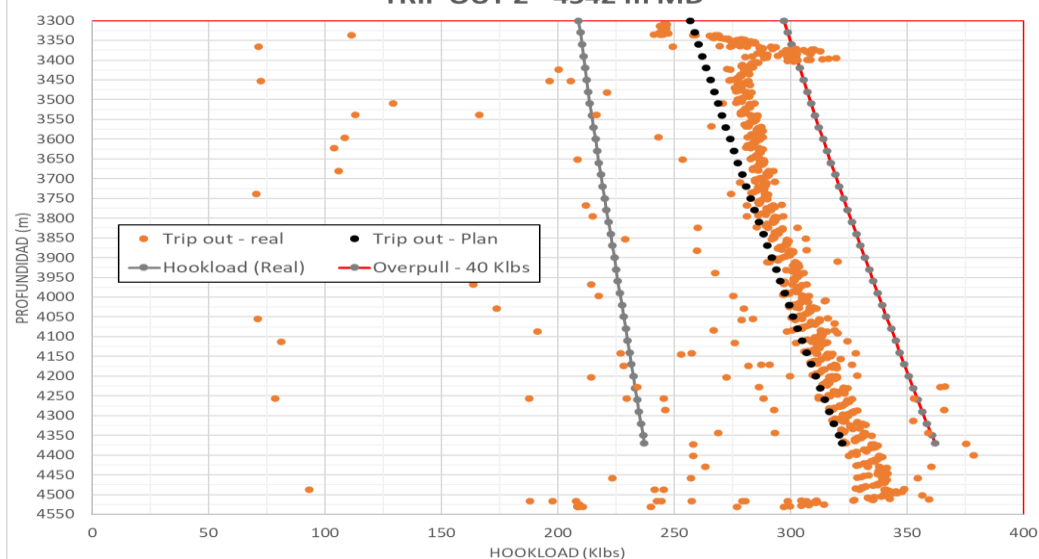
### TRIP OUT 1 - 3913 m MD



### TRIP IN 1 - 3913 m MD



### TRIP OUT 2 - 4542 m MD





# CONTINGENCIAS

## REDUCTORES DE TORQUE

Modelo WWT NRP	SS3-400-SLIM	SS3-400	SS3-450	SS3-500	SS3-550	SS3-578	SS3-658	SS3-658-XL
Diámetro de Drill Pipe	4.00"	4.00"	4.50"	5.00"	5.50"	5.88"	6.63"	6.63"
Diámetro Externo de la Camisa	5.50"	5.75"	6.75"	7.30"	7.75"	8.00"	8.75"	9.13"
Diámetro Externo Del Collar	5.10"	5.38"	6.00"	6.5"	7.0"	7.38"	8.13"	8.13"
Longitud del Ensamblaje	25.00"	25.00"	26.00"	26.00"	26.00"	26.00"	25.00"	25.00"
Volumen de la camisa	111 pulg. <sup>3</sup>	120 pulg. <sup>3</sup>	168 pulg. <sup>3</sup>	177 pulg. <sup>3</sup>	203 pulg. <sup>3</sup>	206 pulg. <sup>3</sup>	233 pulg. <sup>3</sup>	252 in <sup>3</sup>
Capacidad de fuerza lateral	2,200 lb/jt	2,200 lb/jt	3,000 lb/jt	3,000 lb/jt	3,000 lb/jt	3,500 lb/jt	3,500 lb/jt	3,500 lb/jt
Sección transversal	9.5 in <sup>2</sup>	10.9 pulg. <sup>2</sup>	14.8 pulg. <sup>2</sup>	16.6 pulg. <sup>2</sup>	17.6 pulg. <sup>2</sup>	17.3 pulg. <sup>2</sup>	19.8 pulg. <sup>2</sup>	22.6 in <sup>2</sup>



## LUBRICANTE

- Solido
- Liquido



## CONCLUSIONES

- Uso de DP 4" con conexión XT39 ayuda a aumentar el margen de torque en la interface con el DP de 5 7/8".
- Buenas prácticas de perforación ayudan a mantener niveles de ECD y Torque de acuerdo a la simulación.
- Uso de lubricante mecánico y reductores de torque ayudan en reducir stick & slips y torque en superficie.
- Monitoreo y seguimiento del avance de la perforación, ayuda a tomar acciones tempranas a fin de mantener estables el torque e ECD.