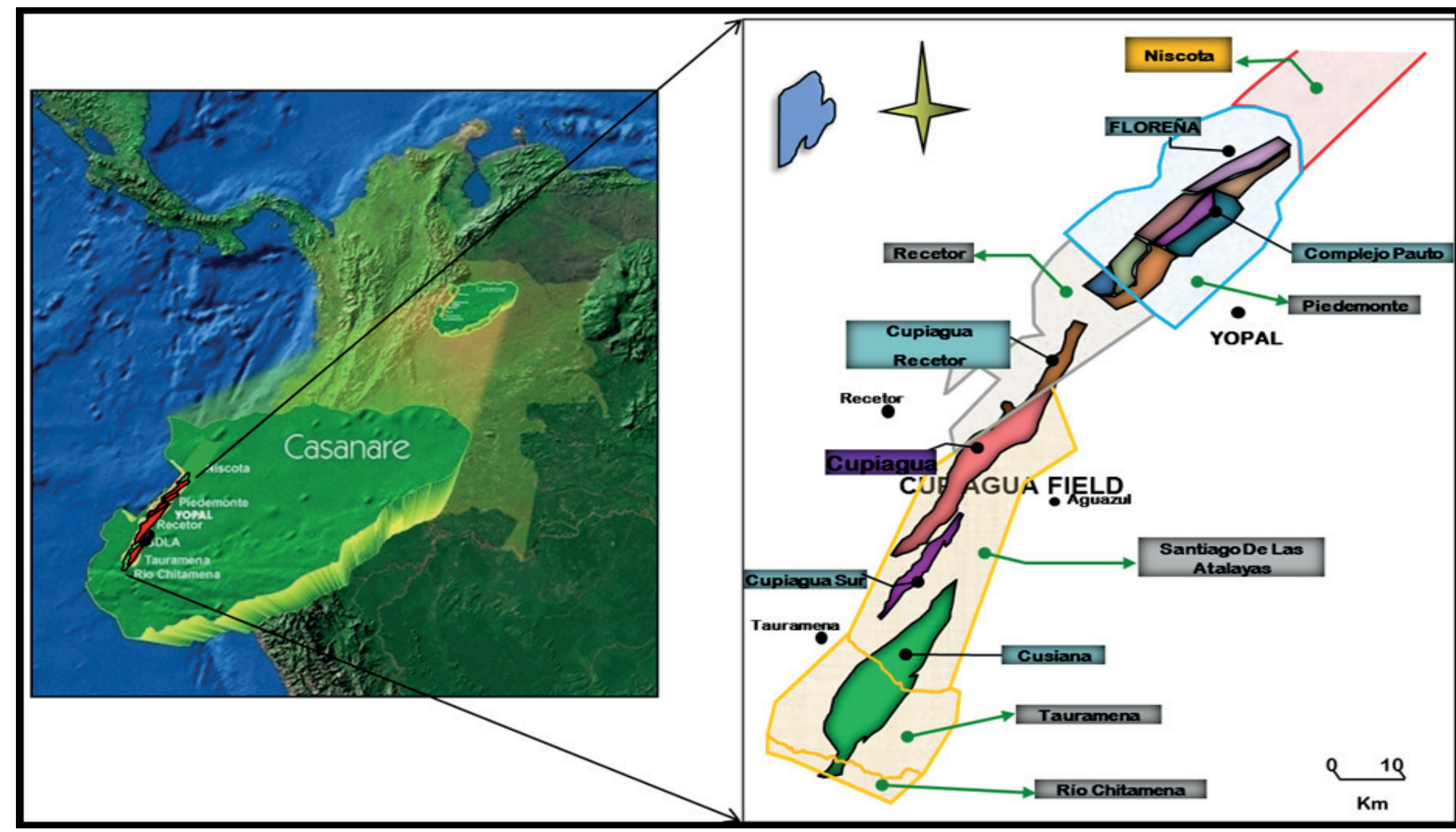


# SLAP-10 SAND JETTING PROVIDES EFFECTIVE DIVERSION FOR STIMULATING HIGHLY HETEROGENEOUS RESERVOIRS

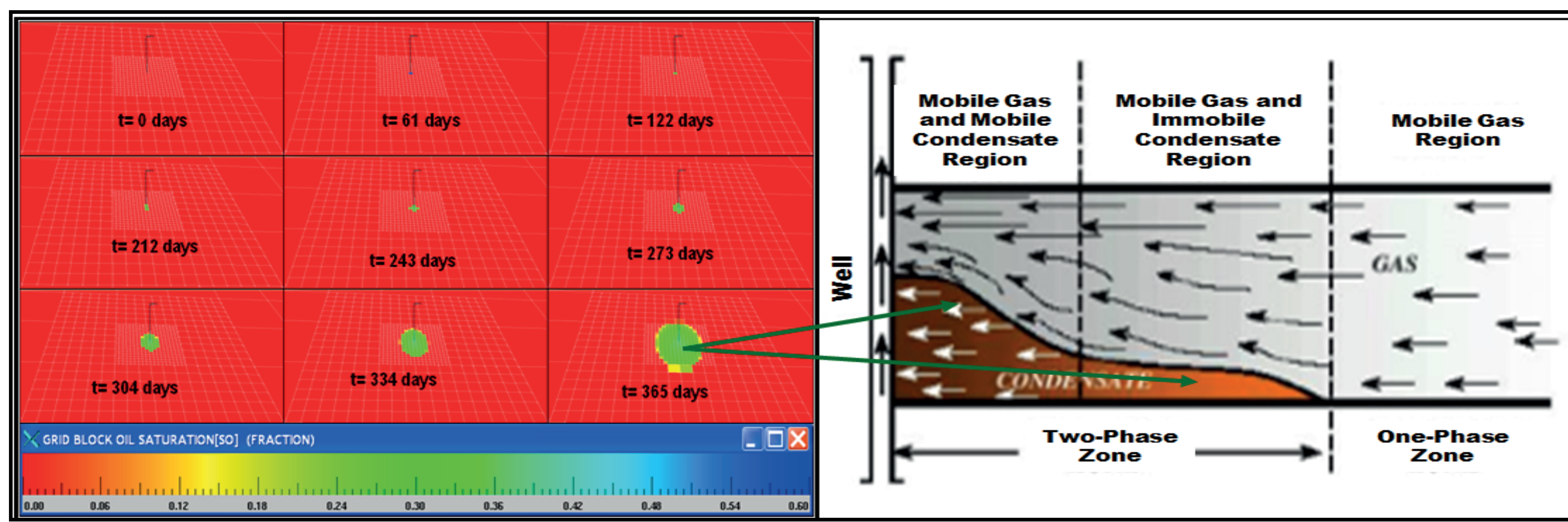
Richard Zabala, Edgar Mora, Natalia Ruiz, Liliana Guarin, Carolina Céspedes, Hector Acuña, Oscar Botero, Ecopetrol, Dubrasky Nava, Carolina Gonzalez, Marcia Benavides, SLB

## INTRODUCTION

Cupiagua field has been one of the most prolific gas-condensate fields currently producing in Colombia. The majority of wells were completed in Mirador, Barco and Guadalupe formations which are characterized by its low petro-physical properties (average permeability is 10 md and average porosity is 6%). Cupiagua is a compositional gas-condensate reservoir with initial API gravity at 42°.

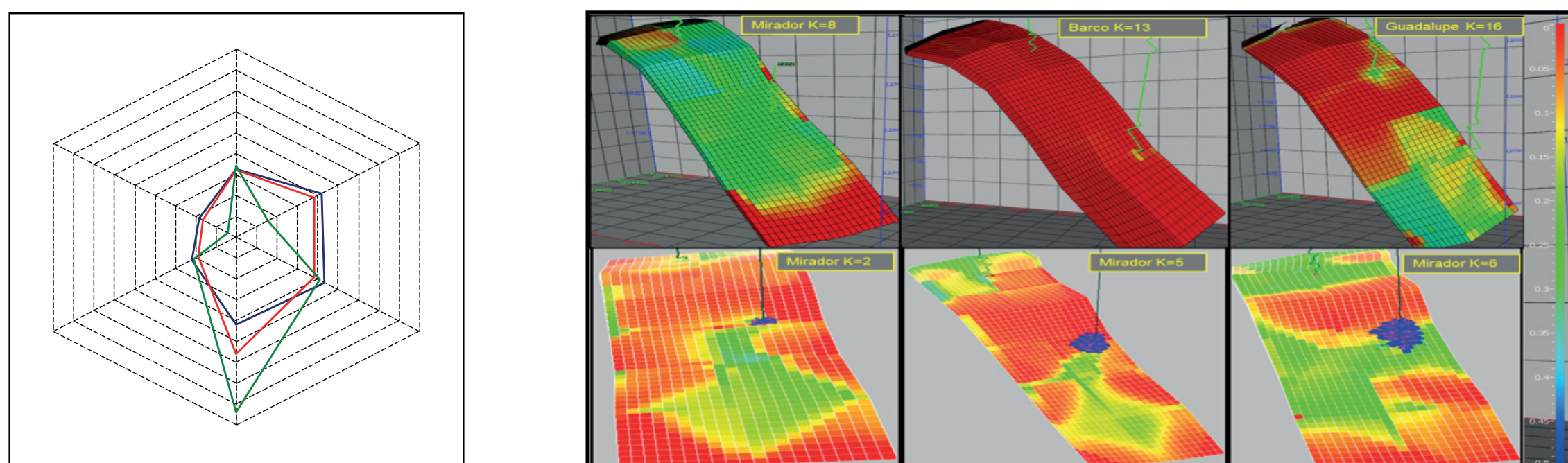


The well productivity in Cupiagua gas-condensate producer wells has been affected by several sources of damage in which mineral scales, organic scales, water blocking, and condensate banking have been recognized as the most important sources of damage



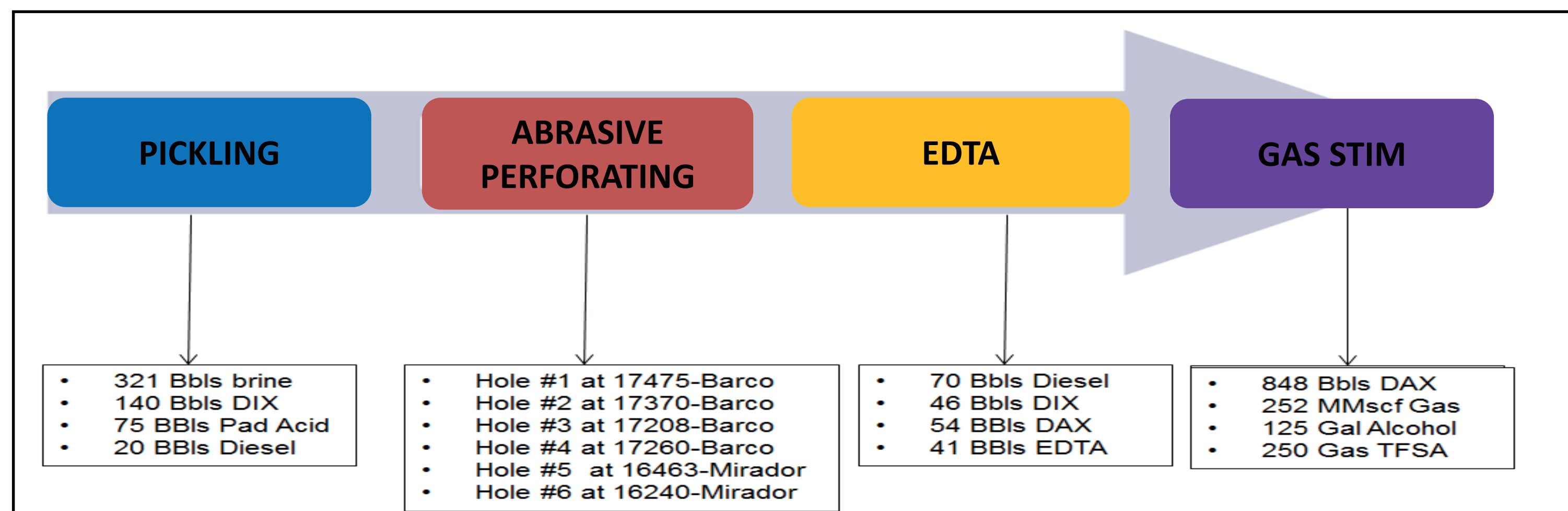
## WELL CANDIDATE

Well B7 is completed in Mirador, Barco and Guadalupe (natural flow). Its base production was 646 bopd, 62.46 MMscfd and 144 bwpd, with a decline rate of 2.9% monthly. Simulation runs shows that the entire Mirador reservoir is affected by the presence of condensate banking, Barco and Guadalupe formations are also affected but it is not present in all layers.



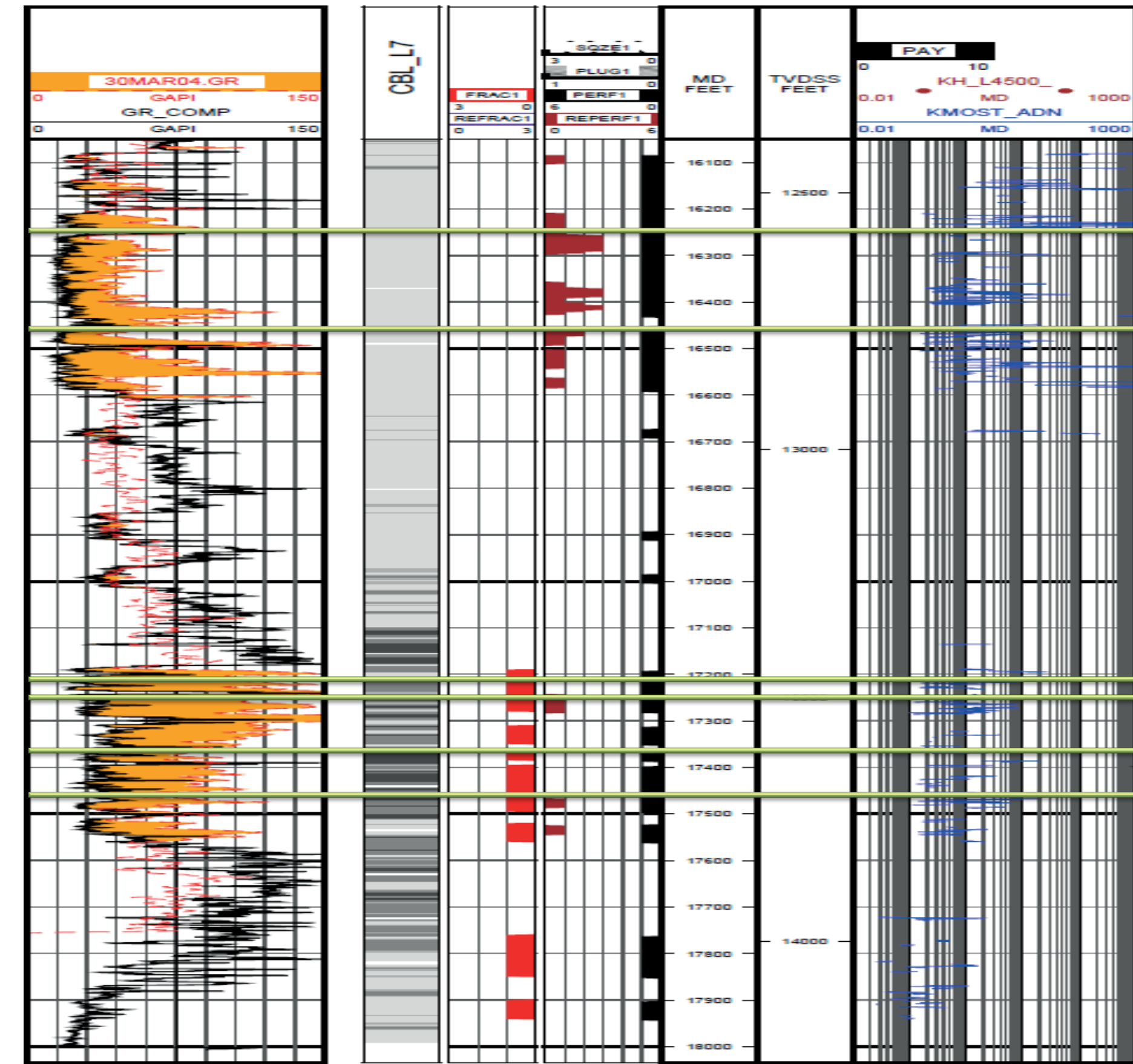
## GAS INHIBITED INJECTION

The stimulation gas injection pilot was designed as the best alternative to mitigate condensate banking and its associated problems



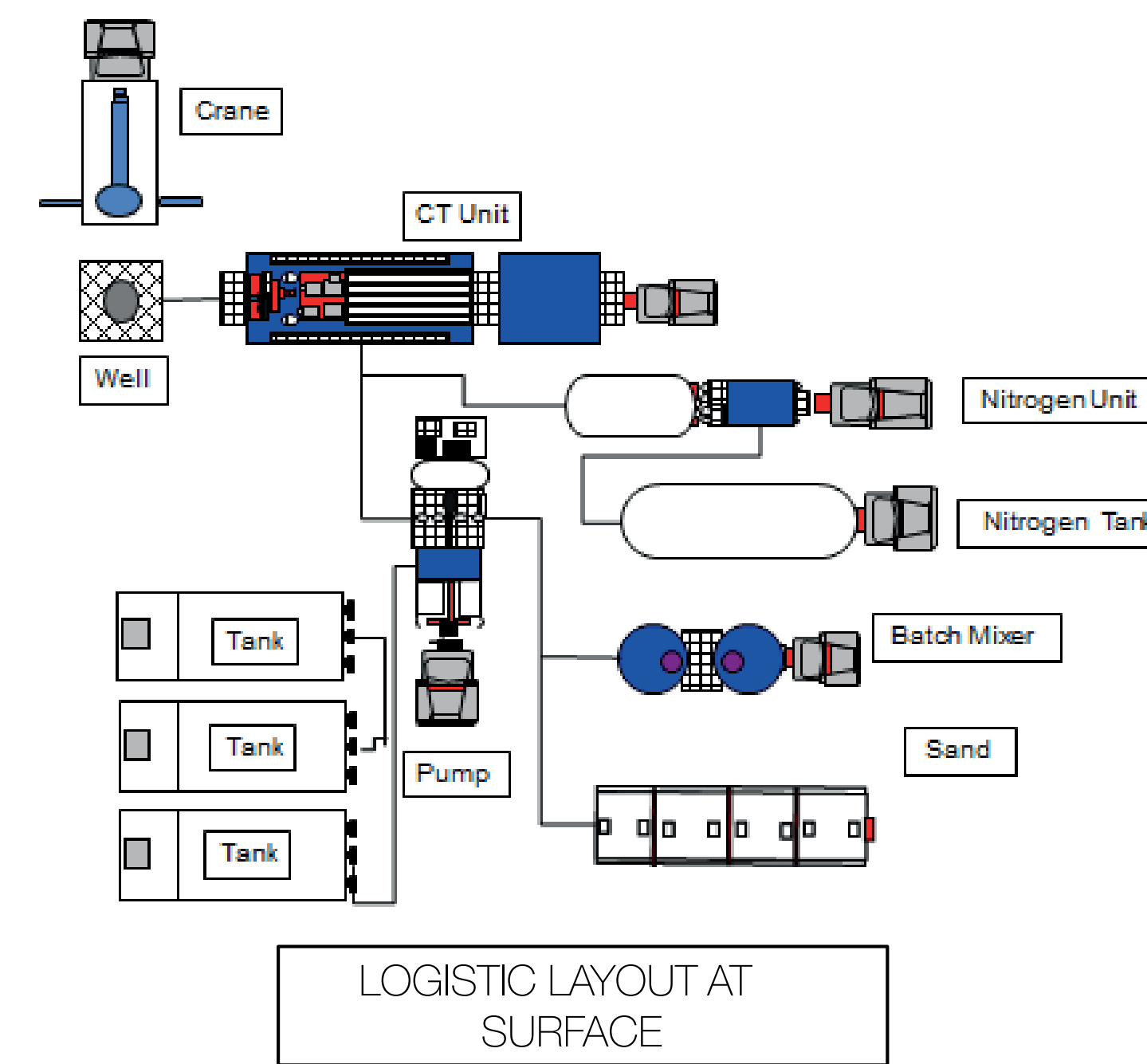
## SAND JETTING

Using sand jetting, undamaged flow paths were created at 6 selected depths, allowing effective mechanical diversion for the stimulating fluids (Diesel, HCl, xylene and injection gas).



The tool used consists of a jetting device with 4 nozzles (90° phased, hole diameter of 0.141", 1.5" of penetration); depth control was achieved with a GR-CCL correlation run to flag the CT; the operation for the abrasive jetting stations was finalized in 2.5 hrs

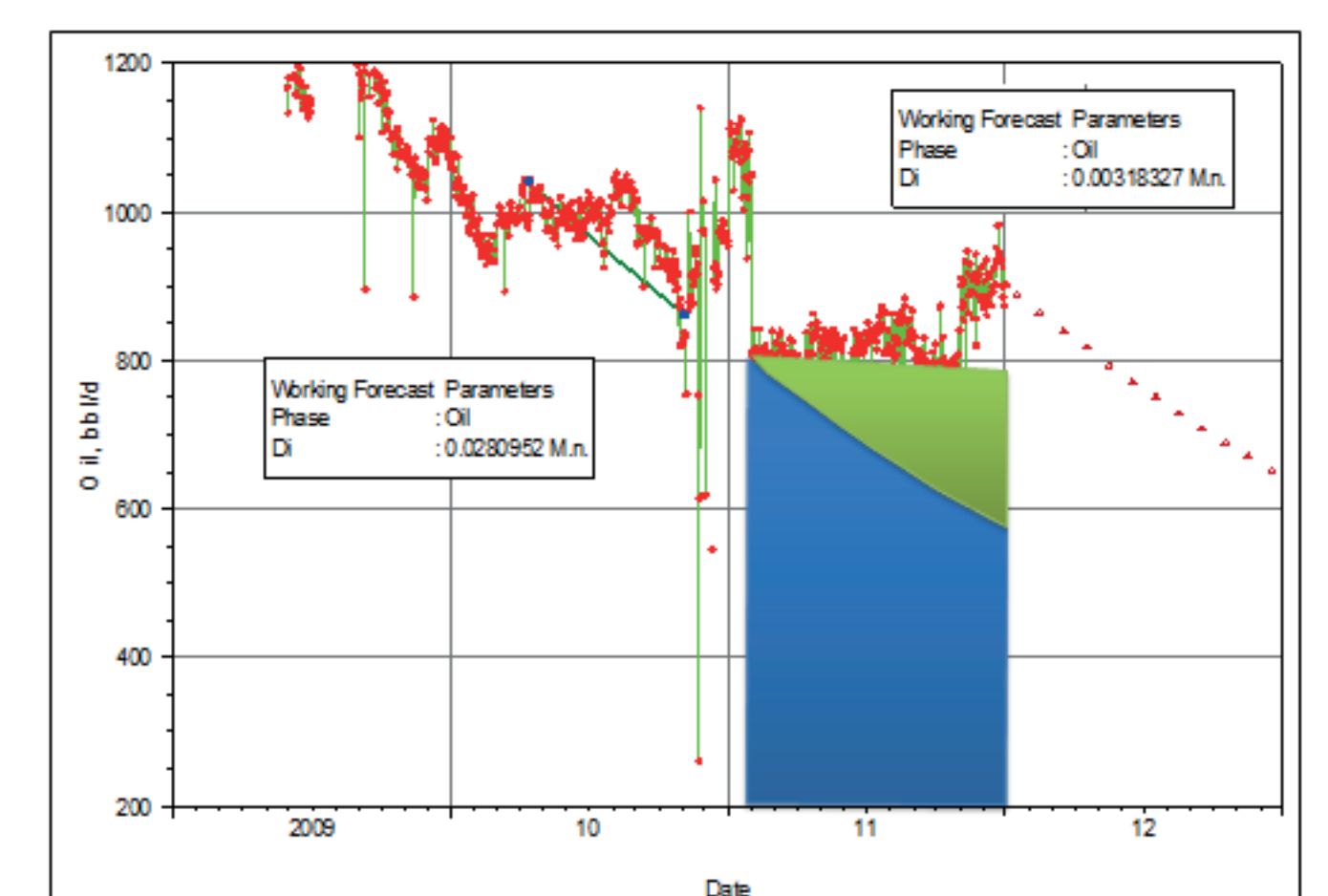
PROPPANT DATA (20/40)		WELL DATA			
Proppant SG	2.65	Xmas Tree	7.1/16 kpsi		
Proppant Bulk Density	13.36 lb/gal	Max. Pressure allowed	5000 psi		
Proppant Density	22.07 ppg	Interest Zone	16079-16718		
JETTING STATION VOLUMES		Well Volume @8396 ft	644.3 bbls		
Slurry Sand Concentration	1 ppa	Minimum ID	5.71 in, Lubricator Valve		
Pumping Rate	2.6 bpm	RESERVOIR PROPERTIES			
Jetting Time	10 min	INPUT DATA	MIRADOR	BARCO	GUADALUPE
Slurry Volume	26 bbls	TOP (ft)	160789	17177	17718
Total Proppant	1044.68 lbs	TVDOSS (ft)	12422	13429	13945
Total Gel Volume	24.87 bbls	NET PAY (ft)	334.77	205.5	64
WELL VOLUME		Porosity (%)	5.98	5.4	4.4
Total Proppant	5223.4 lbs	Permeability (md)	7.02	0.59	0.23
Total Gel Volume	289.35 bbls	Reservoir Pressure (psi)	3980.25	3876	4186.5
Total Pill Volume	50 bbls	Temperature (°F)	254	268	274
Displacement Brine	700 bbls	Saturation Pressure (psi)	5344	5370	5380
Activated Linear Gel	50 bbls				



Schiumberger				Client:	ECP
Well Services				Well Number:	Cuple gas
				Treatment Number:	1
				BHA Name:	Abras Jet
				Date:	Viembre 2010
Component	Name	Description	Tool ID (inch)	Tool ID (inch)	Length (ft)
1	Coil Connector	2-3/8" External Slip-type Coil Connector	3.055	1.97	0.77
2	DFCV	Double Flapper Check Valve	2.75	1.25	1.3
3	Disconnect	Pressure Balanced Disconnect - 7 linear screws (5200 lbs linear screws)	3.066	1.25	1.67
4	Cutting Sub	Small ABRASJET Cutting Sub	3.75	1.38	1.05
5	Ball Seat and Bull Nose	3 Small Down Jets - 0.141" 1 Large Down Jet - 1.13"	2.875	1.38	1.17
			Total Length	6	
			Ball Size	1"	

BHA SCHEMATIC

Once the holes were done; the stimulation fluids pumping sequence was performed. The immediate response of the well was positive to the stimulation, giving a production of 837 bopd, 66.7 MMscfd and 187 bwpd. After a year of production the decline rate has dropped to 0.3%.



## CONCLUSION

The usage of sand for high pressure jetting not only created channels to access new high potential zones but also served as mechanical diversion for chemical stimulations, this technique decreases the operating time by performing a single trip operation.

