



Copyright © 2003 by Epoch Well Services, Inc.

**Houston, TX**  
(281) 784-5500  
**Bakersfield, CA**  
(661) 328-1595  
**New Iberia, LA**  
(337) 364-2322  
**Anchorage, AK**  
(907) 561-2465

## MUDLOG MD

<b>COMPANY</b>	ExxonMobil Production
<b>WELL</b>	FRU 197-33A9
<b>FIELD</b>	FREEDOM RANCH UNIT
<b>REGION</b>	ROCKY MOUNTAINS
<b>COORDINATES</b>	N39.915656 W108.285725
<b>ELEVATION</b>	KB 6415' GL 6388'
<b>COUNTY, STATE</b>	RIO BLANCO COUNTY, CO
<b>API INDEX</b>	05-103-11400-00
<b>SPUD DATE</b>	10/02/2009
<b>CONTRACTOR</b>	HELMRICH AND PAYNE
<b>CO. REP.</b>	RICKY T OWENS
<b>RIG/TYPE</b>	215/FLEX 3
<b>LOGGING UNIT</b>	MLU 51
<b>GEOLOGISTS</b>	GEORGE BAKER BRENDA MARSH
<b>ADD. PERSONS</b>	DEVIN CLAAR BILL JOHANNING
<b>CO. GEOLOGIST</b>	MELISSA SAURBORN

### LOG INTERVAL

**DEPTHS:** 3,800' **TO** 12,281'

**DATES:** 01/05/2010 **TO** 01/24/2010

**SCALE:** 1"=100'

### CASING DATA

16" **AT** 131'

10.75" **AT** 3,833'

7.00" **AT** 8,533'

**AT**

### HOLE SIZE

9.875' **TO** 8,533'

6.125' **TO** 12,281'

**TO**

**TO**

### MUD TYPES

SPUD **TO** 3,833'

LSND **TO** 12,281'

**TO**

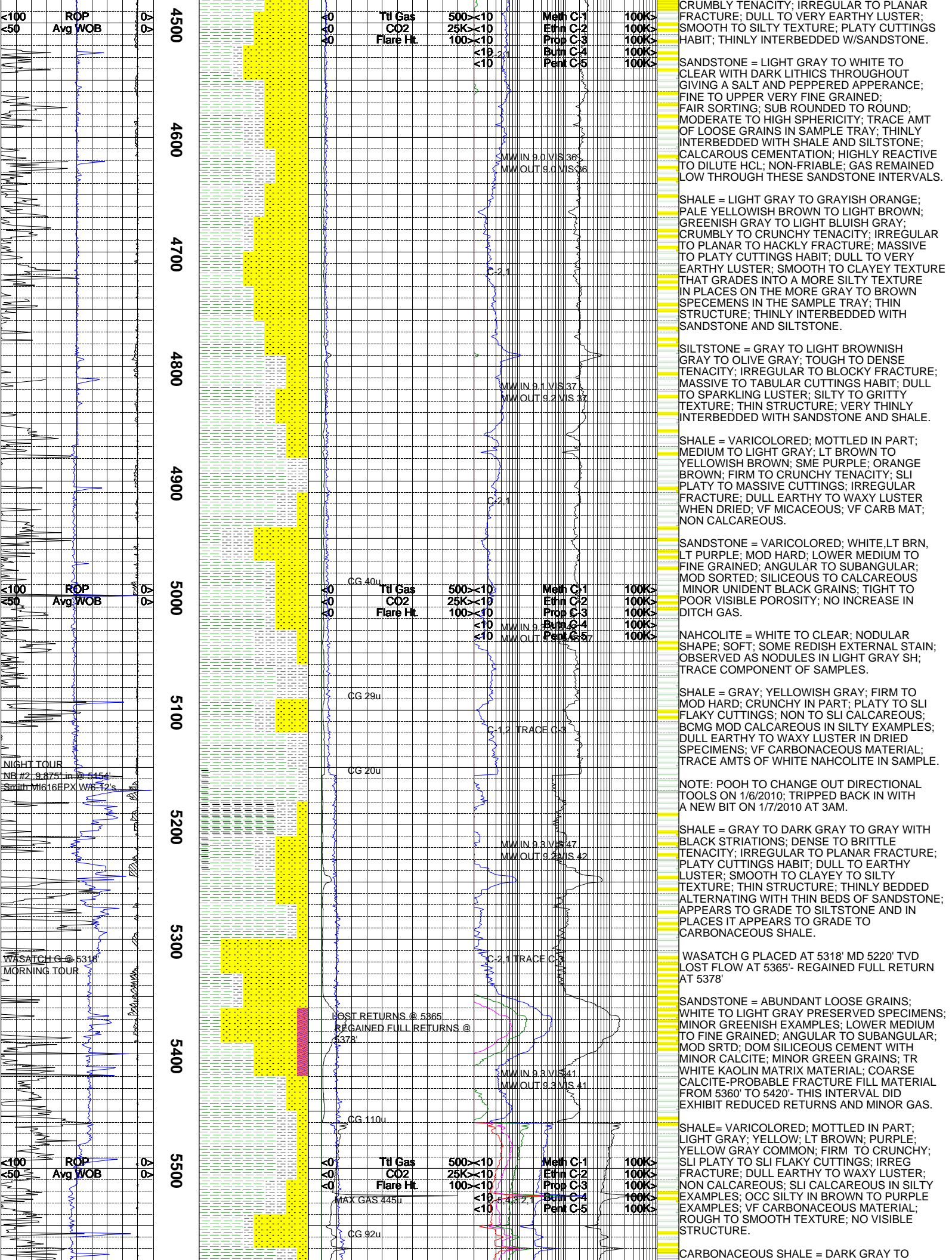
**TO**

### ABBREVIATIONS

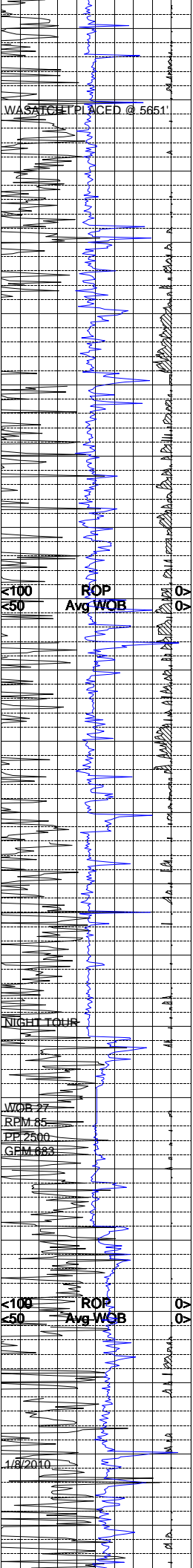
<i>NB</i> NEWBIT	<i>PV</i> PLASTIC VISCOSITY	<i>LC</i> LOST CIRCULATION
<i>RRB</i> RERUN BIT	<i>YP</i> YIELD POINT	<i>CO</i> CIRCULATE OUT
<i>CB</i> CORE BIT	<i>FL</i> FLUID LOSS	<i>NR</i> NO RETURNS
<i>WOB</i> WEIGHT ON BIT	<i>CL</i> PPM CLORIDE ION	<i>TG</i> TRIP GAS
<i>RPM</i> ROTARY REV/MIN	<i>Rm</i> MUD RESISTIVITY	<i>SG</i> SURVEY GAS
<i>PP</i> PUMP PRESSURE	<i>Rmf</i> FILTRATE RESISTIVITY	<i>WG</i> WIPER GAS
<i>SPM</i> STROKES/MIN	<i>PR</i> POOR RETURNS	<i>CG</i> CONNECTION GAS
<i>MW</i> MUD WEIGHT	<i>LAT</i> LOGGED AFTER TRIP	
<i>VIS</i> FUNNEL VISCOSITY	<i>LAS</i> LOGGED AFTER SURVEY	

ALTERED ZONE	CHERT - GLASSY	FELSIC SILIC DIKE	MARL - CALC	SANDSTONE
ANDESITE	CHERT - PORCEL	FOSSIL	METAMORPHICS	SANDSTONE-TUFFACEOUS
ANHYDRITE	CHERT - TIGER STRIPE	GABBRO	MUDSTONE	SERICITIZATION
BASALT	CHERT - UNDIFF	GLASSY TUFF	OBSIDIAN	SERPENTINE
BENTONITE	CLAY	GRANITE	PALEOSOL	SHALE
BIOTITIZATION	CLAY-MUDSTONE	GRANITE WASH	PHOSPHATE	SHALE TUFFACEOUS
BRECCIA	CLYST-TUFFACEOUS	GRANODIORITE	PORCELANITE	SHELL FRAGMENTS
CALCARENITE	CHLORITIZATION	GYPSUM	PORCELANEOUS CLYST	SIDERITE
CALCAREOUS TUFF	COAL	HALITE	PYRITE	SILICIFICATION
CALCILUTITE	CONGLOMERATE	HORNBL-QTZ-DIO	PYROCLASTICS	SILTSTONE
CARBONATES	CONGL. SAND	IGNEOUS (ACIDIC)	QUARTZ DIORITE	SILTST-TUFFACEOUS
CARBONACEOUS MAT	CONGL. SANDSTONE	IGNEOUS (BASIC)	QUARTZ LATITE	TUFF
CARBONACEOUS SH	COQUINA	INTRUSIVES	QUARTZ MONZONITE	VOLCANICLASTICS SEDS
CEMENT CONTAM.	DACITE	KAOLINITIC	RECRYSTALLIZED CALCITE	VOLCANICS
CHALK	DIATOMITE	LIMESTONE	RHYOLITE	
CRYSTALLINE TUFF	DIORITE	LITHIC TUFF	SALT	
CHERT - ARGILL	DOLOSTONE	MARL - DOLO	SAND	

ROP			Depth	Lithology	MGS			Interp. Lith			Remarks
ft/hr					Ttl Gas units			Meth C-1 ppm			Survey Data, Mud Reports, Other Info.
Avg WOB					CO2 ppm			Ethn C-2			
klbs					Flare Ht. ft			Prop C-3			
								Butn C-4			
								Pent C-5			
01/05/2010			3600								ALL ROCK COLORS ARE REFERENCED TO THE GSA ROCK COLOR CHART. ROCK CONSTITUENTS ARE DESCRIBED WET AND LISTED IN ORDER OF MOST ABUNDANT TO LEAST ABUNDANT. ALL SAMPLE DEPTHS ARE REFERENCED TO RKB.
NB# 1-9.8/5 IN @ 3844											
Hughes HCM 504ZX w/4-13											
2-12 SS											
MORNING TOUR			3700								CONNECTION GASES AS WELL AS TRIP AND DOWNTIME GASES ARE NOTED ON THE LOG. LARGE CONNECTION GASES WHICH APPEAR ON THE MUD LOG USUALLY REFLECT UPHOLE GAS INTERVALS BLEEDING GAS INTO THE BOREHOLE DURING CONNECTIONS.
NIGHT TOUR			3800								GAS CHROMATOGRAPHY EQUIPMENT IS CALIBRATED TO A TEST GAS COMPOSED OF METHANE = 10000 PPM ETHANE = 1000 PPM PROPANE = 1000 PPM I-BUTANE = 1000 PPM N-BUTANE = 1000 PPM I-PENTANE = 1000 PPM N-PENTANE = 1000 PPM
MAX GAS 175u			3900								WHEN THE MUD IS RUN THROUGH THE GAS FLUSTER THE INTERVAL IS MARKED ON THE MGS COLUMN AND SIZE OF FLARES NOTED.
MAX GAS 47u			4000								EVIDENCE OF FRACTURE FILL IS NOTED ON THE MUD LOG AS METAMORPHICS. KAOLIN PERCENTAGE IN SS INTERVALS IS ALSO NOTED
MUD DATA @ 4095			4100								1 UNIT OF GAS = 200 PPM METHANE
C-2.1 TRACE C-3			4200								EPOCH WELL SERVICES COMMENCED FULL LOGGING OPERATIONS ON 01/05/2010 AT 3848
MAX GAS 175u			4300								SHALE = MEDIUM GRAY; YELLOW GRAY; FIRM TO MOD HARD; MOTTLED IN PART; SLI PLATY TO SLI FLAKY CUTTINGS; IRREGULAR FRACT; MODERATELY CALCAREOUS; SOME VERY SILTY EXAMPLES; SME ISOLATED QUARTZ GRAINS; VERY FINELY MICACEOUS; MINOR PYRITE; INTERBEDDED WITH THIN SILTSTONE.
MAX GAS 47u			4400								SILTSTONE = GRAY TO BROWNISH GRAY MOTTLED WITH DARK GRAY TO BLACK SPOTS; TOUGH TO DENSE TENACITY; IRREGULAR TO BLOCKY FRACTURE; TABULAR TO WEDGELIKE CUTTINGS HABIT; SILTY TO GRITTY TEXTURE; THICKLY BEDDED WITH THIN BEDS OF SANDSTONE AND SHALE INBETWEEN.
MUD DATA @ 4095											SANDSTONE = LIGHT GRAY TO WHITE WHITE HUES OF GRAYISH BLUE; SPECKLED WITH DARK LITHICS GIVING A DIRTY SALT AND PEPPERED APPEARANCE; LOWER MEDIUM TO FINE GRAINED; FAIR SORTING; SUB ROUND TO ROUND; CLAY TO CALCAREOUS CEMENTATION; HIGHLY REACTIVE TO DILUTE HCL; TR AMT OF PYRITE IN SAMPLE; LOW GAS.
C-2.1 TRACE C-3											SHALE = LIGHT GRAY TO GRAY WITH HUES OF BLUE AND HUES OF ORANGE-BROWN; BRITTLE TO CRUMBLY TENACITY; IRREGULAR TO PLANAR FRACTURE; PLATY CUTTINGS HABIT; SMOOTH TO CLAYEY TEXTURE; THINLY INTERBEDDED WITH SILTSTONE AND SANDSTONE
MAX GAS 175u											SILTSTONE = GRAY TO DARK GRAY WITH HUES OF BROWN; TOUGH TO DENSE TENACITY; IRREGULAR TO HACKLY FRACTURE; TABULAR TO WEDGELIKE CUTTINGS HABIT; EARTHY TO SPARKLING LUSTER; SMOOTH TO SILTY TO GRITTY TEXTURE; THIN STRUCTURE; THINLY INTERBEDDED WITH SHALE AND SANDSTONE.
MAX GAS 47u											SANDSTONE = LIGHT GRAY TO GRAYISH WHITE TO WHITE WITH HUES OF BROWN; DARK LITHIC MATERIAL THROUGHOUT GIVING A DIRTY SALT AND PEPPERED APPEARANCE; FINE TO UPPER VERY FINE GRAINED; VERY TIGHT NON-POROUS CLUSTERS; NON FRIABLE; FAIR TO WELL SORTED; SUB ANGULAR TO SUB ROUNDED; MODERATE TO LOW SPHERICITY; HIGHLY REACTIVE TO DILUTE HCL; CLAY AND CALCAREOUS CEMENTATION; THINLY INTER-BEDDED WITH SHALE AND SILTSTONE.
MUD DATA @ 4095											SILTSTONE = LIGHT GRAY TO GRAY WITH HUES OF DARK BROWN; TOUGH TO DENSE TENACITY; IRREGULAR BLOCKY FRACTURE; MASSIVE TO TABULAR CUTTINGS HABIT; DULL TO SPARKLING LUSTER; SILTY TO GRITTY TO SLIGHTLY GRANULAR TEXTURE; THINLY INTERBEDDED.
C-2.1 TRACE C-3											SHALE = LIGHT GRAY TO ORANGY BROWN TO GRAY WITH BROWN HUES; BRITTLE TO







5600  
5700  
5800  
5900  
6000  
6100  
6200  
6300  
6400  
6500  
6600

RF SCALE GAS <0-500>

MAX GAS 178u

CG 50u

MAX GAS 162u

CG 164u

MAX GAS 1197u

MAX CO2 78595 PPM

CG 474u

MAX GAS 893u

MAX GAS 808u

MAX CO2 94327 PPM

CG 441u

Til Gas

CO2

Flare Ht

MAX GAS 492u

MAX GAS 551u

CG 226u

MAX GAS 596u

CG 259u

MAX GAS 502u

CG 632u

MAX GAS 582u

MAX GAS 364u

CG 95u

Til Gas

CO2

Flare Ht

CG 80u

CG 51u

MAX GAS 124u

BLEW BACK GAS LINE

MW IN 9.3 VIS 42

MW OUT 9.3 VIS 42

C 5.4.3.2

MW IN 9.4 VIS 40

MW OUT 9.4 VIS 40

C 5.4.3.2.1

MW IN 9.3 VIS 40

MW OUT 9.3 VIS 40

C 5.4.3.2.1

MW IN 9.3 VIS 37

MW OUT 9.3 VIS 37

C 5.4.3.2.1

MUD DATA @ 6390

API FL 10.8 GELS 5.17/26.0 H 3.2

CL 450 Cat 40 MBT 17.5 SOL 6.8

24 HR LOSSES = 1052.8 DB S

MW IN 9.1 VIS 39

MW OUT 9.1 VIS 39

C 5.4.3.2.1

MW IN 9.1 VIS 39

MW OUT 9.1 VIS 42

BLACK; FIRM TO MODERATELY HARD; PLATY CUTTINGS; NON CALCAREOUS; DULL EARTHY LUSTER; VF CARBONACEOUS MATERIAL; SMOOTH TO SLIGHTLY SILTY TEXTURE; TRACE COALY MATERIAL IN SAMPLE TRAYS.

SANDSTONE = MEDIUM GRAY TO GRAYBROWN; FINE TO VERY FINE GRAINED; ANGULAR TO SUBROUNDED; WELL SORTED; HARD; DOM CALCITE CEMENT; VERY FINE CARBONACEOUS MATERIAL; SOME COALY LAMINATIONS; ASSOC WITH MINOR GAS; INTERBEDDED WITH CARB SHALE.

CARBONACEOUS SHALE; DARK BROWN; FIRM; PLATY TO FLAKY CUTTINGS; PLANAR TO BLKY FRACTURE; NON TO VSLI CALCAREOUS; DULL EARTHY TO SLI RESINOUS LUSTER; SPECKLED WITH PYRITE; SMOOTH TO OCC SILTY TEXTURE SOME SPECIMENS WITH BLEEDING GAS.

SANDSTONE = WHITE TO LIGHT GRAY; FINE TO VERY FINE GRAINED; ANGULAR TO SBRNDD; WELL SORTED; DOM CALCITE CEMENT; GRAIN SUPPORTED; TR GREEN GRAINS; MINOR UNIDEN BLACK GRAINS; WHITE FRACTURE FILL CALC ADHERING TO SANDSTONE CLUSTERS; ASSOC WITH GAS SHOWS; CALCITE FRACTURE FILL MATERIAL OBSERVED IN THE 5750'-5780' SAMPLE.

CARBONACEOUS SHALE = DARK GRAY TO DARK BROWN; FIRM TO MOD HARD; PLATY TO FLAKY CUTTINGS; PLANAR TO BLOCKY CTGS; RESINOUS LUSTER TO OCC VITREOUS IN COALY EXAMPLES; VF MICACEOUS; CARB MATERIAL; SMOOTH TO SLI SILTY TEXTURE; TR PYRITE; NON CALCAREOUS.

SANDSTONE = LIGHT GRAY; SMEGRAYISH BROWN; MOD HARD; FINE TO VERY FINE GRD; MOD WELL SORTED; DOM CALCAREOUS CMT; GRAIN SUPPORTED; VF CARB MATERIAL; SME BLACK CARBONACEOUS LAMINATIONS TO COALY LAMINATIONS; ANGULAR TO SUBANGULAR; THINLY BEDDED WITH CARBONACEOUS SHALE.

SILTSTONE = LT TO MEDIUM GRAY; SME LT BROWN; HARD; IRREGULAR FRACTURE; SLI TO MOD CALCAREOUS; WAXY TO SLI SPARKLING LUSTER; SILTY TEXTURE; VF CARBONACEOUS MATERIAL; NO VISIBLE STRUCTURE.

SHALE = LT GRAY; LT GREEN; SME LT BROWN; FIRM TO CRUNCHY; IRREGULAR FRACTURE; SLI PLATY CUTTINGS; DULL EARTHY LUSTER; OCC ISOLATED VF QUARTZ GRAINS; SMOOTH TO ROUGH TO SILTY TEXTURE; VARIABLE AMTS OF SILT; GRADING TO SILTSTONE; NON TO SL CALCAREOUS; MICROPYRITE; VF CARBONACEOUS MATERIAL.

SANDSTONE = LIGHT GRAY TO LIGHT BROWNISH GRAY; HARD; FINE TO VERY FINE GRAINED; ANGULAR TO SUBANGULAR; MOD WELL SRD; DOM SILICEOUS CEMENT WITH MINOR CALCITE FILL; MINOR PYRITE; TIGHT TO PR POROSITY MOD REACTION TO DILUTE HCL; THINLY INTERBEDDED; ASSOCIATED WITH MODERATE GAS SHOWS.

CARBONACEOUS SHALE = GRAY TO DARK GRAY TO GRAYISH BLACK; TOUGH TO DENSE TENACITY; IRREGULAR TO BLOCKY TO SLIGHTLY PLANAR FRACTURE; MASSIVE TO PLATY CUTTINGS HABIT; WAXY TO DULL TO EARTHY LUSTER; SMOOTH TO SILTY TEXTURE; SOMETIMES APPERING TO GRADE TO SILTSTONE A TRACE AMT OF PYRITE IN WITH THE SAMPLE AND EMBEDDED ON SOME CARB. SHALE SPECIMENS GIVING A SPARKLING LUSTER.

SANDSTONE = WHITE TO LIGHT GRAY TO OPAQUE WITH HUES OF BLUIH GRAY; FINE TO UPPER VERY FINE GRAINED; IN VERY TIGHT WELL CONSOLIDATED CLUSTERS; FAIR TO WELL SORTING; SUB ANGULAR TO SUB ROUNDED; MODERATE SPHERICITY; MODERATE REACTION TO DILUTE HCL; CALC/SILC CEMENT THINLY INTERBEDDED WITH SHALE AND SILTSTONE; TRACE AMT OF DARK LITHICS EMBEDDED IN THE TIGHT CLUSTERS GIVING A DIRTY SALT AND PEPPERED APPERANCE.

SILTSTONE = LIGHT OLIVE BROWN TO PALE OLIVE TO BROWNISH GRAY TO GREENISH GRAY; TOUGH TO CRUMBLY TENACITY; IRREGULAR TO HACKLY FRACTURE; TABULAR TO WEDGELIKE CUTTINGS HABIT; DULL TO EARTHY TO SLIGHTLY SPARKLING LUSTER; SILTY TO GRANULAR TEXTURE; THIN STRUCTURE; VERY THINLY INTERBEDDED WITH SANDSTONE.

SANDSTONE = LIGHT BLUIH GRAY TO WHITE TO TRANSPARENT TO TRANSLUCENT; SOME DARK LITHICS THROUGHOUT GIVING A SALT AND PEPPERED APPERANCE; ABUNDANT LOOSE GRAINS THAT ARE MEDIUM TO FINE GRAINED TO A FAIR AMOUNT OF TIGHT





