

Office of Environmental Management – Grand Junction



**Remedial Action Plan and
Site Design for Stabilization of
Moab Title I Uranium Mill Tailings
at the Crescent Junction, Utah,
Disposal Site**

**Attachment 5: Field and Laboratory Results,
Volume I**

August 2006



**U.S. Department
of Energy**

Office of Environmental Management

**Remedial Action Plan and Site Design
for Stabilization of Moab Title I Uranium Mill Tailings
at the Crescent Junction, Utah , Disposal Site**

Attachment 5: Field and Laboratory Results Volume I

Work performed under DOE Contract No. DE-AC01-02GJ79491
for the U.S. Department of Energy Office of Environmental Management.
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Appendix A

U.S. Department of Energy—Grand Junction, Colorado

Calculation Cover Sheet

Calc. No.: MOA-02-02-2006-1-03-00

Discipline: Geologic and
Geophysical Properties

No. of Sheets: 4

Project: Moab UMTRA Project

Site: Crescent Junction, Utah

Feature: Corehole Logs

Sources of Data:

Corehole logs

Sources of Formulae and References:

DOE 2005. *Work Plan for Characterization of Crescent Junction Disposal Site*, Revision No. 0, August 12, 2005, DOE-EM/GJ912-2005.

Preliminary Calc. ☐

Final Calc. ☒

Supersedes Calc. No.

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Problem Statement:

Preliminary site selection performed jointly by the U.S. Department of Energy (DOE) and the Contractor has identified a 2,300 acre withdrawal area in the Crescent Flat area just northeast of Crescent Junction, Utah, as a possible site for a final disposal cell for the Moab uranium mill tailings. The proposed disposal cell would cover approximately 300 acres. Based on the preliminary site-selection process, the suitability of the Crescent Junction disposal site is being evaluated from several technical aspects, including geomorphic, geologic, hydrologic, seismic, geochemical, and geotechnical. The objective of this calculation set is to present the corehole logs generated during the drilling program to investigate subsurface geologic conditions at the Crescent Junction disposal site.

This calculation will be incorporated into Attachment 2 (Geology) of the Remedial Action Plan (RAP) and Site Design for Stabilization of Moab Title I Uranium Mill Tailings at the Crescent Junction, Utah, Disposal Site, and summarized in the appropriate sections of the Remedial Action Selection (RAS) report for the Moab site.

Method of Solution:

Ten coreholes (0201 through 0210) were drilled to depths of approximately 300 feet (ft) into the Mancos Shale as shown in Figure 1 and Table 1. These were drilled by Layne GeoConstruction using hollow-stem auger (HSA) and rotary coring. The auger bit size was 8.5 inches and core-bit size was HQ. Surface casing was set to selected depths (up to 40 ft) and cemented in each hole. Core samples were logged in the field using visual soil-classification procedures described in DOE (2005; p.4-6). Field logs were digitized and standardized using the gINT computer software program (gINT Software USA 2005). Appendix A contains the corehole logs for the Crescent Junction Site. These data are also available in the SEEPro database at the DOE Grand Junction office.

Three additional coreholes (0211 through 0213) were drilled to depths of approximately 40 ft, offsetting other selected boreholes, for running packer tests (Appendix B).

Assumptions:

N/A

Calculation:

N/A

Discussion:

Results and evaluation of the core drilling activities at the Crescent Junction disposal site during 2005 are discussed in detail in Attachment 2 (Geology) of the RAP and summarized in relevant sections of the RAS.

Conclusion and Recommendations:

N/A

Computer Source:

gINT computer software was used to digitize and standardize the corehole logs.

References:

DOE 2005. *Work Plan for Characterization of Crescent Junction Disposal Site*, Revision No. 0, August 12, 2005, DOE-EM/GJ912-2005

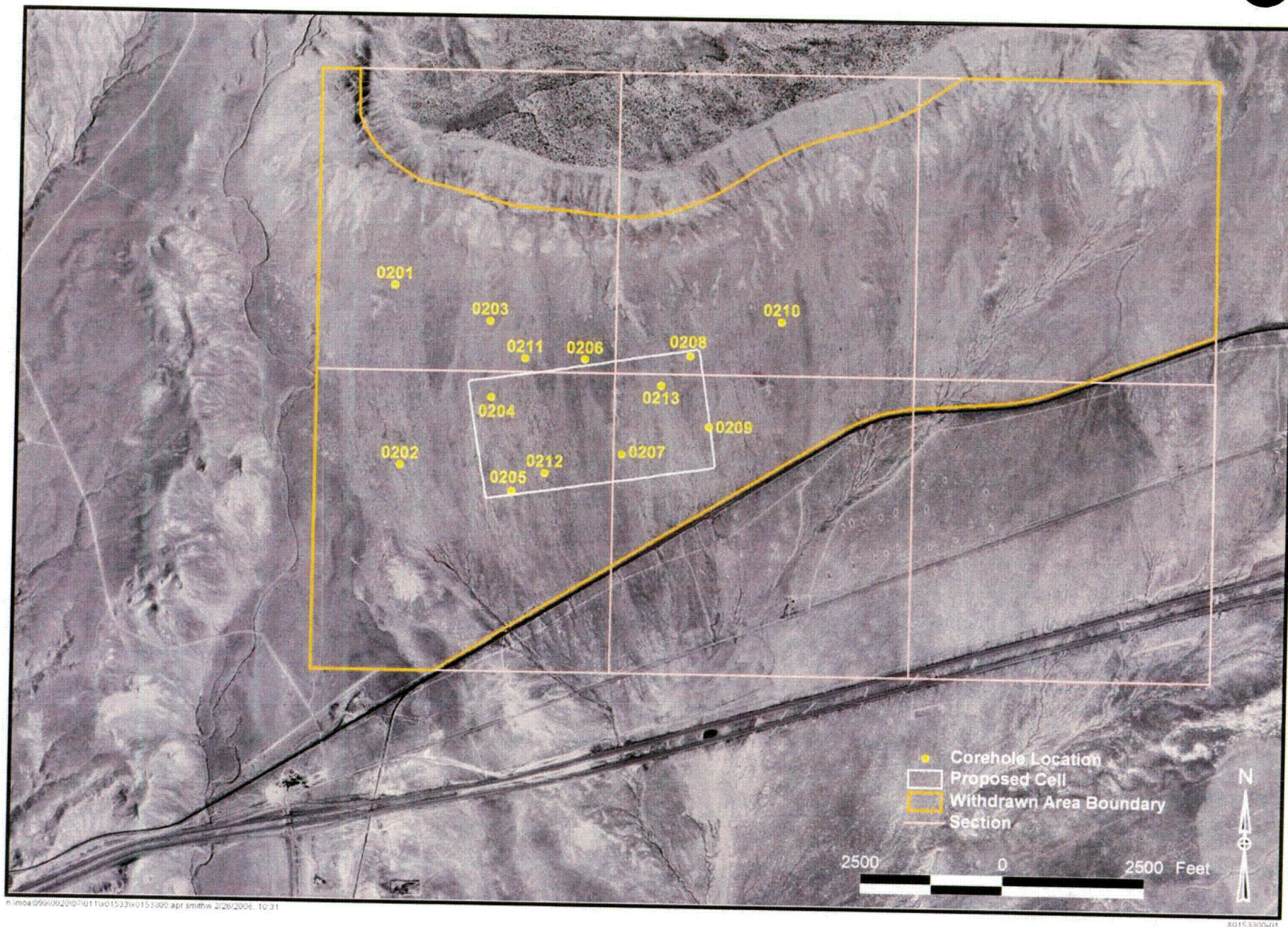


Figure 1. Location of Coreholes at the Crescent Junction Site

Table 1. Corehole Specifications at the Crescent Junction Site

Corehole No.	N Coordinate ^a	E Coordinate ^a	Ground Elevation (ft ngvd) ^b	Total Depth (ft)	Date Completed	Geophysical Logs	Hole Size (in)	Casing (ft)	Sample Type	Drilling Method ^c
CRJ01-0201	6797583.56	2120851.13	5030.00	301.00	8-Nov-05	some	8.5	0-29	HQ core	HSA/rotary core
CRJ01-0202	6794422.62	2120996.12	4960.00	300.00	19-Nov-05	yes	8.5	0-29.5	HQ core	HSA/rotary core
CRJ01-0203	6796977.60	2122543.47	5015.00	301.00	7-Nov-05	yes	8.5	0-30	HQ core	HSA/rotary core
CRJ01-0204	6795633.72	2122583.61	4983.00	300.00	5-Nov-05	yes	8.5	0-25	HQ core	HSA/rotary core
CRJ01-0205	6793981.28	2122975.63	4945.90	300.00	2-Nov-05	yes	8.5	0-25	HQ core	HSA/rotary core
CRJ01-0206	6796324.67	2124232.60	4994.00	302.00	24-Oct-05	yes	8.5	0-26	HQ core	HSA/rotary core
CRJ01-0207	6794658.25	2124919.25	4950.20	300.00	20-Oct-05	yes	8.5	0-25	HQ core	HSA/rotary core
CRJ01-0208	6796412.91	2126089.65	4986.10	301.00	8-Oct-05	yes	8.5	0-40	HQ core	HSA/rotary core
CRJ01-0209	6795168.53	2126441.58	4955.70	300.00	27-Sep-05	yes	8.5	0-35	HQ core	HSA/rotary core
CRJ01-0210	6797035.78	2127690.14	4998.60	302.00	7-Oct-05	yes	8.5	0-23	HQ core	HSA/rotary core
CRJ01-0211	6796327.81	2123173.42	4998.00	40.00	22-Nov-05	no	4.0	no	HQ core	Casing advance
CRJ01-0212	6794311.80	2123552.99	4950.00	42.00	30-Nov-05	no	4.0	no	HQ core	Casing advance
CRJ01-0213	6795880.41	2125591.86	4975.00	40.50	2-Dec-05	no	4.0	no	HQ core	Casing advance

^aLocal coordinate system based on modified state plane coordinate system NAD 83 Utah Central Zone.

^bngvd = National Geodetic Vertical Datum

^cHSA = hollow stem auger

Appendix A
Corehole Logs

BOREHOLE LOG CRJ01-0201

PROJECT MOAB	DATE DRILLED 08/24/2005 to 11/08/2005	BIT SIZE(S) (IN) 8.5
LOCATION Crescent Junction, UT.	DRILLING COMPANY Layne GeoConstruction	CORE SIZE(S) (IN)
SITE Crescent Junction	DRILLING METHOD H.S.A., Rotary Core	LOGGED BY Goodknight, C., Rupp, R.
WELL NUMBER CRJ01-0201	SAMPLING METHOD HQ CORE	WL (FT BGS)
NORTH COORD. (FT) 6797583.56	DRILL OPERATOR Neaman, J. (CME 750, BB80), Hyleman, B. (BB80)	
EAST COORD. (FT) 2120851.13	REMARKS 4-inch steel surface casing cemented to depth of 29.0 feet below land surface.	
SURFACE ELEV. (FT NGVD) 5030.00		
HOLE DEPTH (FT) 301.00		

DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT.)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
							0-4.0 ft. SILT (ML); pale brown (10YR 6/3) with up to 10% siltstone and sandstone rock fragments. Mostly alluvial mud derived from sheet wash. Less than 10% very fine grained sand, highly calcareous.
5	5025	5 20 15 24	4.0-5.0 5.0-6.0				4.0-4.5 ft. SILTY SAND (SM); moderately calcareous, mottled, very pale brown (10YR 7/4) and yellow (10YR 7/8). 4.5-5.0 ft. SANDSTONE; very fine grained rock fragment, yellowish gray (5Y 8/1), slightly calcareous.
10	5020	13 33 30 37	9.0-10.0 10.0-11.0				5.0-14.0 ft. WEATHERED MANCOS SHALE BEDROCK: 5.0-9.0 ft. highly weathered silty shale, soft, mottled, from light gray (N7) to dark yellowish orange (10YR 6/6), with ~5% white gypsum and calcite crystals and masses, moderately calcareous. 9.0-12.0 ft. silty shale moderately weathered, layered, yellowish gray (5Y7/2), moderately calcareous, several % small white masses of gypsum. 10.5-11.0 ft. thin layer of siltstone that is highly calcareous and dark yellowish orange (10YR 6/6). 12.5-14.0 ft. shale becomes increasingly hard and less weathered.
15	5015	50/3"	14.5-17.0				14.0-14.5 ft. Blow refusal @ 14.3 ft. No Recovery.
20	5010		17.0-22.0				14.5-301.0 ft. MANCOS SHALE: 14.5-29.0 ft. mostly siltstone, light olive gray (5Y 5/2) wavy bedding, black surfaces on some bedding is framboidal pyrite, slightly weathered, mostly horizontal bedding plane fractures spaced 0.2 to 0.3 ft. apart. Inclined fracture (~45 degrees) @ 16.0 ft. with white gypsum and calcite. Thin clayey zone at ~16.5 ft. 17.9-22.0 ft. layer of abundant burrows filled with limonitic-colored, dark yellowish orange (10YR 6/6) material, trace white calcite and gypsum. Horizontal fracturing more abundant at spacings of 0.1 ft or less.
25	5005		22.0-27.0		14.5-35.0 Very Poor		22.0-27.0 ft. slightly weathered, mostly siltstone, wavy bedded to bioturbated, abundant horizontal fractures spaced approximately 0.2 ft. apart filled with gypsum. Yellowish gray (5Y 7/2) to pale yellowish brown (10YR 6/2), moderately calcareous. Core much more competent, despite the horizontal fracturing.
30	5000		27.0-29.0 29.0-35.0				27.0-29.0 ft. slight to nonweathered, less horizontal fracturing filled with gypsum and more dark bedding, which is largely colored by framboidal pyrite. Bedding continues to be bioturbated and wavy. Mostly yellowish gray (5Y 7/2). 29.0-35.0 ft. 4.0 ft. recovery - core loss spread over entire run - core severely parted on bedding with no angular fractures - core is moderately weathered, yellowish gray, some gypsum crystals, core is in fragments and pieces up to 0.05-0.1 ft. thick (long).

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BOREHOLE LOG CRJ01-0201

PROJECT MOAB BOREHOLE NUMBER CRJ01-0201
 SITE Crescent Junction Site DATES DRILLED 08/24/2005 to 11/08/2005

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
40	4990		35.0-45.0		35.0-45.0 Poor		35.0-45.0 ft. good recovery 9.6 ft. -still fractured and broken to about 42.0 ft. with gypsum infilling and limonitic stain, normal dark gray coloration and the usual +/-5 degree bedding angle - all lost core is at top of the run. No major high angle fractures in the run - broken core is generally on the nearly horizontal bedding planes. Below 42.0 ft., core becomes largely unweathered.
45	4985						45.0-55.0 ft. unweathered "fresh" core, moderate parting on bedding; some parting on fissile zones. Good Run.
50	4980		45.0-55.0		45.0-55.0 Fair		
55	4975						55.0-65.0 ft. very good run - relatively hard, moderately calcic claystone, dry interior of core, horizontal bedding, usual crenulations and hairline gypsum fillings.
60	4970		55.0-65.0				
65	4965				55.0-75.0 Good		65.0-75.0 ft. very good recovery, breaks and parting on bedding, no fractures, slightly fissile in spots - dry core interior- moderately to strongly calcic.
70	4960		65.0-75.0				

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PROJECT MOAB BOREHOLE NUMBER CRJ01-0201
 SITE Crescent Junction Site DATES DRILLED 08/24/2005 to 11/08/2005

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
75	4955						75.0-85.0 ft. very competent run - excellent recovery. Claystone, dry core interior, slightly fissile from 77.0-78.0 ft., hard, moderately calcic, no fractures, no secondary mineralization, no indication of water.
80	4950		75.0-85.0				
85	4945						85.0-95.0 ft. dark gray, horizontal bedding (at a 90 degree angle to core axis), thin bedding laminations, hard, dry core interior, minor mechanical breaks on bedding, short splinter from drilling stress at 92.7-93.0 ft.
90	4940		85.0-95.0				
95	4935				75.0-301.0 Excellent		95.0-105.0 ft. core splintered by mechanical stress from 97.0-98.5 ft., fissile break at 99.2 ft. Hard, calcic, dry core interior, no indication of formation water.
100	4930		95.0-105.0				
105	4925						105.0-115.0 ft. dark colored silty claystone (medium gray, N5) approximately 90%, and light colored (very light gray, N8), very fine grained sandstone, which represents bioturbated layers ~10%. Bioturbated layers are as much as 0.05 ft. thick. Core hard and competent, dry when broken open. Bioturbated beds are quite contorted in places. Trace fine carbonaceous and framboidal pyrite on bedding. No natural fractures, slightly to moderately calcareous.
110	4920		105.0-115.0				

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BOREHOLE LOG CRJ01-0201

PROJECT MOAB BOREHOLE NUMBER CRJ01-0201
 SITE Crescent Junction Site DATES DRILLED 08/24/2005 to 11/08/2005

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
115	4915						115.0-125.0 ft. core hard and competent, no natural fractures, dry when broken open. Bedding along some bioturbated layers is inclined as much as 25 degrees.
120	4910		115.0-125.0				
125	4905						125.0-135.0 ft. core is hard and competent, no natural fractures, dry when broken open. Carbonaceous mats (up to 0.05 ft. long) occur on some bedding surfaces. Trace fossil imprints on some bedding surfaces.
130	4900		125.0-135.0		75.0-301.0 Excellent		
135	4895						135.0-145.0 ft. bioturbated bedding increases to as much as 15-20% of layering. Carbonaceous mats are on some bedding planes and they break easily. Core hard and competent, no natural fractures, dry when broken open. Thin fissile layer at ~140.0 ft.
140	4890		135.0-145.0				
145	4885						145.0-155.0 ft. bioturbated bedding in as much as 30% of layering. Core is hard and competent, but breaks along finer grained, dark layers of silty claystone and carbonaceous material. Thin fissile layer at ~149 ft. and 155.3 ft.
150	4880		145.0-155.0				

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PROJECT MOAB BOREHOLE NUMBER CRJ01-0201
 SITE Crescent Junction Site DATES DRILLED 08/24/2005 to 11/08/2005

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
155	4875						155.0-165.0 ft. bioturbated layering is ~20% from 155.5-157.0 ft., then decreases rapidly to 2-3% at 159.0 ft., and remains so to bottom of interval. Some near vertical stress fractures from 157.0-159.0 ft. No natural fractures. Core hard and competent and dry when broken open. Coiled nautiloid fossil at 159.2 ft. coated in fine pyrite. Below 159.0 ft., core is much finer grained and more competent.
160	4870		155.0-165.0				
165	4865						165.0-175.0 ft. core placement is jumbled because core was extruded explosively from the barrel and scattered. Core through interval is mostly silty claystone with 2-3% bioturbated layering that is very fine grained sandstone. Several vertical stress fractures caused by drilling. Core from 174.5 to 175.5 ft. is placed correctly.
170	4860		165.0-175.0		75.0-301.0 Excellent		
175	4855						175.0-185.0 ft. silty claystone with 2-3% bioturbated (or storm) layering composed of very fine grained sandstone. Vertical stress fractures at top of interval at 175.5-176.0 ft. At 179.5-180.5 ft. and 181.0-181.5 ft. are vertical fractures that may be natural - no evidence of fluid movement along these tight fractures. At 180.5 and 181.8 ft. are thin fissile layers. Large flattened cephalopod at 177.3 ft.
180	4850		175.0-185.0				
185	4845						185.0-195.0 ft. increase in bioturbated layering to ~5%, some of it is chaotic, especially from 186.0-187.0 ft. Vertical fracture at 189.5- 190.5 ft., appears to be drilling related stress. Bioturbated layering decreases below ~190.0 ft., to about 2-3%. Core is hard and competent throughout, dry when broken apart.
190	4840		185.0-195.0				

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 SITE Crescent Junction Site DATES DRILLED 08/24/2005 to 11/08/2005

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
195	4835						195.0-205.0 ft. bioturbated layering increases below ~202.0 ft. to ~5-10%. Some bioturbated layering is inclined as much as 20 degrees from horizontal. Core is hard and competent throughout, dry when broken open. Some fine carbonaceous material along bedding surfaces.
200	4830		195.0-205.0				
205	4825						205.0-215.0 ft. bioturbated layering composes is nearly 10% of bedding from 206.0-211.0 ft., then decreases quickly to ~1% at 212.0 ft. and below. Core has fissile layers in many locations from 206.0 to 208.5 ft., below which the core is more competent and less broken. A couple of fissile layers from 211.0-212.0 ft. Core is dry when broken open. Fine carbonaceous material along many bedding surfaces.
210	4820		205.0-215.0		75.0-301.0 Excellent		
215	4815						215.0-225.0 ft. silty claystone with only ~10% bioturbated (or storm) layering consisting of lighter colored very fine grained sandstone. Some vertical fracturing at 218.0 and ~224.5-225.5 ft. is probably mechanical stress from drilling - no evidence of fluid movement along the tight fractures. Fissile, thin bedded layers at 221.7-221.9 ft., 222.3-222.5ft., 222.9 and 225.3 ft. Layering looks to dip 5-7 degrees. One or more of the fissile layers may be bentonite.
220	4810		215.0-225.0				
225	4805						225.0-235.0 ft. core splintered by mechanical stress from 225.0-226.3 ft. From 227.0-229.0 ft., core softer and fissile - washed out and rounded. From 229.0-232.0 ft., core generally parted on bedding every 0.3-0.7 ft. From 232.0-235.0 ft., more competent core with only parting on bedding.
230	4800		225.0-235.0				

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BOREHOLE LOG CRJ01-0201

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 SITE Crescent Junction Site DATES DRILLED 08/24/2005 to 11/08/2005

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
235	4795						
240	4790		235.0-245.0				235.0-245.0 ft. very dark gray when wet, mostly medium dark gray (4) when dry, minor parting, no fractures, slightly fissile @239.3 ft. No secondary mineralization.
245	4785						
250	4780		245.0-255.0		75.0-301.0 Excellent		245.0-255.0 ft. very dark gray claystone. Splintered @245.8-246.4 ft., parted on bedding in a few places, otherwise unbroken. Very competent, horizontal bedding, dry core interior, no biocrenulations, no fractures, no formation water.
255	4775						
260	4770		255.0-265.0				255.0-265.0 ft. splintered by mechanical stress @255.0-257.3 ft., and 259.0-261.0 ft., somewhat fissile @261.0, 261.6, and 262.2 ft., otherwise moderately calcic, relatively hard, competent claystone.
265	4765						
	4760		265.0-275.0				265.0-275.0 ft. splintered 265.3-266.0 ft., and 273.0-275.0 ft. Good competent run, no fractures other than stress related, consistent color and hardness, normal bedding and parting, no secondary mineralization.

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 SITE Crescent Junction Site DATES DRILLED 08/24/2005 to 11/08/2005

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
275	4755						
280	4750		275.0-285.0				275.0-285.0 ft. splintered @ 275.0-276.0 ft., fissile (0.1 ft.) @284.0 ft., otherwise standard claystone with normal bedding, coloration, hardness, very competent and only slight parting on bedding planes, core interior is dry, no bioturbation.
285	4745				75.0-301.0 Excellent		285.0-295.0 ft. somewhat fissile overall, broken on fissile sections on bedding @ 285.6, 286.4, 287.0, and 287.3 ft., 288.4-289.0 ft., 291.2, 292.3, 292.6, 293.3, and 294.5 ft.
290	4740		285.0-295.0				
295	4735						295.0-301.0 ft. fissile and parted @297.4, 297.7, 297.9, 298.1, 298.6, 299.6, 300.0, 300.4, and 300.8 ft. No secondary mineralization, no angular fractures, dry core interior, normal bedding angle.
300	4730		295.0-301.0				
305	4725						Total Depth 301.0 ft.

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BOREHOLE LOG CRJ01-0202

PROJECT MOAB	DATE DRILLED 08/25/2005 to 11/19/2005	BIT SIZE(S) (IN) 8.5
LOCATION Crescent Junction, UT.	DRILLING COMPANY Layne GeoConstruction	CORE SIZE(S) (IN)
SITE Crescent Junction	DRILLING METHOD H.S.A., Rotary Core	LOGGED BY Goodknight, C., Rupp, R.
WELL NUMBER CRJ01-0202	SAMPLING METHOD HQ CORE	WL (FT BGS)
NORTH COORD. (FT) 6794422.62	DRILL OPERATOR Neaman, J. (CME 750, BB80), Hyleman, B. (BB80)	
EAST COORD. (FT) 2120996.12	REMARKS 4-inch steel surface cemented to depth of 29.5 feet below land surface. Water used during initial coring.	
SURFACE ELEV. (FT NGVD) 4960.00		
HOLE DEPTH (FT) 300.00		

DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT.)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
		4 8 9 9	0-0.5 0.5-1.0 1.0-1.5 1.5-2.0				0-8.0 ft. CLAYEY SILT (ML); abundant roots and worm hole porosity, light brownish gray (10YR 6/2), highly calcareous, trace white mottling.
5	4955	5 8 8 8	4.0-4.5 4.5-5.0 5.0-5.5 5.5-6.0				4.0-8.0 ft. light yellowish brown (10YR 6/4) to yellowish red (5YR 5/6), compacted, mottled with white calcite and gypsum, slightly calcareous.
10	4950	50/5"					8.0-9.0 ft. SANDY SILT (ML); light brown (7.5YR 6/4), highly calcareous, appears to be eolian-deposited material.
							9.0-15.0 ft. WEATHERED MANCOS SHALE BEDROCK: silty shale, moderately weathered but fairly hard (could not get drive samples), highly calcareous, yellowish gray (5Y 7/2) to dark yellowish orange (10YR 6/6).
15	4945	50/4"					15.0-300.0 ft. MANCOS SHALE: 15.0-17.5 ft. moderately to highly weathered, highly calcareous, soft, mostly clayey siltstone, light olive gray (5Y 5/2) to dark yellowish orange (10YR 6/6), with more of the yellowish orange beds from 15.0-16.0 ft. 17.5-19.5 ft. inclined bedding at ~20 degrees, mostly bedding plane fractures about every 0.1 ft., a few vertical fractures. Some black material (framboidal pyrite?) on bedding surfaces and trace white gypsum crystals, trace of yellow orange (10YR 6/6) beds. 20.0-23.0 ft. moderate to slightly weathered.
20	4940		14.5-19.5				
			19.5-24.5				
25	4935		24.5-29.5		14.5-40.0 Very Poor		23.0-24.0 ft. several bedding plane fractures filled with gypsum (up to 0.03 ft. thick). Several thin layers of limonitic-colored, dark yellowish orange (10YR 6/6) altered material from 24.0 to 24.5 ft. 24.5-29.5 ft. slightly weathered. At 25.8-26.0 ft. is limonitic altered fracture, which is soft; color is dark yellowish brown (10YR 6/6) to light brown (5YR 5/6). A few vertical fractures (with no gypsum or calcite along them) but mostly bedding plane fractures. Highly calcareous. At 28.5 to 29.0 ft. fractures along bedding planes coated with gypsum, black film on bedding surfaces is mostly fine framboidal pyrite.
30	4930		29.5-35.0				29.5-35.0 ft. recovery of 4.5 ft. Top 1.0 ft. lost. Weathered, moderately to highly calcareous. Core is fractured mostly along bedding surfaces at spacings generally from 0.1-0.3 ft. Gypsum coats many fractures and one at 34.5 ft. is colored by limonite (dark yellowish orange, 10YR 6/6). Rock is mostly silty claystone and thin bedded with trace bioturbated layering.

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BOREHOLE LOG CRJ01-0202

PROJECT MOAB BOREHOLE NUMBER CRJ01-0202
 SITE Crescent Junction Site DATES DRILLED 08/25/2005 to 11/19/2005

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
40	4920		35.0-45.0				35.0-45.0 ft. bedding plane fracturing dominates and decreases in spacing frequency from 0.1-0.2 ft. to 0.5-1.0 ft. at 45.0 ft. Gypsum coatings are along many fractures. An inclined (45 degrees) fracture at ~43.5 ft. that is coated with gypsum but it cuts across bedding that contains limonitic coloration (which seems to follow bedding planes in the 3 or 4 occurrences in this core segment). Bedding is inclined at 15 -20 degrees. Bioturbated or storm bedding is trace to 1% of layering and it consists of very fine grained sandstone of very light gray (N8) color. Limonitic colored bands along bedding are as much as 0.07 ft. thick. Core becoming moderately hard and competent below 40.0 ft.
45	4915				40.0-50.0 Poor		45.0-55.0 ft. core hard and competent. Weathering effects are nearly absent. At 49.5 ft. is a 40 degree inclined fracture with limonite coloration along it, also a minor bedding plane fracture with limonite coating at 49.3 ft. A bedding plane fracture with limonite coating at 50.0 ft. that broke along a bioturbated/ storm bedding layer. No other natural fractures observed. Fine carbonaceous material along some bedding surfaces and trace of fossil imprints. Rock here is mainly claystone, medium gray (N5).
50	4910		45.0-55.0				
55	4905						55.0-65.0 ft. core hard and competent - no effects of weathering. Core is dry when broken open. Bedding plane fractures, probably drilling induced occur at thin fissile layers or along partings created by fossil imprints (such as at 56.0, 59.8, and 64.6 ft.). A fossil pelecypod imprint at 57.1 ft. Layering looks to be inclined ~10 degrees. Trace fossil resin at 57.4 ft. Claystone parts easily upon handling.
60	4900		55.0-65.0				
65	4895				50.0-75.0 Fair		65.0-75.0 ft. core loss from 65.0-66.4 ft. occurred due to driller dropping the core barrel and breaking the bit. Footage lost in clearing the bit fragments from the hole. Competent core run with solid core and few breaks. Parting @73.6 ft. shows iron stain and deposit on bedding, possible fracture with water movement.
70	4890		65.0-75.0				

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BOREHOLE LOG CRJ01-0202

PROJECT MOAB BOREHOLE NUMBER CRJ01-0202
 SITE Crescent Junction Site DATES DRILLED 08/25/2005 to 11/19/2005

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
75	4885						75.0-85.0 ft. competent core, solid, few parts on bedding, fossiliferous in places (see 80.0 and 84.5 ft.). No secondary mineralization seen, no fissile locations.
80	4880		75.0-85.0				
85	4875						85.0-95.0 ft. somewhat fissile at 85.0-90.0 ft. and breaking on bedding (particularly 87.0-88.5 ft.). Solid sections are relatively hard and competent. Breaking may be due to mechanical problems as drillers are pulling rods to inspect the bit and lower rods. Inspection shows new bit is wrong style and broken. Bit changed.
90	4870		85.0-95.0				
95	4865						95.0-105.0 ft. shale broken into knobs and pieces; core loss of 1.5 ft. is spread over run, core appears slightly fissile but is obviously damaged by mechanical forces and how the new bit is cutting. Pieces are all broken on bedding planes. No evidence of angular fractures or secondary minerals.
100	4860		95.0-105.0		75.0-125.0 Good		
105	4855						105.0-115.0 ft. soft, fissile. No core loss, but overall condition is only fair. No secondary mineralization, core interior is dry, more of a calcic mudstone than claystone, weak rock integrity.
110	4850		105.0-115.0				

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BOREHOLE LOG CRJ01-0202

PROJECT MOAB BOREHOLE NUMBER CRJ01-0202
 SITE Crescent Junction Site DATES DRILLED 08/25/2005 to 11/19/2005

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
115	4845						115.0-125.0 ft. core loss @ 115.0-116.0 ft. Fissile and broken at 116.0-117.5 ft. More competent @ 117.5-120.5 ft. Broken @ 120.5-121.0 ft. Very soft and fissile @ 122.5-123.4 ft. Generally a mudstone.
120	4840		115.0-125.0				
125	4835						125.0-135.0 ft. generally fissile as previous run with fewer partings. Core is soft but dry on interior surfaces, no secondary mineralization, no bioturbation, bedding angle +/- 5 degrees.
130	4830		125.0-135.0		125.0-300.0 Excellent		
135	4825						135.0-145.0 ft. mostly claystone, trace bioturbated or storm bedding layers. Fissile from 135.0-139.0 ft. and generally soft, but competent in rest of interval with several thin fissile layers. Core dry when broken open. No natural fractures seen. Bedding plane fractures common from 135.0-139.0 ft., but they are drilling induced. Core breaks easily along bedding when handled.
140	4820		135.0-145.0				
145	4815						145.0-155.0 ft. Bedding plane fractures common in 145.0-148.0 ft. interval and core less broken below. These fractures are drilling induced. Rock is fissile and soft throughout except for short interval at 148.3-148.5 ft., which is hard (better cemented). Core dry when broken open, breaks easily when handled.
150	4810		145.0-155.0				

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PROJECT MOAB BOREHOLE NUMBER CRJ01-0202
 SITE Crescent Junction Site DATES DRILLED 08/25/2005 to 11/19/2005

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
155	4805						155.0-165.0 ft. bedding plane fractures common in 155.0-157.0 ft. interval and core broken again only at ~161.0 ft. These are drilling induced fractures. Rock is fissile and soft throughout except for several short segments averaging about 0.2 ft. that are harder and more cemented. Bedding is slightly inclined at ~5 degrees. Core is dry when broken open and breaks easily when handled.
160	4800		155.0-165.0				
165	4795						165.0-175.0 ft. generally very fissile with minor core loss (probably top of the run), parting on bedding with some mechanical rounding, no identifiable fractures, no evident secondary mineralization, dry core interior, continued soft, essentially the same as previous 30.0 ft.
170	4790		165.0-175.0		125.0-300.0 Excellent		
175	4785						175.0-185.0 ft. slightly more competent but generally fissile and soft, easily parts on bedding. Bedding angle is ~10 degrees, no fractures evident, much like previous core run.
180	4780		175.0-185.0				
185	4775						185.0-195.0 ft. fissile with only about 2.0 ft. of competent rock, parting on bedding, no fractures, no secondary mineralization, dry core interior.
190	4770		185.0-195.0				

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 SITE Crescent Junction Site DATES DRILLED 08/25/2005 to 11/19/2005

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
195	4765						195.0-205.0 ft. soft fissile shale, easily parted on bedding, which is ~90 degrees to core axis. Not significantly different than the last 70.0 ft.
200	4760		195.0-205.0				
205	4755						205.0-215.0 ft. core loss spread over run, not much improvement in competency, fissile, easily parted.
210	4750		205.0-215.0		125.0-300.0 Excellent		
215	4745						215.0-225.0 ft. continued soft, fissile, very broken, core loss spread over length of run with no distinct loss location, but likely most loss @215.0-221.0 ft., some fossil imprints.
220	4740		215.0-225.0				
225	4735						225.0-235.0 ft. core loss from 233.0-234.0 ft. Normal bedding angle~90 degrees to core axis, in general the core is slightly less broken but still easily parted on bedding, no significant difference in competency.
230	4730		225.0-235.0				

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 SITE Crescent Junction Site DATES DRILLED 08/25/2005 to 11/19/2005

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
235	4725						235.0-245.0 ft. core loss @ start of run. Overall the core is slightly more competent and not as broken as usual, but still very fissile and soft with the last 2.0 ft. (243.0-245.0 ft.) the hardest and most competent, fossil @ 239.7 ft.
240	4720		235.0-245.0				
245	4715						245.0-255.0 ft. core looking more competent now that the landing ring is back in the rods above the bit, minor core loss @248.0-249.0 ft. due to mechanical problems. Core still looks a little fissile and soft, still parting on bedding, borehole seems to be making water.
250	4710		245.0-255.0		125.0-300.0 Excellent		
255	4705						255.0-265.0 ft. parting on bedding and soft in places but the most competent run since about 75.0 ft. (far less mechanical damage). Bedding angle approximately 5 degrees, no fractures noted.
260	4700		255.0-265.0				
265	4695						265.0-275.0 ft. moderately fissile throughout, but best run of the day. Usual bedding parting, broken and crumbled where very fissile, no uncommon features, core interior dry where competent.
	4690		265.0-275.0				

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PROJECT MOAB BOREHOLE NUMBER CRJ01-0202
 SITE Crescent Junction Site DATES DRILLED 08/25/2005 to 11/19/2005

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
275	4685						
280	4680		275.0-285.0				275.0-285.0 ft. very fissile from 277.0-283.0 ft., easily parted on bedding, not crumbly from drilling, bedding angle ~ 5 degrees, some bioturbation crenulations.
285	4675				125.0-300.0 Excellent		285.0-295.0 ft. good competent rock, minor breaks on bedding at 285.0-286.0 ft., hard, very minor fissile locations and only 0.1 ft. long when fissile, dry core interior, no fractures, some biological or storm related crenulations but not of significant size.
290	4670		285.0-295.0				
295	4665						295.0-300.0 ft. minor core loss at end of run, probably due to drilling stress or dropped out of core barrel. Last foot of recovered core broken on bedding into 0.2 ft. and 0.1 ft. lengths.
300	4660		295.0-300.0				
305	4655						Total Depth 300.0 ft.

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BOREHOLE LOG CRJ01-0203

PROJECT MOAB	DATE DRILLED 08/25/2005 to 11/07/2005	BIT SIZE(S) (IN) 8.5
LOCATION Crescent Junction, UT.	DRILLING COMPANY Layne GeoConstruction	CORE SIZE(S) (IN)
SITE Crescent Junction	DRILLING METHOD H.S.A., Rotary Core	LOGGED BY Goodknight, C., Rupp, R.
WELL NUMBER CRJ01-0203	SAMPLING METHOD HQ CORE	WL (FT BGS)
NORTH COORD. (FT) 6796977.60	DRILL OPERATOR Neaman, J. (CME 750, BB80), Hyleman, B. (BB80)	
EAST COORD. (FT) 2122543.47	REMARKS 4-inch steel surface casing cemented to depth of 30.0 feet below land surface.	
SURFACE ELEV. (FT NGVD) 5015.00		
HOLE DEPTH (FT) 301.00		

DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT.)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
							0-4.0 ft. CLAYEY SILT (ML); moderate root content, some white mottling, highly calcareous, light brownish gray (10YR 6/2), some worm-hole porosity.
5	5010	4 3 5 11	2.0-2.5 2.5-3.0 3.0-3.5 3.5-4.0				4.0-9.5 ft. SANDY SILT (ML); compacted, trace mottling, slightly calcareous, light brownish gray (2.5Y 6/2), ~2% dark shale fragments and trace limonitic siltstone fragments.
10	5005	4 8 14 17	4.5-5.0 5.0-5.5 5.5-6.0 6.0-6.5				8.5-9.5 ft. light brown (7.5YR 6/4), highly calcareous, appears to be eolian transported material.
		12 16 20 24	9.5-10.0 10.0-10.5 10.5-11.0 11.0-11.5				9.5-14.5 ft. WEATHERED MANCOS SHALE BEDROCK: highly weathered for first 2-3 ft., then moderately weathered down to 14.5 ft. Generally yellowish gray (5Y 7/2) to grayish orange (10YR 7/4), mostly highly calcareous. From 10.0-11.0 ft. is a thin layer of reddish yellow (7.5YR 6/8) siltstone that is non-slightly calcareous. White gypsum masses are 2-3% of material.
15	5000	50/4.0"					14.5-301.0 ft. MANCOS SHALE: 14.5-22.0 ft. clayey siltstone, moderately weathered, light olive gray (5Y 5/2), wet color), horizontal bedding, gypsum coatings along some fractures, which are spaced about 0.1 ft. apart. Highly calcareous. Some bioturbated bedding and burrowing. 18.0-19.0 ft. numerous horizontal fractures.
20	4995		15.0-17.5 17.5-19.0 19.0-22.0				@19.9 ft. is a 0.1 ft. thick bentonite bed, yellowish gray (5Y 7/2), moderately calcareous. Horizontal fracturing at least every 0.1 ft. still moderately weathered, some gypsum coatings on fractures. Bedding wavy and bioturbated.
25	4990		22.0-27.0				22.0-23.7 ft. moderately weathered, numerous bedding plane fractures spaced less than 0.1 ft. apart. Only trace gypsum along bedding fractures, Dark bedding surfaces are largely fine framboidal pyrite. Some contorted bedding and bioturbation. Mostly yellowish gray (5Y 7/2).
30	4985		27.0-30.0 30.0-35.0		15.0-35.0 Very Poor		28.0-30.0 ft. numerous horizontal bedding plane fractures. Trace gypsum along fractures. 30.0-35.0 ft. moderately weathered, broken and fractured throughout run due to poor integrity of the rock. Core loss considerable (50%). A couple of fractures inclined 20 degrees to bedding with gypsum coatings.

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PROJECT MOAB BOREHOLE NUMBER CRJ01-0203
 SITE Crescent Junction Site DATES DRILLED 08/25/2005 to 11/07/2005

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
40	4975		35.0-45.0				35.0-45.0 ft. weathered, pale yellowish brown (10YR 6/2) to moderate yellowish brown (10YR 5/4), becoming medium gray (N5) at 44.0 ft. A tiger stripe appearance with abundant gypsum-healed fractures ranging from 0 degree to 50 degree angles inclined from bedding and 0.003 to 0.006 ft. thick. Associated iron stain and limonitic deposits especially from 43.0-45.0 ft. on fractures running parallel (vertical) to core axis. Interesting weathered top of bedrock sequence.
45	4970				35.0-50.0 Poor		45.0-55.0 ft. multiple fractures along bedding planes (up to 30 degree angles), continued gypsum and limonite mineralization to 50.0 ft., at which point the core becomes largely unaltered or unweathered with normal bedding angles of 5 degrees. Consistent dark gray coloration, becomes moderately calcic and relatively hard.
50	4965		45.0-55.0				55.0-65.0 ft. fairly competent with minor breaks on bedding planes, some limonitic alteration.
55	4960						
60	4955		55.0-65.0				
65	4950				50.0-75.0 Fair		65.0-75.0 ft. @68.0 ft. and 73.0 ft. are large fractures inclined 20 degrees to core axis with heavy limonite stain and mineralization. Possibly open water course on parallel fractures.
70	4945		65.0-75.0				

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PROJECT MOAB BOREHOLE NUMBER CRJ01-0203
 SITE Crescent Junction Site DATES DRILLED 08/25/2005 to 11/07/2005

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	ROD Description from core (FT)	GRAPHIC LOG	
75	4940						75.0-85.0 ft. very competent, dark gray, dry core interior, calcic, hard.
80	4935		75.0-85.0				
85	4930						85.0-95.0 ft. very competent, with no parting, core is hard and in one piece, no indication of formation water.
90	4925		85.0-95.0				
95	4920						95.0-105.0 ft. very competent, normal bedding with few parts, no secondary mineralization.
100	4915		95.0-105.0		75.0-125.0 Good		
105	4910						105.0-115.0 ft. fissile partings and breaks at 106.2, 107.3, 110.5, 111.5, 111.7, 112.3, 112.5, 113.5 and 114.4 ft. Hard core, no secondary mineralization, no indication of water, dry core interior.
110	4905		105.0-115.0				

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BOREHOLE LOG CRJ01-0203

PROJECT MOAB BOREHOLE NUMBER CRJ01-0203
 SITE Crescent Junction Site DATES DRILLED 08/25/2005 to 11/07/2005

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
115	4900			X			115.0-125.0 ft. few partings on bedding, good solid core run.
120	4895		115.0-125.0	X			
125	4890			X			125.0-135.0 ft. excellent parting on bedding, no fissile sections, no fractures, no secondary mineralization, no indication of water.
130	4885		125.0-135.0	X	125.0-301.0 Excellent		
135	4880			X			135.0-145.0 ft. good competent shale. Normal bedding angle, nothing abnormal.
140	4875		135.0-145.0	X			
145	4870			X			145.0-155.0 ft. a few partings on bedding, no fractures.
150	4865		145.0-155.0	X			

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 SITE Crescent Junction Site DATES DRILLED 08/25/2005 to 11/07/2005

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	ROD Description from core (FT)	GRAPHIC LOG	
155	4860						155.0-165.0 ft. a few fissile partings @ 157.0, 158.0, 159.9, 160.5, 161.2, and 162.0 ft. No secondary mineralization or indication of formation water, core interior is dry, normal bedding (+/- 5 degrees).
160	4855		155.0-165.0				
165	4850						165.0-175.0 ft. nice competent run, almost no partings, core is relatively hard with normal bedding angles.
170	4845		165.0-175.0		125.0-301.0 Excellent		
175	4840						175.0-185.0 ft. a couple of fissile spots at 176.6, 178.3, 178.6, and 179.6 ft. Good run overall.
180	4835		175.0-185.0				
185	4830						185.0-195.0 ft. fissile @185.7, 190.4, 192.0, 193.5, and 194.0 ft. Splintered from 192.5-193.3 ft. Hard claystone.
190	4825		185.0-195.0				

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BOREHOLE LOG CRJ01-0203

PROJECT MOAB BOREHOLE NUMBER CRJ01-0203
 SITE Crescent Junction Site DATES DRILLED 08/25/2005 to 11/07/2005

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
195	4820						195.0-205.0 ft. good run of competent shale, fossiliferous from 201.0-203.0 ft. Splintered by mechanical stress at 195.5-197.0 ft. No fractures, minor partings.
200	4815		195.0-205.0				
205	4810						205.0-215.0 ft. splintered by mechanical stress from 205.0-207.0 ft. Parted @ 205.7 ft. with rounding by bit. @205.7-215.0 ft., core was solid and unbroken, very nice core, bedding about 90 degrees to core axis (near-horizontal bedding).
210	4805		205.0-215.0		125.0-301.0 Excellent		
215	4800						215.0-225.0 ft. mostly silty claystone, moderately calcareous, medium gray (N5), trace bioturbated and/or storm bedding that is very fine grained sandstone, light gray (N7). Trace fossil imprints and shell (pelecypods) replacements (aragonite). Rock hard and competent through most of interval, more fissile 216.5-217.5 ft. Steeply inclined fracture (80-90 degrees) at 220.0-222.5 ft. that may be natural - it is tight with no gypsum or limonite coating.
220	4795		215.0-225.0				
225	4790						225.0-235.0 ft. hard core and competent throughout. A steeply inclined near-vertical fracture (possibly mechanical, drilling induced) at 225.0-227.0 ft. that is tight with no evidence of fluid movement. Core dry inside when broken apart. Bedding appears to be inclined ~5 degrees from horizontal.
230	4785		225.0-235.0				

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BOREHOLE LOG CRJ01-0203

PROJECT MOAB BOREHOLE NUMBER CRJ01-0203
 SITE Crescent Junction Site DATES DRILLED 08/25/2005 to 11/07/2005

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	ROD Description from core (FT)	GRAPHIC LOG	
235	4780						235.0-245.0 ft. hard and competent core, near vertical tight fracture, possibly mechanical at 237.0-239.0 ft. Mechanical induced fractures at 244.0-246.0 ft.
240	4775		235.0-245.0				
245	4770						245.0-254.0 ft. hard competent core throughout. More fissile interval (~0.1 ft.) at 246.0 ft. Possible natural vertical tight fracture at 247.5-249.0 ft. Thin fissile layer at 249.0 ft. and 249.7 ft. Trace pelecypod and cephalopod fossil imprints.
250	4765		245.0-254.0		125.0-301.0 Excellent		
255	4760		254.0-255.5				255.5-265.5 hard, competent core throughout. Fissile layer ~0.2 ft. thick at 257.5 ft. and one ~0.1 ft thick at 258.5 ft. Other fractures are mechanical and along bedding planes. Core is dry when broken open.
260	4755		255.5-265.5				
265	4750						265.5-275.5 ft. core hard and competent throughout and dry when broken open. Bioturbated or storm bedding forms increase to ~1-2% from 268.5-272.0 ft. At 271.0 ft., possible natural fracture ~20% from horizontal, tight, no evidence of water movement. Other scant fractures are horizontal and likely drilling induced.
	4745						

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BOREHOLE LOG CRJ01-0203

PROJECT MOAB BOREHOLE NUMBER CRJ01-0203
 SITE Crescent Junction Site DATES DRILLED 08/25/2005 to 11/07/2005

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
275	4740		265.5-275.5				275.5-285.5 ft. mostly silty claystone. Bioturbated or storm bedding forms are ~1% with some of the layers as much as 0.05 ft. thick. No natural fractures present, bedding plane fractures seen are drilling induced. Core hard and competent. Dry when core was broken open.
280	4735		275.5-285.5				
285	4730				125.0-301.0 Excellent		285.5-295.5 ft. clayey siltstone, bioturbated and/or storm bedding is 1-2% of layering. Core is hard and competent, no natural fractures. Bedding plane fractures (infrequent) are drilling induced. At 290.0 and 295.5 ft., are thin (0.05-0.1 ft.) layers of porcelaneous, yellowish gray (5Y 8/1), very highly calcareous masses that are amorphous and not appearing to be fossils and have white small specks scattered through them. Core is dry when broken open. Trace fine carbonaceous material along bedding planes.
290	4725		285.5-295.5				
295	4720						295.5-301.0 ft. Core hard and competent, no natural fractures, bioturbation or storm bedding at 1-2% continues. Core dry when broken open. At 298.8 ft. is thin porcelaneous layer.
300	4715		295.5-301				
305	4710						Total Depth 301.0 ft.

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BOREHOLE LOG CRJ01-0204

PROJECT MOAB **DATE DRILLED** 08/26/2005 to 11/05/2005 **BIT SIZE(S) (IN)** 8.5
LOCATION Crescent Junction, UT. **DRILLING COMPANY** Layne GeoConstruction **CORE SIZE(S) (IN)**
SITE Crescent Junction **DRILLING METHOD** H.S.A., Rotary Core **LOGGED BY** Goodknight, C., Rupp, R.
WELL NUMBER CRJ01-0204 **SAMPLING METHOD** HQ CORE **WL (FT BGS)**
NORTH COORD. (FT) 6795633.72 **DRILL OPERATOR** Neaman, J. (CME 750, BB80), Hyleman, B. (BB80)
EAST COORD. (FT) 2122583.61 **REMARKS** 4-inch steel surface casing cemented to depth of 25.0 feet below
SURFACE ELEV. (FT NGVD) 4983.00 land surface.
HOLE DEPTH (FT) 300.00

DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT.)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
		3 6 7 9	0-0.5 0.5-1.0 1.0-1.5 1.5-2.0				0-3.0 ft. SILT (ML); pale brown (10YR 6/3), highly calcareous, highly mottled from 2.0-3.0 ft and light gray (10YR 7/2) overall color with white mottles being caliche masses, soft.
5	4980	20 47 50/5"	5.0-5.5 5.5-6.0 6.0-6.5				3.0-10.0 ft. WEATHERED MANCOS SHALE BEDROCK; soft from 3.0-5.5 ft. Highly weathered down to ~5.5 ft. Moderately weathered with less weathered being pale yellowish brown (10YR 6/2) and more weathered layers being grayish orange (10YR 7/4). Highly calcareous. Generally a silty sandstone, with some sand grains up to medium grain size. Dark bedding plane surfaces have some framboidal pyrite.
10	4975	50/4"					10.0-11.0 ft. No Recovery.
15	4970		10.0-15.0				11.0-300.0 ft. MANCOS SHALE: 11.0-15.0 ft. moderately weathered, mainly light olive gray (5Y 5/2). Trace gypsum crystals along fracture surfaces. Mostly bedding plane fractures spaced 0.1-0.2 ft. apart; a few inclined (near vertical) fractures. Highly calcareous. Several fractures coated with limonite-colored (weathered) material-dark yellowish orange (10YR 6/6). Some arcuate fracturing.
20	4965		15.0-20.0				15.0-16.8 ft. No recovery.
25	4960		20.0-22.5 22.5-25.0		10.0-35.0 Very Poor		16.8-20.0 ft. moderately weathered, highly fractured 0.1 ft. spacing or more frequent. One inclined fracture with limonite coating at ~18.0 ft. Calcitic and gypsum fracture coatings especially at 19.0-20 ft. Highly calcareous. 20.5-22.5 ft. moderate weathering. Well fractured down to ~21.25 ft. Some limonite-coated fractures at 21.5 ft. Bedding seems to be inclined ~10 degrees. Gypsum/calcite along fractures. Soft black material ~22.25-22.5 ft. All highly calcareous. 22.5-25.0 ft. slightly weathered, but highly fractured, some fractures are inclined like the 30 degree fracture at 24.0 ft., and a vertical fracture at 23.0 ft. Gypsum crystals coat several fractures. Highly calcareous shale is medium gray (N5), a damp color. No evidence of slickensides along fractures.
30	4955		25.0-35.0				25.0-35.0 ft. poor recovery (~6.8 ft.) and overall broken and slightly to moderately weathered. Bedding angle appears normal (85 degrees to core axis). Much weak limonitic alteration and prevalent gypsum crystallization in voids on bedding planes. At 31.0-33.0 ft. are several fractures @ 30 degree angles. Core is moderately to strongly calcic and becomes slightly more competent with depth. Most core loss appears to be at the top of the run with some loss throughout.
	4950						

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BOREHOLE LOG CRJ01-0204

PROJECT MOAB BOREHOLE NUMBER CRJ01-0204
 SITE Crescent Junction Site DATES DRILLED 08/26/2005 to 11/05/2005

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
40	4945		30.0-45.0				35.0-45.0 ft. loss of 1.0 ft. over the run but appears to be in the top 5.0 ft. Core is generally parted on bedding @ 0.1-0.3 ft. lengths. Minor fracturing. Bedding appears normal. Some limonitic alteration throughout the run. Gypsum crystallization prevalent throughout. @39.0-40.0 ft. some low angle fracturing (possibility related to bioturbation, alteration markedly decreasing at end of run, @ 44.5 ft. transition to "fresh" rock begins.
45	4940				35.0-50.0 Poor		45.0-55.0 ft. largely unweathered core "fresh." Parted on bedding in 0.2 ft. segments in intervals @45-46.4 ft. and 47.0-48.0 ft. Parted surfaces are coated with yellowish brown iron stain. @ 50.5, 51.0, 52.4, 53.8, 54.4 ft. are fractures on bedding that are significant and coated with iron alterations and trace gypsum mineralization. Bedding angle is normal.
50	4935		45.0-55.0				
55	4930						55.0-65.0 ft. fissile fracture at 55.3 ft and splintered to 57.0 ft. Core @57.0-65.0 ft. is very competent with only a couple of parting breaks @62.0-65.0 ft. Fossil shell @ 65.0 ft. Bedding angle < 3 degrees to almost perpendicular to core axis. Good fresh Mancos Shale, strongly calcic and relatively hard.
60	4925		55.0-65.0		50.0-67.0 Fair		
65	4920						65.0-75.0 ft. slightly fissile @ 65.0-67.0 ft. with break/fracture @67.0 ft. on bedding plane with limonite staining. Regular bedding. Remainder of core is very competent with few parts on bedding; interior of core is dry.
70	4915		65.0-75.0				
	4910						

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BOREHOLE LOG CRJ01-0204

PROJECT MOAB BOREHOLE NUMBER CRJ01-0204
 SITE Crescent Junction Site DATES DRILLED 08/26/2005 to 11/05/2005

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
75	4905		75.0-85.0				75.0-85.0 ft. @81.0 ft. parting on bedding with limonite stain. @81.8, 82.8, and 83.6 ft. are fissile breaks.
80	4900						
85	4895		85.0-95.0				85.0-95.0 ft. parted @ 88.2, 88.5, and 89.2 ft. with clean breaks on bedding. No stain, no mineralization. Core generally hard, no fractures and no water.
90	4890						
95	4885		95.0-105.0				95.0-105.0 ft. broken @ 96.3, 97.3, 98.2, 98.6, 100.3, 102.7, and 103.3-103.7 ft., which is fissile and has heavy limonitic coating, also limonite @ 98.2 ft. Breaks are potential water courses, but no indication of water presently exists. All breaks on bedding.
100	4880						
105	4875		105.0-115.0		67.0-145.0 Good		105.0-115.0 ft. broken @ 105.2, 105.5, 108.0, and 110.7 ft. and fissile @ 108.8-109.0 ft. Parted @ 113.8 ft. No iron stain or deposits in breaks or fissile locations, dry core interior, normal bedding.
110	4870						

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BOREHOLE LOG CRJ01-0204

PROJECT MOAB BOREHOLE NUMBER CRJ01-0204
 SITE Crescent Junction Site DATES DRILLED 08/26/2005 to 11/05/2005

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
115	4865		115.0-125.0				115.0-125.0 ft. good run with no unusual characteristics, fissile @120.0, 124.8 and 125.0 ft.
120	4860						
125	4855		125.0-135.0		67.0-145.0 Good		125.0-135.0 ft. generally fissile @127.0-129.0 ft. with breaks on bedding, but no secondary mineralization or staining Also fissile @130.0-132.0 ft. with fossil replacement @131.0 ft. Bedding angle ~10 degrees.
130	4850						
135	4845		135.0-145.0				135.0-145.0 ft. broken on bedding 2 to 3 places @2.0 ft. intervals. Normal bedding angle; hard core with no observed secondary mineralization, no indication of formation water, core interior is dry.
140	4840						
145	4835		145.0-155.0				145.0-155.0 ft. very competent run, no fissile sections, only minor parting on bedding, which dips approximately 5 degrees, minor mechanical breaks, no fractures.
150							

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BOREHOLE LOG CRJ01-0204

PROJECT MOAB BOREHOLE NUMBER CRJ01-0204
 SITE Crescent Junction Site DATES DRILLED 08/26/2005 to 11/05/2005

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
155	4830						155.0-165.0 ft. competent run with minor parting on bedding and mechanical breaks, no fractures, no secondary mineralization, no indication of formation water, dry.
160	4825		155.0-165.0				
165	4820						165.0-175.0 ft. competent run, minor parting and mechanical damage. Normal bedding angle, moderately calcic.
170	4815		165.0-175.0		145.0-300.0 Excellent		
175	4810						175.0-185.0 ft. moderately fissile @ 176.0-177.0 ft. and 180.6 ft., moderately broken on bedding. @184.5 ft. is a large bioturbation crenulation, which upsets the normal bedding angles. Slightly fossiliferous @185.0 ft.
180	4805		175.0-185.0				
185	4800						185.0-195.0 ft. broken at fissile locations @ 187.7 and 188.0 ft. Fissile but unbroken @189.0 ft. Two broken fissile locations in the 194.0-195.0 ft. interval. Consistent bedding, few biocrenulations. Good run.
190	4795		185.0-195.0				

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BOREHOLE LOG CRJ01-0204

PROJECT MOAB BOREHOLE NUMBER CRJ01-0204
 SITE Crescent Junction Site DATES DRILLED 08/26/2005 to 11/05/2005

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
195	4790						195.0-205.0 ft. mechanical breaks on fissile locations @195.8, 196.4, 196.8, 197.6, 198.0, 202.5, and 203.3 ft. Normal bedding angle, no fractures, no secondary mineralization, no indication of water. Core interior is dry, good competent run.
200	4785		195.0-205.0				
205	4780						205.0-215.0 ft. core is splintering @205.0-210.0 ft. due to mechanical stress. @206.5, 209.8, 211.7, and 212.0 ft., are breaks on fissile bedding, normal bedding angle, no natural fractures, good competent run.
210	4775		205.0-215.0		145.0-300.0 Excellent		
215	4770						215.0-225.0 ft. very competent run with only a couple of partings on bedding, no breaks or fractures.
220	4765		215.0-225.0				
225	4760						225.0-235 ft. very competent run, mechanical breakage @226.0-227.0 ft.
230	4755		225.0-235.0				

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BOREHOLE LOG CRJ01-0204

PROJECT MOAB BOREHOLE NUMBER CRJ01-0204
 SITE Crescent Junction Site DATES DRILLED 08/26/2005 to 11/05/2005

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
235	4750						
240	4745		235.0-245.0				235.0-245.0 ft. @236.2-236.3 ft is a fissile section. @240.4 and 241.0 ft. broken on bedding and fissile. @242.0 ft. is a fissile break and ones also @242.6, 244.7, and 245.0 ft. Normal bedding angle is approximately 5 to 10 degrees. Dry core interior, no secondary mineralization.
245	4740						
250	4735		245.0-255.0		145.0-300.0 Excellent		245.0-255.0 ft. good competent run with few breaks on bedding, core is relatively hard, moderately calcic, and shows no sign of secondary mineralization or formation water.
255	4730						
260	4725		255.0-265.0				255.0-265.0 ft. good run, moderately fissile, no fractures, parting on bedding @ 256.0, 258.7, 259.5, 260.0, and 263.5 ft. Fossiliferous @~260.0-265.0 ft.
265	4720						
	4715		265.0-275.0				265.0-275.0 ft. very competent run with parting and mechanical breaks @ 266.0, 267.5, 271.5, and 272.8 ft. Normal bedding, no secondary mineralization, no indication of formation water.

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BOREHOLE LOG CRJ01-0204

PROJECT MOAB BOREHOLE NUMBER CRJ01-0204
 SITE Crescent Junction Site DATES DRILLED 08/26/2005 to 11/05/2005

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
275	4710						
280	4705		275.0-285.0				275.0-285.0 ft. competent run with no fractures (only breaks on bedding). No indication of water, fissile breaks @276.5, 280.8, 282.0, and 284.5 ft.
285	4700				145.0-300.0 Excellent		285.0-295.0 ft. extremely nice run with only very minor fissility @286.7 ft. Dry core interior, no secondary mineralization, almost no parting.
290	4695		285.0-295.0				
295	4690						295.0-300.0 ft. mechanical breakage due to drilling @296.6, 297.2, 297.8, 299.0, 299.6, and 299.8 ft. No indication of formation water.
300	4685		295.0-300.0				
305	4680						Total Depth 300.0 ft.
	4675						

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BOREHOLE LOG CRJ01-0205

PROJECT MOAB	DATE DRILLED 08/28/2005 to 11/02/2005	BIT SIZE(S) (IN) 8.5
LOCATION Crescent Junction, UT.	DRILLING COMPANY Layne GeoConstruction	CORE SIZE(S) (IN)
SITE Crescent Junction	DRILLING METHOD H.S.A., Rotary Core	LOGGED BY Goodknight, C., Rupp, R.
WELL NUMBER CRJ01-0205	SAMPLING METHOD HQ CORE	WL (FT BGS)
NORTH COORD. (FT) 6793981.28	DRILL OPERATOR Neaman, J. (CME 750, BB80), Hyleman, B. (BB80)	
EAST COORD. (FT) 2122975.63	REMARKS 4-inch steel surface casing cemented to depth of 25.0 feet below	
SURFACE ELEV. (FT NGVD) 4945.90	land surface.	
HOLE DEPTH (FT) 300.00		

DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT.)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
	4945	6 5 7	0-0.5 0.5-1.0 1.0-1.5 1.5-2.0				0-4.0 ft. CLAYEY SILT (ML); light brownish gray (10YR 6/2), highly calcareous, numerous roots, worm hole porosity, some mottling.
5	4940	17 17 23 25	5.5-6.0 6.0-6.5 6.5-7.0				4.0-6.5 ft. SILT (ML); very pale brown (10YR 7/4), ~2% small fragments of shale, highly calcareous, some mottling.
							6.5-10.0 ft. SANDY SILT (ML); light brown (7.5YR 6/4), highly calcareous, some mottling (white), appears to be eolian transported material, ~1% dark mineral grains.
10	4935	38 50/5"	10.0-10.5 10.5-11.0				10.0-11.0 ft. WEATHERED MANCOS SHALE BEDROCK: highly weathered, yellowish gray (5Y 7/2) to dark yellowish orange (10YR 6/6), which reflects limonitic alteration, highly calcareous. Mostly claystone with some silt component.
			11.0-15.0				11.0-300.0 ft. MANCOS SHALE: 11.66-15.0 ft. yellowish gray (5Y 7/2) to grayish orange (10YR 7/4). Moderate to highly weathered with bedding plane fractures - some segments 0.2-0.3 ft. long are intact. Some dark fossil impressions on bedding (some framboidal pyrite). Highly calcareous. White gypsum masses @14.75-15.0 ft.
15	4930		15.0-20.0				15.0-20.0 ft. highly calcareous, much less fracturing - bedding plane fractures about every 0.3-0.4 ft. (main fractures @15.8, 16.75, 17.25, and 15.4 ft. and a steeply inclined fracture (~80 degrees) @18.0-18.5 ft., these fractures all filled with gypsum. Limonitic alteration @~17.8 ft., dark yellowish orange (10YR 6/6). Thin bentonite bed (<0.1 ft.) @ ~18.75 ft., pale yellowish brown (10YR 6/2). Several vertical fractures @~19.7-20.0 ft.
20	4925		20.0-25.0				20.0-21.5 ft. No Recovery.
			20.0-25.0				21.5-25.0 ft. bedding plane fractures generally ~0.1-0.2 ft. spacing, highly calcareous, slightly weathered, inclined bedding indicates dip ~5 degrees. Gypsum along bedding plane fracture @23.8 ft. Thin light brown (5YR 5/6) layer(0.05 ft) @~23.25 ft. along with some ~20 degree inclined bedding.
25	4920		25.0-35.0		11.0-40.0 Very Poor		25.0-35.0 ft. weathered and highly broken to ~32.0 ft., 80% recovery in upper part of run. Some surface slough ~1.0 ft. (hole was tagged @24.0 ft. below ground surface prior to drilling). Core is in generally poor condition to 32.0 ft., fragmented and broken by drilling action. Prolific rusty iron staining and evidence of surface water infiltration. Some calcic and gypsum deposition is distinguishable. Core becoming more competent @ 31.0-32.0 ft., but still shows clay interbedded in iron stained shale. @32.0-35.0 ft., core is regularly broken into 0.2-0.3 ft. long pieces showing the usual +/- 5 degree dip of bedding with gypsum crystallization along faces of breaks. @34.5 ft, thin iron stained band followed by gypsum filled fracture on bedding plane.
30	4915		25.0-35.0				

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BOREHOLE LOG CRJ01-0205

PROJECT MOAB BOREHOLE NUMBER CRJ01-0205
 SITE Crescent Junction Site DATES DRILLED 08/28/2005 to 11/02/2005

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
40	4910		35.0-45.0				35.0-45.0 ft. mildly weathered and moderately broken. 90% recovery, core loss in interval from 35.0-40.0 ft. Secondary gypsum deposits in fractures prevalent to 40.0 ft. and sporadically to 44.0 ft. Iron alteration considered characteristic of the run to 44.0 ft. @44.0 ft., the core becomes "fresh" in appearance, is largely unweathered, competent claystone, dark gray to medium gray with white turbidity crenulations along bedding planes, bedding angle throughout run is approximately 5 degrees. @38.2 ft., rather wide (0.05 ft) gypsum filled fracture with ~20 degree angle to core axis.
45	4905				40.0-50.0 Poor		45.0-55.0 ft. good core run, some breakage to 49.7 ft. due to mechanical action. Breaks @46.2, 46.6, 47.1, 47.5-47.8, 48.6, and 49.7 ft. @48.0-48.2 ft., core is fissile with moderate iron stain. @51.5 and 52.3 ft., core has parted on bedding. @44.4 ft is a 0.1 ft. "storm" - sequence, which is light gray to tan and well cemented. Bedding throughout run is normal, approximately 5 degrees. Core coloration is normal dark to medium gray, and no high angle fracture or secondary mineralization observed.
50	4900		45.0-55.0				55.0-65.0 ft. unweathered with minor mechanical breaks and partings on bedding surfaces, no fractures of high angle or secondary mineralization noted. No indication of formation water, dry core interior.
55	4895				50.0-75.0 Fair		65.0-75.0 ft. minimal mechanical breaks. Fissile @66.7, 66.9, 69.4, and 69.9 ft. @75.0 ft., is rusty iron coating on a definite fracture surface along bedding.
60	4890		55.0-65.0				
65	4885						
70	4880		65.0-75.0				
	4875						

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BOREHOLE LOG CRJ01-0205

PROJECT MOAB	BOREHOLE NUMBER CRJ01-0205
SITE Crescent Junction Site	DATES DRILLED 08/28/2005 to 11/02/2005

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
75	4870						75.0-85.0 ft. no fractures or breaks, only parting of core on bedding surfaces. Bedding at about a 5 degree angle. Competent unbroken core, no significant abnormalities. @81.0 ft. is a fossil crenulation.
80	4865		75.0-85.0				
85	4860				75.0-95.0 Good		85.0-95.0 ft. drilling breaks @85.4, 87.1-87.5 ft. Fissile @ 89.6 ft. Splintered along core axis @90.5 and 91.0 ft. Fissile @ 84.6 ft. No secondary mineralization evident. Core breakage probably due to driller down pressure. Core interior is dry - no evidence of formation water.
90	4855		85.0-95.0				
95	4850						95.0-105.0 ft. core splintered by drilling pressure @95.0-95.5 ft. Core broken across fissile bedding @100.0 ft. Good run, some parting on bedding, bedding angle ~0 degrees (horizontal) or perpendicular to core axis.
100	4845		95.0-105.0				
105	4840				95.0-300.0 Excellent		105.0-115.0 ft. drill breaks across bedding @107.7-108.7 ft., moderately fissile. 30 degree fractures, which appear mechanically induced @111.0-113.0 ft. Couple of parts on bedding planes @114.0-115.0 ft. No indication of water.
110	4835		105.0-115.0				

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BOREHOLE LOG CRJ01-0205

PROJECT MOAB BOREHOLE NUMBER CRJ01-0205
 SITE Crescent Junction Site DATES DRILLED 08/28/2005 to 11/02/2005

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
115	4830						115.0-125.0 ft. Several fissile intervals (~0.1-0.2 ft.) with breakage on bedding planes from 119.0-121.0 ft. @ 123.0-125.0 ft., a few sections parted on bedding. No secondary mineralizations seen, no high angle fractures, no indication of formation water.
120	4825		115.0-125.0				
125	4820						125.0-135.0 ft. bedding angle 0 to 5 degrees, no fractures, some breakage along bedding @ 125.9-126.5, 127.8, 128.3, 128.7, 129.9, and 133.6 ft. Generally, fissile on breaks, but good competent core. No secondary mineralization, dry core interior.
130	4815		125.0-135.0		95.0-300.0 Excellent		
135	4810						135.0-145.0 ft. mechanical breaks @ 135.3, 135.5, 141.7, and 142.6 ft. Fissile also at these breaks @ 143.2-143.4 ft. is a calcic incrustation on core, with white to tan coloration. Usual approximately 5 degree bedding, no secondary mineralization.
140	4805		135.0-145.0				
145	4800						145.0-155.0 ft. fissile and broken on bedding @ 145.5, 151.0, and 151.6 ft. Excellent condition, normal bedding @ approximately 5 degrees, some parting on bedding planes, no high angle fractures, no indication of water, dry core interior.
150	4795		145.0-155.0				

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BOREHOLE LOG CRJ01-0205

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 SITE Crescent Junction Site DATES DRILLED 08/28/2005 to 11/02/2005

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	ROD Description from core (FT)	GRAPHIC LOG	
155	4790		155.0-165.0				155.0-165.0 ft. fissile breaks @ 155.4, 158.5-158.8, 159.1, 159.5, 159.8, 160.6, 160.9-161.2, 160.6, 162.9, 163.4-163.7, and 164.2 ft. All breaks along bedding planes. Approximately 5 degree bedding angles. No unusual characteristics, no evidence of formation water, dry core interiors.
160	4785						
165	4780						165.0-175.0 ft. fissile @ 168.2, 170.5, and 172.4 ft. No fractures, no breaks; only parting on bedding planes. Excellent run.
170	4775		165.0-175.0		95.0-300.0 Excellent		
175	4770						175.0-185.0 ft. fissile breaks @ 176.4-176.8, 177.1, 178.2-178.35, 179.4, 180.5-180.7, and 184.3-184.6 ft. All breaks on bedding which is @ 5 degree angle. No fractures, no secondary mineralizations, no indications of formation water. Core interior is dry, good consistent run.
180	4765		175.0-185.0				
185	4760						185.0-195.0 ft. In general the run is more fissile than usual, all breaks are on bedding planes @ 185.0, 185.6, 186-187.2, 188.2, 188.8-189.5, 190.1, 190.7-191.1, 192.2, 192.9, 193.5-193.7, and 194.2-194.4 ft. No secondary mineralization or staining in breaks. No water identified.
190	4755		185.0-195.0				

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BOREHOLE LOG CRJ01-0205

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 SITE Crescent Junction Site DATES DRILLED 08/28/2005 to 11/02/2005

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
195	4750		195.0-205.0				195.0-205.0 ft. fissile breaks and splintered core from drill pressure throughout run @ 195.0-195.5, 197.6-197.8, 198.4-198.5, and 198.5-199.0 ft. @ 199.0 ft. is a 0.15 ft. break, generally washed out. No noticeable mineralization in partings or breaks, no iron staining. Most of these separations and breaks are mechanical.
200	4745						
205	4740		205.0-215.0		95.0-300.0 Excellent		205.0-215.0 ft. good run. Very minor fissile sections and no fractures. Parting and mechanical breakage only on bedding at fissile intervals. Parted @ 205.2, 210.2, and 212.4 ft. Normal approximately 5 degree angle bedding. No more formation water.
210	4735						
215	4730		215.0-225.0				215.0-225.0 ft. good competent run with minimal breakage on bedding @ 217.9, 222.4, 223.8, and 224.8-225.0 ft. Breakage @ fissile locations. No fractures, no indication of formation water. Bedding angle about 90 degrees to core axis (horizontal)..
220	4725						
225	4720		225.0-235.0				225.0-235.0 ft. 1.0 ft dropped on core retrieval but it was recovered next run. Characteristic run with a little more breakage than last run due to driller pushing to get 140.0 ft. for the day. Breaks along bedding in fissile areas @ 225.6, 226.3, 226.7, 229.0, 229.3, 230.2, 230.9, 231.1, 232.4, and 233.6 ft.
230							

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BOREHOLE LOG CRJ01-0205

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 SITE Crescent Junction Site DATES DRILLED 08/28/2005 to 11/02/2005

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
235	4710		235.0-245.0				235.0-245.0 ft. run is generally fissile and broken in multiple places; splintered @240.0-241.0 ft. Becoming less fissile near bottom of run.
240	4705						
245	4700		245.0-255.0		95.0-300.0 Excellent		245.0-255.0 ft. generally broken by mechanical action and splintered along core axis from 245.5-248.0, 250.0-251.0, and 253.5-255.0 ft. Remaining breaks on bedding, which is approximately 5 degrees, with no secondary mineralization or indication of water. Core interior is dry, no large bioturbation zones.
250	4695						
255	4690		255.0-265.0				255.0-265.0 ft. continued breakage to 258.5 ft., then becoming fossiliferous and more calcic, more competent, and generally unbroken with minor separations on bedding surfaces.
260	4685						
265	4680		265.0-275.0				265.0-275.0 ft. another largely broken run of claystone. Bedding is normal angle (approximately 5 degrees), no fractures. Breakage is along bedding in fissile rock. Most prominent breaks @ 265.0-267.0, 269.0-271.0 and 272.5 ft.

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 SITE Crescent Junction Site DATES DRILLED 08/28/2005 to 11/02/2005

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
275	4675						
	4670						275.0-285.0 ft. moderately fissile and broken, normal bedding, no fractures. Parting only on bedding. @276.0-278.0 ft. ~50 % fissile breaks with some mechanical. @279.7 to 281.0 ft., fissile zone.
280	4665		275.0-285.0				
285	4660				95.0-300.0 Excellent		285.0-295.0 ft. white banding or bedding @284.0-290.0 ft. is strongly pronounced and closely spaced. Somewhat fissile @289.0-290.0 ft.
290	4655		285.0-295.0				
295	4650						295.0-300.0 ft. very competent core with minor parting on bedding. No fractures, no indication of formation water or identifiable secondary mineralization; no indication of explosive gases.
300	4645		295.0-300.0				
							Total Depth 300.0 ft.
305	4640						

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BOREHOLE LOG CRJ01-0206

PROJECT MOAB	DATE DRILLED 08/29/2005 to 10/24/2005	BIT SIZE(S) (IN) 8.5
LOCATION Crescent Junction, UT.	DRILLING COMPANY Layne GeoConstruction	CORE SIZE(S) (IN)
SITE Crescent Junction	DRILLING METHOD H.S.A., Rotary Core	LOGGED BY Goodknight, C., Rupp, R.
WELL NUMBER CRJ01-0206	SAMPLING METHOD HQ CORE	WL (FT BGS)
NORTH COORD. (FT) 6796324.67	DRILL OPERATOR Neaman, J. (CME 750, BB80), Hyleman, B. (BB80)	
EAST COORD. (FT) 2124232.60	REMARKS 4-inch steel surface casing cemented to depth of 26.0 feet below land surface.	
SURFACE ELEV. (FT NGVD) 4994.00		
HOLE DEPTH (FT) 302.00		

DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT.)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
		3 6 7 9	0-0.5 0.5-1.0 1.0-1.5 1.5-2.0				0-1.5 ft. SILT (ML); light brown (7.5YR 6/3), highly calcareous, abundant roots, wormhole porosity.
	4990						1.5-4.0 ft. SANDY SILT (ML); light brownish gray (10YR 6/2), ~2% small pebbles, some mottling, highly calcareous.
5		8 12 16 18	5.0-5.5 5.5-6.0 6.0-6.5 6.5-7.0				4.0-6.5 ft. SILTY SAND (SM); light brownish gray (10YR 6/2), slightly calcareous, ~2% small rock fragments and some coarse sand particles.
	4985						6.5-9.0 ft. SILT (ML); ~10% very fine grained sand, mottled, slightly calcareous, very pale brown (10YR 7/3).
10		22 36 50/4"	10.0-10.5 10.5-11.0				9.0-11.0 ft. WEATHERED MANCOS SHALE BEDROCK: highly weathered, slightly calcareous, soft to moderately hard, yellowish gray (5Y 7/2), some white gypsum crystals and masses along fracture/bedding surfaces.
			11.0-13.0				11.0-12.6 ft. No Recovery.
	4980						12.6-302.0 ft. MANCOS SHALE: 12.6-13.0 ft. moderately weathered, pale yellowish brown (10YR 6/2), mostly siltstone, wavy bedding with some fracturing along them.
15			13.0-18.0				13.0-13.5 ft. No Recovery. 13.5-18.0 ft. highly weathered down to 15.0 ft. (numerous bedding plane fractures) and moderate to slightly weathered down to 18.0 ft. with bedding plane fractures spaced 0.2-0.3 ft. apart. At 15.0-15.3 ft. is a 60 degree fracture. Thin coating of gypsum crystals along about half of the fractures.
	4975						Yellowish gray (5Y 7/2) to light olive gray (5Y 6/1), highly calcareous, bedding is wavy and bioturbated in places. Trace fine (framboidal) pyrite along bedding surfaces.
20			18.0-23.0				18.0-18.8 ft. No Recovery. 18.8-23.0 ft. abundant bedding plane fractures down to ~20.0 ft. Bedding plane fractures about 0.2-0.3 ft. apart down to 23.0 ft. Moderate to slightly weathered. Gypsum crystal coatings along many fractures. Some wavy and bioturbated bedding, pale yellowish brown (10YR 6/2) to olive gray (5Y 4/1) on some bedding surfaces, highly calcareous, no vertical or high angle fractures.
	4970		23.0-26.0		13.0-34.0 Very Poor		23.0-23.3 ft. No Recovery. 23.3-26.0 ft. abundant bedding plane fractures with spacing 0.1 ft. or less. Gypsum crystals along bedding plane fractures ~25.5 to 25.7 ft. Abundant worm burrows and bioturbated bedding, moderately calcareous.
25							26.0-35.0 ft. moderately weathered, prevalent fractures for length of run, but decreasing @34.0 ft. Core loss obvious at beginning of run (@26.0 ft.). Moderately calcic with prominent gypsum crystallization on faces of most fractures. Bedding angle approximately 5 degrees; ~90% of fractures are on bedding, no high angle fractures, some fractures are fissile, wavy bioturbation throughout, no evidence of formation water.
30	4965		26.0-35.0				
	4960						

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BOREHOLE LOG CRJ01-0206

PROJECT MOAB BOREHOLE NUMBER CRJ01-0206
 SITE Crescent Junction Site DATES DRILLED 08/29/2005 to 10/24/2005

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
40	4955		35.0-45.0		34.0-45.0 Poor		35.0-45.0 ft. weathering decreases to unweathered "fresh" bedrock @39.5 ft. Moderately calcic. @36.0-37.7 ft., moderately fractured along bedding, moderately pyritized, with gypsum crystallization and minor iron staining on fractures to 39.4 ft.
45	4950						45.0-55.0 ft. "fresh" appearance to shale, clean mechanical fractures along bedding planes in several locations, no gypsum crystallization or iron staining along fracture faces. No evidence of formation water, core interior dry. Nice claystone.
50	4945		45.0-55.0				
55	4940				45.0-65.0 Fair		55.0-65.0 ft. fissile along fractures @56.0-58.0 ft. @57.0 ft. fractures occur @80 degree angle to core axis (~twice the bedding plane angle). No secondary mineralization on fractures faces.
60	4935		55.0-65.0				
65	4930						65.0-75.0 ft. bedding angle and bioturbation crenulations @80% to core axis. Core is solid overall with no fractures from 66.0-70.0 ft. and only minor mechanical fractures from 70.0-75.0 ft.
70	4925		65.0-75.0				
	4920						

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 SITE Crescent Junction Site DATES DRILLED 08/29/2005 to 10/24/2005

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
75							
	4915		75.0-85.0		65.0-85.0 Good		75.0-85.0 ft. @79.8-80.0 ft. fossiliferous deposit, calcic, heavy encrustations on core, preceded by short splintery fractures along core axis for 0.5 ft.
80							
	4910						
85							85.0-95.0 ft. good competent core, mechanical fractures on bedding planes with bioturbation crenulations, no secondary mineralization observed, no indication of formation water, interior of core dry.
	4905		85.0-95.0				
90							
	4900						
95							95.0-105.0 ft. @103.8 ft. approximately 0.2 ft. bioturbations and silt size cemented zone. Good claystone run with minor mechanical fractures and dry core interior, normal 5 degree angle of bedding, moderately calcic.
	4895		95.0-105.0		85.0-302.0 Excellent		
100							
	4890						
105							105.0-115.0 ft. excellent recovery with only 2 locations of mechanical fracturing on bedding, standard overall appearance.
	4885		105.0-115.0				
110							

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
115	4880						
120	4875		115.0-125.0				115.0-125.0 ft. core generally hard and moderately calcic. @116.0-117.0 ft. core is splintered along axis (mechanically induced). No secondary mineral deposits noted.
125	4870						125.0-135.0 ft. minor mechanical fracturing along bedding planes.
130	4865		125.0-135.0		85.0-302.0 Excellent		
135	4860						135.0-145.0 ft. penetration rate slows, shale harder @140.0 ft. @140.0-140.6 ft. core fissile, biocrenulations, no secondary minerals. @141.0-143.0 ft. core fractured along axis. Drill pipe screened with LEL meter at end of run(0.0 ppm).
140	4855		135.0-145.0				
145	4850						145.0-155.0 ft. formation very hard. @151.0-153.0 ft. abundant fossils, large bivalves.
150	4845		145.0-155.0				

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 SITE Crescent Junction Site DATES DRILLED 08/29/2005 to 10/24/2005

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
155	4840						155.0-165.0 ft. core loss related to drilling, minor loss (~0.5 ft.). Continued hard core, causing mechanical fractures parallel with axis @ 157.0-158.0 ft. and 162.0-164.0 ft.
160	4835		155.0-165.0				
165	4830						165.0-175.0 ft. fissile along bedding @167.0-168.0 ft. Bedding plane angle =90 degrees to core axis. Core continues to drill slow, but formation doesn't appear any different.
170	4825		165.0-175.0		85.0-302.0 Excellent		
175	4820						175.0-185.0 ft. fissile @184.0-185.0 ft. No gas detected.
180	4815		175.0-185.0				
185	4810						185.0-195.0 ft. @185.0-186.0 ft. core is fissile. @189.5 ft. drilling compressor overheats; stopped drilling.
190	4805		185.0-195.0				

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 SITE Crescent Junction Site DATES DRILLED 08/29/2005 to 10/24/2005

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
195	4800						195.0-205.0 ft. @200.0-202.0 ft. heavy fracture zone, core is partly fissile and relatively weak, possible natural fracture zone, doesn't appear completely mechanically induced although the current compressor has minimal PSI to drill and clear cuttings. @200.0 ft. pyrite deposit.
200	4795		195.0-205.0				
205	4790						205.0-215.0 ft. good run, bedding angle is <5 degrees and is almost perpendicular to core axis, minimal bioturbidity crenulations. @214.8-215.0 ft. fissile break.
210	4785		205.0-215.0		85.0-302.0 Excellent		
215	4780						215.0-225.0 ft. @217.8 ft. is a 0.2 ft. fissile break, very broken. @220.7 and 220.9 ft. mechanical breaks. @223.5, and 223.7 ft. fissile with mechanical breaks. @ 224.2 ft. mechanical break.
220	4775		215.0-225.0				
225	4770						225.0-235.0 ft. bedding +/- 5 degree angle, no formation water. @225.5, 225.8, 226.3, and 226.4 ft. mechanical breaks. @ 226.75 fractures on bedding. @227.35 mechanical breaks. @228.9, 229.6, 230.35, 230.55, and 230.75 ft. mechanical breaks, slightly fissile. @232.35, 232.95, 233.2, 233.6, and 234.2 ft. fissile fractures on bedding.
230	4765		225.0-235.0				

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 SITE Crescent Junction Site DATES DRILLED 08/29/2005 to 10/24/2005

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
235	4760						235.0-245.0 ft. mechanical breaks @236.5, 238.2, 241.2, 242.0, 242.9, and 243.7 ft. Fissile fractures @ 238.65, 240.85-240.95, and 242.55 ft. Bedding angle +/- 5 degrees with bioturbidity crenulations, color, hardness, and general condition normal, no secondary mineralization, no indications of formation water.
240	4755		235.0-245.0				
245	4750						245.0-255.0 ft. mechanical breaks @246.3, 248.9, 250.3, 251.2, 252.5, 253.0, 253.9, 254.2, 254.5, and 255.0 ft. Core is generally hard, with dry interior, no indication of formation water.
250	4745		245.0-255.0		85.0-302.0 Excellent		
255	4740						255.0-265.0 ft. mechanical breaks @256.0, 256.5, 257.2, 257.9, 259.4, 259.9, 260.1, 260.5, 261.1, 261.8, and 264.2 ft. Slightly fissile @260.0-260.5 ft. on breaks. 5 degree angle bedding with bioturbation crenulations, moderately calcic.
260	4735		255.0-265.0				
265	4730						265.0-275.0 ft. no indication of formation water, no secondary mineralization identified on break faces. Mechanical breaks @ 266.3, 266.5, 269.9, 270.0, 270.4, 271.0, and 271.2 ft. @271.7 ft. on the face of bedding are several drops of resin (about 0.003 ft. diameter) or petroleum hydrocarbon deposits? Another is seen @ 268.3 on similar face of a break on bedding plane.
	4725		265.0-275.0				

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BOREHOLE LOG CRJ01-0206

PROJECT MOAB BOREHOLE NUMBER CRJ01-0206
 SITE Crescent Junction Site DATES DRILLED 08/29/2005 to 10/24/2005

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
275	4720						
280	4715		275.0-285.0				275.0-285.0 ft. mechanical breaks @275.5, 276.0-276.7, 277.7, 278.2, 278.4, 279.0, 279.5, 283.3, 283.6, and 284.0 ft. Wavy biocrenulations (0.2 ft. thick) @ 281.0 ft. Normal bedding angle is 0-5 degrees. Moderately calcic.
285	4710				85.0-302.0 Excellent		285.0-295.0 ft. mechanical breaks @ 285.7-286.0 ft. 286.0-287.0 ft., 291.6, and 291.8 ft. @ 292.3 ft. "large" storm turbidity? section is light gray. This 10.0 ft. run doesn't appear to be as hard as the penetration rate would indicate.
290	4705		285.0-295.0				
295	4700						295.0-302.0 ft. mechanical breaks @ 396.0-396.6, 397.2, and 398.2 ft. Random bedding plane breaks, no fractures, core not extremely hard. Bedding angle normal, few scattered bioturbidity crenulations, no indication of formation water, core interior is dry.
300	4695		295.0-302.0				
305	4690						Total Depth 302.0 ft.
	4685						

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BOREHOLE LOG CRJ01-0207

PROJECT MOAB	DATE DRILLED 09/10/2005 to 10/20/2005	BIT SIZE(S) (IN) 8.5
LOCATION Crescent Junction, UT.	DRILLING COMPANY Layne GeoConstruction	CORE SIZE(S) (IN)
SITE Crescent Junction	DRILLING METHOD H.S.A., Rotary Core	LOGGED BY Goodknight, C., Rupp, R.
WELL NUMBER CRJ01-0207	SAMPLING METHOD HQ CORE	WL (FT BGS)
NORTH COORD. (FT) 6794658.25	DRILL OPERATOR Neaman, J. (Terramec 1000.), Hyleman, B. (BB80)	
EAST COORD. (FT) 2124919.25	REMARKS 4-inch steel surface casing cemented to depth of 25.0 feet below land surface.	
SURFACE ELEV. (FT NGVD) 4950.20		
HOLE DEPTH (FT) 300.00		

DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT.)	EXTENT	ROD Description from core (FT)	GRAPHIC LOG	
	4950	2 5 10 10 5 11 17 19	0-0.5 0.5-1.0 1.0-1.5 1.5-2.0 2.5-3.0 3.0-3.5 3.5-4.0				0-1.25 ft. CLAYEY SILT (ML); grayish brown (10YR 5/2), highly calcareous, numerous roots, worm hole porosity.
							1.25-3.5 ft. SANDY SILT (ML); ~90% silt, 10% very fine grained sand, light yellowish brown (10YR 6/4), trace roots, some mottling, highly calcareous, trace small rock fragments, trace gypsum crystals.
5	4945	3 21 27 31	5.0-5.5 5.5-6.0 6.0-6.5 6.5-7.0				3.5-5.0 ft. SILT (ML); very pale brown (10YR 7/4), highly calcareous, mottled, trace roots, trace gypsum crystals.
							5.0-5.75 ft. CLAYEY SILT (ML); ~5% small rock fragments, light brownish gray (10YR 6/2), highly calcareous.
							5.75-10.5 ft. WEATHERED MANCOS SHALE BEDROCK; yellowish gray (5Y 7/2) to dark yellowish orange (10YR 6/6), highly calcareous, mostly silty mudstone, soft, numerous bedding plane fractures (highly weathered). Trace gypsum along fractures and bedding surfaces, trace fine pyrite. Color becomes mostly pale yellowish brown (10YR 6/2) by 10.0 ft. depth, and rock becomes harder.
10	4940	50/5"	10.0-10.4				10.5-14.75 ft. No Recovery.
			10.4-15.0				
15	4935		15.0-20.0				14.75-300.0 ft. MANCOS SHALE: bedding plane fractures, mostly silty mudstone, pale yellowish brown (10YR 6/2) to yellowish gray (5Y 7/2), gypsum crystals along fractures.
							15-21.75 ft. No Recovery.
20	4930		20.0-22.0				
			22.0-25.0				21.75-22.0 ft. bedding plane fractures, mostly silty mudstone, gypsum crystals along fractures, trace fish plates and dark framboidal pyrite on bedding surfaces, medium gray (N5) to olive gray (5Y 4/1), moderately calcareous.
25	4925				10.5-40.0 Very Poor		22.0-25.0 ft. rock seems to be more competent with horizontal bedding plane fractures spaced 0.1-0.2 ft. apart, medium light gray (N6) to medium gray (N5), fairly even bedded, moderately calcareous, hard, trace framboidal pyrite, vertical fracture with gypsum crystal fill at 23.0 ft.
			25.0-35.0				25.0-35.0 ft. bedding plane fractures spaced 0.1 to 0.2 ft. apart or less. Rock is silty claystone overall, medium gray (N5), moderately calcareous. Mostly even bedding with only 5% or less bioturbated or storm bedding, which is coarser grained (up to very fine grained sandstone). Thin gypsum crystal coatings of bedding plane fractures. Inclined (45 degree) gypsum coated fractures at ~28.5, 30.0 and 31.5 ft. Bedding appears to be inclined 5-7 degrees. Several bedding surfaces had limonitic-colored, moderate yellowish brown (10YR 5/4) on them, indicating some water movement.
30	4920						

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PROJECT MOAB BOREHOLE NUMBER CRJ01-0207
 SITE Crescent Junction Site DATES DRILLED 09/10/2005 to 10/20/2005

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
40	4915		35.0-38.0				35.0-38.0 ft. could not determine where 1.0 ft. core loss occurred. Bedding plane fractures as above, 30 degree fracture with thin gypsum coating at ~36.0 ft. Numerous horizontal bedding plane fractures 37.0-38.0 ft. and limonitic coloration. Trace fine carbonaceous material on some bedding.
45	4910		38.0-45.0				38.0-45.0 ft. bedding plane fractures decrease in number with depth from ~0.1-0.2 ft. spacing to 0.2-1.0 ft. spacing at 45 ft. Gypsum crystal coatings along some fractures. A 45 degree inclined fracture with gypsum coating at 42.2 ft. and a 30 degree inclined fracture with gypsum coating at 42.9 ft. Shale is even bedded with only trace of lighter-colored very fine grained sandstone layers representing storm layers or bioturbation. Core very fissile and fractures easily when handled.
50	4905		45.0-46.0				45.0-55.0 ft. Limonite and gypsum coated bedding plane fracture. at 45.5 ft. @ 46.0-55.0 ft. bedding plane fracturing generally decreases downward through interval. Thin gypsum crystal coatings on fracture surfaces along with limonitic coloration. A limonitic coating of vertical fracture at ~ 47.0 ft., and a 45 degree fracture with gypsum and limonite coating at 54.3-54.7 ft. Fissile, well fractured zone at ~51.0-51.5 ft. Rock is generally silty claystone and mostly even bedded. Trace bioturbation and storm layers, both of which are represented by very light gray (N8) very fine grained sandstone layers.
55	4900		46.0-55.0		40.0-55.0 Poor		
60	4895		55.0-65.0				55.0-65.0 ft. bedding plane fracturing frequency decreases to generally less than one per foot. Only trace of gypsum coatings on fractures. Core becoming more competent. Amount of bioturbated bedding and storm layers increases below ~60.0 ft to ~5%. Limonite colored material coats most fractures. A high angle (~60 degrees) fracture coated with limonite at 61.3-62.2 ft. and a fissile fractured layer at 62.5 ft. Trace pyritized fossil material.
65	4890		65.0-75.0		55.0-75.0 Fair		65.0-75.0 ft. ~65.0-65.5 ft. for a short core run. Bedding plane fracturing nearly absent, only 2 or 3 in this run. Possible 30 degree inclined fracture at ~73.5 ft. Trace limonitic coatings noted at 65.5 ft., and no limonitic or gypsum coatings on fractures noted for rest of run. Light-colored, storm or bioturbated beds are about 3% of layering. Core becoming more competent, most breaks are drilling-induced. Trace fine carbonaceous material and pyrite along some bedding.
70	4885						
	4880						

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 SITE Crescent Junction Site DATES DRILLED 09/10/2005 to 10/20/2005

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
75	4875						75.0-85.0 ft. fossil @ 80.6 ft., 0.1 x 0.05 ft. Continued low angle bedding (5 degrees), core interior is dry, no indication of water from formation.
80	4870		75.0-85.0				
85	4865				75.0-95.0 Good		85.0-95.0 ft. dark gray (N3-N4) when wet, medium gray (N5) when dry, uniform, thin bedded, calcic, some gypsum, silty claystone. Bedding +/- 5 degrees. Sporadic very fine grained sand to thinly bedded siltstone partings.
90	4860		85.0-95.0				
95	4855						95.0-105.0 ft. mechanical fracturing along bedding planes most common, no fracturing noted except partings along bedding planes, no significant iron alteration zones or infillings, calcite and gypsum predominantly along hairline bedding planes.
100	4850		95.0-105.0		95.0-300.0 Excellent		
105	4845						105.0-115.0 ft. no indication of formation water noted between 75.0-175.0 ft.
110	4840		105.0-115.0				

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
115	4835						
120	4830		115.0-125.0				115.0-165.0 ft. shale or claystone, medium dark gray (N4), as above.
125	4825						
130	4820		125.0-135.0		95.0-300.0 Excellent		
135	4815						
140	4810		135.0-145.0				
145	4805						
150	4800		145.0-155.0				

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	ROD Description from core (FT)	GRAPHIC LOG	
155	4795						
160	4790		155.0-165.0				
165	4785						165.0-175.0 ft. @167.5 ft. is a weak thinly bedded, silty layer about 0.4 ft. thick. @168.0-169.0 ft. couple of hard microcrystalline sand lenses (porcelaneous-appearing) up to 0.1 ft. thick. Sporadic silt and sand beds up to 0.05 ft. thick.
170	4780		165.0-175.0		95.0-300.0 Excellent		
175	4775						175.0-185.0 ft. @175.2-175.4, 175.7-176.3 ft., core is broken into 0.05 ft. pieces. @176.7-177.4 ft. core breaks to 3 pieces 0.2-0.3 ft. long. @179.5-180.5 core in 3 pieces. @182.0-182.5 several broken pieces.
180	4770		175.0-185.0				
185	4765						185.0-195.0 ft. competent with only bedding planes and hairline gaps, calcite filling. No breakage other than mechanical @ 185.0, 187.5, 191.0, and 193.5 ft. Bedding plane <~5 degrees, sporadic bioturbation zones about 0.1 ft. thick.
190	4760		185.0-195.0				

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
195	4755						195.0-205.0 ft. mechanical breakage along bedding planes @ 198.0, 201.3, and 204.0-205.0 ft.
200	4750		195.0-205.0				
205	4745						205.0-215.0 ft. claystone. @205.0-207.5 ft. three 0.3 ft. sections showing strong mechanical fractures, no apparent lithologic cause, could be caused by vibration in drill string. Inner core is dry, no indication of water in the formation.
210	4740		205.0-215.0		95.0-300.0 Excellent		
215	4735						215.0-225.0 ft. three fractures @ 20 degrees to core axis from 216.5-217.0 ft. Clean hairline fractures, no secondary coatings or evidence of water, fractures spacing is approximately 0.1 ft.
220	4730		215.0-225.0				
225	4725						225.0-235.0 ft. From 226.0-226.5 ft. strong mechanical damage. Core is generally very consistent in appearance, random, thin (<0.025 ft.) storm and bioturbation layers.
230	4720		225.0-235.0				

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BOREHOLE LOG CRJ01-0207

PROJECT MOAB	BOREHOLE NUMBER CRJ01-0207
SITE Crescent Junction Site	DATES DRILLED 09/10/2005 to 10/20/2005

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
235	4715						235.0-245.0 ft. @240.2-240.8 ft. zone of silt size, coarser sediment interbedded with dark gray claystone, zone is mechanically fractured, otherwise the run is consistent with previous runs, no significant change in bedding, lithology, amount of mechanical fractures, no indication of formation water.
240	4710		235.0-245.0				
245	4705						245.0-255.0 ft. @ 251.5 ft. hairline clean fracture about 20 degrees to core axis is mechanical in origin. Run is competent with no other remarkable characteristics, usual bedding, coloration, fracturing, recovery, no indication of water in the formation.
250	4700		245.0-255.0		95.0-300.0 Excellent		
255	4695						255.0-265.0 ft. @256.0-259.0 ft. majority of mechanical fractures occur 0.15-0.4 ft. apart. Medium dark gray (N4) claystone with some bedding planes and no indication of water in the formation.
260	4690		255.0-265.0				
265	4685						265.0-275.0 ft. @266.0 ft. is a mechanical fracture that is filled with a lot of clay. This could be from cuttings or (unlikely but possible?) a large clay filled fracture? @268.7- 269.4 ft. zone of fractures along bedding, some bioturbation-associated breakage, friable. Remainder of run is typical shale.
			265.0-275.0				

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 SITE Crescent Junction Site DATES DRILLED 09/10/2005 to 10/20/2005

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DEPTH (FT BGL)	ELEV. (FT NGVD)	BLOW COUNTS	SAMPLE INTERVAL (FT)	EXTENT	RQD Description from core (FT)	GRAPHIC LOG	
275	4675						275.0-285.0 ft. competent, unremarkable. Mechanical fractures prevalent @275.0-277.0 ft. with breaks every 0.2-0.4 ft. Only other break @279.5 ft. Nice consistent run, even bedding, minor bioturbation, no indication of water in the formation.
280	4670		275.0-285.0				
285	4665				95.0-300.0 Excellent		285.0-295.0 ft. @ 291.15-291.4, core is fractured and platy - this fracturing is mechanical, but a result of lower calcic content of core.
290	4660		285.0-295.0				
295	4655						295.0-300.0 ft. no evidence of water.
300	4650		295.0-300.0				
305	4645						Total Depth 300.0 ft.

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