

PROJECT: South Heart Project

PROJECT NUMBER: 063-2174

LOCATION: South Heart, ND

DRILL RIG: CME-850

INCLINATION: -90°

DRILLING METHOD: Hollow Stem Auger

DATE STARTED: 05/07/07 09:32

DATE COMPLETED: 05/07/07 11:15

DRILLING FLUIDS: None

DRILL LUBRICANTS: None

RECORD OF BORING SHMW-01

COORDINATES: N: 447,701 E: 1,364,200

GROUND SURFACE ELEVATION: 2,487.8 ft

PROJECTION: StatePlane, North Dakota South, 3302

DATUM: NAD 27

HORIZONTAL UNITS: Feet

TOTAL DEPTH: 27.0 ft

BOTTOM ELEVATION: 2,460.8 ft

COLLAR ELEVATION: 2,491 NA

HOLE DIAMETER: 7.5 inches

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE NUMBER	BLOWS per 6 in	N	RECOVERY (ft)	COMMENTS
0.0		0.0 - 1.0 Soft, dark yellowish brown (10YR 4/2) CLAY, trace of roots, moist		2486.8	CL		1	1 3 5 7	8	0.8 2	Start drilling at 9:32 am on 5/7/2007
		1.0 - 4.0 Firm to stiff, dark yellowish brown (10YR 4/2), silty CLAY, slightly moist		1.0	CL		2	6 7 8 8	15	0.6 2	
2485				2483.8			3	8 9 10 11	19	0.6 2	
5.0		4.0 - 8.0 Very stiff, dark yellow brown (10YR 4/2), sandy SILT becoming more silty with depth, trace of carbonaceous material, trace of evaporite, slightly moist		4.0	ML	sli. moist	4	7 8 10 11	18	1 2	
2480		8.0 - 10.0 Stiff, dark yellow brown (10YR 4/2), CLAY, slightly moist		8.0	CL		5	6 7 7 7	14	0.9 2	
		9' increasing moisture		2477.8			6	3 3 4 4	7	1.5 2	
10.0		10.0 - 18.5 Firm to stiff, dark yellow brown (10YR 4/2), clayey SILT, slightly moist		10.0	ML		7	3 3 4 4	7	2	
2475		12' trace of sand					8	3 3 5 6	8	1.9 2	
		13' increasing moisture				moist					
		14' trace to little of carbonaceous material									
15.0											

Log continued on next page

MW AVF GNPD SH OB AND MW UPDATED SURVEY DATA 4_48_08.GPJ GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Braun Intertec
DRILLER: C. Powers

GEOLOGIST: S. Doyle, A. Hobson
CHECKED: E. Pottorff
DATE: 8/27/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-01

COORDINATES: N: 447,701 E: 1,364,200
 GROUND SURFACE ELEVATION: 2,487.8 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV.	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE NUMBER	BLOWS per 6 in	N	RECOVERY (ft)	COMMENTS	
				DEPTH (ft)								
15.0		10.0 - 18.5 Firm to stiff, dark yellow brown (10YR 4/2), clayey SILT, slightly moist		2469.3 18.5	ML	moist	8	3 3 3 3 3 3 6	8	1.9 2	20' Saturation first observed	
		16.7' color change to reddish brown and becomes very stiff					9	4 7 8 9	15	2 2		
2470		17.5' more carbonaceous material mottled with light brown lenses		2464.6 23.2	Siltst	v. moist	10	6 6 6 6	12	2 2		
		20' wet					11	3 3 3 3	6	2 2		
		21.5' a fine-grained sand lens		2460.8 27.0	COAL	wet	12	3 11 16 13	27	2 2		
2465		23.2 - 27.0 Hard, black, COAL, wet					13	11 24 35 50 for 4"	59	1.8 2		
25.0							14	50	>100	0.5 0.5		Auger refusal at 27' on 5/7/2007. TD = 27'.

Boring completed at 27 ft.

Boring completed at 27 ft.

MW AVF GNPD SH OB AND MW UPDATED SURVEY DATA 4_48_08.GPJ GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Braun Intertec
 DRILLER: C. Powers

GEOLOGIST: S. Doyle, A. Hobson
 CHECKED: E. Pottorff
 DATE: 8/27/2007

PROJECT: South Heart Project

PROJECT NUMBER: 063-2174

LOCATION: South Heart, ND

DRILL RIG: Gus Pech - RD 300

INCLINATION: -90°

DRILLING METHOD: Rotasonic

DATE STARTED: 10/16/06 07:55

DATE COMPLETED: 10/16/06 10:30

DRILLING FLUIDS: Water

DRILL LUBRICANTS: Well-Guard Monitor Well Thread Compound

RECORD OF BORING SHMW-02

COORDINATES: N: 446,330 E: 1,353,961

GROUND SURFACE ELEVATION: 2,559.9 ft

PROJECTION: StatePlane, North Dakota South, 3302

DATUM: NAD 27

UNITS: Feet

TOTAL DEPTH: 70.0 ft

BOTTOM ELEVATION: 2,489.9 ft

COLLAR ELEVATION: 2,562 ft (approximate)

SOLE DIAMETER: 6 inches

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
0.0		0.0 - 5.0 Dense, hard pan, dk. yellowish brown (10YR, 4/2), sandy SILT, fine grained, whitish, powdery salt coatings throughout, plant roots near top, occ. moderate orange pink (5YR, 8/4) silt inclusions from 1-3', v. moist			ML			Note: Geologic scale was used for grain size descriptions (v. fine through v. coarse) Run 1: 0-5' Driller used water to push out core
5.0	2555	5.0 - 17.0 Soft to v. soft, dk. yellowish brown (10YR, 4/2) changing to mod. olive brown (5Y, 4/4), silty CLAYSTONE, 0-5% fine sand, mod. plasticity, v. sticky, whitish, salty "splinters" throughout, occ. moderate orange pink (5YR, 8/4) silt inclusions from 1-3', v. moist		2554.9 5.0		v. moist		Run 2: 5'-15' Driller used water to push out core
17.0	2545	17.0 - 27.0 V. soft to soft, mod. olive brown (5Y, 4/4) to olive gray (5Y, 4/1), silty CLAYSTONE, mod. lamination, becoming mottled lt. brown (5YR, 5/6) to lt. yellowish orange (10YR, 6/6), whitish, salty "splinters" throughout, v. moist to wet			Cist		Reference Sample SHMW02C 15-25	Run 3: 15'-25' Driller used water to push out core and drive casing
23.8	2535	23.8'-24' zone of v. soft, saturated silty CLAYSTONE						
24.9		24.9' thin, black (N1) COAL stringer						
27.0	2530	27.0 - 32.0 Dense, olive gray (5Y, 4/1), silty CLAYSTONE, 30-50% silt, mod. plasticity, lamianted, occ. to frequent small coal inclusions, v. moist				v. moist	Reference	Run 4: 25'-35' Driller used water to push out core and drive casing

Log continued on next page

MW_GNPD_SH_OB AND MW_UPDATED SURVEY DATA 4_48_08.GPJ GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
DRILLER: Alvin Anderson

GEOLOGIST: R. Marchese
CHECKED: A. Hobson
DATE: 2/22/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-02

COORDINATES: N: 446,330 E: 1,353,961
 GROUND SURFACE ELEVATION: 2,559.9 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
30.0							Sample SHMW02C 29.5-31	
					Clst			
		32.0 - 33.5 Dense (more dense than above), weathered, dk. greenish gray (5GY, 4/1), CLAYSTONE, v. moist		2526.4				
				33.5	Sh			
		33.5 - 34.0 Weathered, black (N1), SHALE, waxy, sub-fissile, v. moist		2525.9	Clst / Siltst			
35.0	2525			34.0				
		34.0 - 35.0 Dk. greenish gray (5G, 4/1) to greenish gray (5GY, 6/1), CLAYSTONE interbedded w/ weathered SILTSTONE, v. moist		2524.9		v. moist	Reference Sample SHMW02C 35-38	Run 5: 35'-45' Driller used water to push out core and drive casing
		35.0 - 38.0 Soft, dk. greenish gray (5G, 4/1), clayey SILTSTONE, 30-50% clay, 5-12% v. fine sand, interbedded w/ multiple/frequent thin coalified wood stringers/veins, vertically and horizontally, numerous pebble-sized pyrite or marcasite encrusted nodules, v. moist		35.0				
40.0	2520				Siltst		Reference Sample (nodules) SHMW02C 35-45	
		38.0 - 45.0 Stiff, weathered, dk. greenish gray (5GY, 4/1), SILTSTONE, interbedded w/ dense, sandy SILTSTONE, fine grained, 12-30% clay, sli. blocky, occ. thin, wet silty lenses slanted to core axis, v. moist						
		41.5' coalified wood stringer w/ visible pyrite or marcasite crystals						
45.0	2515			2514.9				
		45.0 - 47.5 Stiff, olive gray (5Y, 4/1), silty CLAYSTONE/clayey SILTSTONE, thinly bedded, sli. blocky, becoming thinly bedded w/ shale from 46.5' to 47.5', occ. pyrite/marcasite inclusions, wet		45.0	Clst / Siltst	wet	Reference Sample SHMW02C 46-47	Run 6: 45'-48' Driller used water to push out core Note: driller cased off top of coal before continuing drilling
		47.5 - 48.0 Loose, black (N1) to brownish black (5YR, 4/1), COAL seam, 30-50% silt, dull w/ some bright surfaces, fissile, moist to v. moist		2512.4				
		48.0 - 55.0 Loose, black (N1) to brownish black (5YR, 4/1), COAL seam, 30-50% silt, dull w/ some bright surfaces, fissile, occ. pyrite coatings on fresh surfaces, moist to v. moist		47.5			Reference Sample SHMW02C 48-55	Run 7: 48'-55' Driller used water to push out core
50.0	2510					moist to v. moist		
		55.0 - 67.5 Loose, black (N1) to brownish black (5YR, 4/1), COAL seam, 30-50% silt and v. fine sand, dull w/ some bright surfaces, fissile, occ. pyrite coatings on fresh surfaces, v. moist to wet			COAL		Reference Sample SHMW02C 55-60	Run 8: 55'-70' Driller used water to push out core Driller's Note: Casing driven to 55', cored through coal seam, though casing was filled w/ water. Wetness in coal may not be natural; probably came from casing volume when drilled. (Internally, coal core was dry to v. moist.)
55.0	2505							
60.0	2500					v. moist to wet		
65.0	2495							
				2492.4				

Log continued on next page

MW_GNPD_SH_OB AND MW_UPDATED SURVEY DATA 4_48_08_GPJ_GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
 DRILLER: Alvin Anderson

GEOLOGIST: R. Marchese
 CHECKED: A. Hobson
 DATE: 2/22/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-02

COORDINATES: N: 446,330 E: 1,353,961
 GROUND SURFACE ELEVATION: 2,559.9 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
		67.5 - 68.0 Brownish black (5YR, 2/1), SHALE, sub-fissile, v. moist to wet		67.5	Sh			
		68.0 - 70.0 Dense, weathered, dk. greenish gray (5GY, 4/1) to olive gray (5Y, 4/1), clayey SILTSTONE, becoming varved, w/ alternating med. lt. gray to olive gray color bands, w/ occ. thin coal stringers, v. moist to wet		2491.9 68.0 2489.9	Silst	v. moist to wet		TD = 70' (10-16-06, 1030)
70.0	2490	<u>Boring completed at 70.0 ft</u>						
75.0								
80.0								
85.0								
90.0								
95.0								
100.0								
105.0								

MW_GNPD_SH_OB AND MW_UPDATED SURVEY DATA 4_48_08.GPJ GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
 DRILLER: Alvin Anderson

GEOLOGIST: R. Marchese
 CHECKED: A. Hobson
 DATE: 2/22/2007

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PROJECT: South Heart Project

PROJECT NUMBER: 063-2174

LOCATION: South Heart, ND

DRILL RIG: Gus Pech - RD 300

INCLINATION: -90°

DRILLING METHOD: Rotasonic

DATE STARTED: 10/15/06 07:33

DATE COMPLETED: 10/15/06 13:30

DRILLING FLUIDS: Water

DRILL LUBRICANTS: Well-Guard Monitor Well Thread Compound

RECORD OF BORING SHMW-03

COORDINATES: N: 445,930 E: 1,369,603

GROUND SURFACE ELEVATION: 2,500.8 ft

PROJECTION: StatePlane, North Dakota South, 3302

DATUM: NAD 27

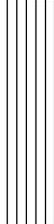
UNITS: Feet

TOTAL DEPTH: 122.0 ft

BOTTOM ELEVATION: 2,378.8 ft

COLLAR ELEVATION: 2,504 ft (approximate)

HOLE DIAMETER: 6 inches

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
0.0	2500	0.0 - 6.0 Dense, hard pan, brownish gray (5YR, 4/1), SILT, tr. fine sand, plant roots near top, v. moist			ML	v. moist		Note: Geologic scale was used for grain size descriptions (v. fine through v. coarse) Run 1: 0'-5' Driller used water to drive casing
5.0	2495	6.0 - 10.0 Loose to compact, lt. olive brown (5Y, 5/6) to dusky yellow (5Y, 6/4), SANDSTONE, fine grained, 5-12% silt, occ. reddish brown (10R, 4/6) fine sand layers, 0-5% clay, NR w/ HCl, moist		2494.8 6.0		moist	Reference Sample SHMW03D 5-15	Run 2: 5'-10'
10.0	2490	10.0 - 15.0 Loose to compact, lt. olive brown (5Y, 5/6) to med. olive brown (5Y, 4/4), SANDSTONE, fine grained, 5-12% silt, occ. reddish brown (10R, 4/6) fine sand layers, 0-5% clay, NR w/ HCl, v. moist to moist						Run 3: 10'-15' Note: Part of core fell out when being emptied into core bags.
15.0	2485	15.0 - 25.0 Loose to v. loose, grayish olive (10Y, 4/2) to pale olive (10Y, 6/2) to dk. yellowish orange (10YR, 6/6), silty SANDSTONE, fine to med. grained, occ. horizons of sli. hardpan consistency, 0-5% clay, NR w/ HCl, moist to v. moist			Ss	moist to v. moist		Run 4: 15'-25' Driller used water to push out core
20.0	2480							
25.0	2475	25.0 - 35.0 Loose to compact, lt. olive brown (5Y, 5/6) to lt. olive gray (5Y, 6/2), sandy SILTSTONE, fine grained, increasing clay content (5-12%), v. moist		2475.8 25.0	Siltst	v. moist	Reference Sample SHMW03D 25-35	Run 5: 25'-35' Driller used water to push out core Note: moisture content may be influenced by drill water

Log continued on next page

MW_GNPD_SH_OB AND MW_UPDATED SURVEY DATA 4_48_GP.J_GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
DRILLER: Alvin Anderson

GEOLOGIST: R. Marchese
CHECKED: A. Hobson
DATE: 2/22/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-03

COORDINATES: N: 445,930 E: 1,369,603
 GROUND SURFACE ELEVATION: 2,500.8 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
70.0	2430	55.0 - 71.5 Loose, black (N1) and dk. reddish brown (10R, 3/4), COAL, 12-50% fine sand and silt, dull w/ some bright faces, no visible sulfur or pyrite crystals, some cleating, saturated			COAL	sat.		
		70'-71.5' becomes more silty		2429.3				
		71.5 - 72.0 Dense, olive black (5Y, 2/1), silty CLAYSTONE, 30-50% clay, v. moist		71.5	Clst			
		72.0 - 75.0 Dense, greenish gray (5GY, 6/1) to dk. greenish gray (5GY, 4/1), clayey SILTSTONE, 12-30% clay, sli. laminated, occ. dk. brown organic inclusions, v. moist		2428.8		v. moist		
		73'-75' becomes sli. blocky		72.0				
		74.5'-75' becomes more massive						
		75.0 - 90.0 Dense, greenish gray (5GY, 6/1) to dk. greenish gray (5GY, 4/1), clayey SILTSTONE, 12-50% clay, sli. laminated, occ. dk. brown organic inclusions, sli. to mod. blocky, thin to massive bedding, moist to v. moist				moist to v. moist		Run 10: 75'-90' Driller used water to push out core
		82'-84' zone of soft and wet material						Driller's Note: Original 10' core run fell out of core barrel in borehole; tripped back down to retrieve and drilled extra 5'
						wet	Reference Grab Sample SHMW03D at 83'	
					Siltst	moist to v. moist		
		90.0 - 106.5 Dense, greenish gray (5GY, 6/1) to dk. greenish gray (5GY, 4/1), clayey SILTSTONE, 12-50% clay, sli. laminated, occ. dk. brown organic inclusions, sli. to mod. blocky, thin to massive bedding, occ. interbedded zones of sandy SILTSTONE, fine grained, moist to v. moist						Run 11: 90'-107' Driller used water to push out core
		92'-93' zone of soft and wet material						Driller's Note: Original 10' core run fell out of core barrel in borehole; tripped back down to retrieve and drilled extra 7'
						wet		
						moist to v. moist	Reference Sample SHMW03D 93-113	
		103'-106.5' color gradually changes to olive gray (5Y, 4/1)						
105.0		Log continued on next page						

MW_GNPD_SH_OB AND MW UPDATED SURVEY DATA 4_48_08_GP.J GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
 DRILLER: Alvin Anderson

GEOLOGIST: R. Marchese
 CHECKED: A. Hobson
 DATE: 2/22/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-03

COORDINATES: N: 445,930 E: 1,369,603
 GROUND SURFACE ELEVATION: 2,500.8 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS	
105.0	2395		x x x x	2394.3	Siltst			Note: SILTSTONE has sli. rxn w/ HCl, SHALE has NR w/ HCl	
106.5 - 107.0		Weathered, olive gray (5Y, 4/1) turning to brownish black (5YR, 2/1), SILTSTONE and SHALE, sub-fissile, v. thinly bedded shale, moist to v. moist	[Green Hatched Box]	106.5	Siltst / Sh		Reference Sample SHMW03D 93-113	Run 12: 107'-122' Driller used water to push out core	
107.0 - 118.0		Weathered, olive gray (5Y, 4/1) to med. gray (N5), interbedded SILTSTONE and CLAYSTONE, sli. blocky to blocky, 5-12% fine sand, mod. rxn. w/ HCl, moist to v. moist		2393.8					
110.0	2390			2389.8					
115.0	2385	114'-116' occ. pyrite encrusted nodule noticed, occ. then, fine grained, sandy silt lenses		2382.8					
118.0 - 118.5		Hard, med. lt. gray (N6), limy SILTSTONE w/ powdery, v. lt. gray residue, vigorous rxn. w/ HCl, dry	x x x	118.0	Siltst	dry	Reference Grab Sample at 118'		
118.5 - 121.1		Weathered, olive gray (5Y, 4/1) to med. gray (N5), interbedded SILTSTONE and CLAYSTONE, sli. blocky to blocky, 5-12% fine sand, mod. rxn. w/ HCl, moist		2382.3	Siltst / Clst	moist			
120.0	2380			118.5					
121.1 - 121.3		Med. strong, pale olive (10Y, 6/2), cherty SILTSTONE, moist		2378.8	Siltst				
121.3 - 122.0		Weathered, olive gray (5Y, 4/1) to med. gray (N5), interbedded SILTSTONE and CLAYSTONE, sli. blocky to blocky, 5-12% fine sand, mod. rxn. w/ HCl, moist		122.0	Siltst / Clst			TD = 122' (10-15-06, 1330)	
125.0		Boring completed at 122.0 ft							
130.0									
135.0									
140.0									

MW_GNPD_SH_OB AND MW_UPDATED SURVEY DATA 4_48_08.GPJ GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
 DRILLER: Alvin Anderson

GEOLOGIST: R. Marchese
 CHECKED: A. Hobson
 DATE: 2/22/2007

FIELD LOG - ROTARY BOREHOLE

SITE NAME AND LOCATION SOUTH HEART, NORTH DAKOTA	DRILLING METHOD: <i>Rotary</i>	BORING NO. SHMW-03HTB
NORTHING: 445863.55 COORDINATE EASTING: 1369634.94 SYSTEM (DATUM): SP 27 ft	DRILLING BIT DIAMETER: 3.75-inch T&P coring bit	SHEET 1 OF 12
	SAMPLING METHOD: Split Spoon (2.3 ft long w/shoe) and HQ Wireline Coring	DRILLING
	DATE	START FINISH TIME TIME
	WATER LEVEL	DATE DATE 10/19/09 10/21/09
COLLAR ELEVATION:	GROUND SURFACE ELEVATION: 2503.86	CASING DEPTH

DRILL RIG CME-75	SURFACE CONDITIONS grass, slight downslope to North
	DRILLING WATER (AMOUNT AND DEPTHS)
	TOTAL DEPTH 224 feet

DEPTH IN FEET	RECOVERY (ft)	BLOW/G IN. #505-OR-ROCK ON SAMPLER	LITHOLOGY/DESCRIPTION	SLT. MOIST TO MOIST	SAMPLE DEPTH IN FEET		DESCRIPTION OF OPERATION AND REMARKS
					FROM	TO	
1	1.4/2	2, 7, 4, 5	0-2 ft V. soft-soft, mod yell br (10YR 5/4) and yell gr (5Y 7/2) v. fine to fine gr. silty SAND, little roots, sli. moist - moist		0	2	Begin drilling on 10/19/2009 at 10:52
2		5					2 ft: Driller starts using water while reaming borehole with 5" rotary bit after each Split Spoon sample
3	1.1/2	7, 9	2-16 ft Ext. weak-v. weak yell gr (5Y 7/2) fine-med. gr. SANDSTONE, tr.-little silt, predom.			4	
4		7, 9					
5	1.0/2	12, 15	fine gr. SANDSTONE, fresh-sli. wthd, moisture NA			6	
6		12					
7	1.7/2	17, 24, 29				8	
8		13					
9	1.5/2	16, 24, 22				10	
10		8					
11	1.5/2	18, 27, 32				12	
12		8					
13	1.6/2	21, 24, 35				14	
14	1.3/2	15, 24					

DRILLING CONTR Braun Intertec
 DRILLERS Kyle Haag
 LOGGED BY Ryan Tolene
 DATE 10/19/2009 CHK'D BY E. Pottorf
 JOB NO.: 063-2212D

FIELD LOG - ROTARY BOREHOLE

BORING NO.
SHMW-03 HTB

SHEET
2 OF 12

DEPTH IN FEET	RECOVERY (ft)	BLOWS/6 IN USGS OR-ROCK TYPE ON SAMPLER	LITHOLOGY/DESCRIPTION	MOISTURE CONTENT	SAMPLE DEPTH IN FEET		DESCRIPTION OF OPERATION AND REMARKS	
					FROM	TO		
15	1.3/2	40	<u>16-26 ft NO RECOVERY</u>	NA (drilling with water)	16	16	16 ft: Begin HQ coring with 3.75" TCP bit	
16	0/10	63			16-26 ft: CORE LOSS not counted as core run #1			
26	1.7/2	17	<u>26-35 ft</u> Ext. weak-v. weak, sli. whd, yell gr (5Y7/2) to lt olv gr (5Y5/2) med. gr. SANDSTONE, little silt, trace clay interbeds, trace iron oxide staining and rusty orange nodules	NA (drilling with water)	26	26	26 ft: Due to core loss, resume driving Split Spoon samples	
		30						
		40						
		50/50						
		8						
	2/2	10						
		14						
		32						
	2/2	19						
		35						
		42						
		51						
		8						
	1.6/2	8						
		12						
		32						
		8						
	1.7/2	19						
34		27						

DRILLING CONTR: Braun Intertec

DRILLERS: Kyle Haag

LOGGED BY: Ryan Tolene

DATE: 10/19/2009 CHK'D BY: E. Pottorff

JOB NO.: 063-2212D

FIELD LOG - ROTARY BOREHOLE

BORING NO.

SHMW-03HTB

SHEET

3 OF **12**

DEPTH IN FEET	RECOVERY (ft)	BLOWS / 6 IN USES OR ROCK TYPE ON SAMPER	LITHOLOGY/DESCRIPTION	MOISTURE CONTENT	SAMPLE DEPTH IN FEET		DESCRIPTION OF OPERATION AND REMARKS
					FROM	TO	
35	1.7/2	29	35-45 ft Ext. weak - v. weak, lt olv gr (5Y 5/2) fine gr. SAND- STONE, little - some silt				
36		41				36	
	1.7/2	17					
		29					
		31					
38		55				38	
	2/2	17					
		30					
		40					
40		50/2"				40	
	2/2	8					
		22					
		22					
42		34			42		
	2/2	15					
		24					
		40					
44		55			44		
	1/1	27					
45		29			45		
			45-53 ft Minimal Recovery			45-53 ft: Driller notes competent rock and begins HQ coring - not counted as core run #1, CORE LOSS	
	0.2/8		~51 ft v. weak, dk yell br (10YR 4/2) and yell gr (5Y 7/2) silty CLAYSTONE, some silt and some iron oxide staining			~50.5 ~52 ft: Driller noted more competent drilling than rock above	
50						~52 ~53 ft: Driller noted that the drilling felt like he got back into sandstone again	
			~53.5-58.3 ft Ext. weak, lt olv gr (5Y 5/2) sandy CLAYSTONE, fine gr. sand, little - some silt			53 ft: Stop drilling for the day on 10/19/2009 at 16:50 Resume drilling on 10/20/2009 by driving Split Spoon samples at 8:06	
53	0.8/1.5	27			53		
54		40					
		50/5"					
54.5		16			54.5		

NA (drilling with water)

DRILLING CONTR Braun Intertec

DRILLERS Kyle Haag

LOGGED BY Ryan Tolenc

DATE 10/19/09 - 10/20/09 CHK'D BY E. Potter

JOB NO.: 063-2212D

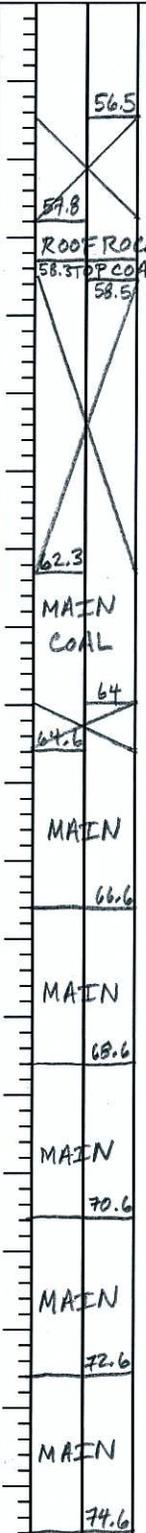
FIELD LOG - ROTARY BOREHOLE

BORING NO.
SHMW-03HTB

SHEET
4 OF **12**

DEPTH IN FEET	RECOVERY (#)	BLANKS / 6 IN. USGS OR ROCK ON SAMPLER	LITHOLOGY/DESCRIPTION	MOISTURE CONTENT	SAMPLE DEPTH IN FEET		DESCRIPTION OF OPERATION AND REMARKS
					FROM	TO	
55		31					
56	1.7/2	37					
56.5		49					
		6					
58	1.1/2	10					
58.5		27					
		60					
60			58.3 ~ 62.3 ft v. weak-weak, mod. - highly wthd, brn blk (5YR 2/1) to blk (N1) COAL				58.4 ft: Driller noted harder drilling (Split Spoon) into coal seam 58.5 ft: Begin HQ coring coal seam
	1.7/5.5		62.3 - 64 ft Med strong - strong brn blk (5YR 2/1) to blk (N1) COAL, platy, trace pyrite veins, trace woody fragments				Core Run 1: 58.5 - 64 ft CORE LOSS From 58.5 - 62.3 ft
64			64 - 76.5 ft Strong - v. strong brn blk (5YR 2/1) to blk (N1) COAL, trace pyrite veins				62.3 - 64 ft: Sample depth approximated based on rock strength
	4.4/5		72.5 ft - pyrite nodules				64 ft: Driller switches to another 3.75-inch TCP bit to try to improve recovery
			74.5 - 74.7 ft clayey zone with pyrite nodules				Run 2: 64 - 69 ft
69							
70							
	8.5/10						Run 3: 69 - 79 ft
74							

NA (drilling with water)



DRILLING CONTR Braun Intertec

DRILLERS Kyle Haag

LOGGED BY Ryan Tolene

DATE 10/20/2009 CHK'D BY E. Poteroff

JOB NO.: 063-2212D

FIELD LOG - ROTARY BOREHOLE

BORING NO.
SHMW-03HTB

SHEET
5 OF **12**

DEPTH IN FEET	RECOVERY (ft)	USCS OR ROCK TYPE	LITHOLOGY/DESCRIPTION	MOISTURE CONTENT	SAMPLE DEPTH IN FEET		DESCRIPTION OF OPERATION AND REMARKS
					FROM	TO	
75	8.5/10	COAL	76.5 - 76.9 ft V. weak-weak, olv gr (5Y4/1) silty CLAYSTONE, some coal stringers		76.0	76.5	
79			76.9 - 104 ft v. weak-weak, (H blu gr (5B7/1) to med blu gr (5B5/1) clayey SILTSTONE		77.0	77.0	77-79 ft: CORE LOSS
80	4.8/5		76.9 - 85 ft Trace woody, coal fragments		79	81	Run 4: 79-84 ft
84					83	85	Run 5: 84-94 ft
85					87	89	85-87 ft: CORE LOSS
90	7.8/10	SILTSTONE			91	93	
94			94-104 ft SILTSTONE as above with trace beds of v. fine gr. sand		95	95	Run 6: 94-104 ft

NA (drilling with water)

DRILLING CONTR Braun Intertec

DRILLERS Kyle Haag

LOGGED BY Ryan Tolene

DATE 10/20/2009 CHK'D BY E. Potbury

JOB NO.: 063-2212D

FIELD LOG - ROTARY BOREHOLE

BORING NO. SHMW-03 HTB

SHEET 6 OF 12

DEPTH IN FEET	RECOVERY (ft)	USCS OR ROCK TYPE	LITHOLOGY/DESCRIPTION	MOISTURE CONTENT	SAMPLE DEPTH IN FEET		DESCRIPTION OF OPERATION AND REMARKS
					FROM	TO	
95			76.9 - 104 ft V. weak-weak, lt blu gr (5B7/1) to med blu gr (5B5/1) clayey SILTSTONE				Run 6: 94 - 104 ft
100	10/10	SILTSTONE				97	
						99	
						101	
						103	
104			104 - 113.6 ft V. weak-weak, med gr (N5) CLAYSTONE, some silt			104	Run 7: 104 - 114 ft
105						106	
	8.6/10	CLAYSTONE				108	
110						110	
						112	
114			113.6 - 114 ft Strong, dusky yell (5Y 6/4) CLAYSTONE			114	

NA (drilling with water)

DRILLING CONTR Braun Intertec
DRILLERS Kyle Haag

JOB NO.: 063-2212D LOGGED BY Ryan Tolene DATE 10/20/2009 CHK'D BY E. Pottorff

FIELD LOG - ROTARY BOREHOLE

BORING NO.
SHMW-03HTB

SHEET
7 OF **12**

DEPTH IN FEET	RECOVERY (ft)	USGS OR ROCK TYPE	LITHOLOGY/DESCRIPTION	MOISTURE CONTENT	SAMPLE DEPTH IN FEET		DESCRIPTION OF OPERATION AND REMARKS
					FROM	TO	
115			<p><u>114-127.7 ft</u> v. weak-weak, med Hgr (N6) to med gr (N5) CLAY-STONE AND SILTSTONE interbedded, predom. CLAYSTONE</p> <p><u>127.7-129.2 ft</u> Strong, brn blk (5YR 2/1) COAL</p> <p><u>129.2-147.2 ft</u> v. weak-weak, H olv gr (5Y 6/1) to med H gr (N6) interbedded CLAYSTONE AND SILTSTONE</p> <p><u>129.2-132.5 ft</u> SILTSTONE grn gr (5G 6/1), trace woody coal stringers</p> <p><u>132.5-139 ft</u> some v. fine gr. sand</p>			<p>Run 8: 114-124 ft</p> <p>Run 9: 124-134 ft</p>	
120							116
124							118
125							120
130							122
134							124
							126
							128
							130
							132
					134		

DRILLING CONTR Braun Intertec

LOGGED BY Ryan Tolene

JOB NO.: 063-2212D

DRILLERS Kyle Haag

DATE 10/20/2009 CHK'D BY E. Pottorf

FIELD LOG - ROTARY BOREHOLE

BORING NO.
SHMW-13HTB

SHEET
8 OF 12

DEPTH IN FEET	RECOVERY (ft)	USCS OR ROCK TYPE	LITHOLOGY/DESCRIPTION	MOISTURE CONTENT	SAMPLE DEPTH IN FEET		DESCRIPTION OF OPERATION AND REMARKS
					FROM	TO	
135			129.2 - 147.2 ft v. weak-weak, lt olv gr (5Y 4/1) to med lt gr (N6) interbedded CLAYSTONE AND SILTSTONE				Run 10: 134-145 ft Run 11: 145-154 ft 153-154 ft: CORE LOSS
140	10.6 / 11	INTERBEDDED CLAYSTONE AND SILTSTONE				136	
						138	
						140	
						142	
						144	
145		SANDSTONE	147.2 - 148 ft v. strong-ext. strong, med lt gr (N6) v. fine-fine gr. SANDSTONE, little clay			146	
		CLAYSTONE AND SILTSTONE	148 - 151.5 ft v. weak-weak, lt olv gr (5Y 4/1) to med lt gr (N6) interbedded CLAYSTONE AND SILTSTONE			148	
150	7.9 / 9	SANDSTONE	151.5 - 157.3 ft v. weak-weak, med lt gr (N6) fine gr. silty SANDSTONE, little clay			150	
						152	
						153	
154						154	

NA (drilling with water)

DRILLING CONTR Braun Intertec

DRILLERS Kyle Haag

LOGGED BY Ryan Tolene

DATE 10/20/09-10/21/09 CHK'D BY E. Potlorsff

JOB NO.: 063-2212D

FIELD LOG - ROTARY BOREHOLE

BORING NO.

SHMW-03HTB

SHEET

9 OF 12

DEPTH IN FEET	RECOVERY (ft)	USGS OR ROCK TYPE	LITHOLOGY/DESCRIPTION	MOISTURE CONTENT	SAMPLE DEPTH IN FEET		DESCRIPTION OF OPERATION AND REMARKS
					FROM	TO	
155		SANDSTONE	154-156.3 ft SANDSTONE as above but V. strong - ext. strong			156	Run 12: 154-164 ft
	10/10	CLAYSTONE AND SILTSTONE	157.3 - 164.3 ft V. weak-weak, lt olv gr (5Y 4/1) to olv gr (5Y 4/1) interbedded CLAYSTONE AND SILTSTONE			158	
160		CLAYSTONE AND SILTSTONE				160	
		CLAYSTONE AND SILTSTONE				162	
164		SANDSTONE	164.3 - 168.9 ft Weak, med lt gr (N6) med gr. SANDSTONE			164 164.3	Run 13: 164-174 ft Lost Core
165	8.4/11	SANDSTONE					164.3 - 169 ft: CORE LOSS
170		CLAYSTONE AND SILTSTONE	168.9 - 173 ft V. weak-weak, lt olv gr (5Y 4/1) to olv blk (5Y 3/1) interbedded CLAYSTONE AND SILTSTONE			169	
		CLAYSTONE AND SILTSTONE				171	
		CLAYSTONE AND SILTSTONE				173	Run 14: 174-175 ft Drill 1 ft to recover core from previous run Core Loss assumed to be top of SANDSTONE from 164.3-166.9 ft
174		CLAYSTONE AND SILTSTONE				175	

NA (drilling with water)

DRILLING CONTR Braun Intertec

DRILLERS Kyle Haag

LOGGED BY Ryan Tolene

DATE 10/21/2009 CHK'D BY E. Pottorf

JOB NO.: 063-2212D

FIELD LOG - ROTARY BOREHOLE

BORING NO.
SHMW-03 HTB

SHEET
10 OF 12

DEPTH IN FEET	RECOVERY (ft)	USCS OR ROCK TYPE	LITHOLOGY/DESCRIPTION	MOISTURE CONTENT	SAMPLE DEPTH IN FEET		DESCRIPTION OF OPERATION AND REMARKS
					FROM	TO	
175			<p><u>168.9 - 193 ft</u> V. weak-weak, lt olv gr (5Y 4/1) to olv blk (5Y 2/1) interbedded CLAYSTONE AND SILTSTONE</p>				Run 15: 175 - 184 ft Poor Recovery 3.3'/9'
180	13.9/14		<p><u>176.8 - 179.3 ft</u> SILTSTONE layers becoming strong with little v. fine gr. sand from 178.3 - 179.3 ft</p>			177 179	
184			<p>0.1 - 0.3 ft thick zones of Med strong, yell gr (5Y 8/1) claystone at 183.6 ft, 184.9 ft, 187.6 ft, 189 ft</p>			181 183	
185			<p><u>189 - 193 ft</u> Thin banding of lt olv gr (5Y 4/1) to brn gr (5YR 4/1) claystone and siltstone (< 0.1 ft bands)</p>			185 187	Run 16: 184 - 189 ft Drill 5 feet to recover core from previous run
190	10/10		<p><u>193 - 193.5 ft</u> Weak, blk (N1) COAL platy, interbedded w/ olv gr (5Y 4/1) CLAYSTONE</p>			189 191	Run 17: 189 - 199 ft
194		COAL CLAYSTONE	<p><u>193.5 - 194.4 ft</u> V. weak-weak, olv gr (5Y 4/1) CLAYSTONE, trace woody coal stringers</p>			193	
		CLAYSTONE	<p>Sec next page for description</p>			195	

DRILLING CONTR Braun Intertec

DRILLERS Kyle Haag

LOGGED BY Ryan Tolene

DATE 10/21/2009 CHK'D BY E. Pottorf

JOB NO.: 063-2212D

FIELD LOG - ROTARY BOREHOLE

BORING NO.
SHMW-03HTB

SHEET
11 OF 12

DEPTH IN FEET	RECOVERY (ft)	USGS OR ROCK TYPE	LITHOLOGY/DESCRIPTION	MOISTURE CONTENT	SAMPLE DEPTH IN FEET		DESCRIPTION OF OPERATION AND REMARKS
					FROM	TO	
195	10/10	CLAYSTONE	194.4-195 ft Weak, blk (NI) COAL interbedded w/ olv gr (5Y 4/1) CLAYSTONE			197 ROOF ROCK 197.5 TOP COAL 198	
199			195-197.5 ft V. weak-weak, (H olv gr (5Y 6/1) becoming grn gr (5G 6/1) CLAYSTONE			MAIN COAL 200	Run 18: 199-209 ft
200			197.5-214.1 ft Weak-strong, blk (NI) COAL with brn blk (5YR 3/1)			MAIN 202	
	9.8/10		V. weak-weak COAL from 197.5-197.7 ft and 202.4-202.6 ft			MAIN 204	
			Med. strong - strong COAL from 197.7-202.4 ft and 202.6-214.1 ft			MAIN 206	
			Pyrite Nodules at 197.9 ft			MAIN 208	
			200.4 ft				
			204.0 ft				
209			205.4 ft			MAIN 210	Run 19: 209-219 ft
			206.4 ft				
			209.6 ft				
			211.0 ft			MAIN 212	
	12.5/15		Clayey zone at 206 ft (<0.1 ft thick)				
214		CL ST	See next page for description			213.6 BOTTOM COAL 214.1 FLOOR ROCK 214.6	

NA (drilling with water)

DRILLING CONTR Braun Intertec

DRILLERS Kyle Haag

LOGGED BY Ryan Tolene

DATE 10/21/2009 CHK'D BY E. Poterff

JOB NO.: 063-2212D

FIELD LOG - ROTARY BOREHOLE

BORING NO. **SHMW-03HTB**

SHEET **12** OF **12**

DEPTH IN FEET	RECOVERY (ft)	USCS OR ROCK TYPE	LITHOLOGY/DESCRIPTION	MOISTURE CONTENT	SAMPLE DEPTH IN FEET		DESCRIPTION OF OPERATION AND REMARKS
					FROM	TO	
215		CLAYSTONE	214.1 - 217.4 ft V. weak-weak, med H gr (N6) CLAYSTONE	NA (drilling with water)			Run 19: 209 - 219 ft Poor Recovery 5.1' / 10'
	12.5	COAL + CLAYSTONE	217.4 - 218.3 ft Weak, brn blk (5YR2.5) COAL, mod. wthd, platy, interb. with grn gr (5G6/1) CLAYSTONE at base			216.6	
	15	CLAYSTONE	218.3 - 218.8 ft Weak, grn gr (5G6/1) CLAYSTONE			218.6	
		SILTSTONE	218.8 - 224 ft. Weak, H olv gr (5Y4/1) to med gr (NS) SILTSTONE w/ olv gr (5Y4/1) bands of SILTSTONE, little v. fine gr. sand			220.6	
220		SILTSTONE	221.3 - 221.5 ft Ext. strong, yell gr (5Y8/1) claystone lens		221.5		221.5 - 224 ft: Core loss assumed based on rock strength and core diameter
		SILTSTONE	221.5 - 224 ft: NO RECOVERY				
224			TD = 224 feet				224 ft: End drilling on 10/21/2009 at 13:50 Ream with 8" bit to depth = 214 feet on 10/22/2009 from 8:15 to 16:15

DRILLING CONTR Braum Intertec

DRILLERS Kyle Haag

LOGGED BY Ryan Tolene

DATE 10/21/2009 CHK'D BY E. P. Hoff

JOB NO.: 063-2212D

PROJECT: South Heart Project

PROJECT NUMBER: 063-2174

LOCATION: South Heart, ND

DRILL RIG: Gus Pech - RD 300

INCLINATION: -90°

DRILLING METHOD: Rotasonic

DATE STARTED: 09/26/06 15:05

DATE COMPLETED: 09/28/06 15:45

DRILLING FLUIDS: Water

DRILL LUBRICANTS: Well-Guard Monitor Well Thread Compound

RECORD OF BORING SHMW-04

COORDINATES: N: 443,811 E: 1,366,818

GROUND SURFACE ELEVATION: 2,543.8 ft

PROJECTION: StatePlane, North Dakota South, 3302

DATUM: NAD 27

UNITS: Feet

TOTAL DEPTH: 255.0 ft

BOTTOM ELEVATION: 2,288.8 ft

COLLAR ELEVATION: 2,547 ft (approximate)

HOLE DIAMETER: 6 inches

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
0.0		0.0 - 5.5 Firm, dusky yellowish brown (10YR, 2/2) to mottled tan brown/lt. brown, sandy SILT, turning to sandy clayey SILT, med. to coarse grained, 12-30% clay, moist to v. moist						Note: Geologic scale was used for grain size descriptions (v. fine through v. coarse)
2540		2.5' silt content increases					Analytical Sample SHMW04D 4-5	Run 1: 0-5'
5.0		5.5 - 10.5 Black, COAL, med. to coarse sand, tr. to little silt, some bright surfaces, oc. whitish calcium deposits, v. moist		2538.3 5.5	COAL			Run 2: 5'-15' Driller used water to push out core
10.0		10.5 - 16.0 V. stiff to dense, olive gray (5Y, 4/1), sandy CLAYSTONE, fine grained, laminations present, 30-50% clay, some silt, occ. calcium deposits (thin), v. moist		2533.3 10.5		v. moist	Analytical Sample SHMW04D 5-10 Analytical Sample SHMW04D 12-14	
15.0		15.0' becomes moist					Analytical Sample SHMW04D 16-18	Run 3: 15'-25'
2525		16.0 - 25.0 Firm, med. gray, silty CLAYSTONE, sli. laminated, turning mottled dusky yellow (5Y, 6/4) to pale olive (10Y, 6/2), sli. blocky, moist			Clst	moist		
20.0		19' becomes moist to v. moist					Analytical Sample SHMW04D 21-23	
2520								
25.0		25.0 - 27.0 Stiff to v. stiff, weathered, med. gray (N5) to dk. greenish gray (5GY, 4/1), SHALE, sli. blocky, sli. to mod. laminated, moist to v. moist		2518.8 25.0	Sh	moist to v. moist		25' Rain event stopped drilling at 16:10 on 9/28/06 Resume drilling 9/29/06 Run 4: 25'-35' Driller used water to drive casing
2515		27.0 - 31.0 Lt. to med. gray (N7 to N5), silty CLAYSTONE / clayey SILTSTONE, moist to v. moist		2516.8 27.0	Clst / Siltst		Analytical Sample SHMW04D 27-30	
30.0		Log continued on next page						

MW_GNPD_SH_OB AND MW_UPDATED SURVEY DATA 4_48_08_GPJ_GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
DRILLER: Alvin Anderson

GEOLOGIST: R. Marchese
CHECKED: A. Hobson
DATE: 2/22/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-04

COORDINATES: N: 443,811 E: 1,366,818
 GROUND SURFACE ELEVATION: 2,543.8 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
30.0		29' silt content increases		2512.8	Clst / Siltst		Analytical Sample SHMW04D 30-32	
		31.0 - 33.0 Stiff, dk. gray (N3) to grayish black (N2), silty CLAYSTONE, mod. to prominent laminations, tr. silt, moist to v. moist		31.0	Clst	moist to v. moist		
	2510	32.5' thin COAL stringer underlain by lt. gray silty CLAYSTONE as above		2510.8	COAL			
		33.0 - 35.0 Loose to broken, blackish red (5R, 2/2), silty COAL, dull w/ bright faces, moist		2508.8		moist		
		35.0 - 39.0 Dense, weathered, med. lt. gray (N6), SHALE, mod. blocky, 12-30% silt, occ. rusty inclusions, moist		2504.8	Sh		Analytical Sample SHMW04D 37-38	Run 5: 35'-45' Driller used water to push out core
	2505	39.0 - 42.0 Soft, lt. gray to med. gray, sandy SILTSTONE, fine to med. grained, occ. alternating brownish gray color bands, v. moist to wet		39.0	Siltst	v. moist to wet	Analytical Sample SHMW04D 39-42	
		41'-41.5' zone of dense, silty CLAY		2501.8				
		42.0 - 45.0 Dense, mod. to highly weathered, dk. gray turning to pale olive gray, SHALE, sli. blocky, sli. brittle, bedding planes, 12-30% clay, occ. rusty inclusions, moist to v. moist		2498.8	Sh			
	45.0	45.0 - 53.0 V. dense to hard, med. lt. gray (N6) alternating w/ lt. gray (N7), clayey SILTSTONE, little clay, tr. to little fine sand, w/ interbedded zones of dense, silty CLAYSTONE, moist to v. moist		45.0			Analytical Sample SHMW04D 46-49	Run 6: 45'-55'
	2495				Siltst / Clst	moist to v. moist		▼ WL = 48.8' (9-29-06, 0730) Boring Depth = 255, Casing Depth = 160
		52.5' thin COAL stringer		2490.8	Sh		Analytical Grab Sample at 54'	
	2490	53.0 - 55.0 V. dense to hard, mod. weathered, dk. greenish gray (5G, 4/1), SHALE, sli. bedding planes, tr. silt, strong rock (several blows required to separate), moist to v. moist		2488.8			Analytical Grab Sample at 56'	Run 7: 55'-69' Driller's Note: part of core fell out, so Alvin went back down; packed core barrel full to retrieve lost core, drilling to 69'. Core became more wet because it was cored twice. Consequently, moisture contents may not be indicative of natural conditions
		55.0 - 69.0 Dense to compact to soft, lt. gray to med. gray, silty SANDSTONE to sandy SILTSTONE, poorly graded, tr. clay, wet				wet		
	2485	58.5'-66' increase in fine to med. sand content					Analytical Grab Sample at 61'	
	60.0	59'-63.5' wet to saturated			Ss / Siltst	wet to sat.		
							Analytical Grab Sample at 66'	
	2480	63.5'-69' v. moist				v. moist		

Log continued on next page

MW_GNPD_SH_OB AND MW_UPDATED SURVEY DATA 4_48_08_GP.J GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
 DRILLER: Alvin Anderson

GEOLOGIST: R. Marchese
 CHECKED: A. Hobson
 DATE: 2/22/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-04

COORDINATES: N: 443,811 E: 1,366,818
 GROUND SURFACE ELEVATION: 2,543.8 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
70.0	2475	69.0 - 85.5 Black (N1) to brownish black, COAL, dull w/ some bright faces, some dk. brown silt, sli. cleating, wet		2474.8 69.0	Ss / Siltst	v. moist		Coal encountered at 69' Run 8: 69'-80'
75.0	2470				COAL	wet		
80.0	2465	80.0' becomes moist to v. moist						Run 9: 80'-91' Driller used water to push out core
85.0	2460			2458.3 85.5				
85.5 - 91.0		Highly weathered, med. dk. gray (N4) to lt. gray (N7), SHALE, 30-50% clay, sli. to mod. blocky, moist to v. moist			Sh	moist to v. moist	Analytical Grab Sample at 87'	
90.0	2455							
91.0 - 95.0		Dense to v. stiff, weak, weathered, lt. gray to med. dk. gray, silty SHALE, mod. blocky, sli. laminated, moist to v. moist					Analytical Grab Sample at 92'	Run 10: 91'-104'
95.0	2450			2448.8 95.0				
95.0 - 104.0		Dense to v. stiff, weak, weathered, med. gray (N5) to dk. gray (N3), SILTSTONE, mod. blocky, sli. laminated, interbedded zones of v. stiff, prominently laminated CLAYSTONE, moist			Siltst / Clst	moist	Analytical Grab Sample at 97'	
100.0	2445						Analytical Grab Sample at 102'	
104.0	2440			2439.8 104.0	Clst	moist to v. moist	Analytical Sample	

Log continued on next page

MW_GNPD_SH_OB AND MW_UPDATED SURVEY DATA 4_48_GPJ_GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
 DRILLER: Alvin Anderson

GEOLOGIST: R. Marchese
 CHECKED: A. Hobson
 DATE: 2/22/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-04

COORDINATES: N: 443,811 E: 1,366,818
 GROUND SURFACE ELEVATION: 2,543.8 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
105.0		104.0 - 108.0 Dense, v. compact, olive gray (5Y, 3/2), silty CLAYSTONE, 12-30% clay, tr. v. fine sand, moist to v. moist			Clst		SHMW04D 104-105	Run 11: 104'-115'
	2435	108.0 - 112.0 V. stiff, weathered SHALE, moist to v. moist		2435.8 108.0	Sh	moist to v. moist	Analytical Grab Sample at 109'	
110.0		112.0 - 115.0 Dense, v. compact, olive gray (5Y, 3/2), silty CLAYSTONE, 12-30% clay, tr. v. fine sand, moist to v. moist		2431.8 112.0	Clst		Analytical Grab Sample at 114'	
	2430	115.0 - 121.0 Dense to v. stiff, weathered, med. gray (N5) to med. dk. gray (N4), SHALE, tr. to little silt, sli. laminated, low plasticity, moist		2428.8 115.0	Sh	moist	Analytical Grab Sample at 119'	Run 12: 115'-131' Driller's Note: Most of core fell out of core barrel during extraction. Alvin will trip back down to retrieve remaining core after drilling another 4'. Will drive 6" casing to approx. 135' to continue coring. Currently drilled w/ casing at 35'. Significant amount of water entering hole from upper zone.
115.0		121.0 - 124.0 V. dense, med. gray (N5) to med. dk. gray (N4), SANDSTONE, well-graded, 5-12% silt, v. moist		2422.8 121.0	Ss	v. moist		
	2425	124.0 - 136.0 Med. dk. gray (N4) to med. gray (N5), clayey SILTSTONE, stratified, sli. laminated, sli. blocky, moist		2419.8 124.0	Siltst	moist	Analytical Grab Sample at 124'	
125.0		132' color change to olive gray (5Y, 4/1)					Analytical Grab Sample at 129'	Run 13: 131'-135'
	2415	135' color change to olive gray (5Y, 3/2)					Analytical Grab Sample at 134'	
130.0		136.0 - 138.0 Black (N1) to brownish black (5YR, 2/1), sandy silty COAL, 30-50% med. to fine sand and silt, dull w/ some bright faces, wet to saturated		2407.8 136.0	COAL	wet to sat.		Run 14: 135'-145' Note: low to no rxn. w/ HCl
	2410	138.0 - 145.0 Dense to compact, dk. greenish gray, silty SANDSTONE, well-graded, v. moist to wet		2405.8 138.0	Ss	v. moist to wet	Analytical Grab Sample at 139'	
135.0								
140.0								

Log continued on next page

MW_GNPD_SH_OB AND MW_UPDATED SURVEY DATA 4_48_08.GPJ GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
 DRILLER: Alvin Anderson

GEOLOGIST: R. Marchese
 CHECKED: A. Hobson
 DATE: 2/22/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-04

COORDINATES: N: 443,811 E: 1,366,818
 GROUND SURFACE ELEVATION: 2,543.8 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
2400	138.0 - 145.0	Dense to compact, dk. greenish gray, silty SANDSTONE, well-graded, v. moist to wet				v. moist to wet	Analytical Grab Sample at 144'	
145.0	145.0 - 162.0	Compact, dk. greenish gray (5GY, 4/1), SANDSTONE, well-graded, 12-30% silt, sli. stratified, sli. liquefaction, occ. alternating brownish gray (5YR, 4/1) and brownish black (5YR, 2/1) lenses (silt?), low to no rxn. w/ HCl, wet to saturated						Run 15: 145'-155'
2395	153'-154'	possible coal stringers				wet to sat.	Analytical Sample SHMW04D 148-153	
2390	156'	sli. mottled brownish gray (5YR, 4/1) and dk. greenish gray (5GY, 4/1)					Analytical Sample SHMW04D 153-158	Run 16: 155'-163' Note: low rxn w/ HCl
2385	160'	becomes more dense			Ss		Analytical Sample SHMW04D 158-163	
2380	162.0 - 163.0	V. strong to ext. strong, med. lt. gray (N6) to dk. greenish gray (5GY, 4/1), SANDSTONE, coarse grained, some powder, dry		2381.8 162.0 2380.8 163.0		dry		Note: Could not fracture Sandstone specimen w/ geologic hammer (R5-R6). Mod. to strong rxn w/ HCl. 163' End drilling 9/27/06 Resume drilling 9/28/06 Run 17: 163'-175' Note: no rxn w/ HCl Note: drilled through Sandstone layer at about 163.5', then rest of run was sand
2375	163.0 - 190.0	Compact to dense, dk. greenish gray (5GY, 4/1), SANDSTONE, well-graded, 12-30% silt, 0-5% clay, v. moist to wet				v. moist to wet	Analytical Sample SHMW04D 163-168 and BD 092806RT	
2370	175'	becomes v. moist with increased coarse sand content					Analytical Sample SHMW04D 168-173	
2365						v. moist	Analytical Sample SHMW04D 173-180	Run 18: 175'-185' Driller used water to push out core Note: no rxn w/ HCl Note: upper 5' of core is slough from above (sat. sand)
180.0	Log continued on next page							

MW_GNPD_SH_OB AND MW_UPDATED SURVEY DATA 4_48_08_GP.J GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
 DRILLER: Alvin Anderson

GEOLOGIST: R. Marchese
 CHECKED: A. Hobson
 DATE: 2/22/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-04

COORDINATES: N: 443,811 E: 1,366,818
 GROUND SURFACE ELEVATION: 2,543.8 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
180.0		163.0 - 190.0 Compact to dense, dk. greenish gray (5GY, 4/1), SANDSTONE, well-graded, 12-30% silt, 0-5% clay, v. moist to wet					Analytical Sample SHMW04D 180-185	
2360					Ss	v. moist		
185.0							Analytical Sample SHMW04D 185-190	Run 19: 185'-195' Driller used water to push out core Note: upper 3'-4' of core is slough from above
2355				2353.8				
190.0		190.0 - 194.0 V. dense to hard, weathered, dk. greenish gray (5GY, 4/1) to grayish olive (10Y, 4/2), SHALE, bedding planes apparent, waxy appearance on bedding plane surfaces, sli. angular/blocky structure, occ. large (1"-2") fragments of hard, mod. olive brown (5Y, 4/4) to mod. yellowish brown (10YR, 4/4) siltstone, moist		190.0	Sh		Analytical Sample SHMW04D 190-195	Note: Lithology change at approx. 190'. Contact of well-graded SANDSTONE and SHALE units apparent (possible confining layer?)
2350				2349.8	Ss			
195.0		194.0 - 194.2 Soft to firm, SANDSTONE, well-graded, moist		194.0				
2345		194.2 - 195.5 V. dense to hard, weathered, olive black (5Y, 2/1) to greenish black (5GY, 2/1), SHALE, waxy appearance, poss. carbonaceous, occ. siltstone fragments, moist				moist	Analytical Sample SHMW04D 195-200	Run 20: 195'-205' Driller used water to push out core Driller's Note: Hard drilling through this run
200.0		195.5 - 201.0 Dense, highly weathered, mod. dk. gray (N4), SHALE, 5-12% silt, thinly bedded, sli. blocky, becoming varved w/ alternating bands of brownish black (5YR, 2/1) laminations, low plasticity, moist			Sh			
2340		201.0 - 202.0 V. dense to hard, highly weathered, dk. gray (N3), SHALE, 5-12% silt, thinly bedded, sli. blocky, becoming varved w/ alternating bands of lt. gray (N7) and olive gray (5Y, 4/1), laminations (waxy appearance on planar surfaces, low plasticity, moist					Analytical Sample SHMW04D 200-204	
205.0		202.0 - 205.0 V. dense to hard, highly weathered, olive gray (5Y, 4/1) to olive black (5Y, 2/1), SHALE, 5-12% silt, thinly bedded, sli. blocky, becoming varved, laminations (waxy appearance on planar surfaces, low plasticity, carbonaceous, moist		2338.8				6" casing driven to 195'
2335		205.0 - 221.0 Loose, black (N1) to blackish red (5R, 2/2), COAL, abundant pyrite crystals, mostly dull w/ bright fresh faces, v. fissile, intermixed dk. brown silt, no visible sulfur, v. moist to wet		205.0	COAL	v. moist to wet		Run 21: 205'-220' Driller used water to push out core
210.0								
2330								
215.0								

Log continued on next page

MW_GNPD_SH_OB AND MW_UPDATED SURVEY DATA 4_48_08_GP.J GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
 DRILLER: Alvin Anderson

GEOLOGIST: R. Marchese
 CHECKED: A. Hobson
 DATE: 2/22/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-04

COORDINATES: N: 443,811 E: 1,366,818
 GROUND SURFACE ELEVATION: 2,543.8 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
220.0	2325	205.0 - 221.0 Loose, black (N1) to blackish red (5R, 2/2), COAL, abundant pyrite crystals, mostly dull w/ bright fresh faces, v. fissile, intermixed dk. brown silt, no visible sulfur, v. moist to wet		2322.8	COAL	v. moist to wet		Run 22: 220'-235' Driller used water to push out core Upper 1'-1.5' is coal slough from above
225.0	2320	221.0 - 224.0 V. dense, dk. greenish gray (5GY, 4/1), sandy SILTSTONE, fine grained, little fine to med. sand, moist		221.0	Siltst		Analytical Sample SHMW04D 222-227	
230.0	2315	224.0 - 227.0 V. dense, dk. greenish gray (5GY, 4/1), sandy SILTSTONE, fine grained, little fine to med. sand, stratified, varved, moist		2316.8	Siltst		Analytical Sample SHMW04D 227-232	
235.0	2310	227.0 - 235.0 V. dense to hard, highly weathered, dk. gray (N3) to dk. greenish gray (5GY, 3/1) to med. lt. gray (N7), CLAYSTONE, sli. blocky, thinly to mod. bedded, becoming sandy CLAYSTONE, fine grained, 12-30% silt, occ. stratified, moist		227.0	Clst	moist	Analytical Sample SHMW04D 227-232	
240.0	2305	231' Thin reddish brown coalified wood stringer		2308.8	Clst		Analytical Sample SHMW04D 232-235	
245.0	2300	235.0 - 238.0 V. dense, weathered, SILTSTONE, 5-12% clay, interbedded lenses of soft, wet siltstone, moist to v. moist		235.0	Siltst		Analytical Sample SHMW04D 235-240	Run 23: 235'-243'
250.0	2295	238.0 - 240.0 Dense to v. dense, olive gray (5Y, 4/1) to brownish gray (5YR, 4/1), clayey SILTSTONE, 12-30% clay, mod. stratified, moist to v. moist		240.0	Siltst		Analytical Sample SHMW04D 240-243	
255.0	2290	240.0 - 243.0 V. dense, greenish black (5GY, 2/1), CLAYSTONE, 5-12% silt, sli. blocky, sli. waxy surfaces, sli. laminated, sub-fissile, moist to v. moist		2300.8	Clst		Analytical Sample SHMW04D 240-243	
		241.5'-242' carbonaceous SHALE		243.0	Siltst / Clst	moist to v. moist	Analytical Sample SHMW04D 243-250	Run 24: 243'-255'
		243.0 - 247.0 Weathered, dk. greenish gray (5GY, 4/1) to med. gray (N5), SILTSTONE, thinly laminated, interbedded w/ silty CLAYSTONE, moist to v. moist		2296.8	Siltst / Clst	moist to v. moist	Analytical Sample SHMW04D 243-250	
		247.0 - 249.0 Hard, med. lt. gray (N6), SILTSTONE, fractured, interbedded powdery white silt, mod. rxn. w/ HCl, moist to v. moist		247.0	Siltst		Analytical Sample SHMW04D 251-255	
		249.0 - 255.0 V. dense, weathered, thin alt. bands of med. dk. gray (N4) and dk. greenish gray (5GY, 4/1), clayey SILTSTONE, mod. stratified, 5-12% fine sand, moist to v. moist		2288.8	Siltst		Analytical Sample SHMW04D 251-255	TD = 255' (9-28-06, 1700)

Log continued on next page

MW_GNPD_SH_OB AND MW_UPDATED SURVEY DATA 4_48_08.GPJ GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
 DRILLER: Alvin Anderson

GEOLOGIST: R. Marchese
 CHECKED: A. Hobson
 DATE: 2/22/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-04

COORDINATES: N: 443,811 E: 1,366,818
 GROUND SURFACE ELEVATION: 2,543.8 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV.	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
				DEPTH (ft)				
255.0		254' becomes noticeably varved		255.0				
		<u>Boring completed at 255.0 ft</u>						
260.0								
265.0								
270.0								
275.0								
280.0								
285.0								
290.0								

MW_GNPD_SH_OB AND MW_UPDATED SURVEY DATA 4_48_08_GP.J GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
 DRILLER: Alvin Anderson

GEOLOGIST: R. Marchese
 CHECKED: A. Hobson
 DATE: 2/22/2007

PROJECT: South Heart Project

PROJECT NUMBER: 063-2174

LOCATION: South Heart, ND

DRILL RIG: Gus Pech - RD 300

INCLINATION: -90°

DRILLING METHOD: Rotasonic

DATE STARTED: 09/30/06 14:22

DATE COMPLETED: 10/03/06 12:19

DRILLING FLUIDS: Water

DRILL LUBRICANTS: Well-Guard Monitor Well Thread Compound

RECORD OF BORING SHMW-05

COORDINATES: N: 441,206 E: 1,353,789

GROUND SURFACE ELEVATION: 2,638.6 ft

PROJECTION: StatePlane, North Dakota South, 3302

DATUM: NAD 27

UNITS: Feet

TOTAL DEPTH: 250.0 ft

BOTTOM ELEVATION: 2,388.6 ft

COLLAR ELEVATION: 2,641 ft (approximate)

HOLE DIAMETER: 6 inches

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
0.0		0.0 - 1.0 Dk. yellowish brown (10YR, 4/2), CLAY / TOPSOIL, many roots, tr. gravel, moist		2637.6	CL	moist		Note: Geologic scale was used for grain size descriptions (v. fine through v. coarse)
		1.0 - 3.0 Hard to v. hard, mod. yellowishbrown CLAY, sli. bedding, mottled, sli. moist		2635.6	CL	sli. moist		
	2635	3.0 - 5.0 no recovery		2633.6		unknown		
5.0		5.0 - 12.0 Stiff to v. stiff, mottled mod. olive brown (5Y, 4/4) and lt. olive brown, CLAYSTONE, fissile, occ. stringers of lighter material and dryer material, many leaf impressions, moist		2630	Clst		Analytical Sample SHMW05D 5-10 and BD 093006RMW	5'-10' run was dropped on drill rig - possibly incorrect order w/in run
	2625	12.0 - 16.0 V. stiff, mod. olive brown (5Y, 4/4), CLAYSTONE, tr. hallite increasing w/ depth, NR w/ HCl, moist		2625			moist	
	2620	16.0 - 16.5 Firm, dusky brown (5YR, 2/2), CLAYSTONE, mottled, moist		2621.6	Stlst		Analytical Sample SHMW05D 17-20	
	2620	16.5 - 17.0 V. stiff, mod. olive brown (5Y, 4/4), CLAYSTONE, tr. hallite increasing w/ depth, NR w/ HCl, moist		17.0				
	2620	17.0 - 20.0 V. stiff, lt. olive gray (5Y, 5/2), SILTSTONE, oxidized stringers, moist		2618.6	Sh			
	2615	20.0 - 21.0 Mod. olive brown (5Y, 4/4), SHALE, blocky, moist		2617.6	Clst / Ss			
	2615	21.0 - 22.0 V. stiff, dk. yellowish brown (10YR, 4/2), silty CLAYSTONE w/ interbedded SANDSTONE, fine to med. grained, laminated, partially coalified wood fragments, moist		2616.6	Clst		Analytical Sample SHMW05D 22-26	
	2615	22.0 - 26.0 Mottled lt. olive brown (5Y, 5/6) and olive gray (5Y, 3/2), CLAYSTONE, tr. hallite, partially coalified wood impressions, moist		2612.6				
	2610	26.0 - 26.5 Stiff, highly weathered, grayish black (N2), COAL, sli. moist		2612.1	COAL	sli. moist		
	2610	26.5 - 32.0 V. stiff, med. dk. gray (N4), SILTSTONE, sli. bedding increasing w/ depth, ox. stringers, moist		26.5	Stlst	moist	Analytical Sample SHMW05D 27-32	

Log continued on next page

MW_GNPD_SH_OB AND MW_UPDATED SURVEY DATA 4_48_08_GP.J GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
DRILLER: Tom Devick

GEOLOGIST: J. Elliott / R. Witt
CHECKED: A. Hobson
DATE: 2/22/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-05

COORDINATES: N: 441,206 E: 1,353,789
 GROUND SURFACE ELEVATION: 2,638.6 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
2570	70.0	68.0 - 74.0 Extremely weak, med. bluish gray (5B, 5/1), silty SANDSTONE, laminated, fissile, moist Color changes to med. gray (N4)	x x x	2570.6 68.0	Siltst	moist	65-68 and Reference Sample SHMW05D 65-68 Analytical Sample SHMW05D 69-74 and Reference Sample SHMW05D 69-74	Reference Sample also collected from 69-74'
2565	75.0	74.0 - 75.0 Hard, lt. gray (N7), mottled fine SANDSTONE and SILTSTONE, sli. moist 75.0 - 100.0 Extremely weak, med. gray (N5), SANDSTONE, fine grained, laminated, fissile, sli. moist		2564.6 74.0 2563.6 75.0	Ss / Siltst		Analytical Sample SHMW05D 75-80	Driller adding water to soften hard material - moisture contents likely affected
2555	85.0						Analytical Sample SHMW05D 80-85	▼ WL = 82' (10-2-06, 0700) Boring Depth = 115, Casing Depth = 115
2550	90.0				Ss	sli. moist	Analytical Sample SHMW05D 85-90	
2545	95.0						Analytical Sample SHMW05D 90-95	90' driller notes easier drilling - seems to correspond w/ v. slight moisture increase
2540	100.0						Analytical Sample SHMW05D 95-100	
2535	105.0	100.0 - 115.0 Extremely weak, brownish gray (5YR, 4/1), silty SANDSTONE, fine to v. fine grained, honeycomb structure, sli. moist					Analytical Sample SHMW05D 100-105	

Log continued on next page

MW_GNPD_SH_OB AND MW_UPDATED SURVEY DATA 4_48_GP.J GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
 DRILLER: Tom Devick

GEOLOGIST: J. Elliott / R. Witt
 CHECKED: A. Hobson
 DATE: 2/22/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-05

COORDINATES: N: 441,206 E: 1,353,789
 GROUND SURFACE ELEVATION: 2,638.6 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS	
105.0		100.0 - 115.0 Extremely weak, brownish gray (5YR, 4/1), silty SANDSTONE, fine to v. fine grained, honeycomb structure, sli. moist	[Dotted pattern]		Ss	sli. moist	Analytical Sample SHMW05D 105-110	Hard material pulverised, most of run lost. Possible that increasing moisture at 110' is due to drilling water 115' End drilling 10/1/06 Resume drilling 10/2/06	
2530		110' changes from sli. moist to moist							Analytical Sample SHMW05D 110-115
110.0		115.0 - 124.0 Extremely weak, lt. olive gray (5Y, 6/1), SANDSTONE, fine grained, horizontally stratified, sub-fissile, moist							moist
2525							Analytical Sample SHMW05D 120-124		
115.0				2514.6					
120.0				124.0					
125.0		124.0 - 133.0 V. stiff, olive gray (5Y, 4/1), silty CLAYSTONE, tr. fine sand, massive, mod. plasticity, moist	[Green diagonal lines]		Clst		Analytical Sample SHMW05D 124-129		
2510		128' - Hard, yellowish gray (5Y, 8/1), silty CLAYSTONE stringer, dry 128.5' - Narrow (<0.5") band of coalified wood					dry	Analytical Sample SHMW05D 129-133	
130.0				2505.6					
2505		133.0 - 136.0 Extremely weak, med. gray (N5), clayey SANDSTONE, fine to v. fine grained, mottled consistency w/ some zones more clayey than others, moist		133.0			Analytical Sample SHMW05D 133-136		
135.0		136.0 - 152.5 Extremely weak, med. gray (N5), SANDSTONE, mostly fine grained and sub-rounded, little silt, massive, moist			Ss		Analytical Sample SHMW05D 136-141		
2500									
140.0									

Log continued on next page

MW_GNPD_SH_OB AND MW_UPDATED SURVEY DATA 4_48_08_GP.J GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
 DRILLER: Tom Devick

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RECORD OF BORING SHMW-05

COORDINATES: N: 441,206 E: 1,353,789
 GROUND SURFACE ELEVATION: 2,638.6 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS	
2495	145.0	136.0 - 152.5 Extremely weak, med. gray (N5), SANDSTONE, mostly fine grained and sub-rounded, little silt, massive, moist			Ss	moist	Analytical Sample SHMW05D 141-146	152.5' Driller notes change in drilling conditions COAL from 152.5' to 155.0' logged by Dave Leppert of Norwest	
		145' becomes moist to v. moist							
2490	150.0	148' partially coalified wood veins 149'-150' tr. strong pyrite coated nodules (1/4"-1" dia.) poss. marcasite					moist to v. moist		Analytical Sample SHMW05D 146-151
2485	155.0	152.5 - 155.0 Black (N1) COAL, sli. moist		2486.1 152.5		sli. moist			
		155.0 - 175.0 Brownish black (N1), COAL as above, dry to sli. moist				COAL	dry to sli. moist		
2475	165.0			2463.6 175.0			Analytical Sample SHMW05D 175-177.5		
2470	170.0	175.0 - 177.5 Hard, med. gray (N5), CLAYSTONE, little silt, horizontally stratified, sil. moist to moist		2461.1 177.5		sli. moist to moist			
2465	175.0	177.5 - 178.0 Extremely weak, v. lt. gray (N8), SANDSTONE, fine grained, dry				Ss	dry moist		

Log continued on next page

MW_GNPD_SH_OB AND MW_UPDATED SURVEY DATA 4_48_08.GPJ GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
 DRILLER: Tom Devick

GEOLOGIST: J. Elliott / R. Witt
 CHECKED: A. Hobson
 DATE: 2/22/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-05

COORDINATES: N: 441,206 E: 1,353,789
 GROUND SURFACE ELEVATION: 2,638.6 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
180.0		178.0 - 179.5 Extremely weak, med. dk. gray (N4), silty SANDSTONE, fine grained, horizontally stratified, moist				sli. moist / moist		Run 181'-190' pulled 10/2/06, logged 10/3/06
		Partially coalified wood band				dry		
2455		179.5 - 180.5 Extremely weak, lt. gray (N7), SANDSTONE, fine grained, tr. silt, tr. clay, sli. moist			Ss			
185.0		180.5 - 182.0 Extremely weak, med. lt. gray (N6), silty SANDSTONE, fine grained, fissile, horizontally stratified, moist				moist	Analytical Sample SHMW05D 184-188	
		182.0 - 184.0 Med. strong to strong, v. lt. gray (N8), SANDSTONE, w/ two 1" stringers of grayish black (N2) sandstone, dry				dry	Rep. Sample 188-189'	190' End drilling 10/2/06 Resume drilling 10/3/06
2450		184.0 - 188.0 Extremely weak, dk. greenish gray (5G, 4/1), silty SANDSTONE, moist		2449.6 189.0				
190.0		188.0 - 189.0 V. strong, lt. gray (N7), SANDSTONE, coalified wood stringers (<1mm to 3mm), tr. pyrite, dry			Ss / Clst	moist / dry (intrbd)		
		189.0 - 193.0 Extremely weak, dk. greenish gray (5G, 4/1), SANDSTONE, moist --interbedded with-- brownish gray (5YR, 4/1) CLAYSTONE and v. strong, lt. gray (N7), SANDSTONE, dry		2445.6 193.0				Analytical Sample SHMW05D 193-198
2445		193.0 - 238.0 Extremely weak, dk. greenish gray (5GY, 4/1), SANDSTONE, fine grained, little silt, massive, moist to v. moist						
195.0								
2440							Analytical Sample SHMW05D 198-203 and BD 100306RMW	
200.0								
2435								Analytical Sample SHMW05D 205-210
205.0					Ss	moist to v. moist		
2430								
210.0							Analytical Sample SHMW05D 210-215	
2425								Analytical Sample SHMW05D 215-220
215.0								

Log continued on next page

MW_GNPD_SH_OB AND MW_UPDATED SURVEY DATA 4_48_08_GP.J GNPP.GDT 4/29/08



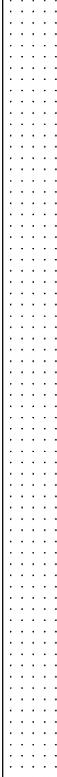
DRILLING CONTRACTOR: Boart Longyear
 DRILLER: Tom Devick

GEOLOGIST: J. Elliott / R. Witt
 CHECKED: A. Hobson
 DATE: 2/22/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-05

COORDINATES: N: 441,206 E: 1,353,789
 GROUND SURFACE ELEVATION: 2,638.6 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV.	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
				DEPTH (ft)				
2420	193.0 - 238.0	Extremely weak, dk. greenish gray (5GY, 4/1), SANDSTONE, fine grained, little silt, massive, moist to v. moist			Ss	moist to v. moist	Analytical Sample SHMW05D 215-220	
220.0	220' material strengthens, but remains extremely weak rock			Analytical Sample SHMW05D 220-225				
2415				Analytical Sample SHMW05D 225-230				
2410				Analytical Sample SHMW05D 230-235				
2405				Analytical Sample SHMW05D 235-238				
2400	238.0 - 239.5	Stiff to v. stiff, olive gray (5Y, 4/1), SHALE, some sand, fissile, partially coalified wood fragments throughout, moist		2400.6 238.0	Sh	moist		
240.0	239.5 - 244.0	Stiff to v. stiff, greenish gray (5G, 6/1), SHALE, non-fissile, blocky, moist					Analytical Sample SHMW05D 239.5-242	
2395	244.0 - 250.0	Stiff to v. stiff, interbedded pale olive gray (10Y, 6/2) and olive gray (5Y, 3/2), SHALE, non-fissile, moist		2394.6 244.0			Analytical Sample SHMW05D 242-244	
2390							Analytical Sample SHMW05D 244-250	
250.0				2388.6 250.0				TD = 250' (10/3/06, 1219)
Boring completed at 250.0 ft								

MW_GNPD_SH_OB AND MW UPDATED SURVEY DATA 4_48_08.GPJ GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
 DRILLER: Tom Devick

GEOLOGIST: J. Elliott / R. Witt
 CHECKED: A. Hobson
 DATE: 2/22/2007

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PROJECT: South Heart Project

PROJECT NUMBER: 063-2174

LOCATION: South Heart, ND

DRILL RIG: Gus Pech - RD 300

INCLINATION: -90°

DRILLING METHOD: Rotasonic

DATE STARTED: 09/26/06 15:40

DATE COMPLETED: 09/29/06 16:00

DRILLING FLUIDS: Water

DRILL LUBRICANTS: Well-Guard Monitor Well Thread Compound

RECORD OF BORING SHMW-06

COORDINATES: N: 438,877 E: 1,364,184

GROUND SURFACE ELEVATION: 2,549.9 ft

PROJECTION: StatePlane, North Dakota South, 3302

DATUM: NAD 27

UNITS: Feet

TOTAL DEPTH: 252.0 ft

BOTTOM ELEVATION: 2,297.9 ft

COLLAR ELEVATION: 2,552 ft (approximate)

HOLE DIAMETER: 6 inches

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS	
0.0		0.0 - 1.5 Firm, dk. yellowish brown (10YR, 4/2), clayey silty SAND, fine to med. grained, many roots, dry		2548.4	SM-SC	dry		Note: Geologic scale was used for grain size descriptions (v. fine through v. coarse)	
1.5		1.5 - 5.0 Dk. yellowishbrown (10YR, 4/2), CLAY, tr. gravel, sli. laminated (1 lam. every 0.1'-0.2'), sli. moist		1.5	CL	sli. moist	Analytical Sample SHMW06 1.5-5		
5.0	2545	5.0 - 8.0 Firm, mottled dk. yellowish brown (10YR, 4/2) and mod. yellowish brown (10YR, 3/4), sandy CLAY, no-low plasticity, 30-40% fine to med. sand, sli. moist		8.0				Analytical Sample SHMW06 5-8	
8.0		8.0 - 11.5 Very weak, loose, mottled dk. yellowish brown (10YR, 4/2) and mod. yellowish brown (10YR, 3/4), clayey SANDSTONE, sli. moist		2541.9	Ss	dry		Driller's Note: Consistently hard drilling from 11'-30', switch bits and continue	
11.5		11.5 - 16.0 V. weak to extremely weak, yellowish gray (5Y, 7/2), SANDSTONE, poorly graded, v. fine to med. grained, sli. stratified, tr. clay, dry		15.0			2535		Analytical Sample SHMW06 11.5-15
13'-15'		13'-15' no clay, mod. rxn w/ HCl						Reference Sample also collected from 15-20'	
14.5'-14.8'		14.5'-14.8' oxidized stringer, dk. yellowish orange (10YR, 6/6)					Analytical Sample SHMW06 15-20		
16.0		16.0 - 21.5 V. loose, yellowish gray (5Y, 7/2), SANDSTONE, fine-med grained, tr. silt, poorly graded, moist						Reference Sample also collected from 21.5-25'	
21.5		21.5 - 25.0 Loose, mottled lt. olive brown (5Y, 5/6) and mod. olive brown (5Y, 4/4), silty SANDSTONE, v. fine to coarse grained, tr. bands of alternating colors, mod. stratified, v. poorly consolidated, moist					Analytical Sample SHMW06 21.5-25		
25.0	2525	25.0 - 30.0 Sli. compact, mottled lt. olive brown (5Y, 5/6) and mod. olive brown (5Y, 4/4), silty SANDSTONE, v. fine to coarse grained, coarsens w/ depth, tr. bands of alternating colors, mod. stratified, v. poorly consolidated, moist						Analytical Sample SHMW06 25-30	
30.0	2520	Log continued on next page							

MW_GNPD_SH_OB AND MW_UPDATED SURVEY DATA 4_48_08.GPJ GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
DRILLER: Tom Devick

GEOLOGIST: R. Witt
CHECKED: A. Hobson
DATE: 2/22/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-06

COORDINATES: N: 438,877 E: 1,364,184
 GROUND SURFACE ELEVATION: 2,549.9 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
30.0		30.0 - 33.0 Compact, lt. olive brown (5Y, 5/6), SANDSTONE, fine to coarse grained, 5-10% silt, sli. blocky, tr. alternating bands of lt. olive gray (5Y, 6/1), moist				moist	Analytical Sample SHMW06 30-35	33'-35' clay is probably a remnant in the sample barrel from 0-5' core not previously recovered
35.0	2515	33.0 - 35.0 Compact, lt. olive brown (5Y, 5/6), SANDSTONE, fine to coarse grained, 5-10% silt, sli. blocky, tr. alternating bands of lt. olive gray (5Y, 6/1), tr. bands of dk. yellowishbrown clay as seen at surface, moist				sli. moist	Analytical Sample SHMW06 35-37	
		35.0 - 37.0 V. weak, compact, lt. olive brown, SANDSTONE, fine to coarse grained, 5-15% silt, sli. moist			Ss	moist	Analytical Sample SHMW06 37-41	
40.0	2510	37.0 - 41.0 V. weak, dusky yellow (5Y, 6/4), silty SANDSTONE, fine to coarse grained, moist				dry to sli. moist	Analytical Sample SHMW06 41-45	
45.0	2505	41.0 - 45.0 Compact, yellowish gray (5Y, 7/2), SANDSTONE, med. to coarse grained, -- interbedded with -- lt. olive gray SILTSTONE in thin bands (0.5mm-1mm) spaced every 1/8" to 1/4", sli. moist to dry		2504.9				
		45.0 - 46.5 V. soft, mod. yellowish brown (10YR, 5/4), CLAYSTONE, highly plastic, mottled w/ clayey SANDSTONE from 46.5' to 53', v. moist		2503.4	Clst	v. moist		▼ WL = 46.62 (9-28-06, 1707) Boring depth = 205, Casing depth = 205
		46.5 - 53.0 Alt. color bands of lt. olive gray (5Y, 5/2), olive gray (5Y, 3/2), mod. olive brown (5Y, 4/4), clayey SANDSTONE, fine to coarse grained, fissile, sli. laminated, NR w/ HCl, moist		46.5			Analytical Sample SHMW06 46.5-51.5 and BD 092706JDE	
50.0	2500				Ss	moist		
		53.0 - 54.1 Black, COAL, v. moist		2496.9	COAL			
		54.1 - 54.5 Mottled dk. yellowish orange, mod. yellow (5Y, 7/6), and lt. olive gray, silty CLAYSTONE, w/ tr. to few halite crystals, NR w/ HCl		2495.4	Clst		Reference Grav Sample at 54'	All sample bags containing coal were left unopened - waiting for Dave Leppert of Norwest to sample coal
55.0	2495	54.5 - 54.7 Hard, black, COAL interbedded w/ CLAYSTONE from above		54.5				
		54.7 - 69.5 Black to blackish red, COAL, v. moist			COAL	v. moist		Driller's Note: Much harder drilling from 65'-69.5' - hence the 4.5' run

Log continued on next page

MW_GNPD_SH_OB AND MW_UPDATED SURVEY DATA 4_48_08_GP.J GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
 DRILLER: Tom Devick

GEOLOGIST: R. Witt
 CHECKED: A. Hobson
 DATE: 2/22/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-06

COORDINATES: N: 438,877 E: 1,364,184
 GROUND SURFACE ELEVATION: 2,549.9 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS	
		54.7 - 69.5 Black to blackish red, COAL, v. moist			COAL	v. moist			
70.0	2480	69.5 - 72.5 V. firm, mottled lt. olive gray (5Y, 5/2) and mod. olive brown (5Y, 4/4), silty SHALE, some coal fragments and partially coalified wood fragments, moist		2480.4 69.5	Sh		Analytical Sample SHMW06 69.5-72.5	Driller's Note: Much harder drilling still	
		72.5 - 75.0 V. weak, SHALE, blocky, --interbedded with-- olive gray (5Y, 3/2) SANDSTONE, fine to coarse grained, moist		2477.4 72.5	Sh / Ss	moist	Analytical Sample SHMW06 72.5-77.5 and Reference Sample SHMW06 72.5-77.5		
75.0	2475	75.0 - 77.5 V. firm, lt. olive gray (5Y, 5/2), clayey SANDSTONE, fine to coarse grained, tr. shale, blocky, sub-fissile, moist		2474.9 75.0	Ss			Note: Core hot enough to melt through core bag - drillers use hose to cool exterior of core barrel and try again to remove the core - core melted through the bag once again, losing significant recovery on the 69.5'-72.5' run 72.5'-75' Driller's Note: drilling got much easier again. Tom wanted to push 10' more, but R. Witt asked him to recover this sample and decon/rinse the core barrel before drilling deeper. Clayey portions may have been blocky SHALE prior to sonic vibration - this portion of core was in the barrel a long time due to the 15' run	
		77.5 - 88.0 Firm, lt. olive gray (5Y, 5/2), sandy SILTSTONE, fine to coarse grained, 10-15% clay, moist --interbedded in 1'-2.5' beds with-- lt. olive gray (5Y, 5/2), clayey SANDSTONE, tr. silt, med. to coarse grained (coarsening w/ depth), v. moist (thickness of sandstone beds increases w/ depth, thickness of siltstone beds decreases w/ depth)		2472.4 77.5	Siltst / Ss	moist / v. moist (intrbd)	Analytical Sample SHMW06 78-83		
85.0	2465						Analytical Sample SHMW06 83-88		
		88.0 - 90.0 Firm, lt. olive gray (5Y, 5/2), clayey SANDSTONE, med. to coarse grained, v. moist		2461.9 88.0	Ss	v. moist	Analytical Sample SHMW06 88-93		
90.0	2460	90.0 - 93.0 Firm, lt. olive gray (5Y, 5/2), clayey SANDSTONE, med. to coarse grained, wet				wet		Reference Sample representative of 80' to 105' core collected in addition to analytical samples over this range	
		93.0 - 97.0 Firm, lt. olive gray (5Y, 5/2), sandy SILTSTONE, fine to coarse grained, 10-15% clay, moist --interbedded in 0.5'-3' beds with-- lt. olive gray (5Y, 5/2), clayey SANDSTONE, tr. silt, med. to coarse grained (coarsening w/ depth), v. moist		2456.9 93.0	Siltst / Ss	moist / v. moist (intrbd)	Analytical Sample SHMW06 93-97		
95.0	2455								
		97.0 - 99.5 Lt. olive gray (5Y, 5/2), clayey SANDSTONE, fine to med. grained, tr. silt, fissile, sli. plastic, moist		2452.9 97.0		moist	Reference Grab Sample at 98' Analytical Sample SHMW06 97-99.5		
100.0	2450	99.5 - 105.0 Firm, lt. olive gray (5Y, 5/2), SANDSTONE, 20-30% clay, med. to coarse grained, v. moist			Ss	v. moist	Analytical Sample SHMW06 99.5-105		
105.0	2445	Log continued on next page							

MW_GNPD_SH_OB AND MW UPDATED SURVEY DATA 4_48_08_GP.J_GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
 DRILLER: Tom Devick

GEOLOGIST: R. Witt
 CHECKED: A. Hobson
 DATE: 2/22/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-06

COORDINATES: N: 438,877 E: 1,364,184
 GROUND SURFACE ELEVATION: 2,549.9 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
145.0	2405	138.2 - 142.0 V. weak, olive gray (5Y, 4/1), SANDSTONE, fine to coarse grained (mostly coarse), tr. silt, massive, moist --interbedded with-- stiff to v. stiff, olive gray (5Y, 3/2), SHALE, some alt. bands of lt. olive gray (5Y, 6/2), moist	[Dotted pattern]	2406.4	Ss / Sh	moist	Analytical Sample SHMW06 144-149	
		142.0 - 143.5 V. weak, olive gray (5Y, 4/1), SANDSTONE, fine to coarse grained (mostly coarse), tr. silt, massive, moist --interbedded with-- stiff to v. stiff, olive gray (5Y, 3/2), SHALE, some alt. bands of lt. olive gray (5Y, 6/2), moist		143.5				
150.0	2400	143.5 - 155.0 Stiff, olive gray (5Y, 4/1), SANDSTONE, fine to coarse grained (mainly coarse), tr. clay, tr. silt, massive, tr. 1/2"-4" dia. nodules of olive gray (5Y, 3/2) and yellowish gray shale, v. moist	[Dotted pattern]		Ss	v. moist	Analytical Sample SHMW06 150-155	
		154'-155' material is softer - almost loose		2394.9				
155.0	2395	155.0 - 155.3 V. stiff, brownish black (5YR, 2/1), carbonaceous SHALE, sli. lamination, fissile, moist	[Horizontal lines]	155.0	Sh	moist		
		155.3 - 155.5 V. weak, brownish black, COAL, fissile, sli. blocky, moist		2394.4	COAL	v. moist to wet		
160.0	2390	155.5 - 156.5 Firm, olive gray (5Y, 4/1), SANDSTONE, fine to coarse grained, tr. clay, massive, v. moist to wet	[Horizontal lines]	156.5	Ss	moist	Analytical Sample SHMW06 157-160	
		156.5 - 157.0 V. stiff, mottled yellowishgray (5Y, 7/2) and olive grays (5Y, 4/1 + 5Y, 3/2), SHALE, sli. lamination, 2" dia. inclusion of v. hard, dry, dusky yellow SHALE at 156.6', moist		2389.9	COAL			
165.0	2385	160.0 - 160.1 Brownish black, COAL stringer, moist	[Horizontal lines]	160.0	Sh	v. moist to wet	Analytical Sample SHMW06 162-167	
		160.1 - 160.5 Brownish black, sandy SHALE, fine to coarse grained, moist		2389.4	COAL / Sh			
170.0	2380	160.5' Partially coalified wood fragment	[Horizontal lines]	162.0			Analytical Sample SHMW06 167-172 and BD 092806JDE	
		162.0 - 165.0 Brownish black, interbedded COAL and carbonaceous SHALE, mod. to highly laminated, tr. visible sulfur, mostly dull, v. moist to wet		160.5				
175.0	2375	165.0 - 175.0 V. stiff to hard, olive gray (5Y, 4/1), clayey SANDSTONE, fine to med. grained, coarsens with depth, 5-15% silt, sli. stratified, tr. inclusions of reddish black, moist	[Dotted pattern]		Ss	moist	Analytical Sample SHMW06 172-177	
		175.0 - 177.0 V. stiff to hard, olive gray (5Y, 4/1), silty clayey SANDSTONE, fine to coarse. grained, sli. stratified, tr. inclusions of reddish black, moist		2371.4				
180.0	2370	177.0 - 178.5 Firm, lt. olive gray (5Y, 6/1), SANDSTONE, fine to coarse grained (mostly coarse), tr. silt, tr. clay, some bedding, moist to v. moist	[Cross-hatch pattern]	178.5	Siltst / Ss	moist to v. moist		Core from 175'-185' run fell out into hole. Drillers trip back down and drill further to attempt retrieval - sample recovered at 16:00
		Log continued on next page						

MW_GNPD_SH_OB AND MW_UPDATED SURVEY DATA 4_48_08.GPJ GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
 DRILLER: Tom Devick

GEOLOGIST: R. Witt
 CHECKED: A. Hobson
 DATE: 2/22/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-06

COORDINATES: N: 438,877 E: 1,364,184
 GROUND SURFACE ELEVATION: 2,549.9 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS	
220.0	2330	215.5 - 215.7 Firm, yellowish gray (5Y, 7/2), CLAYSTONE (bentonite), fragments of hard, dry, lt. olive gray (5Y, 6/1), SHALE throughout, v. moist			Sh	moist	Analytical Sample SHMW06 216-221	Repeated trouble getting 218'-225' run out of barrel - ended up using core rod jammed through core inside of barrel to remove 2" dia. core from center of original sample - no way to estimate true recovery in this apparently expansive material.	
		215.7 - 218.0 V. stiff, brownish black (5YR, 2/1), SHALE, tr. pyrite (powder) evenly distributed, fissile, yellowish gray (5Y, 7/2) bentonite coatings on many layers, moist							sli. moist
		218.0 - 223.0 V. stiff, brownish black (5YR, 2/1) with 5-15% lt. olive gray (5Y, 6/1) bands, SHALE, tr. pyrite (powder) evenly distributed, fissile, yellowish gray (5Y, 7/2) bentonite coatings on many layers, sli. moist							
225.0	2325	223.0 - 224.8 V. stiff, brownish black (5YR, 2/1), SHALE, tr. pyrite powder (evenly distributed), 0.5-1mm dia. pyrite crystals at 224.5', fissile, highly laminated, sli. moist			2325.1	COAL	moist		
		224.8 - 225.0 Brownish black (5YR, 2/1), COAL, dull, many pyrite coatings throughout, moist			224.8	Sh	sli. moist		
		225.0 - 226.0 V. stiff, brownish black (5YR, 2/1), SHALE, tr. pyrite powder (evenly distributed), fissile, highly laminated, sli. moist			2323.9		moist		
230.0	2320	226.0 - 228.5 Weathered, brownish black (5YR, 2/1) to black (N1), COAL, wet to saturated			226.0		wet to sat.		
		228.5 - 232.0 Firm to soft, brownish black (5YR, 2/1), COAL, dull, poorly developed bedding, v. moist to wet				COAL			
		232.0 - 238.0 Firm, black (N1) to brownish black (5YR, 2/1), COAL, sli. platy, tr. pyrite (powder) evenly distributed throughout, moist					v. moist to wet		
235.0	2315	238.0 - 241.0 Hard, brownish black (5YR, 2/1), COAL, platy, some cleating (fractures perpendicular to main horizontal plates), dull w/ tr. less dull planes, increasing pyrite w/ depth, dry					moist		
		241.0 - 242.5 V. stiff, med. lt. gray (N6), SHALE, tr. silt, fissile, mod. laminated, dry to sli. moist			2308.9		dry		
		242.5 - 242.6 COAL stringer, moist			241.0	Sh	dry to sli. moist		
245.0	2305	242.6 - 252.0 V. stiff, med. gray (N5), SHALE, 5-15% silt, many leaf and wood impressions between layers, dry to sli. moist			2307.4		moist		Analytical Sample SHMW06 243-248 and BD 092906JDE
		247'-247.1' stringer of v. hard, yellowish gray (5Y, 7/2), SHALE, dry			242.5	COAL	moist		
250.0	2300	250'-250.3' stringer of v. hard, yellowish gray (5Y, 7/2), SHALE, dry				dry to sli. moist	Analytical Sample SHMW06 248-252		
						dry			
				2297.9		dry to sli. moist			
				252.0					

Boring completed at 252.0 ft

TD = 252' (9-29-06, 1600)

MW_GNPD_SH_OB AND MW_UPDATED SURVEY DATA 4_48_08.GPJ GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
 DRILLER: Tom Devick

GEOLOGIST: R. Witt
 CHECKED: A. Hobson
 DATE: 2/22/2007

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PROJECT: South Heart Project

PROJECT NUMBER: 063-2174

LOCATION: South Heart, ND

DRILL RIG: Gus Pech - RD 300

INCLINATION: -90°

DRILLING METHOD: Rotosonic

DATE STARTED: 10/11/06 10:14

DATE COMPLETED: 10/17/06 11:45

DRILLING FLUIDS: Water

DRILL LUBRICANTS: Well-Guard Monitor Well Thread Compound

RECORD OF BORING SHMW-07

COORDINATES: N: 437,912 E: 1,375,290

GROUND SURFACE ELEVATION: 2,507.1 ft

PROJECTION: StatePlane, North Dakota South, 3302

DATUM: NAD 27

UNITS: Feet

TOTAL DEPTH: 135.0 ft

BOTTOM ELEVATION: 2,372.1 ft

COLLAR ELEVATION: 2,510 ft (approximate)

HOLE DIAMETER: 8 inches

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
0.0		0.0 - 4.5 Firm to stiff, dk. yel. brown (10YR, 4/2), sandy CLAY, fine to coarse sand, with grass and roots, moist				moist		Note: Geologic scale was used for grain size descriptions (v. fine through v. coarse)
2505		0.5' no more roots, becomes sli. moist				CL	sli. moist	
4.5		4.5 - 5.0 Firm, dk. yel. brown (10YR 4/2), sandy CLAY, fine to coarse sand, subfissile to fissile, w/white crystal coatings on layers, WR w/ HCl, moist		2501.6				Reference Sample SHMW07C 6-7
5.0		5.0 - 5.5 Mottled lt. brown (5YR, 6/6) and white, sandy CLAY, moist		5.5	COAL			
2500		5.5 - 5.7 Weathered COAL stringer		2500.6	CL			
5.7		5.7 - 6.5 Mottled lt. brown (5YR, 6/6) and white, sandy CLAY, moist		6.5				
10.0		6.0' - 6.5' increasing white powder coatings, w/ weathered COAL mixed throughout the core				Clst		
2495		6.5 - 15.0 Firm to stiff, yellowish gray (5Y, 7/2), CLAYSTONE, trace to 10% fine to med. sand, sli. blocky, stratified, w/ occ. layers of dk. yel. orange (10YR, 6/6), 10-15% silt, moist						
15.0		15.0 - 16.0 Soft, yellowish gray (5Y, 7/2), CLAYSTONE, trace to 10% fine to med. sand, sli. blocky, stratified, w/ many layers of dk. yel. orange (10YR, 6/6), 10-20% weathered COAL powder throughout core, 10-15% silt, moist			2489.1		moist	
2490		16.0 - 18.0 Stiff, olive gray (5Y, 3/2), CLAYSTONE, subfissile, sli. laminated, 10-15% silt, tr. v. fine to fine sand, tr. pyrite, moist		18.0				
20.0		18.0 - 25.0 Stiff, olive gray (5Y, 3/2), CLAYSTONE, subfissile, sli. laminated, 10-15% silt, tr. v. fine to fine sand, tr. pyrite (increasing with depth), moist, interbedded in thin layers (<3 cm) w/ silty SANDSTONE, v. fine to fine grained, fissile, moist				Clst / Ss		
2485		25.0 - 31.0 Stiff, olive gray (5Y, 3/2) CLAYSTONE, sli. stratified, non-laminated, non-fissile, tr. fine to med. sand, moist		2482.1				
25.0					25.0		Clst	
2480								
30.0								

Log continued on next page

MW_GNPD_SH_OB AND MW_UPDATED SURVEY DATA 4_48_GP.J GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
DRILLER: Tom Devick / Alvin Anderson

GEOLOGIST: R. Witt / R. Marchese
CHECKED: A. Hobson
DATE: 2/22/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-07

COORDINATES: N: 437,912 E: 1,375,290
 GROUND SURFACE ELEVATION: 2,507.1 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
30.0				2476.1	Clst	moist		
31.0 - 35.0	2475	Loose, olive gray (5Y, 3/2), SANDSTONE, v. fine to med grained, trace pyrite throughout, moist to v. moist		31.0	Ss	moist to v. moist		
35.0		34' Marcasite nodule, 1" diameter		2472.1				
35.0 - 38.0	2470	Stiff, olive gray (5Y, 3/2) CLAYSTONE, sli. stratified, non-laminated, non-fissile, tr. fine to med. sand, moist		35.0	Clst	moist		
38.0 - 40.0		CLAYSTONE as above, interbedded w/ Dense, olive gray (5Y, 4/1), silty SANDSTONE, v. fine to med. grained (coarsens w/depth), sli. stratified, v. moist		2469.1	Clst / Ss			
40.0				2467.1				
40.0 - 45.0	2465	Dense, olive gray (5Y, 4/1), silty SANDSTONE, v. fine to med. grained (coarsens w/depth), sli. stratified, v. moist		40.0		v. moist		
45.0								
45.0 - 55.0	2460	Dense, olive gray (5Y, 4/1), SANDSTONE, fine to coarse grained, tr. silt, tr. pyrite, v. moist to wet			Ss			
50.0								
55.0								
55.0 - 58.5	2450	Compact, olive gray (5Y, 4/1), silty SANDSTONE, v. fine to med. grained, 5-15% clay, v. moist to wet						
58.5 - 59.0		Hard, black (N1), COAL, w/ stringer of silty SANDSTONE as above, sli. moist		2448.6		sli. moist		58' encountered coal seam
59.0 - 61.0		Hard, blackish red, COAL and partially coalified wood fragments, dry		58.5		dry		59.0 - 61.0 moisture appears to have been cooked out of the coal by the drilling process
61.0 - 65.0	2445	Hard, black (N1) and blackish red, COAL, tr. pyrite, moderate sulfur odor, sli. moist			COAL			
65.0								
65.0 - 75.0	2440	V. stiff, black (N1), COAL, platy, mostly dull with tr. bright faces, tr. pyrite, sli. moist						

Log continued on next page

MW_GNPD_SH_OB AND MW_UPDATED SURVEY DATA 4_48_08.GPJ GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
 DRILLER: Tom Devick / Alvin Anderson

GEOLOGIST: R. Witt / R. Marchese
 CHECKED: A. Hobson
 DATE: 2/22/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-07

COORDINATES: N: 437,912 E: 1,375,290
 GROUND SURFACE ELEVATION: 2,507.1 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
70.0	2435	67.0' - 67.1' Hard, dk. yel. brown (10YR, 4/2), CLAYSTONE stringer, dry 65.0 - 75.0 V. stiff, black (N1), COAL, platy, mostly dull with tr. bright faces, tr. pyrite, sli. moist	[Graphic Log]					
75.0	2430	73.0' - 73.1' Many veins of lt. brownish gray (5YR, 6/1) throughout core, metallic sheen, powdery consistency 75.0 - 82.0 V. stiff, black (N1) to blackish red, COAL, platy, mostly dull with tr. bright faces, tr. pyrite, sli. moist	[Graphic Log]		COAL	moist	Reference Grab Sample at 73'	
80.0	2425	82.0 - 82.4 Brownish black (5YR, 2/1), SHALE, laminated, fissile, sli. plastic, waxy appearance, moist 82.4 - 82.5 COAL stringer	[Graphic Log]	2425.1 82.0 2424.6 82.5	Sh COAL Sh			
85.0	2420	82.5 - 85.0 Lt. olive gray (5Y, 6/1), SHALE, laminated, fissile, sli. plastic, waxy appearance, moist 85.0 - 88.5 Olive gray (5Y, 4/1) to dk. greenish gray (5Y, 4/1), interbedded SILTSTONE and CLAYSTONE, occ. small zones (0.3'-0.4' thick) of dense, fine-sandy SILTSTONE, 12-30% clay, and interbedded sub-fissile SHALES, blocky to stratified, v. moist	[Graphic Log]	2422.1 85.0 2418.6 88.5	Siltst / Clst / Sh COAL	v. moist dry		TD SHMW-07C = 85' (10-12-06, 1057) SHMW-07D drilled to 85' using air rotary, logging from cuttings. Begin roto sonic drilling and coring SHMW-07D at 85'. Run 1: 85'-94' Driller used water to push out core
90.0	2415	88.7 - 94.0 Olive gray (5Y, 4/1) to dk. greenish gray (5Y, 4/1), interbedded SILTSTONE and CLAYSTONE, occ. small zones (0.3'-0.4' thick) of dense, fine-sandy SILTSTONE, 12-30% clay, and interbedded sub-fissile SHALES, blocky to stratified, v. moist	[Graphic Log]	2413.1 94.0 2412.6 94.5 2412.1 95.0 2410.6 96.5	Siltst / Clst / Sh Ss Siltst Ss			Run 2: 94'-105' Driller used water to push out core
95.0	2410	94.0 - 94.5 Mostly v. dense, dk. greenish gray (5G, 4/1), clayey SANDSTONE, fine grained, >50% clay, increasing coarseness from 100'-105', v. moist 94.5 - 95.0 V. stiff, lt. olive gray (5Y, 6/1), clayey SILTSTONE, 5-12% v. fine sand, v. moist 95.0 - 96.5 Mostly v. dense, dk. greenish gray (5G, 4/1), clayey SANDSTONE, fine grained, >50% clay, increasing coarseness from 100'-105', v. moist	[Graphic Log]	2408.1 99.0 2407.6 99.5	Siltst Ss Siltst	v. moist		
100.0	2405	96.5 - 96.8 V. stiff, lt. olive gray (5Y, 6/1), clayey SILTSTONE, 5-12% v. fine sand, v. moist 96.8 - 99.0 Mostly v. dense, dk. greenish gray (5G, 4/1), clayey SANDSTONE, fine grained, >50% clay, increasing coarseness from 100'-105', v. moist	[Graphic Log]	2402.1	Ss			
105.0		Log continued on next page						

MW_GNPD_SH_OB AND MW_UPDATED SURVEY DATA 4_48_08.GPJ GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
 DRILLER: Tom Devick / Alvin Anderson

GEOLOGIST: R. Witt / R. Marchese
 CHECKED: A. Hobson
 DATE: 2/22/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-07

COORDINATES: N: 437,912 E: 1,375,290
 GROUND SURFACE ELEVATION: 2,507.1 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
105.0		99.0 - 99.5 V. stiff, lt. olive gray (5Y, 6/1), clayey SILTSTONE, 5-12% v. fine sand, v. moist		105.0	Cist / Siltst	v. moist		Run 3: 105'-108' Note: noticeable audible clattering of drill rods near middle of run 3 - vigorous HCl rxn.
				2401.1	Siltst	dry		
2400		99.5 - 105.0 Mostly v. dense, dk. greenish gray (5G, 4/1), clayey SANDSTONE, fine grained, >50% clay, increasing coarseness from 100'-105', v. moist		107.0	Cist / Siltst			Run 4: 108'-120' Driller used water to push out core
				2399.1		v. moist		
110.0		105.0 - 106.0 V. stiff, weathered, olive gray (5Y, 4/1) to brownish gray (5YR, 4/1), CLAYSTONE/SILTSTONE, blocky, v. moist		108.0	Siltst			
		106.0 - 107.0 Hard, greenish gray (5G, 6/1), limy SILTSTONE, v. hard to break w/ hammer, dry		2395.1		v. moist w/ wet lenses		
2395		107.0 - 108.0 V. stiff, weathered, olive gray (5Y, 4/1) to brownish gray (5YR, 4/1), CLAYSTONE/SILTSTONE, blocky, v. moist		112.0	Siltst / Cist / Sh			
		108.0 - 112.0 Weathered, med. gray (N5) to olive gray (5Y, 4/1), SILTSTONE, >30% clay, blocky, occ. intermittent saturated thin (<0.1' thick) silt lenses at approx. 111', 112', 113', v. moist		2393.1				
115.0		110.5'-110.6' Hard, dusky yellow (5Y, 6/4) to lt. olive brown (5Y, 5/6), cherty SILTSTONE, v. moist		114.0	Sh / Siltst	v. moist		
2390		112.0 - 114.0 Weathered, mostly olive gray (5Y, 4/1), SILTSTONE grading to CLAYSTONE w/ interbedded SHALES, sli. carbonaceous, multiple coalified woody lenses and fragments throughout, v. moist		2387.1				
120.0		114.0 - 120.0 dk. greenish gray (5GY, 4/1), interbedded SHALES grading to extremely dense, clayey SILTSTONE, multiple coalified wood fragments throughout, grading into stratified, dense, clayey SILTSTONE, 30-50% clay, v. moist		120.0				Run 5: 120'-135' Note: wetness is internal to core
2385		120.0 - 128.0 V. soft to firm, olive gray (5Y, 4/1), clayey SILTSTONE, sli. blocky to sli. honeycombed structure, v. moist			Siltst	wet to sat.		
125.0		123' becomes wet to saturated						
2380		128.0 - 128.5 Hard, limy SILTSTONE, sli. interbedded w/ firm, clayey SILTSTONE material, dry		2378.6		dry		
130.0		128.5 - 135.0 V. dense, weathered, olive gray (5Y, 4/1) to brownish gray (5YR, 4/1), CLAYSTONE, sli. blocky, v. moist		128.5				
2375				2372.1	Cist	v. moist		
135.0		Boring completed at 135.0 ft		135.0				TD = 135' (10-17-06, 1145)

MW_GNPD_SH_OB AND MW_UPDATED SURVEY DATA 4_48_GP.J GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
 DRILLER: Tom Devick / Alvin Anderson

GEOLOGIST: R. Witt / R. Marchese
 CHECKED: A. Hobson
 DATE: 2/22/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174

LOCATION: South Heart, ND

DRILL RIG: Gus Pech - RD 300

INCLINATION: -90°

DRILLING METHOD: Rotasonic

DATE STARTED: 10/15/06 11:42

DATE COMPLETED: 10/16/06 16:30

DRILLING FLUIDS: Water

DRILL LUBRICANTS: Well-Guard Monitor Well Thread Compound

RECORD OF BORING SHMW-08

COORDINATES: N: 437,791 E: 1,358,944

GROUND SURFACE ELEVATION: 2,608.9 ft

PROJECTION: StatePlane, North Dakota South, 3302

DATUM: NAD 27

UNITS: Feet

TOTAL DEPTH: 215.0 ft

BOTTOM ELEVATION: 2,393.9 ft

COLLAR ELEVATION: 2,611 ft (approximate)

HOLE DIAMETER: 6 inches

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
0.0		0.0 - 1.0 Firm, dusky yellowish brown (10YR, 2/2), sandy CLAY, v. fine to coarse sand, many roots, moist		2607.4	CL	moist		Note: Geologic scale was used for grain size descriptions (v. fine through v. coarse) Run 1: 0'-5'
1.0		1.0 - 1.5 Firm, dk. yellowish brown (10YR, 4/4), sandy CLAY, v. fine to coarse sand, sli. laminated, v. sli. moist		1.5	SC	v. sli. moist		
2605		1.5 - 4.0 Loose, mottled mod. yellowish brown (10YR, 5/4) and pale yellowish brown (10YR, 6/2) and dusky yellowish brown (10YR, 2/2), clayey SAND, fine to coarse grained, 10-20% silt, tr. patches of pale yellowish orange (10YR, 8/6), sli. blocky, v. sli. moist		2604.9		dry		Run 2: 5'-10'
5.0		4.0 - 5.0 Soft/loose, v. pale yellowish brown (10YR, 7/2), SILT, tr. clay, tr. v. fine to med. sand, sli. blocky, dry		4.0	ML	sli. moist		
2600		5.0 - 10.0 Firm, mottled mainly mod. yellowish brown (10YR, 5/4) with pale yellowish brown (10YR, 6/2) and dusky yellowish brown (10YR, 2/2), clayey SILT, 5-15% v. fine to fine sand, tr. mica, sli. platy, sli. moist		2598.9				Run 3: 10'-20'
10.0		10.0 - 12.0 Firm, mod. weathered, mottled lt. olive gray (5Y, 5/2) w/ lt. olive brown (5Y, 5/6), CLAYSTONE, blocky, moist		10.0	Clst	moist		
2595		10.5'-10.6' Dusky brown (10YR, 2/2) to brownish black weathered coal stringer		2594.9	COAL			Reference Sample SHMW08D 14.8-15
15.0		12.0 - 14.0 Sli. weathered, lt. olive gray (5Y, 5/2), CLAYSTONE, 5-10% silt, tr. v. fine to fine sand, tr. lt. olive brown layers, sub-fissile, moist		14.0		sli. moist		
2590		14.0 - 15.0 Loose, sli. weathered, blackish red, COAL, many veins of sulfur from 14.9'-15', sli. moist						
20.0		15.0 - 20.0 Stiff, dk. yellowish brown (10YR, 4/2) to pale yellowish brown (10YR, 6/2) (color lightens w/ depth), silty CLAYSTONE, sli. platy, tr. v. fine to med. sand, sli. moist			Clst			
2585		15.5' Black, COAL stringer w/ yellow sulfur veins						Run 4: 20'-30' Some of recovery appears to be missing recovery from previous runs
20.0		20.0 - 23.1 Firm, mod. weathered, mottled lt. olive gray (5Y, 5/2) w/ lt. olive brown (5Y, 5/6), CLAYSTONE, blocky, moist		2585.8		moist		
25.0		21'-21.1' many halite crystals		23.1	Sltst			
23.1		23'-23.1' many halite crystals		2582.9				
2580		23.1 - 26.0 Firm, lt. olive gray (5Y, 5/2), clayey SILTSTONE, 5-10% v. fine to fine sand, sub-fissile, stratified, moist		26.0	Ss	sli. moist		
25.0		26.0 - 28.0 Loose, v. poorly consolidated, pale yellowish brown (10YR, 6/2), silty SANDSTONE, v. fine to fine grained, 10-15% clay, sli. stratified, sli. moist		2580.9	Clst	moist		
30.0				2578.9				

Log continued on next page

MW_GNPD_SH_OB AND MW_UPDATED SURVEY DATA 4_48_08.GPJ GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
 DRILLER: Tom Devick

GEOLOGIST: R. Witt
 CHECKED: A. Hobson
 DATE: 2/22/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-08

COORDINATES: N: 437,791 E: 1,358,944
 GROUND SURFACE ELEVATION: 2,608.9 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
30.0		28.0 - 30.0 Soft, weathered, mottled lt. olive gray (5Y, 5/2) w/ lt. olive brown (5Y, 5/6), CLAYSTONE, honeycombed structure, low to mod. plasticity, moist	[Dotted pattern]	30.0				Run 5: 30'-35' Driller's Note: hard drilling this run - a likely cause of the loose consistency of the core
	2575	30.0 - 35.0 Very weak, yellowishgray (5Y, 7/2), lt. olive brown (5Y, 5/6) and lt. olive gray (5Y, 5/2), silty SANDSTONE, v. fine to fine grained, 5-15% clay, fissile, occ. laminated layers, sli. moist						
35.0		32.5'-33' stringer of higher clay content, olive gray (5Y, 3/2)	[Dotted pattern]					Run 6: 35'-45'
	2570	35.0 - 55.0 V. weak, mod. olive brown (5Y, 4/4), silty SANDSTONE, v. fine to fine grained, 5-10% clay, sub-fissile, sli. moist						
40.0			[Dotted pattern]		Ss	sli. moist		
	2565							
45.0			[Dotted pattern]					Run 7: 45'-55'
	2560							
50.0			[Dotted pattern]					
	2555	53'-53.5' V. thin alternating bands of dk. olive gray (5Y, 4/1) and black (N1) CLAY (CL) w/in the silty SANDSTONE			2553.9			
55.0		55.0 - 57.0 Stiff, olive gray (5Y, 3/2), sandy CLAYSTONE, v. fine to fine grained, 10-15% silt, sli. blocky, moist	[Diagonal hatching]	55.0	Clst	moist		Run 8: 55'-70'
			[Diagonal hatching]	2551.9				
		57.0 - 57.5 Firm/compact, lt. olive gray, SANDSTONE, fine to med. grained, 10-15% silt, 10-15% clay, v. moist	[Diagonal hatching]	57.0	Ss	v. moist		
	2550		[Diagonal hatching]	2551.4				
		57.5 - 61.5 Stiff, olive gray (5Y, 3/2), sandy CLAYSTONE, v. fine to fine grained, 10-15% silt, sli. blocky, sli. laminated, moist	[Diagonal hatching]	57.5	Clst	moist		
		59' becomes mod. lamiated	[Diagonal hatching]	2547.4				
		61'-61.5' mottled color w/ dk. yellowish orange and olive gray (5Y, 3/2)	[Dotted pattern]	61.5				▼ WL= 61' (10/17/06, 0805) Boring Depth = 200', Casing Depth = 195'
	2545	61.5 - 70.0 1.5'-2' thick layers of compact, olive gray (5Y, 4/1), clayey SANDSTONE, fine to med. grained, 5-15% silt, massive, moist to sli. moist --interbedded with-- 0.1'-0.5' thick layers of mod. weathered, mod. olive brown (5Y, 4/4) and dk. yellowish orange, SANDSTONE, v. fine to med. grained, tr. silt, fissile, moist	[Dotted pattern]		Ss	sli. moist to moist / moist (intrbd)		▼ WL= 63' (10/16/06, 1700) Boring Depth = 200', Casing Depth = 195'

Log continued on next page

MW_GNPD_SH_OB AND MW_UPDATED SURVEY DATA 4_48_08.GPJ GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
 DRILLER: Tom Devick

GEOLOGIST: R. Witt
 CHECKED: A. Hobson
 DATE: 2/22/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-08

COORDINATES: N: 437,791 E: 1,358,944
 GROUND SURFACE ELEVATION: 2,608.9 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV.	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
				DEPTH (ft)				
70.0	2540	70.0 - 79.0 0.1'-0.5' thick layers of compact, olive gray (5Y, 4/1), clayey SANDSTONE, fine to med. grained, 5-15% silt, massive, moist to sli. moist --interbedded with-- 1.5'-2.0' thick layers of mod. weathered, mod. olive brown (5Y, 4/4) and dk. yellowish orange, SANDSTONE, v. fine to med. grained, tr. silt, fissile, moist	[Dotted pattern]		Ss	sli. moist to moist / moist (intrbd)	Reference Sample SHMW08D 69-70	Run 9: 70'-85' Driller's Note: softer/easier drilling
75.0	2535	73'-74' many lenses/alternating bands of coal in sandstone, fissile 77'-78' many lenses/alternating bands of coal in sandstone, fissile 78.5'-78.9' many lenses/alternating bands of coal in sandstone, fissile	[Dotted pattern]					
80.0	2530	79.0 - 85.0 Stiff to v. stiff, lt. olive gray (5Y, 6/1), silty CLAYSTONE, tr. v. fine to fine grained sand, sli. moist	[Diagonal hatching]	2529.9 79.0	Clst	sli. moist	Reference Sample SHMW08D 78.5-79	
85.0	2525	85.0 - 94.0 Loose to v. loose, mod. olive brown (5Y, 4/4), SANDSTONE, v. fine to med. grained, tr. coarse grains, tr. clay, v. moist to wet	[Dotted pattern]	2523.9 85.0				Run 10: 85'-101'
90.0	2520	85.3' dusky yellow (5Y, 6/4), chert stringer	[Dotted pattern]		Ss	v. moist to wet		
95.0	2515	94.0 - 94.3 COAL stringer, sli. clayey, fissile, moist 94.3 - 101.0 Loose, mod. olive brown (5Y, 4/4), SANDSTONE, fine to coarse grained, well-graded, wet to saturated	[Dotted pattern]	2514.9 94.0	COAL	moist		Run 11: 101'-115'
100.0	2510		[Dotted pattern]		Ss	wet to sat.		
105.0	2505	101.0 - 105.0 Firm, sli. weathered, olive gray (5Y, 3/2), CLAYSTONE, tr. v. fine to med. sand, sli. blocky, tr. saturated pockets w/in core, moist to v. moist	[Diagonal hatching]	2507.9 101.0	Clst	moist to v. moist		
		Log continued on next page		2503.9				

MW_GNPD_SH_OB AND MW_UPDATED SURVEY DATA 4_48_08_GP.J GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
 DRILLER: Tom Devick

GEOLOGIST: R. Witt
 CHECKED: A. Hobson
 DATE: 2/22/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-08

COORDINATES: N: 437,791 E: 1,358,944
 GROUND SURFACE ELEVATION: 2,608.9 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
105.0		105.0 - 111.0 Stiff to v. stiff, olive gray (5Y, 3/2), silty CLAYSTONE, tr. v. fine to fine sand, tr. v. thin clay lenses, sli. moist --interbedded with-- Stiff to v. stiff, olive gray (5Y, 3/2), clayey SANDSTONE, v. fine to med. grained, tr. coarse sand, tr. silt, sli. moist		105.0	Clst/Ss	sli. moist		
110.0		111.0 - 111.3 Olive black (5Y, 2/1), SHALE, laminated, sub-fissile, sli. blocky, moist to v. moist		2497.9 111.0	Sh Ss	moist to v. moist moist		
115.0		111.3 - 113.0 Compact, clayey SANDSTONE, v. fine to coarse grained, tr. silt, massive, moist		2495.9 113.0	Clst	sli. moist to moist		
120.0		113.0 - 116.0 Stiff, dk. olive gray (5Y, 4/1), sandy CLAYSTONE, fissile, lt. olive gray (5Y, 6/1) silt coatings between layers, sli. moist to moist		2492.9 116.0		moist to v. moist		115' End drilling 10/15/06 Resume drilling 10/16/06 Run 12: 115'-126' 5' of core from the middle of the run is stuck in the middle of the barrel (8' recovery from top of run, 3' from bottom)
125.0		116.0 - 116.3 V. stiff, black (N1), COAL, sli. platy, moist to v. moist				wet to sat.		
130.0		116.3 - 121.0 Soft to v. soft, weathered, black (N1), COAL, wet to saturated						
135.0		121.0 - 122.0 Hard, sli. weathered, black (N1), COAL, platy, v. moist		2486.9 122.0		v. moist		
140.0		122.0 - 125.0 no recovery				unknown		
145.0		125.0 - 126.0 Hard, sli. weathered, black (N1), COAL, platy, v. moist		2483.9 125.0	COAL	v. moist		Run 13: 126'-135' Middle 7" of recovery is stuck in barrel (7' recovery from top of run, 6' from bottom) Drillers trying to free coal from core barrel
150.0		126.0 - 129.0 Hard, brownish black (5YR, 2/1) to black (N1), COAL, sli. platy, dull, free water visible in fresh fractures, tr. v. fine to coarse pyrite, moist				moist		
155.0		129.0 - 132.0 no recovery		2479.9 129.0		unknown		
160.0		132.0 - 134.4 Hard, black (N1), COAL, tr. v. fine to med. pyrite, dull, blocky, sli. moist		2476.9 132.0		sli. moist		
165.0		134.4 - 134.5 Firm, brownish black (5YR, 2/1), SHALE, fissile, laminated, waxy, two 1/2" dia. marcasite nodules, moist		2474.5 134.4	Sh			Run 14: 135'-150' No rxn. w/ HCl
170.0		134.5 - 135.0 Firm, olive gray (5Y, 3/2), SHALE, fissile, highly laminated, waxy, mod. plasticity, moist		2471.9 137.0		moist		
175.0		135.0 - 137.0 Firm, olive gray (5Y, 3/2), SHALE, 10-20% silt, fissile, sli. laminated, waxy, no plasticity, moist			Sltst			
180.0		137.0 - 140.0 Stiff, olive gray (5Y, 4/1), sandy SILTSTONE, v. fine to fine grained, 10-15% clay, stratified, sub-fissile, moist		2468.9 140.0	Ss	moist to v. moist		

Log continued on next page

MW_GNPD_SH_OB AND MW_UPDATED SURVEY DATA 4_48_08.GPJ GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
 DRILLER: Tom Devick

GEOLOGIST: R. Witt
 CHECKED: A. Hobson
 DATE: 2/22/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-08

COORDINATES: N: 437,791 E: 1,358,944
 GROUND SURFACE ELEVATION: 2,608.9 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
145.0	2465	140.0 - 147.0 Firm, med. olive gray (5Y, 5/1), clayey SANDSTONE, v. fine to med. grained, tr. coarse grains, massive, moist to v. moist	[Dotted pattern]			moist to v. moist		
150.0	2460	147.0 - 150.0 Firm, med. olive gray (5Y, 5/1), clayey SANDSTONE, v. fine to med. grained, tr. coarse grains, massive, v. moist to wet (with soft, saturated stringers and pockets)	[Dotted pattern]					
155.0	2455	150.0 - 160.0 Soft to firm, med. olive gray (5Y, 5/1), clayey SANDSTONE, v. fine to coarse grained, massive, tr. saturated pockets, NR w/ HCl, v. moist to wet	[Dotted pattern]		Ss	v. moist to wet w/ sat. pockets		Run 15: 150'-165'
160.0	2450	160.0 - 162.0 V. stiff, olive gray (5Y, 3/2), sandy SILTSTONE, v. fine to fine grained, fissile, stratified, NR w/ HCl, moist	[Cross-hatch pattern]	2448.9 160.0	Siltst	moist		160'-162' Driller's Note: drilling much harder
165.0	2445	162.0 - 165.0 Firm, lt. olive gray (5Y, 6/1), clayey SANDSTONE, v. fine to med. grained, tr. coarse grains, tr silt (10%), NR w/ HCl, moist to v. moist	[Dotted pattern]	2446.9 162.0		moist to v. moist		
170.0	2440	165.0 - 180.0 Firm, med. olive gray (5Y, 5/1), clayey SANDSTONE, v. fine to coarse grained, tr. silt, occ./tr. saturated lenses, moist	[Dotted pattern]		Ss	moist		Run 16: 165'-180' Material is becoming slightly more consolidated as depth increases 165'-170' weak rxn. w/ HCl
175.0	2435							170'-175' mod. rxn. w/ HCl
180.0	2430			2428.9				175'-180' mod. rxn. w/ HCl - increasing w/ depth

Log continued on next page

MW_GNPD_SH_OB AND MW UPDATED SURVEY DATA 4_48_08.GPJ GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
 DRILLER: Tom Devick

GEOLOGIST: R. Witt
 CHECKED: A. Hobson
 DATE: 2/22/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-08

COORDINATES: N: 437,791 E: 1,358,944
 GROUND SURFACE ELEVATION: 2,608.9 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV.	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
				DEPTH (ft)				
180.0		180.0 - 185.0 Soft to firm, med. olive gray (5Y, 5/1), clayey SANDSTONE, v. fine to coarse grained, 5-10% silt, weak rxn. w/ HCl, wet (w/ saturated pockets)	[Dotted pattern]	180.0	Ss	wet w/ sat. pockets		Run 17: 180'-195'
2425		182' several 0.5" to 1.5" dia. olive gray (5Y, 3/2), sandstone corestones, v. weak rock, mod. rxn. w/ HCl, moist						
185.0		185.0 - 197.3 Firm, med. olive gray (5Y, 5/1), clayey SANDSTONE, v. fine to coarse grained, 5-10% silt, weak to no rxn. w/ HCl, moist to v. moist	[Dotted pattern]		Ss	moist to v. moist		Run 18: 195'-215'
2420								
190.0		192'-192.1' olive gray (5Y, 3/2) stringer	[Dotted pattern]		Ss	moist to v. moist		Run 18: 195'-215'
2415								
195.0		197'-197.3' color becomes mod. olive brown	[Dotted pattern]		Ss	wet to sat.		Run 18: 195'-215'
2410		197.3 - 199.0 Soft, olive gray (5Y, 5/1), clayey SANDSTONE, v. fine to coarse grained, 5-10% silt, wet to saturated						
200.0		199.0 - 215.0 Firm, olive gray (5Y, 5/1), SANDSTONE, v. fine to coarse grained, 5-10% clay, 5-10% silt, v. moist to moist	[Dotted pattern]		Ss	v. moist to moist		Run 18: 195'-215'
2405								
205.0			[Dotted pattern]		Ss	v. moist to moist		Run 18: 195'-215'
2400								
210.0			[Dotted pattern]		Ss	v. moist to moist		Run 18: 195'-215'
2395								
215.0		Boring completed at 215.0 ft		2393.9 215.0				TD = 215' (10/16/06, 1630)

MW_GNPD_SH_OB AND MW_UPDATED SURVEY DATA 4_48_08_GP.J GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
 DRILLER: Tom Devick

GEOLOGIST: R. Witt
 CHECKED: A. Hobson
 DATE: 2/22/2007

FIELD LOG – ROTARY BOREHOLE

SITE NAME AND LOCATION
SOUTH HEART, NORTH DAKOTA

DRILLING METHOD: *Rotary*

BORING NO.
SHMW-08HTB

DRILLING BIT DIAMETER: *3.75-inch TCP coring bit*

SHEET
1 OF 16

SAMPLING METHOD: *Split Spoon (2.3 ft long w/ shoe) and HQ Wireline Coring*

NORTHING: *437741.02*
EASTING: *1358946.50*

COORDINATE SYSTEM (DATUM): *SP 27 ft*

COLLAR ELEVATION:

GROUND SURFACE ELEVATION: *2607.65*

DRILLING	
DATE	TIME
DATE	TIME
DATE	TIME
<i>10/24/09</i>	<i>11:30</i>
DATE	TIME
<i>10/26/09</i>	<i>13:40</i>

DRILL RIG *CME-75*

SURFACE CONDITIONS *stubble wheat field*

DRILLING WATER (AMOUNT AND DEPTHS)

TOTAL DEPTH *314 feet*

DEPTH IN FEET	RECOVERY (ft)	BLOWS / 6 IN. USGS-OR-ROCK ON SAMPLER	LITHOLOGY/DESCRIPTION	MOISTURE CONTENT	SAMPLE DEPTH IN FEET		DESCRIPTION OF OPERATION AND REMARKS
					FROM	TO	
1	1.5/2	4 12 11 8	0~5 ft Stiff-hard, dk yell brn (10YR 4/2) silty CLAY, some roots, little v. fine gr. sand, v. moist at ground surface becoming sli. moist	SILT. MOIST TO V. MOIST	0	2	Begin drilling on 10/24/2009 at 11:30
2							2 ft: Driller starts using water while reaming borehole with 5" rotary bit after each Split Spoon sample
5	1.9/2	8 8 15 15	5~11 ft Stiff, yell gr (5Y 7/2) clayey SILT, little v. fine gr. sand, moisture NA	NA (drilling with water)	5	7	
10	1.8/2	6 9 10 14	~11~14 ft V. weak, lt olv gr (5Y 5/2) CLAYSTONE		10	12	
12			11.4-12 ft Dusky brn (10YR 3/2), med wthd coal stringer				
See next page for description							

DRILLING CONTR *Braun Intertec*

DRILLERS *Kyle Haag*

LOGGED BY *Ryan Tolene*

DATE *10/24/2009* CHK'D BY *E. Pottorff*

JOB NO.: *063-2212D*

FIELD LOG - ROTARY BOREHOLE

BORING NO.

SHMW-08HTB

SHEET

2 OF 16

DEPTH IN FEET	RECOVERY (ft)	BLOWS OR FEET PER USES OR ROCK ON SAMPLER	LITHOLOGY/DESCRIPTION	MOISTURE CONTENT	SAMPLE DEPTH IN FEET		DESCRIPTION OF OPERATION AND REMARKS
					FROM	TO	
15	2/2	5	14-16.4 ft Ext. weak, highly-compl. wthd, blk (N1) COAL, some yellow sulfur veins			17	
		8					
		11					
		15					
			16.4~20 ft Weak, pale yell brn (10YR 4/2) silty CLAYSTONE				
20	2/2	8	20~25 ft V. weak, lt blu gr (5B7/1) and lt olv gr (5Y 6/1) CLAYSTONE, little silt			22	
		14					
		17					
		21					
			25-26 ft Ext. weak, lt olv gr (5Y 5/2) sandy SILTSTONE, v. fine gr. sand, little clay				
25	2/2	17	26~32 ft Ext. weak - v. weak, yell gr (5Y 7/2) v. fine - fine gr. silty SANDSTONE, predom. v. fine gr. sandstone			27	
		31					
		50					
		50/50					
			~32-36.2 ft V. weak-weak, med gr (N5) SILTSTONE, some clay				
30	2/2	17	~32-36.2 ft V. weak-weak, med gr (N5) SILTSTONE, some clay			32	
		29					
		31					
		45					
34							

NA (drilling with water)

DRILLING CONTR Braun Intertec

DRILLERS Kyle Haag

LOGGED BY Ryan Tolene

DATE 10/24/2009 CHK'D BY E. Potter

JOB NO.: 063-2212D

FIELD LOG - ROTARY BOREHOLE

BORING NO.
SHMW-08HTB

SHEET
3 OF **16**

DEPTH IN FEET	RECOVERY (ft)	BLAWS / 6 IN USCS OR ROCK TYPE SAMPLER	LITHOLOGY/DESCRIPTION	MOISTURE CONTENT	SAMPLE DEPTH IN FEET		DESCRIPTION OF OPERATION AND REMARKS
					FROM	TO	
35		20	<div style="border: 1px solid black; padding: 5px;"> 36.2 - 54 ft Weak, yell gr (5Y 7/2), dusky yell (5Y 4/4), and med gr (N5) clayey SILTSTONE, some interbeds of v. weak, yell gr (5Y 7/2) v. finegr. sandstone (0.5 ft thick), predom. med gr (N5) SILTSTONE </div>				
	2/2	21					
		27					
		42					
40		20	NA (drilling with water)				
	2/2	23					
		28					
		36					
45			SILTSTONE				
46							
50		7.8 / 8	See next page for description				
54							

NA (drilling with water)

46 ft: Begin HQ coring with 3.75" TCP bit
Run 1: 46 - 54 ft

DRILLING CONTR Braun Intertec

DRILLERS Kyle Haag

LOGGED BY Ryan Tolenc

DATE 10/24/2009 CHK'D BY E. Potter

JOB NO.: 063-2212D

FIELD LOG - ROTARY BOREHOLE

BORING NO.
SHMW-08HTB

SHEET
4 OF **16**

DEPTH IN FEET	RECOVERY (H)	USCS OR ROCK TYPE	LITHOLOGY/DESCRIPTION	MOISTURE CONTENT	SAMPLE DEPTH IN FEET		DESCRIPTION OF OPERATION AND REMARKS
					FROM	TO	
55			54-61 ft Weak, lt olv gr (5Y 4/1) sandy SILTSTONE, v. fine gr. sand, with thin (<0.1 ft) bands of brn gr (5YR 4/1) siltstone				Run 2: 54-64 ft
60	7.7 / 10	SILTSTONE				56	
			61-65 ft Ext. weak, lt olv gr (5Y 4/1) fine gr. silty SANDSTONE			58	
		SANDSTONE				60	
64						61.7	
		SANDSTONE				64	Run 3: 64-74 ft
65			65-73.8 ft Weak, olv gr (5Y 4/1) CLAYSTONE, little - some silt			66	
		CLAYSTONE				68	
70	10 / 10					70	
		CLAYSTONE				72	
74			73.8-75.8 ft CLAYSTONE as above interbedded with Ext. weak - v. weak med yell brn (10YR 5/4) fine gr. silty SANDSTONE			74	
		CLST + SS					

NA (drilling with water)

DRILLING CONTR Braun Intertec

DRILLERS Kyle Haag

LOGGED BY Ryan Tolene

DATE 10/24/2009 CHK'D BY E. P. Horff

JOB NO.: 063-2212D

FIELD LOG - ROTARY BOREHOLE

BORING NO.

SHMW-08HTB

SHEET

5 OF 16

DEPTH IN FEET	RECOVERY (ft)	USCS OR ROCK TYPE	LITHOLOGY/DESCRIPTION	MOISTURE CONTENT	SAMPLE DEPTH IN FEET		DESCRIPTION OF OPERATION AND REMARKS
					FROM	TO	
75		CLST + SS	73.8-75.8 ft CLAYSTONE as above interbedded w/ Ext. weak -v. weak, mod yell brn (10YR 5/4) fine gr. silty SANDSTONE			76	Run 4: 74-84 ft
80	7.1/10		75.8 ~ 100.4 ft Ext. weak -v. weak, mod yell brn (10YR 5/4) to dk yell brn (10YR 4/2) fine-med. gr. silty SANDSTONE			78	
84			From ~84 ft, SANDSTONE becoming med. grained			80	
85		SANDSTONE	Blk (NI) coal stringers at 75.4 ft and 78.0 ft			81	Run 5: 84-94 ft Lost Core through catcher. Assumed to be same ext. -v. weak/ loose sandstone as above
90	0/10		81 ~ 100.4 ft NO RECOVERY of ext. -v. weak sandstone				Driller noted he lost loose sandstone at end of Run 4 and in Run 5 even with new core catcher that is better at retaining sand
94							Run 6: 94-104 ft

NA (drilling with water)

DRILLING CONTR Braun Intertec

DRILLERS Kyle Haag

LOGGED BY Ryan Tolene

DATE 10/24/2009 CHK'D BY E. P. Horst

JOB NO.: 063-2212D

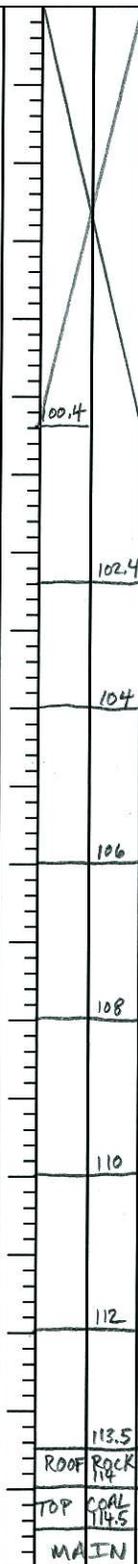
FIELD LOG - ROTARY BOREHOLE

BORING NO.
SHMW-08 HTB

SHEET
6 OF 16

DEPTH IN FEET	RECOVERY (ft)	USCS OR ROCK TYPE	LITHOLOGY/DESCRIPTION	MOISTURE CONTENT	SAMPLE DEPTH IN FEET		DESCRIPTION OF OPERATION AND REMARKS
					FROM	TO	
95		SANDSTONE	75.8 ~ 100.4 ft Ext. weak-v. weak, med yell brn (10YR 5/4) to dk yell brn (10YR 4/2) fine-med. gr. silty SANDSTONE				Run 6: 94-104 ft 94-100.4 ft; CORE LOSS
100	3.6/10	SANDSTONE AND SILTSTONE	100.4 - 107.7 ft Weak, lt olv gr (5Y 6/1) interbedded CLAYSTONE AND SILTSTONE				
104		CLAYSTONE AND SILTSTONE					104 ft: End drilling on 10/24/09 at 17:22 Resume drilling on 10/25/09 at 8:20
105		SANDSTONE	107.7 - 110.7 ft Weak, grn gr (5GY 6/1) fine-med. gr. SANDSTONE, little clay				Run 7: 104-114 ft
110	10/10	SANDSTONE AND SILTSTONE	110.7 - 114 ft Weak, lt olv gr (5Y 6/1) to olv gr (5Y 4/1) clayey SILTSTONE				
114		COAL	See next page for description				

NA (drilling with water)



DRILLING CONTR Braun Intertec

DRILLERS Kyle Haag

LOGGED BY Ryan Tolene

DATE 10/24/09-10/25/09 CHK'D BY E. Pott

JOB NO.: 063-2212D

FIELD LOG - ROTARY BOREHOLE

BORING NO.

SHMW-08 HTB

SHEET

7 OF 16

DEPTH IN FEET	RECOVERY (ft)	USCS OR ROCK TYPE	LITHOLOGY/DESCRIPTION	MOISTURE CONTENT	SAMPLE DEPTH IN FEET		DESCRIPTION OF OPERATION AND REMARKS
					FROM	TO	
115			<p>114~134 ft Med. strong - v. strong, blk (NI) COAL</p> <p>114~117.5 ft Med. strong COAL</p> <p>117.5 - 124 ft Strong - v. strong COAL</p> <p>124~134 ft Med. strong COAL</p> <p>Pyrite nodules at 114-115 ft 122.9 ft 125 ft</p>				<p>Run 8: 114-124 ft</p> <p>MAIN COAL 116.5</p> <p>MAIN 118.5</p> <p>MAIN 120.5</p> <p>MAIN 122.5</p> <p>MAIN 124.5</p> <p>MAIN 126.5</p> <p>MAIN 128.5</p> <p>MAIN 130.5</p> <p>MAIN 131.5</p> <p>134 FLOOR ROCK 134.5</p>
120	9.4 / 10						
124		COAL					<p>Run 9: 124-134 ft</p> <p>Driller believes he lost the bottom 2.5 ft of weaker coal</p>
125							
130	7.5 / 10		<p>131.5 - 134 ft NO RECOVERY assumed weaker coal</p>				<p>131.5 - 134 ft: CORE LOSS</p>
134		CL ST	<p>134 - 134.5 ft Weak, olv gr (5Y 4/1) silty CLAYSTONE, little coal stringers</p>				
			See next page for description				

DRILLING CONTR Braun Intertec

DRILLERS Kyle Haag

LOGGED BY Ryan Tolene

DATE 10/25/2009 CHK'D BY E. Pottorf

JOB NO.: 063-2212D

FIELD LOG - ROTARY BOREHOLE

BORING NO.
SHMW-08 HTB

SHEET
8 OF **16**

DEPTH IN FEET	RECOVERY (ft)	USCS OR ROCK TYPE	LITHOLOGY/DESCRIPTION	MOISTURE CONTENT	SAMPLE DEPTH IN FEET		DESCRIPTION OF OPERATION AND REMARKS
					FROM	TO	
135		CLAYSTONE AND SILTSTONE	134.5-139.3 ft Weak, grn gr (5G 6/1) interbedded SILTSTONE AND CLAYSTONE				<p>Run 10: 134-144 ft</p> <p>Driller believes coal seam ended at ~134 ft and the core loss was from ~140.8 - ~144 ft.</p>
140	6.8 / 10		139.3-144 ft Weak, grn gr (5G 6/1) v. fine - fine gr. silty SANDSTONE, predom. fine gr. sandstone				
144			144-156.5 ft v. weak-weak, grn gr (5G 6/1) med. gr. SANDSTONE, poorly graded				
145		SANDSTONE	146.4-154 ft NO RECOVERY assumed med. gr. sandstone as above and below				<p>Run 11: 144-154 ft</p> <p>Driller noted entire run was through sandstone unit. Unable to retain w/ core catcher.</p> <p><u>146.4-154 ft</u>: CORE LOSS</p>
150	2.4 / 10						
154							

NA (drilling with water)

DRILLING CONTR Braun Intertec
 DRILLERS Kyle Haag
 LOGGED BY Ryan Tolene
 DATE 10/25/2009 CHK'D BY E. Pottorf
 JOB NO.: 063-2212D

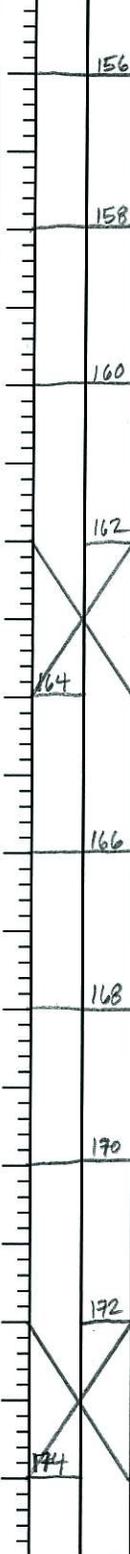
FIELD LOG - ROTARY BOREHOLE

BORING NO. SHMW-08HTB

SHEET 9 OF 16

DEPTH IN FEET	RECOVERY (H)	USCS OR ROCK TYPE	LITHOLOGY/DESCRIPTION	MOISTURE CONTENT	SAMPLE DEPTH IN FEET		DESCRIPTION OF OPERATION AND REMARKS
					FROM	TO	
155		SANDSTONE	156.5 - 159.5 ft Weak, med lt gr (N6) to lt olv gr (5G 4/1) sandy SILTSTONE, some v. fine gr. sand				Run 12: 154-164 ft
	9.2/10	SILTSTONE					
160		SANDSTONE	159.5 - 175.5 ft v. weak, grn gr (5G 4/1) to dk grn gr (5G 4/1) med. gr. SANDSTONE, poorly graded				
164		SANDSTONE	166.2 - 166.5 ft Blk (N1) coal stringer				
165	8.3/10	SANDSTONE					
170							
174							

NA (drilling with water)



162-164 ft: CORE LOSS

Run 13: 164-174 ft

172-174 ft: CORE LOSS

DRILLING CONTR Braun Intertec

DRILLERS Kyle Haag

LOGGED BY Ryan Tolene

DATE 10/25/2009 CHK'D BY E. Pottorf

JOB NO.: 063-2212D

FIELD LOG – ROTARY BOREHOLE

BORING NO.

SHMW-08 HTB

SHEET

12 OF 16

DEPTH IN FEET	RECOVERY (ft)	USCS OR ROCK TYPE	LITHOLOGY/DESCRIPTION	MOISTURE CONTENT	SAMPLE DEPTH IN FEET		DESCRIPTION OF OPERATION AND REMARKS
					FROM	TO	
215			194 ~ 223.8 ft SANDSTONE as above becoming med gray (N5) in color				Run 18: 214-224 ft Driller noted he was going through sandstone until the bottom few inches when he felt he was drilling into a harder unit. Core catcher came up opened w/ coal stuck in it and no recovery.
220	0.3 / 10	SANDSTONE	223.8 ~ 224.1 ft Med. strong, blk (N1) COAL stringer	NA (drilling with water)			Core catcher came up opened w/ coal stuck in it and no recovery.
224		SANDSTONE	224.1 - 238.8 ft Weak-med. strong, grn gr (5GY6/1) and lt olv gr (5Y4/1) to olv gr (5Y4/1) interbedded CLAYSTONE AND SILTSTONE, trace coal stringers, predom. claystone				Run 19: 224-234 ft No Recovery
225		SANDSTONE					
230	8.9 / 11	CLAYSTONE AND SILTSTONE					Run 20: 234-235 ft Drill 1 ft to recover lost core from previous run
234							

DRILLING CONTR. Braun Intertec

DRILLERS: Kyle Haag

LOGGED BY Ryan Tolene

DATE 10/25/2009 CHK'D BY E. B. Hoff

JOB NO.: 063-2212D

FIELD LOG - ROTARY BOREHOLE

BORING NO.
SHMW-08HTB

SHEET
13 OF 16

DEPTH IN FEET	RECOVERY (ft)	USGS OR ROCK TYPE	LITHOLOGY/DESCRIPTION	MOISTURE CONTENT	SAMPLE DEPTH IN FEET		DESCRIPTION OF OPERATION AND REMARKS
					FROM	TO	
235		CLAYSTONE AND SILTSTONE	238.8 - 241.8 ft v. weak-weak dk grn gr (5Y 4/1) v. fine-med. gr. clayey SANDSTONE interbedded with lt olv gr (5Y 4/1) to olv gr (5Y 4/1) SILTSTONE				Run 21: 235-244 ft
240	7.4/9	SANDSTONE AND SILTSTONE	241.8 - 244.5 ft Weak, lt olv gr (5Y 4/1) to olv gr (5Y 4/1) SILT- STONE				
244		SILTSTONE	244.5 - 252.8 ft Weak-med. strong, lt olv gr (5Y 4/1) to olv blk (5Y 2/1) CLAYSTONE				242.4 - 244 ft: CORE LOSS Run 22: 244-254 ft
245		CLAYSTONE	252.8 - 253.8 ft Strong, blk (N1) COAL stringer, platy				
250	10/10	CLAYSTONE	253.8 - 264 ft Med. strong - strong, olv gr (5Y 4/1) CLAY- STONE, trace coal stringers				
254		CLAYSTONE					254 - 256.3 ft: CORE LOSS

NA (drilling with water)

DRILLING CONTR Brann Intertec
DRILLERS Kyle Haag

JOB NO.: 063-2212D LOGGED BY Ryan Tolene
DATE 10/25/2009 CHK'D BY E. P. [Signature]

FIELD LOG - ROTARY BOREHOLE

BORING NO.
SHMW-08HTB

SHEET
14 OF **16**

DEPTH IN FEET	RECOVERY (ft)	USCS OR ROCK TYPE	LITHOLOGY/DESCRIPTION	MOISTURE CONTENT	SAMPLE DEPTH IN FEET		DESCRIPTION OF OPERATION AND REMARKS
					FROM	TO	
255			<p><u>253.8 - 264 ft Med. strong - strong, olv gr (5Y 4/1) CLAYSTONE, trace coal stringers</u></p> <p><u>256.3 - 260.3 ft CLAYSTONE as above becoming dk grn gr (5GY 4/1)</u></p>		256.3	258.3	Run 23: 254 - 264 ft
260	7.7 / 10	CLAYSTONE			260.3	262.3	
264			<p><u>264 - 274 ft CLAYSTONE as above interbedded w/ weak - med. strong, med gr (N5) SILTSTONE, predom. siltstone</u></p>	NA (drilling with water)	264	266	<p>264 ft; End drilling on 10/25/09 at 17:35</p> <p>Resume drilling on 10/26/09 at 8:27</p> <p>Driller noted there was 7 feet of slough overnight</p> <p>Run 24: 264 - 274 ft</p> <p>CORE stuck in barrel, hammered on barrel to loosen</p>
265					266	268	
270	10 / 10	SILTSTONE AND CLAYSTONE			270	272	
274		SILTSTONE	See next page for description		274		

DRILLING CONTR Braun Intertec

DRILLERS Kyle Haag

LOGGED BY Ryan Tolene

DATE 10/25/09 - 10/26/09 CHK'D BY E. Pottorff

JOB NO.: 063-2212D

FIELD LOG - ROTARY BOREHOLE

BORING NO.
SHMW-08HTB

SHEET
15 OF 16

DEPTH IN FEET	RECOVERY (ft)	USCS OR ROCK TYPE	LITHOLOGY/DESCRIPTION	MOISTURE CONTENT	SAMPLE DEPTH IN FEET		DESCRIPTION OF OPERATION AND REMARKS
					FROM	TO	
275		SS	274 - 284.3 ft Weak - med. strong, med gr (NS) and 1/2 olv gr (SY 6/1) SILTSTONE				Run 25: 274 - 284 ft Poor Recovery 3.5'/10'
280	14/14	SILTSTONE	275.2 - 275.7 ft Strong, med 1/2 gr (N6) v. fine-fine gr. silty SANDSTONE lens				
284		CLAY-STONE	284.3 - 286.1 ft Med. strong, 1/2 olv gr (SY 6/1) to olv gr (SY 4/1) CLAY-STONE				Run 26: 284 - 288 ft Drill 4 feet to recover core from previous run
288		COAL	286.1 - 296.6 ft Med. strong - strong, brn blk (SYR 3/1) to blk (NI) COAL Pyrite nodules at 288.7 ft 289.9 ft 290.3 ft 291.2 ft Strong - v. strong coal from 288 - 296.6 ft				Run 27: 288 - 299 ft
294	10.5/11	COAL					

NA (drilling with water)

DRILLING CONTR Braun Intertec
 DRILLERS Kyle Hang
 LOGGED BY Ryan Tolene
 DATE 10/26/2009 CHK'D BY E. B. Hoff
 JOB NO.: 063-2212D

FIELD LOG - ROTARY BOREHOLE

BORING NO.
SHMW-08HTB

SHEET
16 OF 16

DEPTH IN FEET	RECOVERY (ft)	USCS OR ROCK TYPE	LITHOLOGY/DESCRIPTION	MOISTURE CONTENT	SAMPLE DEPTH IN FEET		DESCRIPTION OF OPERATION AND REMARKS	
					FROM	TO		
295		COAL	<p>296.6 ft Distinct contact between bottom of COAL and top of SILTSTONE, no gradation</p>		MAIN	296.1		
	10.5 / 11				BOTTOM COAL	296.6		
					FLOOR ROCK	297.1		
299		SILTSTONE	<p>296.6 - 314 ft Weak, grn gr (5GY 4/1) SILTSTONE, little v. fine gr. sand, trace coal stringers from 296.6 - 296.8 ft</p>			299	<p>Run 28: 299 - 309 ft Recovery 8.2' / 10'</p>	
300						301		
							303	
305				<p>305.7 - 307.2 ft v. strong - ext. strong grn gr (5GY 4/1) sandy SILTSTONE, some v. fine-fine gr. sand</p>			305	
	14.9 / 15						307	
			<p>307.2 - 314 ft SILTSTONE as above w/ little interbeds of dr gr (5Y 4/1) claystone, trace coal stringers</p>			307.2	<p>Run 29: 309 - 314 ft Recover 1.7 feet from base of Run 28 plus 5' / 5'</p>	
309						309.2		
310						311.2		
						313.2	<p>314 ft: End drilling on 10/26/09 at 13:40</p>	
314			<p>TD = 314 feet</p>			314	<p>Ream w/ 8" bit to depth = 295 feet from 10/26/09 16:50 to 10/29/09 12:58</p>	

NA (drilling with water)

DRILLING CONTR Braun Intertec
DRILLERS Kyle Haag

JOB NO.: 063-2212D LOGGED BY Ryan Tolene DATE 10/26/2009 CHK'D BY E. Poterff

PROJECT: South Heart Project

PROJECT NUMBER: 063-2174

LOCATION: South Heart, ND

DRILL RIG: CME-850

INCLINATION: -90°

DRILLING METHOD: Hollow Stem Auger

DATE STARTED: 05/02/07 10:30

DATE COMPLETED: 05/02/07 12:30

DRILLING FLUIDS: None

DRILL LUBRICANTS: None

RECORD OF BORING SHMW-09

COORDINATES: N: 438,182 E: 1,370,974

GROUND SURFACE ELEVATION: 2,501.8 ft

PROJECTION: StatePlane, North Dakota South, 3302

DATUM: NAD 27

HORIZONTAL UNITS: Feet

TOTAL DEPTH: 30.2 ft

BOTTOM ELEVATION: 2,471.6 ft

COLLAR ELEVATION: 2,505 NA

HOLE DIAMETER: 7.5 inches

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE NUMBER	BLOWS per 6 in	N	RECOVERY (ft)	COMMENTS
0.0		0.0 - 2.4 Loose, pale yellow brown (10YR 6/2), fine-grained silty SAND, trace of roots (more roots in upper 6"), weak reaction to HCL, moist			SM	moist	1	1 2 3 3	5	$\frac{0.8}{2}$	Start drilling at 10:30 on 5/2/2007
2.500		2' becoming dusky yellow brown (10YR 2/2)		2499.4			2	6 8 7 7	15	$\frac{1.3}{2}$	
		2.4 - 13.5 Loose to compact, pale yellow brown (10YR 6/2), poorly graded, fine-grained silty SAND, trace of roots, strong reaction to HCL, dry		2.4		dry	3	5 4 5 5	9	$\frac{1.6}{2}$	
5.0		6' Moderate reaction to HCL					4	5 6 7 7	13	$\frac{1}{2}$	
	2495	~6' becoming mod. yellow brown (10YR, 5/4), zones increasing silt, trace of mica flakes, weak reaction to HCL, dry to slightly damp,			SP-SM		5	4 6 5 6	11	$\frac{0.6}{2}$	
10.0		10' No reaction to HCL				sli. moist	6	4 5 6 6	11	$\frac{0.7}{2}$	
	2490	12' Trace of carbonaceous material					7	3 6 8 10	14	$\frac{0.7}{2}$	
15.0		13.5 - 15.2 Very stiff, dark yellow brown (10YR 4/2), silty CLAY with trace of sand, trace of roots, trace of white calcareous material, moderate reactions to HCL, damp to moist		2488.3	CL-ML		8	5 7 9 11	16	$\frac{1.4}{2}$	

Log continued on next page

MW AVF GNPD SH OB AND MW UPDATED SURVEY DATA 4_48_08.GPJ GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Braun Intertec
DRILLER: C. Powers

GEOLOGIST: E. Pottorff
CHECKED: E. Pottorff
DATE: 8/27/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-09

COORDINATES: N: 438,182 E: 1,370,974
 GROUND SURFACE ELEVATION: 2,501.8 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV.	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE NUMBER	BLOWS per 6 in	N	RECOVERY (ft)	COMMENTS	
				DEPTH (ft)								
15.0		15.2 - 18.8 Stiff to very stiff, dusky yellow brown (10YR 2/2), CLAY with trace to some of silt, trace of sand, trace of patches of fine gravel, no reaction to HCL, moist			CL	moist	8	5 7 9 11	16	1.4 2	22' water in hole	
	2485	16-16.4 sandy CLAY lenses 16.4-18.8 no sandy lenses						9	6 6 6	12		2 2
		18.8 - 19.8 Soft to firm, dark yellow brown (10YR 4/2), sandy CLAY with little silt, no reaction to HCL, moist to wet		2483.0			18.8	10	3 2 3	5		1.9 2
20.0		19.8 - 21.4 Soft, dark yellow brown (10YR 4/2), CLAY with little sand, no reaction to HCL, moist to wet		2482.0	19.8	CL	v. moist	11	1 2 2 2	4		1.8 2
	2480	21.4 - 23.2 Soft, moderate yellow brown (10YR 5/4) silty CLAY with little fine-grained sand, trace of carbonaceous material, wet		2480.4	21.4	CL-ML	wet	12	1 2 2 2	4		1.8 2
		22' becoming interbedded with fine-grained sandy lenses, wet		2478.6	23.2	SP		13	0 0 2 2	2		2 2
25.0		23.2 - 25.7 Very loose to loose, moderate yellow brown (10YR 5/4), poorly graded, fine- to medium-grained SAND, trace to little of silt, trace of clay with occasional clay lenses or stringers, trace of carbonaceous material, no reaction to HCL, wet		2476.1	25.7	Clst to Siltst	moist	14	2 3 4 4	7		2 2
	2475	25.7 - 28.9 Highly weathered, grayish olive (10Y 4/2), poorly cemented, CLAYSTONE to SILTSTONE with trace of sand, and sandy lenses, trace of mica, weak reaction to HCL, extremely weak rock, moist				15		10 17 50 for 5"	>100	1.4 1.4		
		26' slightly decreasing silt 27.6' trace of gravel 27.9' leaf fossil		2472.9	28.9	COAL		sli. moist				
		28.5' to 28.9' the rock has increasing silt, little sand, increasing carbonaceous material, damp to moist, no reaction to HCL		2471.8	30.0	Siltst	dry					Auger refusal at 30.2' at 12:30 pm on 5/2/2007.
30.0		28.9 - 30.0 Highly weathered, olive black (5Y 2/1), slightly mottled, COAL with SILTSTONE stringers, hard, no reaction to HCL, very weak rock, damp to moist		2471.6	30.2							
		30.0 - 30.2 Hard, medium light gray (N6), SILTSTONE, trace of carbonaceous streaks, little sand, strong reaction to HCL, dry										

Boring completed at 30.2 ft.

Boring completed at 30.2 ft.

MW AVF GNPD SH OB AND MW UPDATED SURVEY DATA 4_48_08.GPJ GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Braun Intertec
 DRILLER: C. Powers

GEOLOGIST: E. Pottorff
 CHECKED: E. Pottorff
 DATE: 8/27/2007

PROJECT: South Heart Project

PROJECT NUMBER: 063-2174

LOCATION: South Heart, ND

DRILL RIG: Gus Pech - RD 300

INCLINATION: -90°

DRILLING METHOD: Rotasonic

DATE STARTED: 09/29/06 10:35

DATE COMPLETED: 10/02/06 15:15

DRILLING FLUIDS: SW Pipeline Water

DRILL LUBRICANTS: Well-Guard Monitor Well Thread Compound

RECORD OF BORING SHMW-10

COORDINATES: N: 436,730 E: 1,370,596

GROUND SURFACE ELEVATION: 2,501.9 ft

PROJECTION: StatePlane, North Dakota South, 3302

DATUM: NAD 27

UNITS: Feet

TOTAL DEPTH: 400.0 ft

BOTTOM ELEVATION: 2,101.9 ft

COLLAR ELEVATION: 2,505 ft (approximate)

HOLE DIAMETER: 8 inches

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
0.0	2500	0.0 - 5.0 Compact to dense, lt. olive brown (5Y, 5/6) to lt. olive gray (5Y, 6/1), sandy SILT, 12-30% fine sand, occ. salt deposits (white powdery material), sli. moist			ML	sli. moist	Analytical Sample SHMW 10D2 0-5	Note: Geologic scale was used for grain size descriptions (v. fine through v. coarse) Run 1: 0-5' Driller used water to push out core
		3' changes from sli. moist to moist		2496.9		moist		
5.0	2495	5.0 - 10.5 Stiff to dense, olive gray (5Y, 3/2) to lt. olive gray (5Y, 6/1), interbedded clayey SILT and silty CLAY, 12-50% clay, sli. blocky, angular breaks in core, occ. thin (0.1'-0.2'), dusky yellow (5Y, 6/4), interbedded fine-sandy silt zones, low plasticity, tr. fine sand, v. moist		5.0	CL-ML		Analytical Sample SHMW 10D2 5-10	Run 2: 5'-15' Driller used water to push out core Drive 6" casing down to approx. 15'
10.0	2490	10.5 - 12.5 Compact, greenish gray (5GY, 6/1) to grayish olive (10Y, 4/2), sandy SILTSTONE, fine to coarse grained, 12-30% clay, sli. stratified, v. moist		2491.4			Analytical Sample SHMW 10D2 10-15	▼ WL = 12.3' (9/30/06 0723) Boring Depth = 115', Casing Depth = 112'
		12.5 - 13.0 Compact, clayey SILTSTONE, 5-12% fine sand, sli. blocky, v. moist		10.5	Siltst	v. moist		
15.0	2485	13.0 - 15.0 Compact, greenish gray (5GY, 6/1) to grayish olive (10Y, 4/2), sandy SILTSTONE, fine to coarse grained, 12-30% clay, sli. stratified, v. moist					Analytical Sample SHMW 10D2 15-20	Run 3: 15'-25' Driller used water to push out core
		15.0 - 20.0 Dense to compact, greenish gray (5GY, 6/1) to grayish olive (10Y, 4/2), silty SANDSTONE, 5-12% clay, mostly med. to coarse grained, sli. stratified, occ. lt. brown (5YR, 5/6) mottling throughout, increasing coarseness towards 18', v. moist		2481.9	Ss			
20.0	2480	20.0 - 21.0 V. stiff, mod. olive brown (5Y, 4/4) to lt. olive brown (5Y, 5/6), clayey SILTSTONE, sli. laminated, sli. varved, possible mica crystals on fresh surfaces, moist to v. moist		20.0	Siltst	moist to v. moist	Analytical Sample SHMW 10D2 20-25	
		21.0 - 22.5 SANDSTONE as above at 15'-20', v. moist		2480.9				
		22.5 - 23.0 SILTSTONE as above at 20'-21', moist to v. moist		21.0	Ss	v. moist		
		23.0 - 24.7 SANDSTONE as above at 15'-20', v. moist		2479.4	Siltst	moist to v. moist		
25.0	2475	24.7 - 25.0 SILTSTONE as above at 20'-21', v. moist		2478.9	Ss	v. moist	Analytical Sample SHMW 10D2 25-30	Run 4: 25'-35' Driller used water to push out core
				23.0	Ss	v. moist		
				2477.2	Siltst			
				24.7				
30.0						v. moist to wet		

Log continued on next page

MW_GNPD_SH_OB AND MW_UPDATED SURVEY DATA 4_48_08.GPJ GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
DRILLER: Alvin Anderson

GEOLOGIST: R. Marchese / R. Tolene
CHECKED: A. Hobson
DATE: 2/22/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-10

COORDINATES: N: 436,730 E: 1,370,596
 GROUND SURFACE ELEVATION: 2,501.9 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
30.0		25.0 - 35.0 Loose to compact, grayish olive (10Y, 4/2) to grayish olive (10Y, 6/2), silty SANDSTONE, med. to coarse grained, 5-12% clay, occ. mod. reddish brown (10R, 4/6) small (>0.05' dia.) "nodules" or inclusions of dense silt, occ. lt. brown (5YR, 6/4) to dk. yellowish orange (10YR, 6/6) spotting throughout, pyrite crystals in silt inclusions, v. moist to wet			Ss	v. moist to wet	Analytical Sample SHMW 10D2 30-35	
	2470			2466.9				
		31.5'-33' occ. rounded, small (0.5") pebbles		35.0	Sltst	v. moist	Analytical Sample SHMW 10D2 35-38	Run 5: 35'-40' Driller's Note: Attempted to perform 5' run on the encountered coal seam, but coal fell out of core barrel.
35.0		35.0 - 36.5 Compact to dense, grayish olive (10Y, 4/2), clayey SILTSTONE, some med. to coarse sand, mod. varved, alternating dk. greenish gray (5G, 4/1) to olive black (5Y, 2/1) color banding, v. moist		2465.4				
	2465			36.5	Ss			
		36.5 - 37.4 V. soft, silty SANDSTONE, fine grained, 12-20% med. grained, 5-30% clay, v. moist		2464.5				
		37.4 - 54.5 Black (N1) to med. brown (5YR, 3/4), COAL, mostly dull w/ bright fresh faces, sulfide coatings on most faces (as per Dave Leppert of Norwest), abundant pyrite crystals near top of seam (as per DL), abundant SAND in upper 3' (possibly contamination from above), dry		37.4	COAL	dry		Run 6: 40'-54' Retrieved lost coal from run 5 in this run Note: Core bags near bottom of coal v. warm to the touch
40.0								
	2460							
	2455							
	2450							
	2445							
		54.5 - 65.0 V. dense, med. gray (N5) to grayish olive (10Y, 4/2), clayey SILTSTONE, sli. laminated, occ. rusty brown inclusions, moist		2447.4				
55.0				54.5				Run 7: 54'-65' Driller used water to push out core
	2445						Analytical Sample SHMW 10D2 56-60	
					Sltst	moist		
	2440						Analytical Sample SHMW 10D2 60-65	
	2435			2436.9				
				65.0	Sh / Sltst	v. moist / wet (intrbd)	Analytical Sample SHMW 10D2 65-75	Run 8: 65'-80' Driller used water to push out core Driller's Note: Most of original 10' core

Log continued on next page

MW_GNPD_SH_OB AND MW UPDATED SURVEY DATA 4_48_08_GP.J GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
 DRILLER: Alvin Anderson

GEOLOGIST: R. Marchese / R. Tolene
 CHECKED: A. Hobson
 DATE: 2/22/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-10

COORDINATES: N: 436,730 E: 1,370,596
 GROUND SURFACE ELEVATION: 2,501.9 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
		65.0 - 68.0 Weak, sli. to mod. weathered olive gray (5Y, 4/1) to olive black (5Y, 2/1) to grayish black (N2), SHALE w/ interbedded mod. to highly weathered SILTSTONE, v. moist with thin wet zones in some of SHALE bedding	x x x	2433.9 68.0	Sh	v. moist	Analytical Sample SHMW 10D2 65-75	fell out, tripped back down to retrieve the core with a different bit
70.0		68.0 - 70.0 Thin zone of black friable SHALE, v. moist	x x x	2431.9 70.0	Sh / Siltst	v. moist / wet (intrbdy)		
	2430	70.0 - 71.0 Weak, sli. to mod. weathered olive gray (5Y, 4/1) to olive black (5Y, 2/1) to grayish black (N2), SHALE w/ interbedded mod. to highly weathered SILTSTONE, v. moist with thin wet zones in some of SHALE bedding	x x x	2430.9 71.0	Sh	v. moist (intrbd)		
		71.0 - 72.0 Thin zone of black friable SHALE, v. moist	x x x	2429.9 72.0	Sh / Siltst	v. moist / wet (intrbd)		
75.0		72.0 - 74.0 Weak, sli. to mod. weathered olive gray (5Y, 4/1) to olive black (5Y, 2/1) to grayish black (N2), SHALE w/ interbedded mod. to highly weathered SILTSTONE, v. moist with thin wet zones in some of SHALE bedding	x x x	2427.9 74.0	Sh	v. moist	Analytical Sample SHMW 10D2 75-80	
	2425	74.0 - 76.0 Thin zone of black friable SHALE	x x x	2425.9 76.0	Sh / Siltst	v. moist / wet (intrbd)		
80.0		76.0 - 80.0 Weak, sli. to mod. weathered olive gray (5Y, 4/1) to olive black (5Y, 2/1) to grayish black (N2), SHALE w/ interbedded mod. to highly weathered SILTSTONE, v. moist with thin wet zones in some of SHALE bedding	x x x	2421.9 80.0	Clst		Analytical Sample SHMW 10D2 80-86	Run 9: 80'-92' Driller used water to push out core
	2420	80.0 - 83.5 V. dense, weathered, olive gray (5GY, 4/1) to grayish olive (10Y, 4/2), silty CLAYSTONE, thinly bedded, interbedded silt btw. bedding planes, v. moist	x x x	2418.4 83.5	Clst / Sh / Siltst	v. moist		
85.0		83.5 - 84.0 CLAYSTONE as above (80'-83.5'), dk greenish gray (5GY, 4/1), interbedded w/ highly weathered SHALE and SILTSTONE, thinly bedded, v. moist	x x x	2417.9 84.0	Ss			
	2415	84.0 - 84.5 Weak, dk. greenish gray (5GY, 4/1) to olive gray (5Y, 4/1), SANDSTONE, mostly med. to coarse grained, v. moist	x x x	2416.4 85.5	Siltst	dry	Analytical Sample SHMW 10D2 86-90 and BD092906RT	Driller's Note: 88'-89' Hard drilling through approx. 1' thick hard Sandstone/Siltstone lense
90.0		84.5 - 85.5 Dense, dk. greenish gray (5GY, 4/1) to olive gray (5Y, 4/1), silty SANDSTONE, 12-30% silt, 5-12% clay, v. moist	x x x	2409.9 92.0				
	2410	85.5 - 88.0 Weathered, med. lt. gray (N6) and dk. greenish gray (5GY, 4/1) alt. banding, SILTSTONE, v. moist	x x x	2409.9 92.0			Analytical Sample SHMW 10D2 92-95	Run 10: 92'-105'
		88.0 - 89.0 V. hard, SILTSTONE, w/ powdery white silt, dry	x x x					
95.0		89.0 - 92.0 Dense to stiff, olive gray to med. gray, clayey SILTSTONE, thinly bedded, stratified, v. moist	x x x				Analytical Sample SHMW 10D2 95-105	
	2405	92.0 - 98.5 Stiff to v. stiff, olive gray (5Y, 4/1) to dk. greenish gray (5GY, 4/1), silty CLAYSTONE, sli. blocky, occ. whitish crystal inclusions (possibly mica or sulfides), occ. interbedded, thinly bedded (>0.2') blackish weathered shale zones, v. moist	x x x	2403.4 98.5				
100.0		98.5 - 108.0 Dense, olive gray (5Y, 4/1) to dk. greenish gray (5GY, 4/1), clayey sandy SILTSTONE, 12-30% fine sand, sli. to mod. stratified, occ. interbedded coalified wood stringers near 101' and from 103'-105', v. moist	x x x		Siltst			
105.0		Log continued on next page	x x x					

MW_GNPD_SH_OB AND MW_UPDATED SURVEY DATA 4_48_08.GPJ GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
 DRILLER: Alvin Anderson

GEOLOGIST: R. Marchese / R. Tolene
 CHECKED: A. Hobson
 DATE: 2/22/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-10

COORDINATES: N: 436,730 E: 1,370,596
 GROUND SURFACE ELEVATION: 2,501.9 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
105.0	2395	98.5 - 108.0 Dense, olive gray (5Y, 4/1) to dk. greenish gray (5GY, 4/1), clayey sandy SILTSTONE, 12-30% fine sand, sli. to mod. stratified, occ. interbedded coalified wood stringers near 101' and from 103'-105', v. moist	XXXXXX	2393.9	Siltst	v. moist	Analytical Sample SHMW 10D2 105-108	Run 11: 105'-115' 6" casing driven to 115'. Driller lifted rods and casing up to allow any drill water to expel in borehole WL = 108.6' (10/11/06, 0745) Boring Depth = 400', 8" Casing Depth = 295'
		108.0 - 109.5 V. dense, dk greenish gray (5GY, 4/1) to grayish olive (10Y, 4/2), interbedded sandy SILTSTONE and silty SANDSTONE, well-graded, sli. stratified, sandy silt beds, occ black (N1), thin, COAL stringers, v. moist	XXXXXX	2392.4	Siltst / Ss			
110.0	2390	109.5 - 114.7 Dense, silty SANDSTONE, well-graded, 12-30% clay, non-stratified, v. moist to wet	2387.2	Ss	v. moist to wet	Analytical Sample SHMW 10D2 108-115 and BD 093006RT	115' End drilling 9/29/06 Resume drilling 9/30/06 Run 12: 115'-130' Driller used water to push out core Driller's Note: Core fell out of barrel on the drill rig deck, drillers rebagged core in order before laying on ground
115.0	2385	114.7 - 114.9 Black (N1), COAL, dull w/ bright faces, occ. pyrite crystals, sub-fissile to fissile, possible sulfide coatings on some fresh surfaces, v. moist to wet	XXXXXX	114.7	COAL		Reference Grab Sample at 114.7'	
		114.9 - 128.0 Dense to v. dense, mostly dk. greenish gray (5GY, 4/1), sandy SILTSTONE to clayey SILTSTONE w/ interbeds of v. dense silt, 12-30% clay, v. moist	XXXXXX				Analytical Sample SHMW 10D2 115-123	
120.0	2380	117'-120' occ. oxidation staining 118'-119' occ. pyrite "nuggets"	XXXXXX		Siltst	v. moist		
125.0	2375	122'-124' occ. pyrite "nuggets" 125'-128' sl. stratified	XXXXXX				Analytical Sample SHMW 10D2 123-130	WL=129.5' (10/3/06, 0745) Boring Depth = 400', Casing Depth = 345' Run 13: 130'-140' Driller used water to push out core WL=131.1' (10/2/06, 1550) Boring Depth = 400', Casing Depth = 345'
130.0	2370	128.0 - 130.0 Dense to v. dense, mostly dk. greenish gray (5GY, 4/1), sandy SILTSTONE to clayey SILTSTONE w/ interbeds of v. dense silt, 20-35% clay, sl. stratified, v. moist	XXXXXX	2371.9				
		130.0 - 138.1 V. dense to hard, highly weathered, med. dk. gray (N4) to dk. greenish gray (5GY, 4/1), interbedded silty CLAYSTONE and clayey SILTSTONE, mod. blocky, moist to v. moist	XXXXXX	130.0			Analytical Sample SHMW 10D2 130-135	
135.0	2365	131' interbedded silt lens, wet 132.4' interbedded silt lens, wet 133' interbedded silt lens, wet	XXXXXX	2363.8			Analytical Sample SHMW 10D2 135-140	Run 14: 140'-148' Driller used water to push out core Note: moisture content may be
		138' interbedded silt lens, wet	XXXXXX	138.1	Siltst	v. moist		
140.0	2360	138.1 - 140.0 Dense, alt. bands of brownish black (5YR, 2/1) and med. gray (N5), sandy SILTSTONE, stratified, 12-30% to 50% clay, v. moist	XXXXXX	2361.9				
		139.2' dusky yellow (5Y, 6/4) weathered SILTSTONE stringer		Ss	wet		

Log continued on next page

MW_GNPD_SH_OB AND MW_UPDATED SURVEY DATA 4_48_08.GPJ_GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
 DRILLER: Alvin Anderson

GEOLOGIST: R. Marchese / R. Tolene
 CHECKED: A. Hobson
 DATE: 2/22/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-10

COORDINATES: N: 436,730 E: 1,370,596
 GROUND SURFACE ELEVATION: 2,501.9 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
		140.0 - 143.0 V. dense, highly weathered, dk. greenish gray (5GY, 4/1), SANDSTONE, fine to med. grained, 12-30% silt and clay, alt. brownish black (5YR, 2/1) banding, stratified, sli. varved, (fragmented sandstone w/ soft fine-sand and silt infilling), wet		2358.9 143.0	Ss	wet		affected by drill water
145.0		141.3' COAL stringer		2357.4 144.5	Clst		Analytical Sample SHMW 10D2 142-148	
	2355	143.0 - 144.5 Hard, dk. greenish gray (5GY, 4/1), silty CLAYSTONE (poorly bedded shales), thinly laminated, sli. blocky, v. moist			Sh			
		144.5 - 150.0 Hard, grayish black (N2), SHALE, poorly bedded, waxy bedding surface, sub-fissile, v. moist		2351.9 150.0				Run 15: 148'-162' Driller used water to push out core
150.0		150.0 - 151.5 V. dense to hard, weathered, interbedded SILTSTONE and CLAYSTONE, angular and blocky structure, narrow interbeds of fine-sandy silt, occ. coal stringers, v. moist		2350.4 151.5	Siltst / Clst		Analytical Sample SHMW 10D2 148-155	
	2350	151.5 - 151.7 Dusky yellow (5Y, 6/4) CHERT stringer		2349.9 152.0	CHERT		Reference Grab Sample at 153'	
		151.7 - 152.0 Interbedded SILTSTONE and CLAYSTONE as above (150'-151.5')		2348.4 153.5	CHERT	v. moist		
155.0		152.0 - 152.2 Dusky yellow (5Y, 6/4) CHERT stringer						
	2345	152.2 - 153.5 Interbedded SILTSTONE and CLAYSTONE as above (150'-151.5')			Siltst / Clst		Analytical Sample SHMW 10D2 155-162	
		153' - abundant pyrite crystals w/ large "nugget" of pyrite in this zone						
	2340	153.5 - 153.7 Dusky yellow (5Y, 6/4) CHERT stringer		2339.9 162.0			Analytical Sample SHMW 10D2 162-166	Run 16: 162'-170' Driller used water to push out core Note: bottom core bag (COAL) very warm to the touch
160.0		153.7 - 162.0 Interbedded SILTSTONE and CLAYSTONE as above (150'-151.5')			Siltst / Clst / Sh			
	2335	162.0 - 167.0 Weak, weathered, interbedded SILTSTONE and CLAYSTONE w/ thin interbeds of grayish black (N2) SHALE, sli. stratified, v. moist		2334.9 167.0				
		167.0 - 168.0 Loose, black (N1) to brownish black (5YR, 2/1), COAL, mostly dull w/ bright fresh faces, pyrite coatings on most planar faces, occ. 0.1' long pyrite nugget, no visible sulfur, moist		2333.9 168.0	COAL	moist		
170.0		168.0 - 169.2 V. dense, weathered, dk. greenish gray (5GY, 4/1), SHALE, sli. carbonaceous, waxy surfaces, thinly bedded, moist		2332.7 169.2	Sh			
	2330	169.2 - 169.4 COAL as above (167'-168')		2332.2 169.7	COAL			Run 17: 170'-185' Driller used water to push out core Note: all bags (COAL) very warm to the touch
		169.4 - 169.7 V. dense, weathered, dk. greenish gray (5GY, 4/1), SHALE, sli. carbonaceous, waxy surfaces, thinly bedded, moist						
175.0		169.7 - 182.0 Black (N1) to brownish black (5YR, 2/1), COAL, dull w/ bright faces, sli. cleating, possible sulfide or pyrite coatings on faces near bottom of seam (~182'), 30-50% fine sand and silt, wet to saturated			COAL	wet to sat.		Wetness of Run 17 may be influenced by drill water (6" casing was driven down to 170' before coring)
180.0		Log continued on next page						

MW_GNPD_SH_OB AND MW_UPDATED SURVEY DATA 4_48_08.GPJ GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
 DRILLER: Alvin Anderson

GEOLOGIST: R. Marchese / R. Tolene
 CHECKED: A. Hobson
 DATE: 2/22/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-10

COORDINATES: N: 436,730 E: 1,370,596
 GROUND SURFACE ELEVATION: 2,501.9 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
180.0								
	2320	182.0 - 183.5 Highly weathered, black (N1) to dk. gray (N3), SHALE, poorly to sli. bedded, sli. carbonaceous, waxy surfaces, moist to v. moist		2319.9 182.0	COAL	wet to sat.		
		183.5 - 187.5 V. dense, mottled dk. greenish gray to olive gray to brownish black (5YR, 2/1), weathered SANDSTONE, fine grained, sli. stratified, 5-12% silt, 12-30% clay, moist to v. moist		2318.4 183.5	Sh			
185.0						moist to v. moist		
	2315	187.5 - 189.0 Weathered, dk. greenish gray (5GY, 4/1) to olive gray (5Y, 4/1), interbedded SILTSTONE and CLAYSTONE, thinly to mod. bedded, moist to v. moist		2314.4 187.5	Siltst / Clst			Run 18: 185'-195' Driller used water to push out core Some hard drilling noticed through this run
		189.0 - 190.0 COAL, wet		2312.9 189.0 2311.9 190.0	COAL	wet	Analytical Sample SHMW 10D2 185-195	
190.0		190.0 - 195.0 Weathered, dk. greenish gray (5GY, 4/1) to olive gray (5Y, 4/1), interbedded SILTSTONE and CLAYSTONE, thinly to mod. bedded, moist to v. moist			Siltst / Clst			
195.0		195.0 - 196.5 V. dense, weathered, med. dk. gray (N4) to olive gray (5Y, 4/1), sandy SILTSTONE, 5-30% fine sand, 12-30% clay, w/ dusky yellow (5Y, 6/4) mod. weathered, fine-grained sandstone at 195.2-195.3' moist to v. moist		2306.9 195.0	Siltst			Run 19: 195'-210' Driller used water to push out core
	2305	196.5 - 196.7 Mod. weathered, fine-grained SANDSTONE stringer		2305.4 196.5	Ss	moist to v. moist	Analytical Sample SHMW 10D2 195-204	
200.0		196.7 - 203.5 V. dense, weathered, med. dk. gray (N4) to olive gray (5Y, 4/1), sandy SILTSTONE, 5-30% fine sand, 12-30% clay, moist to v. moist			Siltst			
	2300	198'-199' small, rounded, rust-colored nodules						
		203.5 - 204.0 Interbedded SILTSTONE and carbonaceous SHALE, thinly bedded, moist to v. moist		2298.4 203.5 2297.9 204.0	Siltst / Sh			204'-210' COAL is v. wet throughout
205.0		204.0 - 210.0 Black (N1), COAL, v. dull w/ bright faces, no noticeable pyrite coatings, occ. minor cleating, wet to saturated			COAL	wet to sat.		
210.0		210.0 - 221.0 V. dense, v. stiff, weathered, dk. greenish gray (5G, 4/1) to olive gray (5Y, 4/1), interbedded SILTSTONE, CLAYSTONE and SHALE, sli. massive to poorly bedded, approx. 50% clay content overall, low plasticity of claystonebeds, sli. blocky, sli. stratification of siltstone beds, sli. sub-fissile thinly bedded shales, shale units mostly grayish black (N2), possibly carbonaceous, occ. rusty brown oxidation inclusions throughout, v. moist		2291.9 210.0	Siltst / Clst / Sh	v. moist	Analytical Sample SHMW 10D2 210-215	Run 20: 210'-221' (logged 10/1/06) Driller used water to push out core
215.0							Analytical Sample SHMW 10D2 215-224	
2285								

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MW_GNPD_SH_OB AND MW_UPDATED SURVEY DATA 4_48_08.GPJ GNPP.GDT 4/29/08



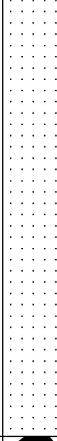
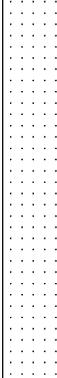
DRILLING CONTRACTOR: Boart Longyear
 DRILLER: Alvin Anderson

GEOLOGIST: R. Marchese / R. Tolene
 CHECKED: A. Hobson
 DATE: 2/22/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-10

COORDINATES: N: 436,730 E: 1,370,596
 GROUND SURFACE ELEVATION: 2,501.9 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
255.0		251.0 - 266.5 Firm to stiff, med. gray (N5) and dk. greenish gray (5GY, 4/1), clayey SANDSTONE, moist to v. moist			Ss		Analytical Sample SHMW 10D2 255-265	
2245								
260.0		266.5 - 266.8 COAL stringer		2235.4	COAL	moist to v. moist		Run 24: 267'-279'
2240								
265.0		266.8 - 278.0 Firm to stiff, med. dk. gray (N4) and dk. greenish gray (5GY, 4/1), clayey SANDSTONE, moist to v. moist			Ss		Analytical Sample SHMW 10D2 267-277	
2235								
270.0		278.0 - 282.0 V. soft to soft, black to dk. reddish brown, COAL, bright-fresh faces, pyrite nodules at 278', dry from 279'		2223.9	COAL	dry		Run 25: 279'-292' Driller used water to push out core
2230								
275.0		282.0 - 286.0 Stiff, med. lt. gray (N6) and greenish gray (5G, 6/1), clayey SILTSTONE, occ. coalified wood inclusions, small vertical veins of coal (~0.1' long) from 282'-283', moist to v. moist		2219.9	Silst	moist to v. moist	Analytical Sample SHMW 10D2 282.5-287.5	
2225								
280.0		285'-285.4' large coalified wood inclusion		2215.9	Ss	v. moist to wet		
2220								
285.0		286.0 - 288.0 Soft, med. gray (N5), silty SANDSTONE, fine grained, 12-30% clay, v. moist to wet		2213.9	Ss	v. moist to wet		
2215								
290.0		288.0 - 292.0 Stiff to v. stiff, med. gray (N5) to dk. gray (N3), clayey SILTSTONE, thinly bedded, few coalified wood inclusions, moist			Silst	moist	Analytical Sample SHMW 10D2 288-292	
2210								
				2209.9				

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MW_GNPD_SH_OB AND MW_UPDATED SURVEY DATA 4_48_08.GPJ GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
 DRILLER: Alvin Anderson

GEOLOGIST: R. Marchese / R. Tolene
 CHECKED: A. Hobson
 DATE: 2/22/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-10

COORDINATES: N: 436,730 E: 1,370,596
 GROUND SURFACE ELEVATION: 2,501.9 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
295.0	2205	292.0 - 301.0 Stiff to hard, sli. to mod. weathered, med. gray (N5) to dk. gray (N3), SILTSTONE, interbedded from 299 to 301 w/ CLAYSTONE, blocky, some thin stratification, moist to v. moist			Siltst / Clst	moist to v. moist	Analytical Sample SHMW 10D2 294-299	Run 26: 292'-302' Driller used water to push out core Driller's Note: Drill rods rattling through middle of run (denser/more difficult rock)
300.0	2200	301.0 - 307.0 V. soft to soft, dk. reddish brown to black, COAL w/ bright fresh faces, dry		2200.9 301.0	COAL	dry		Run 27: 302'-315' Driller used water to push out core
305.0	2195	307.0 - 308.0 Med. strong, med. gray (N5) to black (N1), SHALE, carbonaceous, v. thinly bedded, dry		2194.9 307.0 2193.9 308.0	Sh			
310.0	2190	308.0 - 315.0 Stiff to v. stiff, greenish gray (5GY, 6/1) to dk. greenish gray (5GY, 4/1), clayey SILTSTONE, blocky, moist 308'-310' several coalified wood inclusions			Siltst	moist	Analytical Sample SHMW 10D2 308-312	
315.0	2185	315.0 - 316.0 Stiff to v. stiff, med. gray (N5) to dk. gray (N3), SILTSTONE, 5-12% clay, v. thinly bedded, v. moist		2185.9		v. moist		Run 28: 315'-321' Driller used water to push out core Driller's Note: hard drilling in middle of run
320.0	2180	316.0 - 317.0 Strong, lt. gray (N7), SANDSTONE, v. fine grained, dry		316.0 2184.9 317.0	Ss	dry	Analytical Sample SHMW 10D2 315-320 and BD 10-01-06RJM	
325.0	2175	317.0 - 322.0 Extremely weak, med. lt. gray (N6) to dk. gray (N3), SILTSTONE, interbedded w/ soft lenses, moist			Siltst	moist		321' End drilling 10/1/06 Resume drilling 10/2/06 Run 29: 321'-329.5' Driller used water to push out core
330.0		322.0 - 324.0 Extremely weak, lt. gray (N7) to black (N1), SHALE, carbonaceous, thinly bedded, sub-fissile, few lenses (~0.2') of sub-fissile, waxy coal, dry		2179.9 322.0	Sh	dry	Analytical Sample SHMW 10D2 321-326	
		324.0 - 325.0 Ext. weak to v. weak, lt. gray (N3), interbedded SILTSTONE and CLAYSTONE, moist		2177.9 324.0 2176.9 325.0	Siltst / Clst Ss			
		325.0 - 325.2 Yellowish gray (5Y, 8/1) SANDSTONE stringer, v. fine grained, moist			Siltst / Clst	moist		
		325.2 - 331.0 Ext. weak to v. weak, lt. gray (N3), interbedded SILTSTONE and CLAYSTONE, moist						

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MW_GNPD_SH_OB AND MW_UPDATED SURVEY DATA 4_48_08.GPJ GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
 DRILLER: Alvin Anderson

GEOLOGIST: R. Marchese / R. Tolene
 CHECKED: A. Hobson
 DATE: 2/22/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-10

COORDINATES: N: 436,730 E: 1,370,596
 GROUND SURFACE ELEVATION: 2,501.9 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
330.0				2170.9	Siltst / Clst	moist		Run 30: 329.5'-345' Driller used water to push out core
	2170	331.0 - 334.0 Ext. weak, dk. reddish brown to black, COAL, sub-fissile to fissile, several saturated lenses, dry		331.0	COAL	dry		
				2167.9				
		334.0 - 335.0 V. soft, dk. yellowish brown, saturated MUD/CLAY, has consistency of pudding		334.0	MUD / CLAY	sat.	Analytical Sample SHMW 10D2 334-335	
335.0				2166.9				
	2165	335.0 - 343.0 Stiff to v. stiff, greenish gray (5GY, 6/1) to dk. greenish gray (5GY, 4/1), sandy SILTSTONE, fine grained, 5-12% clay, few coalified wood inclusions, moist		335.0			Analytical Sample SHMW 10D2 335-338	
	2160							
				2158.9				
		343.0 - 343.4 V. soft, dk. yellowish brown, saturated MUD/CLAY, has consistency of pudding		343.0	MUD / CLAY	sat.		
	2155	343.4 - 345.0 Ext. weak to v. weak, lt. gray (N7) and greenish gray (5GY, 6/1) to dk. greenish gray (5GY, 4/1), SILTSTONE, some interbedded CLAYSTONE, occ. coalified wood inclusions, moist		345.0	Siltst / Clst	moist		Run 31: 345'-353' Driller used water to push out core Hot and steaming coal V. hard drilling
		345.0 - 350.0 Ext. weak to v. weak, lt. gray (N7) and greenish gray (5GY, 6/1) to dk. greenish gray (5GY, 4/1), SILTSTONE, little yellowish gray (5Y, 8/1) mottling, occ. coalified wood inclusions, moist to v. moist			Siltst	moist to v. moist	Analytical Sample SHMW 10D2 346-351	
				2151.9				
350.0		347' no more yellowish gray mottling or coalified wood inclusions, transitions to v. fine grained sandy SILTSTONE, 5-12% clay		350.0	COAL	dry		
	2150	350.0 - 351.0 Ext. weak to v. weak, dk. reddish brown to black, COAL, fissile, warm and steaming after coming out of core barrel, dry		351.0				
				2148.9				
		351.0 - 353.0 V. weak, med. lt. gray (N6), SILTSTONE, thinly bedded, interbedded clay lenses, 5-12% clay, moist		353.0	Sh	dry		Run 32: 353'-367'
		353.0 - 354.0 Ext. weak, med. dk. gray (N4) to black (N1), SHALE, v. thinly bedded, carbonaceous, v. thin lenses of coal, dry		2147.9				
355.0								
	2145	354.0 - 355.0 V. weak, med. lt. gray (N6), SILTSTONE, thinly bedded, interbedded clay lenses, 5-12% clay, moist		354.0		moist		
		355.0 - 361.0 V. soft to soft, lt. gray (N7) to med. gray (N5), sandy SILTSTONE, v. fine grained, 5-12% clay, wet to saturated				wet to sat.	Analytical Sample SHMW 10D2 356-361	
360.0								
	2140	361.0 - 367.0 Ext. weak to v. weak, lt. gray (N7) to med. gray (N5), SILTSTONE, thinly bedded, 12-30% clay, occ. coalified wood inclusions, moist						
	2135			2134.9				
				367.0				

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MW_GNPD_SH_OB AND MW_UPDATED SURVEY DATA 4_48_08.GPJ GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
 DRILLER: Alvin Anderson

GEOLOGIST: R. Marchese / R. Tolene
 CHECKED: A. Hobson
 DATE: 2/22/2007

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PROJECT: South Heart Project

PROJECT NUMBER: 063-2174

LOCATION: South Heart, ND

DRILL RIG: CME-850

INCLINATION: -90°

DRILLING METHOD: Hollow Stem Auger

DATE STARTED: 05/01/07 11:10

DATE COMPLETED: 05/01/07 12:45

DRILLING FLUIDS: None

DRILL LUBRICANTS: None

RECORD OF BORING SHMW-11

COORDINATES: N: 434,135 E: 1,362,245

GROUND SURFACE ELEVATION: 2,518.3 ft

PROJECTION: StatePlane, North Dakota South, 3302

DATUM: NAD 27

HORIZONTAL UNITS: Feet

TOTAL DEPTH: 30.5 ft

BOTTOM ELEVATION: 2,487.8 ft

COLLAR ELEVATION: 2,520 NA

HOLE DIAMETER: 7.5 inches

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE NUMBER	BLOWS per 6 in	N	RECOVERY (ft)	COMMENTS
0.0		0.0 - 2.5 Loose, dark yellow brown (10YR 4/2), fine-grained silty SAND, many roots at surface, moist			SM	moist	1	2 2 2 2	4	0.6 2	Start drilling at 11:10 am on 5/1/2007
	2515	2.5 - 6.0 Loose, pale yellow brown (10YR 6/2), fine-grained SAND with trace of silt, dry		2515.8 2.5	SP		2	2 3 3 4	6	1.2 2	
		4'-6' slightly moist				sli. moist	3	2 3 3 3	6	0.4 2	
		6.0 - 8.0 Loose, dark yellow brown (10YR 4/2), silty SAND, slightly moist		2512.3 6.0	SM		4	2 2 3 3	5	1 2	
	2510	8.0 - 12.0 Very soft to soft, moderate yellow brown to dark yellow brown (10YR 5/4 to 10YR 4/2) or dusky yellow brown (10YR 2/2), sandy CLAY, low to medium plasticity, moist		2510.3 8.0	CL	moist	5	2 2 2 1	4	0 2	8'-10' logged from cuttings (did not match sample recovered from this run)
							6	1 1 1 1	2	0.2 2	10' cutting are becoming wet
	2505	12.0 - 17.2 Very soft, dark yellow brown (10YR 4/2), CLAY with trace of fine-grained sand, medium to high plasticity, wet		2506.3 12.0	CL	wet	7	1 1 1 for 12"	>100	1.4 2	
		14.4' color becomes mottled dark yellow brown (10YR 4/2)					8	0 0 0 0	0	1.8 2	14.8' Free water

Log continued on next page

MW AVF GNPD SH OB AND MW UPDATED SURVEY DATA 4_48_08.GPJ GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Braun Intertec
DRILLER: C. Powers

GEOLOGIST: R. Witt
CHECKED: E. Pottorff
DATE: 8/27/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-11

COORDINATES: N: 434,135 E: 1,362,245
 GROUND SURFACE ELEVATION: 2,518.3 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV.	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE NUMBER	BLOWS per 6 in	N	RECOVERY (ft)	COMMENTS	
				DEPTH (ft)								
15.0		and light olive (5Y 5/2) 12.0 - 17.2 Very soft, dark yellow brown (10YR 4/2), CLAY with trace of fine-grained sand, medium to high plasticity, wet			CL	wet	8	0 0 0 0	0	1.8 2	26' Density and strength of material increasing with depth 28' sample barrel dripping wet Auger refusal at 30.5' on 5/1/2007 at 12:45. TD = 30.5'	
				2501.1				9	0 0 0 0	0		2 2
	2500	17.2 - 20.8 Very soft, olive gray (5Y, 5/1), fine- to medium-grained sandy CLAY, wet			17.2		CL	10	0 0 0 0	0		1.6 2
20.0					2497.5			11	0 0 0 0	0		1.7 2
		20.8 - 23.5 Very soft, medium dark gray (N4), silty CLAY with trace of very fine-grained sand, medium plasticity, wet			20.8		CL	12	0 0 0 3	0		2.0 2
	2495				2494.8			13	1 1 2 2	3		2 2
		23.5 - 26.0 Very loose, medium dark gray (N4), very fine- to medium-grained SAND with trace of clay and coal fragments, wet			23.5		SP	14	3 5 13 20	18		2 2
25.0		24.7'-24.8' coal fragment			2492.3			Ss	15	50		>100
		26.0 - 27.6 Medium hard, medium olive gray (5Y 5/1), very fine- to coarse- grained SANDSTONE, with trace of coal			26.0		COAL		16	50 50 50		100
	2490	27.6 - 30.5 Hard, black, COAL (well developed plates), very little cleating, mostly dull, wet			2490.7			30'-30.5' increase in cleating and brightness				
30.0					2487.8							
					30.5							

Boring completed at 30.5 ft.

Boring completed at 30.5 ft.

MW AVF GNPD SH OB AND MW UPDATED SURVEY DATA 4_48_08.GPJ GPPP.GDT 4/29/08



DRILLING CONTRACTOR: Braun Intertec
 DRILLER: C. Powers

GEOLOGIST: R. Witt
 CHECKED: E. Pottorff
 DATE: 8/27/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174

LOCATION: South Heart, ND

DRILL RIG: Gus Pech - RD 300

INCLINATION: -90°

DRILLING METHOD: Rotasonic

DATE STARTED: 10/12/06 13:05

DATE COMPLETED: 10/14/06 09:45

DRILLING FLUIDS: Water

DRILL LUBRICANTS: Well-Guard Monitor Well Thread Compound

RECORD OF BORING SHMW-12

COORDINATES: N: 432,062 E: 1,369,166

GROUND SURFACE ELEVATION: 2,558.6 ft

PROJECTION: StatePlane, North Dakota South, 3302

DATUM: NAD 27

UNITS: Feet

TOTAL DEPTH: 250.0 ft

BOTTOM ELEVATION: 2,308.6 ft

COLLAR ELEVATION: 2,561 ft (approximate)

HOLE DIAMETER: 6 inches

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
0.0		0.0 - 4.8 Dense, med. olive brown (5Y, 4/4), clayey SILT, 12-30% fine sand, 12-50% clay, occ. med. yellow (5Y, 7/6) and lt. olive brown (5Y, 5/6) mottling, moist			ML	moist	Analytical Sample SHMW-12D 0-5	Note: Geologic scale was used for grain size descriptions (v. fine through v. coarse) Run 1: 0-5' Driller used water to push out core
5.0		4.8 - 6.5 Dense, med. olive brown (5Y, 4/4), sandy SILT, fine grained, 12-30% clay, moist		2552.1			Analytical Sample SHMW-12D 5-8	Run 2: 5'-15' Driller used water to push out core
		6.5 - 8.0 Stiff, dk. greenish gray (5GY, 4/1) to olive gray (5Y, 4/1), silty CLAY, moist		6.5	CL			
		6.8'-6.9' Possibly v. soft, lt. gray (N7) bentonite		2550.6			Analytical Sample SHMW-12D 8-11	
		6.9'-7.1' V. weathered, black (N1) SHALE		8.0	Clst			
10.0		8.0 - 11.0 Stiff, weathered, olive gray (5Y, 4/1), CLAYSTONE, sli. blocky, v. moist to wet		2547.6			Analytical Sample SHMW-12D 11-14.5	
		11.0 - 14.5 Dense to compact, dk. greenish gray (5GY, 4/1) to mod. yellow brown (10YR, 5/4), silty SANDSTONE, fine to med. grained, 12-30% clay, v. moist to wet		11.0	Ss	v. moist to wet	Analytical Sample SHMW-12D 11-14.5	
		11.5'-12.0' weathered CLAYSTONE		2544.1			Analytical Sample SHMW-12D 14.5-19	Run 3: 15'-25' Driller used water to push out core Note: wet zones may be perched water (internal to core), but could also be a result of drilling
		14.5 - 15.0 Hard, brownish black (5YR, 2/1) to olive black (5Y, 2/1), limy SILTSTONE, some calc. carbonate, w/ sandy silt, some mod. yellowish brown (10YR, 5/4) fine grained silty sand, v. moist to wet		14.5			Analytical Sample SHMW-12D 19-24	
		15.0 - 25.0 Stiff, weathered, med. dk. gray (N4) to olive gray (5Y, 4/1), SILTSTONE, occ. interbedded zones of stiff to firm, silty CLAYSTONE/clayey SILTSTONE, 0-5% fine sand, 5-12% med. sand, v. moist to wet			Slst	v. moist w/ wet zones	Analytical Sample SHMW-12D 24-29	▼ WL = 24.5 (10-14-06, 0730) Boring Depth = 207, Casing Depth = 195 Run 4: 25'-35' Driller used water to push out core
		25.0 - 33.0 SILTSTONE as above w/ interbedded clayey silt beds containing intermittent wet lenses in between bedding planes, v. moist to wet					Analytical Sample SHMW-12D 24-29	

Log continued on next page

MW_GNPD_SH_OB AND MW_UPDATED SURVEY DATA 4_48_08.GPJ GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
 DRILLER: Alvin Anderson

GEOLOGIST: R. Marchese
 CHECKED: A. Hobson
 DATE: 2/22/2007

SHEET 1 of 7

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-12

COORDINATES: N: 432,062 E: 1,369,166
 GROUND SURFACE ELEVATION: 2,558.6 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
2490	66.0 - 70.0	Loose, blackish red (5R, 2/2) to brownish black (5YR, 2/1), COAL, dull, sub-fissile, occ. pyrite coatings, moist		2488.6	COAL		Analytical Sample SHMW-12D 66-70	73' End drilling 10/12/06 Resume drilling 10/13/06 Run 9: 73'-85' Driller used water to push out core
70.0	70.0 - 73.0	V. dense, weathered, greenish gray (5GY, 6/1) to lt. olive gray (5Y, 6/1), SILTSTONE, occ. coalified wood inclusions, moist		70.0		moist	Analytical Sample SHMW-12D 70-75 + BD-AGV-2	
2485	73.0 - 80.0	Dense, greenish gray (5GY, 6/1), clayey SILTSTONE, sli. stratified, sli. varved, alternating olive gray (5Y, 4/1) and med. gray (N5) color bands, occ. intermittent zones (2' thick) of compact silt, 12-30% clay, 5-12% fine sand, sli. liquefaction apparent, v. moist		2478.6	Siltst	v. moist	Analytical Sample SHMW-12D 75-80	
2480	80.0 - 81.5	V. dense, olive black (5Y, 2/1), CLAYSTONE, waxy, low plasticity, shiny appearance, thin bedding planes visible, moist		80.0	Clst		Analytical Sample SHMW-12D 80-81.5	Run 10: 85'-95' Driller used water to push out core
	81.5 - 82.5	Brownish black (5YR, 2/1), poorly defined COAL seam, dull w/ some bright surfaces, mixed w/ firm, silty CLAYSTONE, med. gray (N5), moist		2477.1	COAL	moist	Reference Grati Sample at SHMW-12D 81.5'	
2475	82.5 - 85.0	V. dense, weathered, dk. greenish gray (5GY, 4/1), CLAYSTONE, 5-12% silt, occ. partially coalified wood inclusions, possible marcasite spotting on some planar surfaces, moist		2476.1	Clst		Analytical Sample SHMW-12D 81.5-86	
85.0	85.0 - 90.0	Dense, weathered, brownish gray (5YR, 4/1) to dk. greenish gray (5GY, 4/1), interbedded CLAYSTONE and SILTSTONE, sli. blocky, occ. thin wet silty lenses, v. moist		2473.6	Clst / Siltst	v. moist	Analytical Sample SHMW-12D 86-90 Reference Sample SHMW-12D 85-95	
2470	90.0 - 105.0	Dense to compact, dk. greenish gray (5GY, 4/1) to greenish gray (5GY, 6/1), silty SANDSTONE, fine to med. grained, 5-12% clay, v. sli. to sli. liquefaction when shaken, wet to saturated		85.0			Analytical Sample SHMW-12D 90-95	
2465		95' clay content increases to 12-30%			Ss	wet to sat.	Reference Sample 95-105 Analytical Sample SHMW-12D 95-100 Analytical Sample SHMW-12D 100-105	Run 11: 95'-105' Driller used water to push out core

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MW_GNPD_SH_OB_AND_MW_UPDATED_SURVEY_DATA_4_48_08_GPJ_GNPP_GDT_4/29/08



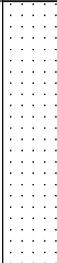
DRILLING CONTRACTOR: Boart Longyear
 DRILLER: Alvin Anderson

GEOLOGIST: R. Marchese
 CHECKED: A. Hobson
 DATE: 2/22/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-12

COORDINATES: N: 432,062 E: 1,369,166
 GROUND SURFACE ELEVATION: 2,558.6 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
105.0		102'-105' increasing med. sand content			Ss	wet to sat.	Analytical Sample SHMW-12D 105-110	Run 12: 105'-115' Driller used water to push out core
110.0	2450	105.0 - 115.0 Dense to compact, dk. greenish gray (5GY, 4/1) to olive gray (5Y, 4/1), silty SANDSTONE, fine to med. grained, 12-50% clay, v. sli. to sli. liquefaction when shaken, occ. thin organic stringers (brownish black (5YR, 2/1)), wet to saturated						
115.0	2445	112'-115' becomes sli. more silty, clay content decreases (to 5-30%), sli. more fine to med. sand content		2443.6				
115.0		115.0 - 122.0 Dense, dk. greenish gray (5GY, 4/1) to olive gray (5Y, 4/1), silty SANDSTONE, fine grained, 12-50% clay, grading to hard, weathered CLAYSTONE and interbedded SHALES, olive gray (5Y, 4/1) to brownish gray (5YR, 4/1), v. moist to wet		115.0	Ss / Clst / Sh	v. moist to wet	Analytical Sample SHMW-12D 115-120	Run 13: 115'-125' Driller used water to push out core
120.0	2440	119.5' occ. pyrite 'nuggets' found						
		120'-122' occ. organic coalified wood stringers		2436.6				
125.0	2435	122.0 - 136.0 Loose, black (N1) to brownish black (5YR, 4/1), COAL, dull w/ some bright surfaces, wet			122.0	COAL	wet	
130.0	2430							Note: COAL seam not sampled
135.0	2425							
135.0		136.0 - 143.0 V. dense, weathered, olive black (5YR, 2/1) to brownish gray (5YR, 4/1), CLAYSTONE w/ interbeds of weathered SHALES, waxy surfaces, sli. blocky, moist to v. moist		2422.6	Clst / Sh	moist to v. moist	Analytical Sample SHMW-12D 138-143	Run 15: 136'-148' Driller used water to push out core
140.0	2420							

Log continued on next page

MW_GNPD_SH_OB_AND_MW_UPDATED_SURVEY_DATA_4_48_08_GP.J_GNPP.GDT_4/29/08



DRILLING CONTRACTOR: Boart Longyear
 DRILLER: Alvin Anderson

GEOLOGIST: R. Marchese
 CHECKED: A. Hobson
 DATE: 2/22/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-12

COORDINATES: N: 432,062 E: 1,369,166
 GROUND SURFACE ELEVATION: 2,558.6 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
180.0		180.0 - 181.0 V. weathered, brownish gray (5YR, 4/1) to brownish black (5YR, 2/1), CLAYSTONE, waxy, 5-12% silt, v. moist		180.0 2377.6 181.0	Clst	v. moist		Run 19: 182'-191' Driller used water to push out core
		181.0 - 183.0 V. dense, weathered, SILTSTONE, sli. varved, v. moist						
	2375	182.0' becomes moist to v. moist					Analytical Sample SHMW-12D 182.5-187.5 + BD JE-02	
185.0		183.0 - 187.5 SILTSTONE from above becomes interbedded w/ lt. gray (N7) to olive gray (5Y, 4/1), clayey SILTSTONE, varved, 30-50% clay, moist to v. moist			Siltst	moist to v. moist		
		187.5 - 188.0 V. hard, lt. gray (N7), SILTSTONE, v. fragmented, powdery residue, dry				dry		Run 20: 191'-207' Driller used water to push out core
	2370	188.0 - 191.0 Dense, weathered, lt. olive gray (5Y, 6/1), SILTSTONE, sli. blocky, interbeds of varved clayey silt, moist to v. moist		2367.6		moist to v. moist		
190.0		191.0 - 192.0 Lt. olive gray (5Y, 6/1) to olive gray, interbedded CLAYSTONE and SILTSTONE, 5-12% fine sand, occ. dk. brown organic inclusions, moist to v. moist		191.0 2366.6 192.0	Clst / Siltst		Analytical Sample SHMW-12D 191-195.5	
		192.0 - 194.0 Wet SILT (extremely weathered SILTSTONE)		2364.6	Siltst	wet		▼ WL = 195.4 (10-14-06, 1205) Boring Depth = 250, Casing Depth = 195
	2365	194.0 - 195.5 Lt. olive gray (5Y, 6/1) to olive gray, interbedded CLAYSTONE and SILTSTONE, 5-12% fine sand, occ. dk. brown organic inclusions, moist to v. moist		2363.1 195.5 2362.1 196.5	Clst / Siltst	moist to v. moist		
195.0		195.5 - 196.5 Sli. to mod. weathered, black (N1) to blackish red (5R, 2/2), COAL, dull, v. moist to wet			COAL	v. moist to wet		207' End drilling 10/13/06 Resume drilling 10/14/06 Run 21: 207'-220' Driller used water to push out core
	2360	196.5 - 202.5 Lt. olive gray (5Y, 6/1) to olive gray, interbedded CLAYSTONE and SILTSTONE, 5-12% fine sand, occ. dk. brown organic inclusions, moist to v. moist		2355.1 203.5	Clst / Siltst	moist to v. moist	Analytical Sample SHMW-12D 196.5-202.5	
200.0		202.5 - 203.5 Sli. to mod. weathered, black (N1) to blackish red (5R, 2/2), COAL, dull, v. moist to wet			COAL	v. moist to wet		
	2355	203.5 - 207.0 V. weathered, grayish green (10G, 4/2), SANDSTONE, --interbedded with-- dense, weathered, olive gray (5Y, 4/1), SILTSTONE, occ. dk. brown coalified wood / organic inclusions / nodules throughout, v. moist		2351.6 207.0	Ss / Siltst	v. moist	Analytical Sample SHMW-12D 203.5-207	
205.0		207.0 - 213.0 Weak, weathered, olive gray (5Y, 4/1) to dk. greenish gray (5GY, 4/1), interbedded SILTSTONE and CLAYSTONE, blocky, moist to v. moist			Siltst / Clst			207' End drilling 10/13/06 Resume drilling 10/14/06 Run 21: 207'-220' Driller used water to push out core
	2350	213.0 - 216.0 Brownish gray, med. lt. gray and olive gray banding, clayey SILTSTONE, varved, zone of closely spaced silt lenses w/ dk. organic bedding planes from 213'-213.4', moist to v. moist		2345.6 213.0		moist to v. moist	Reference Sample SHMW12D 213-215 and Analytical Sample SHMW12D 213-216.5	

Log continued on next page

MW_GNPD_SH_OB AND MW_UPDATED SURVEY DATA 4_48_08.GPJ GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
 DRILLER: Alvin Anderson

GEOLOGIST: R. Marchese
 CHECKED: A. Hobson
 DATE: 2/22/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-12

COORDINATES: N: 432,062 E: 1,369,166
 GROUND SURFACE ELEVATION: 2,558.6 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
2340		216.0 - 220.0 Dense to v. dense, sandy SILTSTONE, fine grained, 30-50% clay, moist to v. moist	XXXXXX	2338.6	Silst	moist to v. moist	Analytical Sample SHMW-12D 216.5-220	Run 22: 220'-235' Driller used water to push out core
220.0		219.5' becomes varved 220.0 - 225.0 Dense to v. dense, olive gray (5Y, 4/1) to dk. greenish gray (5GY, 4/1), interbedded CLAYSTONE and SHALE, occ. interbeds of weathered siltstone, sli. moist to moist	XXXXXX	220.0	Clst / Sh	sli. moist to moist	Analytical Sample SHMW-12D 220-225	
2335		223'-223.4' zone of saturation	XXXXXX	2333.6			sat. sli. moist to moist	
225.0		225.0 - 225.2 Hard, dusky yellow (5Y, 6/4), cherty SILTSTONE, fractured, dry	XXXXXX	225.0	Silst	dry	Analytical Sample SHMW-12D 225-230	
2330		225.2 - 233.5 Dense to v. dense, olive gray (5Y, 4/1) to dk. greenish gray (5GY, 4/1), interbedded CLAYSTONE and SHALE, occ. interbeds of weathered siltstone, sl. moist to moist w/ occ. wet lenses	XXXXXX	2325.1	Clst / Sh	sli. moist to moist w/ wet lenses	Analytical Sample SHMW-12D 230-235	
2325		233.5 - 234.0 Dense, sandy SILTSTONE, fine grained, 30-50% clay, sli. moist to moist	XXXXXX	233.5		Silst	sli. moist to moist	
235.0		234.0 - 234.5 Varved clayey SILTSTONE, sli. moist to moist	XXXXXX	2324.1	Clst / Sh	sli. moist to moist w/ wet lenses	Analytical Sample SHMW-12D 235-240 + BD RJM-03	Run 23: 235'-250'
2320		234.5 - 235.0 Dense to v. dense, olive gray (5Y, 4/1) to dk. greenish gray (5GY, 4/1), interbedded CLAYSTONE and SHALE, occ. interbeds of weathered siltstone, sli. moist to moist w/ occ. wet lenses	XXXXXX	234.5		Clst / Sh	moist to moist w/ wet lenses	
240.0		235.0 - 243.0 Dk. greenish gray (5GY, 4/1) to olive gray (5Y, 4/1), interbedded CLAYSTONE and SILTSTONE, sli. blocky, numerous thin wet lenses w/in bedding planes, v. moist w/ wet lenses	XXXXXX	2323.6	Clst / Silst	v. moist w/ wet lenses	Analytical Sample SHMW-12D 240-245	
2315		243.0 - 250.0 Weathered, black (5Y, 2/1), SHALE, sub-fissile, waxy surfaces --interbedded with-- olive gray, SILTSTONE, moist to v. moist	XXXXXX	2315.6				
245.0			XXXXXX	243.0	Sh / Silst	moist to v. moist	Analytical Sample SHMW-12D 245-250	
2310			XXXXXX	2308.6				
250.0		Boring completed at 250.0 ft		250.0				TD = 250' (10/14/06, 0945)

MW_GNPD_SH_OB AND MW_UPDATED SURVEY DATA 4_48_08_GPJ_GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
 DRILLER: Alvin Anderson

GEOLOGIST: R. Marchese
 CHECKED: A. Hobson
 DATE: 2/22/2007

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PROJECT: South Heart Project

PROJECT NUMBER: 063-2174

LOCATION: South Heart, ND

DRILL RIG: Gus Pech - RD 300

INCLINATION: -90°

DRILLING METHOD: Rotasonic

DATE STARTED: 10/13/06 07:59

DATE COMPLETED: 10/14/06 14:18

DRILLING FLUIDS: Water

DRILL LUBRICANTS: Well-Guard Monitor Well Thread Compound

RECORD OF BORING SHMW-13

COORDINATES: N: 425,009 E: 1,364,906

GROUND SURFACE ELEVATION: 2,567.8 ft

PROJECTION: StatePlane, North Dakota South, 3302

DATUM: NAD 27

UNITS: Feet

TOTAL DEPTH: 200.0 ft

BOTTOM ELEVATION: 2,367.8 ft

COLLAR ELEVATION: 2,570 ft (approximate)

HOLE DIAMETER: 6 inches

MW_GNPD_SH_OB AND MW_UPDATED SURVEY DATA 4_48_GP.J_GNPP.GDT 4/29/08

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
0.0		0.0 - 1.8 Soft, dk. yellowishbrown (10YR, 4/2), sandy CLAY, v. fine to med. grained, tr. silt, many roots, low-no plasticity, moist				moist		Note: Geologic scale was used for grain size descriptions (v. fine through v. coarse) Run 1: 0-5'
1.8	2565	1.8 - 3.5 V. stiff to hard, yellowishbrown (10YR, 5/2), silty CLAY, tr. v. fine to med. sand, tr. roots, dry			CL	dry		
3.5	5.0	3.5 - 8.0 V. stiff to hard, dk. yellowishbrown (10YR, 4/2), silty CLAY, tr. v. fine to med. sand, marbled/veined white material (calcite), sli. moist				sli. moist	Run 2: 5'-15'	
8.0	2560	8.0 - 15.0 Firm, mottled dk. yellowish brown (10YR, 5/4) and olive gray (5Y, 3/2), CLAYSTONE, tr. sand, tr. silt, low to no plasticity, honeycomb structure throughout, sli. platy/stratified, tr. calcite, NR w/ HCl (except calcite has WR), moist		2559.8 8.0				
15.0	2555	15.0 - 20.0 Firm, dk. yellowish brown (10YR, 4/2), silty CLAYSTONE, tr. (10%) v. fine to med. sand, moist						Run 3: 15'-25'
18'	2550	18' color becomes mottled w/ mod. olive brown (5Y, 4/4)			Clst	moist		15'-32' NR w/ HCl except as noted below
20.0	2545	20.0 - 28.0 Stiff to firm, olive gray (5Y, 3/2), CLAYSTONE, 5-15% silt, sub-fissile, mod. laminated, low plasticity, sli. blocky, waxy, moist						Run 4: 25'-32'
25.0	2540			2539.8 28.0	Ss	v. moist		26' some powder coatings btw. layers in claystone w/ mod. rxn to HCl
30.0		Log continued on next page						



DRILLING CONTRACTOR: Boart Longyear
DRILLER: Tom Devick

GEOLOGIST: R. Witt
CHECKED: A. Hobson
DATE: 2/22/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-13

COORDINATES: N: 425,009 E: 1,364,906
 GROUND SURFACE ELEVATION: 2,567.8 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
30.0		28.0 - 31.5 Loose, v. poorly consolidated, lt. olive gray (5Y, 5/2), clayey SANDSTONE, v. fine to coarse grained (mostly fine to med.), tr. pyrite or mica, v. moist		2536.3 31.5	Ss	v. moist		Moisture content probably affected by drilling - free water visible in fresh breaks, core is steaming a lot from heat of drilling 32' Drilling becomes much harder Run 5: 32'-35' Run 6: 35'-45' Note: run fell out of sample barrel - retrieved on second try w/ recovery bit Run 7: 45'-55' Note: run fell out of sample barrel - retrieved on second try w/ recovery bit Run 8: 55'-70' Note: 20' of recovery in 20' core barrel, 6' of recovery jammed into 2" dia. rods Driller's Note: hole feels like it is making water ▼ WL = 64.5 (10-13-06, 1705) Boring Depth = 138', Casing Depth = 115' ▼ WL = 66.3 (10-14-06, 0745) Boring Depth = 138', Casing Depth = 115'
	2535	31.5 - 31.9 Stiff to firm, olive gray (5Y, 3/2), CLAYSTONE, 5-15% silt, sub-fissile, mod. laminated, low plasticity, sli. blocky, waxy, moist		2535.9 31.9	Clst	dry		
		31.8'-31.9' color becomes brownish black (5YR, 2/1)		2532.8				
35.0		31.9 - 32.0 Hard, brownish black (5YR, 2/1), COAL, platy, tr. clay, dry		35.0	COAL	v. moist		
		32.0 - 35.0 Hard, brownish black (5YR, 2/1), COAL, platy, v. moist			Clst	moist		
	2530	35.0 - 39.5 Stiff, lt. olive gray (5Y, 5/1), CLAYSTONE, tr. v. fine to fine sand, tr. silt, tr. pyrite or mica, sli. blocky, moist		2528.3 39.5		v. moist		
40.0		39' color becomes brownish black (5YR, 2/1), v. moist		2527.8 40.0	COAL			
		39.5 - 40.0 Soft, v. weathered, black (N1) to brownish black (5YR, 2/1), COAL, mod. plasticity, v. moist				moist		
	2525	40.0 - 45.0 Firm to stiff, lt. olive gray (5Y, 6/1), clayey SILTSTONE, tr. v. fine to fine sand, tr. mica or pyrite, blocky, hardness increases w/ depth, moisture decreases w/ depth, moist			Sltst			
45.0		45.0 - 48.0 Firm to stiff, lt. olive gray (5Y, 6/1), clayey SILTSTONE, 5-15% v. fine to med. sand, tr. mica or pyrite, blocky, hardness increases w/ depth, moisture decreases w/ depth, 1/2"-2" dia. inclusions of saturated material at center of core every 2-3", moist		2519.8 48.0		moist w/ sat. pockets		
	2520	48.0 - 50.0 Firm to compact, lt. olive gray (5Y, 6/1), silty SANDSTONE, v. fine to med. grained, stratified, tr. mica/pyrite throughout, sli. blocky, moist						
50.0		50.0 - 57.0 Compact, SANDSTONE, v. fine to med. grained, tr. silt, tr. clay, moist			Ss	moist		
	2515	54'-55' tr. partially coalified wood fragments						
		57.0 - 61.0 Stiff, blackish red to brownish black (5YR, 2/1), COAL, 2 stringers of weathered coal, v. moist		2510.8 57.0				
	2510				COAL	v. moist		
60.0		61.0 - 63.0 Lt. olive gray (5Y, 6/1), sandy SILTSTONE, v. fine to med. grained, sub-fissile, moist		2506.8 61.0				
	2505			2504.8 63.0	Sltst	moist		
		63.0 - 70.0 Stiff to v. stiff, clayey SANDSTONE, v. fine to med. grained, sli. stratified, blocky, tr. silt, tr. pyrite, v. moist						
	65.0				Ss	v. moist		

Log continued on next page

MW_GNPD_SH_OB AND MW UPDATED SURVEY DATA 4_48_08.GPJ GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
 DRILLER: Tom Devick

GEOLOGIST: R. Witt
 CHECKED: A. Hobson
 DATE: 2/22/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-13

COORDINATES: N: 425,009 E: 1,364,906
 GROUND SURFACE ELEVATION: 2,567.8 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
2500		64' 1/2" dia. marcasite/pyrite nodule				v. moist		
						dry		
						v. moist		
70.0		64.5' 1/2" dia. marcasite/pyrite nodule			Ss	dry		
		63.0 - 70.0						
		Stiff to v. stiff, clayey SANDSTONE, v. fine to med. grained, sli. stratified, blocky, tr. silt, tr. pyrite, v. moist				v. moist		
		65'-70' changes from tr. silt to 5-15% silt		2495.8				
				72.0				
				2495.3	Clst	sli. moist		Run 9: 70'-85' NR w/ HCl - entire run
				72.5				
2495		68'-68.1' v. hard, yellowish gray (5Y, 8/1), chert stringer, dry						
		69.5'-69.6' v. hard, yellowish gray (5Y, 8/1), chert stringer, dry						
75.0		70.0 - 72.0						
		Compact, lt. olive gray (5Y, 6/1), silty SANDSTONE, sli. stratified, v. moist						
		72.0 - 72.5						
		V. stiff, brownish black (5YR, 2/1), CLAYSTONE, sli. laminated, occ. coal layer (4 total), sli. moist						
2490		72.5 - 85.0						
		Compact, lt. olive gray (5Y, 6/1), clayey SANDSTONE, v. fine to med. grained, tr. coarse grains, tr. to 7% silt, tr. mica or pyrite, v. moist						
80.0								
2485								
						v. moist	Reference Grab Sample at 83'	
85.0		85.0 - 95.0		2482.8				Run 10: 85'-100'
		Compact, lt. olive gray (5Y, 6/1), SANDSTONE, v. fine to coarse grained, tr. silt, tr. to 15% clay, v. moist		85.0				
2480								
					Ss			
90.0								
2475								
95.0		95.0 - 103.0		2472.8				
		Compact, lt. olive gray (5Y, 6/1), SANDSTONE, v. fine to coarse grained, tr. silt, tr. to 15% clay, wet		95.0				
2470								
						wet		
100.0								Run 11: 100'-115'
2465								
105.0		103.0 - 114.0		2464.8				
		Compact, lt. olive gray (5Y, 6/1), SANDSTONE, v. fine to coarse grained, tr. silt, tr. to 15% clay, v. moist		103.0				
						v. moist		

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MW_GNPD_SH_OB AND MW UPDATED SURVEY DATA 4_48_08.GPJ GNPP.GDT 4/29/08



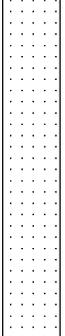
DRILLING CONTRACTOR: Boart Longyear
 DRILLER: Tom Devick

GEOLOGIST: R. Witt
 CHECKED: A. Hobson
 DATE: 2/22/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-13

COORDINATES: N: 425,009 E: 1,364,906
 GROUND SURFACE ELEVATION: 2,567.8 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV.	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
				DEPTH (ft)				
105.0	2460	103.0 - 114.0 Compact, lt. olive gray (5Y, 6/1), SANDSTONE, v. fine to coarse grained, tr. silt, tr. to 15% clay, v. moist			Ss	v. moist		
		114.0 - 114.1 Stringer of marcasite nodules		2453.8 114.0	Marc	sli. moist		Run 12: 115'-127'
115.0	2455	114.1 - 115.0 Hard, dk. greenish gray (5G, 4/1), silty CLAYSTONE, mod. laminated, sli moist						
		115.0 - 124.0 V. stiff to hard, brownish black (5YR, 2/1), CLAYSTONE, tr. silt, tr. v. fine to med. sand, tr. pyrite, sli. blocky, inclusions of 2"-3" long saturation / free water in center of core (approx. 1 every 0.5')sli. moist			Clst	sli. moist w/ sat. pockets		
		120'-124' saturated inclusion become less frequent (1 every 1.5'-2')						
		124.0 - 127.0 Hard, black (N1) to reddish black (5R, 2/2), COAL, sli. platy, cooked by drilling, moist		2443.8 124.0		moist		Driller's Note: v. hard drilling in the coal
		127.0 - 131.0 Soft, weathered, black (N1), COAL, mod. to high plasticity, v. moist to wet				v. moist to wet		Run 13: 127'-138'
		131.0 - 137.0 Firm to stiff, black (N1) to reddish black (5R, 2/2), COAL, sli. blocky, tr. saturated pockets, moist			COAL			
		137.0 - 139.0 Firm, brownish black (5YR, 2/1), CLAYSTONE, fissile, mod. to highly laminated, waxy, mod. plasticity, moist		2430.8 137.0	Clst			Run 14: 138'-145'
		139.0 - 140.0 Stiff, med. dk. gray (N4), sandy SILTSTONE, v. fine to fine grained, sub-fissile, 5-10% clay, moist		2428.8 139.0 2427.8 140.0	Silst			Driller's Note: much harder drilling, sound of drilling changed
		140.0 - 141.5 V. strong (R5), med. lt. gray (N6), SHALE, dry		2426.3 141.5 2425.8	Sh Clst Silst	dry moist		

Log continued on next page

MW_GNPD_SH_OB AND MW_UPDATED SURVEY DATA 4_48_08.GPJ GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
 DRILLER: Tom Devick

GEOLOGIST: R. Witt
 CHECKED: A. Hobson
 DATE: 2/22/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-13

COORDINATES: N: 425,009 E: 1,364,906
 GROUND SURFACE ELEVATION: 2,567.8 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE ID	COMMENTS
2425	141.5 - 142.0	V. stiff to hard, brownish black (5YR, 2/1), CLAYSTONE, mod. laminated, waxy, sub-fissile, moist	XXXXXX	142.0	Slstst			
145.0	142.0 - 145.0	Stiff to v. stiff, lt. olive gray, sandy SILTSTONE, v. fine to fine sand, tr. clay, stratified, moist	XXXXXX	2422.8	Slstst / Clst			Run 15: 145'-155'
2420	145.0 - 146.0	Stiff to v. stiff, lt. olive gray, sandy SILTSTONE, v. fine to fine sand, tr. clay, stratified, moist --interbedded in 0.1' layers with-- V. stiff to hard, brownish black (5YR, 2/1), CLAYSTONE, mod. laminated, waxy, sub-fissile, moist	XXXXXX	146.0		moist		
150.0	146.0 - 155.0	Stiff to v. stiff, olive gray (5Y, 4/1), CLAYSTONE, 5-15% silt, tr. v. fine to fine sand, low plasticity, tr. inclusions of hard and dry yellowish gray (5Y, 8/1) chert, moist 151'-155' sand increases to 5-15% and coarsens slightly	XXXXXX	2412.8	Clst			
2415	153.5'-153.6'	stringer of stratified darker banding, many partially coalified wood fragments	XXXXXX	155.0	Slstst	sli. moist		Run 16: 155'-163'
155.0	155.0 - 156.5	Stiff, med. dk. gray (N4), sandy SILTSTONE, v. fine to med. sand, 5-15% clay, sli. moist	XXXXXX	2411.3	Sh	dry		
2410	156.5 - 157.0	V. strong (R5), med. lt. gray (N6), SHALE, dry	XXXXXX	2410.8				
160.0	157.0 - 160.5	Stiff to v. stiff, med. gray (N5), clayey SILTSTONE, 5-15% v. fine to fine sand, sli. moist	XXXXXX	157.0	Slstst	sli. moist		
2405	160.5 - 163.0	Stiff to v. stiff, med. gray (N5), clayey SILTSTONE, 5-15% v. fine to fine sand, approx. one 0.1' stringer per foot of med. dk. gray (N4) claystone, fissile, mod. lamination, honeycombed texture, sli. moist	XXXXXX	2404.8				
165.0	163.0 - 164.5	Compact, med. gray (N5), clayey SANDSTONE, v. fine to med. grained, 10-15% silt, stratified, bands of olive gray (5Y, 4/1), moist to v. moist	XXXXXX	163.0	Ss	moist to v. moist		Run 17: 163'-175'
2400	164.5 - 167.0	Compact to dense, clayey SANDSTONE, v. fine to fine grained, tr. coarse grains, 15-20% silt, sub-fissile, moist	XXXXXX	2400.8		moist		
170.0	167.0 - 173.0	Stiff to v. stiff, lt. gray (N6), CLAYSTONE, tr. fine to med. sand, sub-fissile, sli. moist to moist	XXXXXX	167.0	Clst	sli. moist to moist		
2395	173.0 - 174.0	Stiff to v. stiff, lt. gray (N6), CLAYSTONE, tr. fine to med. sand, sub-fissile, 1"x1/16" pinkish gray (5YR, 8/1) inclusion - strong rxn w/ HCl, metallic luster, mica-like appearance, moist to v. moist	XXXXXX	2393.8		moist to v. moist	Reference Grab Sample at 173' (Pink Inclusion)	
175.0	174.0 - 185.0	Stiff, olive gray (5Y, 4/1), sandy SILTSTONE, v. fine to fine grained, 10-20% silt, fissile, varved, moist	XXXXXX	174.0	Slstst	moist		Run 18: 175'-185' Note: core fell out of sample barrel, crew went back down to retrieve it along w/ Run 19 - core was v. disturbed in the process
2390			XXXXXX					
180.0			XXXXXX					

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MW_GNPD_SH_OB AND MW_UPDATED SURVEY DATA 4_48_08.GPJ GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Boart Longyear
 DRILLER: Tom Devick

GEOLOGIST: R. Witt
 CHECKED: A. Hobson
 DATE: 2/22/2007

PROJECT: South Heart Project

PROJECT NUMBER: 063-2174

LOCATION: South Heart, ND

DRILL RIG: CME-850

INCLINATION: -90°

DRILLING METHOD: Hollow Stem Auger

DATE STARTED: 05/04/07 11:45

DATE COMPLETED: 05/10/07 13:30

DRILLING FLUIDS: None

DRILL LUBRICANTS: None

RECORD OF BORING SHMW-14

COORDINATES: N: 433,188 E: 1,365,970

GROUND SURFACE ELEVATION: 2,514.6 ft

PROJECTION: StatePlane, North Dakota South, 3302

DATUM: NAD 27

HORIZONTAL UNITS: Feet

TOTAL DEPTH: 42.0 ft

BOTTOM ELEVATION: 2,472.6 ft

COLLAR ELEVATION: 2,517 NA

HOLE DIAMETER: 7.5 inches

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE NUMBER	BLOWS per 6 in	N	RECOVERY (ft)	COMMENTS		
0.0		0.0 - 4.7 Firm, pale to medium yellowbrown (10YR 6/2 to 10YR 5/4), sandy SILT with sand very fine- to fine-grained, abundant roots, trace of gravel fragments, slight reaction to HCL, slightly moist to dry			ML	dry to sli. moist	1	2 2 3 4	5	0.6 2	Start drilling at 11:45 am on 5/4/2007		
		2'-4' trace of clay		sli. moist		2	7 9 10 11	19	0.3 2				
		4'-4.7' increasing clay			2509.9	SP	moist	3	5 3 3 3	6		1.6 2	
5.0	2510	4.7 - 5.5 Moderate yellow brown (10YR 5/4), poorly graded, very fine- to medium grained SAND with trace of silt, clay, moderate reaction to HCL		4.7									
		5.5 - 6.0 Moderate yellow brown (10YR 5/4), poorly graded, very fine to fine-grained clayey SAND with silt, moderate reaction to HCL, moist		2509.1	5.5	SM		4	4 3 4 4	7		1.2 2	7' Wet
		6.0 - 9.5 Moderate yellow brown (10YR 5/4), poorly graded, very fine- to fine-grained silty SAND with clay, no reaction to HCL, wet at 7'		2508.6	6.0								
		7.2-7.4 Lense of pale yellow brown (10YR 6/2), SILT, slight reaction to HCL			2505.1	CH	wet	6	4 3 4 2	7		1.6 2	
		9.5 - 14.0 Very soft to soft, moderate yellow brown (10YR 5/4) CLAY, trace of silt, trace of very fine-grained sand, high plasticity, weak reaction to HCL, wet		9.5									
		10'-12' trace of fine gravel, trace of carbonaceous material			CL		7	1 2 1 2	3	0.9 2	13' Saturated		
		13' clay is wet		2500.6									
				14.0			8	1 1 1 2	2	1.1 2			

Log continued on next page

MW AVF GNPD SH OB AND MW UPDATED SURVEY DATA 4_48_08.GPJ GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Braun Intertec
DRILLER: C. Powers

GEOLOGIST: R. Witt
CHECKED: E. Pottorff
DATE: 8/27/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-14

COORDINATES: N: 433,188 E: 1,365,970
 GROUND SURFACE ELEVATION: 2,514.6 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV.	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE NUMBER	BLOWS per 6 in	N	RECOVERY (ft)	COMMENTS
				DEPTH (ft)							
15.0		14' occasional streaks of olive gray 14.0 - 15.6 Soft, moderate yellow brown (10YR 5/4), CLAY with trace of silt, little very fine-grained sand, medium plasticity, weak reaction to HCL, wet		2499.0 15.6	CL	wet	8	1 1 1 2	2	1.1 2	22' Flowing sands, drilling is flushing the augers
		15.6 - 17.2 Soft, moderate yellow brown (10YR 5/4), sandy CLAY with very fine to medium-grained sand		2497.4 17.2	CL		9	1 2 1 2	3	1.7 2	
		17.2 - 22.0 Very loose, moderate yellow brown (10YR 5/4), very fine- to coarse-grained clayey SAND, with lens of CLAY, medium plasticity, wet 17.7' to 18' lens of medium plasticity CLAY			SC(CL)		10	0 2 2 2	4	2 2	
2495		18'-20' trace of gravel					11	2 3 3 3	6	1.6 2	
20.0		22.0 - 23.2 Very loose, moderate yellow brown (10YR 5/4), very fine- to coarse-grained SAND with trace of silt/clay, wet		2492.6 22.0			SW	12	2 1 2 2	3	
		23.2 - 24.0 Soft, olive gray (5Y 4/1) sandy CLAY with some silt, sand is very fine to fine-grained, low plasticity, trace of iron oxidized stains, no reaction to HCL, wet		2491.4 23.2	CL		13	3 3 3 4	6	1.7 2	
2490		24.0 - 27.8 Loose, mostly gray hue but mottled, medium to coarse-grained SAND trace of silt, trace of zones of fine to medium grained sand, wet 26'-27.8' sand coarsens with depth, trace of gravel, trace of coal fragments		2490.6 24.0	SP		14	9 4 2 2	6	0.9 2	
25.0		27.8 - 33.5 Loose, olive gray (5Y 3/2), very fine to medium-grained clayey SAND, wet		2486.8 27.8			15	5 4 2 2	6	1.4 2	
2485		30-32' interbedded medium to coarse clayey SAND and very fine-grained to medium clayey SAND			SC		16	3 3 4 4	7	1.6 2	
30.0				2481.1 33.5	Clst		17	2 2 3 2	5	1.6 2	

Log continued on next page

MW AVF GNPD SH OB AND MW UPDATED SURVEY DATA 4_48_08.GPJ GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Braun Intertec
 DRILLER: C. Powers

GEOLOGIST: R. Witt
 CHECKED: E. Pottorff
 DATE: 8/27/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-14

COORDINATES: N: 433,188 E: 1,365,970
 GROUND SURFACE ELEVATION: 2,514.6 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE NUMBER	BLOWS per 6 in	N	RECOVERY (ft)	COMMENTS
35.0 40.0	2480	33.5 - 35.2 Highly weathered, olive brown, CLAYSTONE with trace of sand, trace of gravel, trace of coal, wet		2479.4	Clst	wet	17		5		
		35.2 - 37.1 COAL with clay interlayers		35.2			COAL	pockets of wet	18	3 5 8 10	
		37.1 - 42.0 Medium greenish gray (5G 5/1) SILTSTONE with trace of coal fragments, interlayers of claystone		2477.5	Siltst	v. moist			19	10 13 16 17	
							20	9 14 16 18	30	2.0 2	
				2472.6			21	10 10 15 16	25	1.6 2	
			42.0								

Completed at 13:30 on 5/4/2007. Auger TD = 40', Standard Split Spoon TD = 42'.

Boring completed at 42 ft.

Boring completed at 42 ft.

MW AVF GNPD SH OB AND MW UPDATED SURVEY DATA 4_48_08.GPJ GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Braun Intertec
 DRILLER: C. Powers

GEOLOGIST: R. Witt
 CHECKED: E. Pottorff
 DATE: 8/27/2007

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PROJECT: South Heart Project

PROJECT NUMBER: 063-2174

LOCATION: South Heart, ND

DRILL RIG: CME-850

INCLINATION: -90°

DRILLING METHOD: Hollow Stem Auger

DATE STARTED: 05/03/07 11:40

DATE COMPLETED: 05/03/07 13:25

DRILLING FLUIDS: None

DRILL LUBRICANTS: None

RECORD OF BORING SHMW-15

COORDINATES: N: 448,532 E: 1,376,137

GROUND SURFACE ELEVATION: 2,461.7 ft

PROJECTION: StatePlane, North Dakota South, 3302

DATUM: NAD 27

HORIZONTAL UNITS: Feet

TOTAL DEPTH: 35.0 ft

BOTTOM ELEVATION: 2,426.7 ft

COLLAR ELEVATION: 2,464 NA

HOLE DIAMETER: 7.5 inches

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV.	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE NUMBER	BLOWS per 6 in	N	RECOVERY (ft)	COMMENTS
				DEPTH (ft)							
0.0	2460	0.0 - 3.5 Very loose to compact, dark yellow brown (10YR 4/2), very fine- to medium-grained silty SAND with roots, no reaction to HCL	[Dotted pattern]	2458.2	SM	moist	1	1 1 2 3	3	0.2 2	Start drilling at 11:40 am on 5/3/2007
				3.5				2	3 5 5 5	11	
5.0		3.5 - 6.0 Loose, moderate yellow brown (10YR 5/4), silty SAND, trace of gravel, increasing sand with depth, moderate reaction to HCL	[Dotted pattern]	2455.7	SM	moist	3	4 4 5 6	9	0.7 2	
				6.0				4	5 4 3 5	7	
10.0	2455	6.0 - 9.4 Firm, dark yellow brown (10YR 4/2), sandy CLAY, some roots, wood fragments, trace of carbonaceous material, no reaction to HCL, moist	[Diagonal hatching]	2452.3	CL		5	3 2 2 3	4	0.8 2	
				9.4				6	3 3 4 3	7	
15.0	2450	9.4 - 14.5 Loose, medium to dark yellow brown (10YR 5/4) to (10YR 4/2), poorly graded, fine- to medium-grained SAND, no reaction to HCL, wet 10'-11.3' trace of silty/clayey lense 10' -12' weak reaction to HCL 11.3' to 12' color is olive gray 12'-14' streaks of carbonaceous material 14'-14.5' very moist	[Dotted pattern]	2447.2	SP	wet	7	2 3 2 2	5	1.7 2	
				14.5			Sltst	8	4 12 3 3	15	

Log continued on next page

MW AVF GNPD SH OB AND MW UPDATED SURVEY DATA 4_48_08.GPJ GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Braun Intertec
DRILLER: C. Powers

GEOLOGIST: R. Witt
CHECKED: E. Pottorff
DATE: 8/27/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-15

COORDINATES: N: 448,532 E: 1,376,137
 GROUND SURFACE ELEVATION: 2,461.7 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE NUMBER	BLOWS per 6 in	N	RECOVERY (ft)	COMMENTS	
15.0		14.5 - 16.0 Highly weathered, olive gray (5Y 7/1) poorly cemented, SILTSTONE with lignite lens, moist		2445.7	Siltst		8	4 12 3 3	15	1.3 2		
	2445	16'-18' behaves like a stiff CLAY with trace of very fine-grained sand, trace of silt, trace of cobbles		16.0	Clst		9	5 8 10 14	18	1.8 2		
		16.0 - 20.0 Medium gray (N5), sandy CLAYSTONE with silt, trace of carbonaceous lenses interbedded with sandy siltstone with clay, no reaction to HCL, moist					10	6 8 10 14	18	2 2		
		18-20' trace of pyrite nodules		2441.7								
20.0		20.0 - 25.1 Highly weathered, medium gray (N5), very fine to fine-grained, silty SANDSTONE with carbonaceous layers, some clay, moist		20.0	Ss	moist	11	7 11 12 14	23	2 2		
	2440	20'-23' behaves like a poorly graded, silty SAND with some clay					12	7 9 11 13	20	2 2		
		24'-25.1' color changes to medium dark gray (N4)		2436.6			13	8 9 10 11	19	2 2		
25.0		25.1 - 29.0 Hard, olive gray (5Y 3/2), CLAYSTONE, trace of gravel, trace of wood fragments, carbonaceous lenses, no reaction to HCL, moist		25.1								
	2435	26'-28' color changing to dark olive gray (5Y 3/1)			Clst		14	7 9 11 13	20	2 2		
		28'-29' coal lenses		2432.7			15	7 13 50	63	1.5 1.5		
30.0		29.0 - 35.0 Black (N1), dull COAL with wood fragments and pyrite nodules, sandy, no reaction to HCL, dry		29.0	COAL	dry					29.5'-30' Auger down (no sample)	
	2430						16	50	>100	0.5 0.5		
							17	40 50	>100	1 1		

Log continued on next page

MW AVF GNPD SH OB AND MW UPDATED SURVEY DATA 4_48_08.GPJ GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Braun Intertec
 DRILLER: C. Powers

GEOLOGIST: R. Witt
 CHECKED: E. Pottorff
 DATE: 8/27/2007

PROJECT: South Heart Project
 PROJECT NUMBER: 063-2174
 LOCATION: South Heart, ND

RECORD OF BORING SHMW-15

COORDINATES: N: 448,532 E: 1,376,137
 GROUND SURFACE ELEVATION: 2,461.7 ft

DEPTH (ft)	ELEVATION (ft)	LITHOLOGY DESCRIPTION	GRAPHIC LOG	ELEV. DEPTH (ft)	MATERIAL TYPE	MOISTURE DESCRIPTION	SAMPLE NUMBER	BLOWS per 6 in	N	RECOVERY (ft)	COMMENTS
		29.0 - 35.0 Black (N1), dull COAL with wood fragments and pyrite nodules, sandy, no reaction to HCL, dry		2426.7 35.0	COAL	dry	18	50	>100	0.5 0.5	Auger refusal at 35' at 13:25 on 5/3/2007. TD = 35'.

Boring completed at 35 ft.

Boring completed at 35 ft.

35.0

2425

40.0

45.0

50.0

MW AVF GNPD SH OB AND MW UPDATED SURVEY DATA 4_48_08.GPJ GNPP.GDT 4/29/08



DRILLING CONTRACTOR: Braun Intertec
 DRILLER: C. Powers

GEOLOGIST: R. Witt
 CHECKED: E. Pottorff
 DATE: 8/27/2007

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Soil Descriptions

Consistency or Density, Geological Society of America (GSA) or Munsell color name (code), grain size, USCS name, minor characteristics, plasticity, moisture

CONSISTENCY (Clay and Silt)			
Pocket Penetrometer			
Very Soft	N < 2	< 0.25	Easily penetrated several centimeters (cm) by fist
Soft	N = 2-4	0.25-0.50	Easily penetrated several cm by thumb
Firm	N = 5-8	0.50-1.0	Can not be penetrated several cm by thumb with moderate effort
Stiff	N = 9-15	1.0-2.0	Readily indented by thumb
Very Stiff	N = 16-30	2.0-4.0	Readily indented with thumbnail
Hard	N > 30	> 4.0	Indented with difficulty by thumbnail

N = Standard penetration resistance where

Nm = number of blows from 0.5 to 1.0 ft + number of blows from 1.0 to 1.5 ft

DENSITY (Sand)		
Very Loose	N = 0-4	Easily penetrated with shovel handle
Loose	N = 4-10	Easily excavated with hand shovel
Compact	N = 10-30	Difficult to excavate with hand shovel
Dense	N = 30-50	Must be loosened with pick to excavate
Very Dense	N > 50	Cannot be penetrated with 1/4-inch steel probe

For Munsell color code see either Munsell Color (1998) or Rock-Color Chart Committee (1991).

Component Proportion

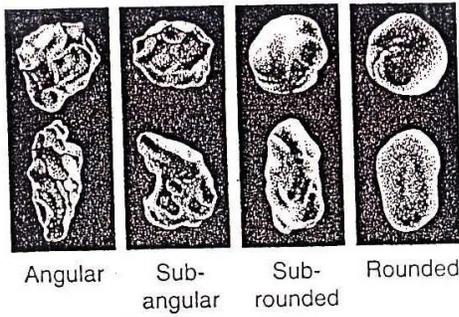
Trace	0-5%
Little	5-12%
Some	12-30%
And	30-50%

MOISTURE	
Dry	Absence of moisture, dusty, dry to the touch
Slightly Moist	Apparent moisture but well below optimum moisture content
Moist	Damp, but no visible water; at or near optimum moisture content
Very Moist	Above optimum moisture content
Wet	Visible free water, below water table

FIELD PLASTICITY

Nonplastic	A 1/8-inch thread cannot be rolled at any water content
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit
Medium	The thread is easy to roll and not much time required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several time after reaching the plastic limit.

From ASTM International (2000).



GRAIN-SIZE Engineers		
mm	inches	Sieve
305	12.0	Boulders
76.2	3.0	3.0 in. Cobbles
19.05	0.75	Gravel - coarse
4.75	0.19	No. 4 Gravel - fine
2.0	0.08	No. 10 Sand - coarse
0.425		No. 40 Sand - medium
0.074		No. 200 Sand - fine
0.005		Silt
		Clay

Rock Descriptions

Weathered state, Geological Society of America (GSA) or Munsell color name (code), grain size, ROCK TYPE, minor characteristics, moisture

Abbreviations

- Clst = claystone
- Slst = siltstone
- Ss = sandstone
- Sh = Shale

Weathering

Term	Description	Grade
Fresh	No visible sign of rock material weathering; perhaps slight discoloration on major discontinuity surfaces	I
Slightly Weathered	Discoloration indicates weathering of rock material and discontinuity surfaces. All the rock material may be discolored by weathering and may be somewhat weaker externally than in its fresh condition	II
Moderately Weathered	Less than half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discolored rock is present either as a continuous framework or as corestones	III
Highly weathered	More than half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discolored rock is present either as a continuous framework or as corestones	IV
Completely Weathered	All rock material is decomposed and/or disintegrated to soil. The original mass structure is still largely intact	V
Residual Soil	All rock material is convert to soil. The mass structure and material fabric are destroyed. There is a large change in volume, but the soil has not been significantly transported	VI

Rock Material Strength

Grade	Description	Field Identification	App. range of uniaxial compressive strength (MPa)
R0	Extremely Weak Rock	Indented with thumbnail	0.25 - 1.0
R1	Very Weak Rock	Crumbles under firm blows with point of geological hammer, can be peeled by a pocket knife	1.0 – 5.0
R2	Weak Rock	Can be peeled by a pocket knife with difficulty, shallow indentations made by a firm blow with point of geological hammer	5.0 - 25
R3	Medium Strong Rock	Cannot be scraped or peeled with a pocket knife, specimen can be fractured with single blow of geologic hammer	25 – 50
R4	Strong Rock	Speciman requires more than one blow of geologic hammer to fracture it	50 - 100
R5	Very Strong Rock	Speciman requires many blows of geological hammer to fracture it	100 - 250
R6	Extremely Strong Rock	Speciman can only be chipped with geological hammer	>250

REFERENCES

ASTM International. 2000.

Designation D2488-00, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) in *2000 Annual Book of ASTM Standards: Soil and Rock (1) D420-D5779*. ASTM International, West Conshohocken, PA.

Munsell Color. 1998.

Munsell Soil Color Charts revised Washable Edition. Gretag Macbeth, New Windsor, New York.

Rock-Color Chart Committee. 1991.

The Geological Society of America Rock-Color Chart with genuine Munsell® color chips. Distributed by the Geological Society of America, Boulder, Colorado.

Lithologic Log Notes

Abbreviations

approx. = approximately

blk = black

blu = bluish

br or brn = brown, brownish

compl. = completely

dia. = diameter

dk = dark

ext = extremely

ft or ' = feet

gr = gray, followed by a Munsell color code in parenthesis, e.g. Yell gr (5Y 7/2)

gr. = grained, indicating size of sand

grn = greenish

HCL = Hydrochloric acid

In or in or " = inch

lt = light

med. = medium

mm = millimeter

mod. = moderate

NA or N/A = not applicable

NAD = North American Datum

ND = North Dakota

olv = olive

predom. = predominantly

sli. = slightly

TD = total depth

tr. = trace

v. = very

w/ = with

WL = water level

wthd = weathered

yell = yellow, yellowish

% = percent

> = greater than

< = less than

Abbreviations from Unified Soil Classification System (USCS)

GW = well-graded gravel

GP = poorly-graded gravel

GM = silty gravel

GC = clayey gravel

SW = well-graded sand

SP = poorly-graded sand

SM = silty sand

SC = clayey sand

ML = silt

CL = clay

CH = fat clay

Soil lens is indicated by parenthesis. Example: SM(SP) indicates lenses of SP in predominantly SM unit

See ASTM International (2000) for description of USCS visual-manual procedure

Soil Descriptions

Consistency or Density, Geological Society of America (GSA) or Munsell color name (code), grain size, USCS name, minor characteristics, plasticity, moisture

For Munsell color code see either Munsell Color (1998) or Rock-Color Chart Committee (1991).

BOARD OF WATER WELL CONTRACTORS
900 E. BOLLIVARD AVE., DEPT. 770 * BISMARCK, NORTH DAKOTA 58505-0850

SHO-01

SHC Identification

WELL DRILLER'S REPORT

State law requires that this report be filed with the State Board of Water Well Contractors within 30 days after completion or abandonment of the well.

1. WELL OWNER

Name Kienergy Inc
Address 203 S Main, Suite 2004
Sheridan, WY 82801

2. WELL LOCATION

West well 2A
139-98-17CBB



County Stark

SW1/4 NW1/4 NW1/4 Sec.17 Twp.139 N.Rge.98 W

3. PROPOSED USE Geothermal Monitoring
Domestic Irrigation Industrial
Stock Municipal Test Hole

4. METHOD DRILLED

Cable Reverse Rotary Bored
 Forward Rotary Jetted Auger
If other, specify _____

5. WATER QUALITY

Was a water sample collected for:
Chemical analyses? Yes No
Bacteriological Analyses? Yes No
If so, to what laboratory was it sent? _____

6. WELL CONSTRUCTION

Diameter of Hole 5 inches Depth 240 feet
Casing: Steel Plastic Concrete
 Threaded Welded Other

If other, specify _____
Pipe Weight: Diameter: From: To:
lb/Ft 2 inches +2.2 feet 217.5 feet
lb/Ft 2 inches 227.5 feet 232.5 feet
lb/Ft _____ inches _____ feet _____ feet

Was perforated pipe used? Yes No
Perforated pipe set from _____ ft to _____ feet
Was casing left open end? Yes No
Was a well screen installed? Yes No

Material PVC Diameter 2 inches
Slot Size 10 set from 217.5 feet to 227.5 feet
Slot Size _____ set from _____ feet to _____ feet
Was packer or seal used? Yes No
If so, what material _____ Depth _____ ft

Type of well: Straight screen Gravel packed
Depth grouted: From 0 To 207
Grouting material: Cement Other

If other explain: Bentonite Chips
Well head completion: Pitless unit
12" above grade Other

If other, specify 2.2' above grade
Was pump installed? Yes No
Was well disinfected upon completion? Yes No

WSIQ2\WDRPT01

7. WATER LEVEL

Static water level 139.7 feet below surface
If flowing: closed-in pressure _____ psi
GPM flow _____ through _____ inch pipe
Controlled by: _____ Valve _____ Reducers _____ Other _____
If other, specify _____

8. WELL TEST DATA

Pump _____ Bailer _____ Other _____
Pumping level below land surface
_____ ft. after _____ hrs. pumping _____ gpm
_____ ft. after _____ hrs. pumping _____ gpm
_____ ft. after _____ hrs. pumping _____ gpm

9. WELL LOG

Formation	Depth (Ft.)
Silt, yellowish brown, oxidized	10
Clay, yellowish brown, oxidized	15
Clay, brown, Shale	23
Rock	23.5
Shale, brownish gray	28
Shale, light gray	35
Lignite	37
Shale, gray w/lignite lenses	66
Lignite	72.5
Shale, gray	95.5
Lignite	97
Shale, gray, rock at 113	130
Sand, silty, gray	139
Lignite	156
Shale, gray	190
Shale, silty, gray	197
Sand, fine, silty	227
Sandstone rock	228
Sand, fine	233
Shale, green	240

(use separate sheet if necessary)

10. DATE COMPLETED 27 Mar 02

11. WAS THE HOLE PLUGGED OR ABANDONED?

Yes No
if so, how? _____

12. REMARKS 400# of Abrasives Inc sand pack to 207', 625# bentonite chips to surface.

13. DRILLER'S CERTIFICATION

This well was drilled under my jurisdiction and this report is true to the best of my knowledge

Driller's or Firm's Name Mohl Drilling, Inc. Certificate No. 105
Address Beulah ND 58503



BOARD OF WATER WELL CONTRACTORS
900 E. BOULEVARD AVE., DEPT. 770 * BISMARCK, NORTH DAKOTA 58505-0850

SHO-02

SHC Identification

WELL DRILLER'S REPORT

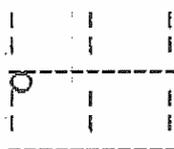
State law requires that this report be filed with the State Board of Water Well Contractors within 90 days after completion or abandonment of the well.

1. WELL OWNER

Name Kienergy Inc
Address 203 S Main, Suite 2004
Sheridan, WY 82801

2. WELL LOCATION

Center well 2B
139-98-17CBB



County Stark
SW1/4 NW1/4 NW1/4 Sec.17 Twp.139 N.Rge.98 W

3. PROPOSED USE Geothermal Monitoring
Domestic Irrigation Industrial
Stock Municipal Test Hole

4. METHOD DRILLED

Cable Reverse Rotary Bored
 Forward Rotary Jetted Auger
If other, specify _____

5. WATER QUALITY

Was a water sample collected for:
Chemical analyses? Yes No
Bacteriological Analyses? Yes No
If so, to what laboratory was it sent?

6. WELL CONSTRUCTION

Diameter of Hole 5 5/8 inches Depth 158 feet
Casing: Steel Plastic Concrete
 Threaded welded Other _____

If other, specify _____
Pipe Weight: Diameter: From: To:
lb/ft 2 inches +2 feet 147 feet
lb/ft inches feet feet
lb/ft inches feet feet

Was perforated pipe used? Yes No
Perforated pipe set from ft to feet
Was casing left open end? Yes No
Was a well screen installed? Yes No
Material PVC Diameter 2 inches

Slot Size 10 set from 147 feet to 157 feet
Slot Size set from feet to feet
Was packet or seal used? Yes No
If so, what material _____ Depth _____ ft

Type of well: Straight screen Gravel packed 20-40
Depth grouted: From 0 To 142
Grouting material: Cement Other
If other explain: Bentonite Chips
Well head completion: Fittless unit _____
12" above grade Other
If other specify 2' above grade _____
Was pump installed? yes No
Was well disinfected upon completion? yes No

WSIQZ\WRPT01

7. WATER LEVEL

Static water level _____ Feet below surface
If flowing: closed-in pressure _____ psi
GPM flow _____ through _____ inch pipe
Controlled by: Valve Reducers Other _____
If other, specify _____

8. WELL TEST DATA

Pump Bailer Other _____
Pumping level below land surface
ft. after hrs. pumping gpm
ft. after hrs. pumping gpm
ft. after hrs. pumping gpm

9. WELL LOG

Formation	Depth(Ft.)
Silt, yellowish brown, oxidized	10
Clay, yellowish brown, oxidized	15
Clay, brown, Shale	23
Rock	23.5
Shale, brownish gray	28
Shale, light gray	35
Lignite	37
Shale, gray w/lignite lenses	66
Lignite	72.5
Shale, gray	95.5
Lignite	97
Shale, gray, rock at 113	130
Sand, silty, gray	139
Lignite	156
Shale, gray	158

10. DATE COMPLETED 28 Mar 02

11. WAS THE HOLE PLUGGED OR ABANDONED?
 Yes No

If so, how? _____

12. REMARKS 280# of Abrasives Inc sand
pack to 142', 1,400# bentonite chips
to 3', cuttings to surface.

13. DRILLER'S CERTIFICATION

This well was drilled under my jurisdiction and this report is true to the best of my knowledge

Driller's or Firm's Name MoHL Drilling, Inc Certificate No. 105
Address Beulah ND 58523

BOARD OF WATER WELL CONTRACTORS
 900 E. BOULEVARD AVE, DEPT. 770 * BISMARCK, NORTH DAKOTA 58505-0850

SHO-03
 SHC Identification

WELL DRILLER'S REPORT

State law requires that this report be filed with the State Board of Water Well Contractors within 30 days after completion or abandonment of the well.

1. WELL OWNER

Name Kienergy Inc
 Address 203 S Main, Suite 2004
Sheridan, WY 82801

2. WELL LOCATION

East well 2C
 139-98-17CBB

County Stark

SW1/4 NW1/4 NW1/4 Sec. 17 Twp. 139 N. Rge. 98 W

3. PROPOSED USE

Geothermal Monitoring
 Domestic Irrigation Industrial
 Stock Municipal Test Hole

4. METHOD DRILLED

Cable Reverse Rotary Bored
 Forward Rotary Jetted Auger
 If other, specify _____

5. WATER QUALITY

Was a water sample collected for:
 Chemical analyses? Yes No
 Bacteriological Analyses? Yes No
 If so, to what laboratory was it sent?

6. WELL CONSTRUCTION

Diameter of Hole 5 inches Depth 73 feet
 Casing: Steel Plastic Concrete
 Threaded Welded Other

If other, specify _____
 Pipe Weight: Diameter: From: To:
 _____ lb/ft 2 inches +2 feet 68 feet
 _____ lb/ft _____ inches _____ feet _____ feet
 _____ lb/ft _____ inches _____ feet _____ feet

Was perforated pipe used? Yes No
 Perforated pipe set from _____ ft to _____ feet
 Was casing left open end? Yes No
 Was a well screen installed? Yes No

Material PVC Diameter 2 inches
 Slot Size 10 set from 68 feet to 73 feet
 Slot Size _____ set from _____ feet to _____ feet

Was packer or seal used? Yes No
 If so, what material _____ Depth _____ ft

Type of well: Straight screen Gravel packed _____
 Depth grouted: From 0 To ??

Grouting material: Cement Other
 If other explain: Bentonite Chips

Well head completion: Pitless unit
 12" above grade _____ Other

If other, specify 2' above grade
 Was pump installed? Yes No

Was well disinfected upon completion? Yes No
 WS1QZ\WDRPT01

7. WATER LEVEL

Static water level _____ Feet below surface
 If flowing: closed-in pressure _____ psi
 GPM flow _____ through _____ inch pipe
 Controlled by: Valve Reducers Other
 If other, specify _____

8. WELL TEST DATA

Pump Bailer Other
 Pumping level below land surface
 _____ ft. after _____ hrs. pumping _____ gpm
 _____ ft. after _____ hrs. pumping _____ gpm
 _____ ft. after _____ hrs. pumping _____ gpm

9. WELL LOG

Formation	Depth (Ft.)
Silt, yellowish brown, oxidized	10
Clay, yellowish brown, oxidized	15
Clay, brown, Shale	23
Rock	23.5
Shale, brownish gray	28
Shale, light gray	35
Lignite	37
Shale, gray w/lignite lenses	66
Lignite	72.5
Shale, gray	73

10. DATE COMPLETED 28 Mar 02

11. WAS THE HOLE PLUGGED OR ABANDONED?

Yes No
 if so, how? _____

12. REMARKS 120# of Abrasives Inc sand pack to ??', 450# bentonite chips to 2', cuttings to surface.

13. DRILLER'S CERTIFICATION

This well was drilled under my jurisdiction and this report is true to the best of my knowledge

Driller's or Firm's Name MoH2 Drilling Inc Certificate No. 105
 Address Beulah ND 58502

BOARD OF WATER WELL CONTRACTORS
900 E. BOULEVARD AVE., DEPT. 770 * BISMARCK, NORTH DAKOTA 58505-0850

SHO-04

SHC Identification

WELL DRILLER'S REPORT

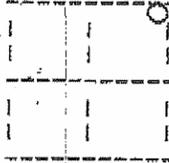
State law requires that this report be filed with the State Board of Water Well Contractors within 30 days after completion or abandonment of the well.

1. WELL OWNER

Name Kienergy Inc
Address 203 S Main, Suite 2004
Sheridan, WY 82801

2. WELL LOCATION

South well 11A
139-98-23AAA

County Stark

NE1/4 NE1/4 NE1/4 Sec.23 Twp.139 N.Rge.98 W

3. PROPOSED USE

Geothermal Monitoring
Domestic Irrigation Industrial
Stock Municipal Test Hole

4. METHOD DRILLED

Cable Reverse Rotary Bored
 Forward Rotary Jetted Auger
If other, specify _____

5. WATER QUALITY

Was a water sample collected for:

Chemical analyses? Yes NoBacteriological Analyses? Yes No

If so, to what laboratory was it sent? _____

6. WELL CONSTRUCTIONDiameter of Hole 5 inches Depth 195 feetCasing: Steel Plastic Concrete Threaded Welded Other _____

If other, specify _____

Pipe Weight: Diameter: From: To:

lb/ft 2 inches +2 feet 175 feetlb/ft 2 inches 185 feet 190 feetlb/ft _____ inches _____ feet _____ feetWas perforated pipe used? Yes No

Perforated pipe set from _____ ft to _____ feet

Was casing left open end? Yes NoWas a well screen installed? Yes NoMaterial PVC Diameter 2 inchesSlot Size 10 set from 175 feet to 185 feet

Slot Size _____ set from _____ feet to _____ feet

Was packer or seal used? Yes No

If so, what material _____ Depth _____ ft

Type of well: Straight screen Gravel packed Depth grouted: From 0 To 173Grouting material: Cement Other If other explain: Bentonite Chips

Well head completion: Pitless unit _____

12" above grade Other If other, specify 2' above grade _____Was pump installed? Yes NoWas well disinfected upon completion? Yes No

WSIQ\WDRPT01

7. WATER LEVEL

Static water level _____ Feet below surface

If flowing: closed-in pressure _____ psi

GPM flow _____ through _____ inch pipe

Controlled by: _____ Valve _____ Reducers _____ Other _____

If other, specify _____

8. WELL TEST DATA

Pumping level below land surface _____

ft. after _____ hrs. pumping _____ gpm

ft. after _____ hrs. pumping _____ gpm

ft. after _____ hrs. pumping _____ gpm

9. WELL LOG

Formation _____ Depth (Ft.) _____ To _____

Clay, silty to sandy, yellowish 10brown, oxidized 18Shale, yellowish brown, oxidized 21Shale, silty, brown, w/ organics 42Silt, sandy, gray 48Sand, silty gray 69.5Lignite 72Shale, light gray 74Lignite & brown organic shale 76Silt, sandy, gray 108Shale, silty, gray, lime rock at 112100' & lignite at 108' 129Shale, greenish gray 131Shale, silty, gray 166Sandstone 170Shale, silty, gray 172Shale, brown, organic 185Shale, silty, gray w/lignite seam 195Lignite _____Shale, gray _____

(use separate sheet if necessary)

10. DATE COMPLETED 28 Mar 02**11. WAS THE HOLE PLUGGED OR ABANDONED?** Yes No

if so, how? _____

12. REMARKS 1,240# of Abrasives Inc sand pack to 173', 550# bentonite chips to 3', cuttings to surface.**13. DRILLER'S CERTIFICATION**

This well was drilled under my jurisdiction and this report is true to the best of my knowledge

Driller's or Firm's Name

Mo HL Drilling, Inc

Address

Beulah ND 58523

Certificate No.

105

51

BOARD OF WATER WELL CONTRACTORS
900 E. BOULEVARD AVE., DEPT. 770 " BISMARCK, NORTH DAKOTA 58505-0850

SHO-05
SHC Identification

WELL DRILLER'S REPORT

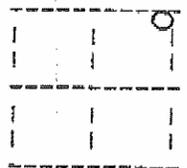
State law requires that this report be filed with the State Board of Water Well Contractors within 30 days after completion or abandonment of the well.

1. WELL OWNER

Name Kienergy Inc
Address 203 S Main, Suite 2004
Sheridan, WY 82801

2. WELL LOCATION

North well 11B
139-98-23AAA



County Stark
NE1/4 NE1/4 NE1/4 Sec.23 Twp.139 N.Rge.98 W

3. PROPOSED USE Geothermal Monitoring
Domestic Irrigation Industrial
Stock Municipal Test Hole

4. METHOD DRILLED

Cable Reverse Rotary Bored
 forward Rotary Jetted Auger
If other, specify _____

5. WATER QUALITY

Was a water sample collected for:
Chemical analyses? Yes No
Bacteriological Analyses? Yes No
If so, to what laboratory was it sent?

6. WELL CONSTRUCTION

Diameter of Hole 5 3/8 inches Depth 72 feet
Casing: Steel Plastic Concrete
 Threaded welded Other

If other, specify _____
Pipe Weight: Diameter: From: To:
lb/ft 2 inches +2 feet 60 feet
lb/ft inches feet feet
lb/ft inches feet feet

Was perforated pipe used? Yes No
Perforated pipe set from ft to feet
Was casing left open end? Yes No
Was a well screen installed? Yes No
Material PVC Diameter 2 inches

Slot Size 10 set from 60 feet to 70 feet
Slot Size set from feet to feet
Was packer or seal used? Yes No
If so, what material Depth ft

Type of well: Straight screen Gravel packed
Depth grouted: From 0 to 46
Grouting material: Cement Other

If other explain: Bentonite Chips
Well head completion: Fittless unit
12" above grade Other

If other, specify 2' above grade
Was pump installed? yes No
Was well disinfected upon completion? yes No
WSIQZ\WDRPT01

7. WATER LEVEL

Static water level _____ Feet below surface
If flowing: closed-in pressure _____ psi
GPM flow _____ through _____ inch pipe
Controlled by: _____ Valve _____ Reducers _____ Other
If other, specify _____

8. WELL TEST DATA

_____ Pump _____ Bailer _____ Other
Pumping level below land surface
_____ ft. after _____ hrs. pumping _____ gpm
_____ ft. after _____ hrs. pumping _____ gpm
_____ ft. after _____ hrs. pumping _____ gpm

9. WELL LOG

Formation	Depth (Ft.)
Clay, silty to sandy, yellowish brown, oxidized	10
Shale, yellowish brown, oxidized	18
Shale, silty, brown, w/ organics	21
Silt, sandy, gray	42
Sand, silty gray	48
Lignite	69.5
Shale, light gray	72

(use separate sheet if necessary)

10. DATE COMPLETED 28 Mar 02

11. WAS THE HOLE PLUGGED OR ABANDONED?

Yes No
if so, how? _____

12. REMARKS 240# of Abrasives Inc sand pack to 46', 300# bentonite chips to 3', cuttings to surface.

13. DRILLER'S CERTIFICATION

This well was drilled under my jurisdiction and this report is true to the best of my knowledge

Driller's or Firm's Name MoHL Drilling, Inc Certificate No. 105
Address Bellaire ND 58523