

United States Department of Agriculture



Natural Resources Conservation Service
Geological Services Unit
501 Felix, Bldg. 49S
Fort Worth, Texas 76115



April 28, 2014

Subject: Geology Report, Plum Creek Site 6, Hays County, Texas

To: John Mueller, State Conservation Engineer, Temple, Texas

During the month of August 2010, William York, Geologist, Fort Worth, Texas and Daniel Wilkinson, Physical Science Technician, Fort Worth, Texas performed a Geological Investigation of Plum Creek Site 6, Hays County, Texas. Additional work was performed by Bryan S. Moffatt, Geologist and Daniel Wilkinson August and September 2010. The purpose of the investigation was to acquire data for rehabilitation of the site. The following report is a reconstituted summary of the investigation due to the departure of William York from the Agency.

General Data

Watershed:	Guadalupe River
Sub-watershed:	Plum Creek (Porter Creek)
County:	Hays
State:	Texas
Location:	3 miles E and 1 mi. N of Kyle, Texas N 30.002337 W -97.822603
Structure Class:	High Hazard
Type of Equipment:	Simco Power Auger
Investigated by:	William York, Bryan Moffatt, Daniel Wilkinson

Site Data

Drainage Area:	5,376 acres (as-built 03/16/1966)
Type of Structure:	Earthen
Purpose:	Flood Retarding
Direction of Valley:	North – South
Sediment Storage Acre/Ft:	896 (as-built 03/16/1966)
Floodwater Storage Acre/Ft:	2,867 (as-built 03/16/1966)
Volume of Fill:	203,540 yds ³
Height of Dam:	40ft (as-built 03/16/1966)
Length of Dam:	2,923ft (Sta. 10+17 CL Dam to Sta. 39+40 CL Dam)
Top of Dam (effective)	642.5ft (as-built 03/16/1966)
Upstream Embankment Slope:	2.5H to 1V
Downstream Embankment Slope:	2.5H to 1V
Principal Spillway Crest:	638.5ft (as-built 03/16/1966)

Pipe Invert:	607.55ft Sta.3+75 PS (as-built 03/16/1966)
Auxiliary Spillway Location:	Left Abutment
Width Auxiliary Spillway:	350ft
Auxiliary Spillway Crest:	638.5ft
Auxiliary Spillway Capacity, ft ³ /sec:	6257 (as-built 03/16/1966)

Surface Geology and Physiography

Physiographic Description:	Blackland Prairie
Mineral Land Unit:	C-1 Expansive Clay
Topography:	Flat to Gently Rolling Prairie
Physical Properties:	Low Slope Stability, Low Foundation Strength, Highly Plastic and Expansive Clays, High Corrosion Potential
Attitude of Beds (Regional):	Strike: Approximately N 24° E Dip: 0.5° N 114° E

General Geology

Two horizons are present within the Plum Creek Site 6 location. The horizons consist of Upper Cretaceous Pecan gap (Kpg) and Recent Quaternary Alluvium (Qal).

Pecan Gap

The claystone of the Kpg occurs at depth throughout the site. It outcrops on both abutments and the outside cut and floor of the Auxiliary Spillway. The Kpg is generally described as very soft rock (hard soil-like material on outcrop), silty, thinly bedded to laminated claystone. The material is light brown mottled gray when weathered and dark gray when slight to non-weathered. Iron stained and gypsum filled fractures and a few carbonate concretions are present.

Quaternary Alluvium

Qal material outcrops in the Plunge Basin, along portions of the Downstream Toe of the Dam and the Exit Slope of the Auxiliary Spillway. The material is generally composed of two broad horizons. The upper horizon is generally described as silty, stiff, highly plastic brown clay, CH. The lower horizon is generally described as stiff, highly plastic, silty clay with some fine to coarse grain sand and gravel CH. The lower horizon by Gamma Log analyses and drilling characteristics indicates some thin streaks of GC to GM material may be present.

Seismic

Probabilistic ground motion values as measured by %g for this site indicates low seismicity (Note: the term “low” is used as a descriptive term and not a classification term). The attached Texas Seismic Hazard Map and Deaggregation plots (USGS) indicate the main seismic contribution to the site is from magnitude 4 to 6 earthquakes within a 200 km radius of the site. Additional contributions are from 5.5 to 7.0 magnitude earthquakes in a 500 km radius (Meers

Fault north of Lawton OK and Rio Grande Rift Zone Trans-Pecos Texas Northern Mexico) and 7.5 to 8.0 magnitude earthquakes 900 plus km away. Peak Horizontal Ground Acceleration at this site is 0.03177, 0.04956 and 0.07580 g with a Mean Return Time of 2475, 4950 and 9950 years with an Annual Exceedance Rate of 0.405×10^{-3} , 0.202×10^{-3} and 0.101×10^{-3} respectively (Values from USGS Earthquake Hazard Custom Mapping and Analysis Tools, <http://earthquake.usgs.gov/hazards/apps/#deaggint> . Mw verses distance liquefaction plots verses the Papadopoulos and Lefkopoulos e – e' curve indicate “low” potential for occurrence of liquefaction. Further, as outlined in FEMA 65, Section IV Part 3.C.a:

- Dam and foundation materials are not subject to liquefaction and do not include loose soils or sensitive clays.
- Embankment was built with a minimum dry density, percent of field density test, maximum dry density of 85
- Phreatic Line is “well” below the slope of the embankment (projected from water levels Hole 301, 802 and lake level at time of drilling.
- Maximum peak ground acceleration at the base of the embankment is less than 0.2g (site 0.07580g, Exceedance Rate 0.101×10^{-3} , Mean Return Time 9,900 years).
- Freeboard of the embankment is greater than 3% to 5% embankment height and greater than 3 feet. Embankment height 40 feet, freeboard TOD 643.4 – PS Crest 626.4 = 17 feet or 42.5%. (Data from as-built 03/18/1966)

General

Background

Construction of Plum Creek 6 was completed on 03/01/1967 (as-built 03/18/1966). The structure is located on Porter Creek. Porter Creek flows into the Bunton Branch 2.6 miles south southeast of the site. Bunton Branch flows into Plum Creek 0.48 miles further southeast.

The structure was built as a “low” hazard classification and has been reclassified to “high”. County Road 157, Goforth Road, is parallel and downstream of the dam’s alignment, crosses between the Principal Spillway pipe and toe of the structure and crosses the exit slope of the Auxiliary Spillway at an angle. Several small businesses are on the southwest side of Goforth Road downstream of the dam.

There are several homes built along the downstream toe of the dam beginning at approximately Sta. 26+00 CL Dam 70’ DS and continuing to the right abutment. A quadplex is located downstream near Sta. 31+50 CL Dam. The septic system for this dwelling is at or on the toe of the dam beginning at approximately Sta. 29+15 CL Dam 63’ DS and ending at approximately Sta. 30+30 CL Dam 63’ DS. Several homes and outbuildings are built northwest of the permanent pool area. Some of these structures appear by visual observation to be built within the flood pool.

Centerline of the Dam

No holes were drilled along the Centerline of the Dam during the 2010 investigation.

Auxiliary Spillway

Six holes were drilled along the inside cut of the Auxiliary Spillway for erodibility. Nine samples were taken within the Auxiliary Spillway. A list of the samples taken is outlined in the following table:

Hole	Depth	Type	Description Remarks
201	0' – 2'	3" Push	CH Topsoil and CS, hi/wea, breaks down to hi/pl clay CH
201	10' – 11'	3" Push	CS, fe stain and gyp, hi/wea, breaks down to hi/pl clay CH
201	30' – 35'	Small	CS gyp filled frac, sl-non/wea, breaks down to hi/pl clay CH
202	5' – 7'	3" Push	CS gyp filled frac, hi/wea, breaks down to hi/pl clay CH
202	10' – 11'	3" Push	CS gyp, frac, hi/wea, breaks down to hi/pl clay CH, refusal 11'
202	15' – 16'	3" Push	CS gyp, frac, hi/wea, breaks down to hi/pl clay CH, refusal 16'
202	19' – 20'	Small	CS gyp filled frac, hi/wea, breaks down to hi/pl clay CH, fe stain
202	20' – 20.5'	3" Push	CS gyp, frac, wea, breaks down to hi/pl clay CH, refusal 20.5'
203	17' – 19'	Small	CS gyp filled frac, hi/wea, breaks down to hi/pl clay CH, fe stain
203	24' – 25'	Small	CS gyp filled frac, hi/wea, breaks down to hi/pl clay CH, fe stain

A Labyrinth Weir over the crest of the dam is planned to replace the Auxiliary Spillway. This design change requires plugging of the existing Auxiliary Spillway in favor of a structural spillway located on the embankment negates the erodibility assessment normally provided for.

Preliminary material characterization indicated very weak to weak material existed to a depth of approximately 10 feet in the control section with the material then becoming stronger with depth. It also appears all the material may be extremely sensitive to water and may be more erosive than might be expected of a soil of this type. Any assessment would have required sensitivity analyses utilizing SITES with results yielding a high probability that engineered structural measures may be necessary to control erosion.

Principal Spillway

Two holes were drilled to investigate design for a new Principal Spillway pipe and Impact Basin. A list of the samples taken is outlined in the following table:

Hole	Depth	Type	Description Remarks
301	14' – 16'	5" Push	Clay, silty, sl/fine grain gravel, hi/pl, sat., CH
802	7' – 8.5'	3" Push	Clay, silty, sl/fine grain gravel, hi/pl, sat., CH

The existing Principal Spillway pipe is to be filled with grout and replaced with a new 42" diameter pipe and a new intake tower constructed. In Hole 301 and 802 on the Downstream Toe there is 15ft to 16ft of CH, slight gravel alluvial material on top of weathered claystone. The alluvial material was removed to weathered claystone and replaced with compacted fill at the core trench under the current spillway. Under the slopes of the dam, the pipe is placed within CH alluvial material and compacted fill. The procedure to remove and replace material to claystone

at the centerline of the dam and thru alluvial CH under the slopes of the dam provided an adequate foundation with desired support for the existing pipe.

Toe Drain

11 holes were drilled to investigate placement of a Toe Drain. All the holes were drilled to non-weathered claystone to project core trench material removed during original construction and investigate potential water movement thru fractures. Recovery tests from holes 801 and 803 indicate permeability between 0.001799 to 0.004126 ft/day. Water levels ranged from 1.5ft (hole 802) to 9.1ft (hole 807) on 08/13/10. Holes 808 – 811 encountered no water during drilling operations in August 2010.

A profile of the downstream toe was constructed. The profile indicates that there is a secondary buried alluvial channel north and west of 807. No water was observed in the holes drilled through this buried channel.

No holes were drilled north and west of Hole 811 because of septic systems and development downstream of the dams toe. There is a septic leach field and tanks known to exist approximately 90ft northwest of Hole 811. It is unknown if the home between Sta.27+00 and 28+00 CL Dam is on a septic system.

Conclusions and Recommendations

Dam

The as-built diagrams indicate zonation construction within the dam. Claystone material from Auxiliary Spillway was used in construction of the dam. It is suggested that 5" Undisturbed samples of foundation material be taken within the footprint of the Labyrinth Weir. It is also suggested that SPT be performed through the fill material and into the claystone material under the dam to assure material integrity.

Principal Spillway

It is suggested that 5" undisturbed samples be taken at the foundation level of the Impact Structure / pipe support. An additional hole is suggested on the centerline of the dam for pipe foundation support information.

Auxiliary Spillway

The dam is to be extended filling in the Auxiliary Spillway. It is suggested to drill 2 investigation borings along the dam extension in the spillway to identify depth of desiccation. Hole depth is estimated to be 10ft

Toe Drain

No additional holes are recommended for Toe Drain investigation. Placement of the toe Drain

should take into account septic systems in the area to prevent a direct path for effluent to enter the creek. No water was observed past approximately Sta. 22+65. It is suggested that the Toe Drain not be installed northwest of this approximate location. Abundant iron staining was observed in drill cuttings. It is suggested that the upstream end of the drain be day lighted with a cleanout port.

Borrow

No borrow work was performed in 2010. It is suggested that a borrow area be designated and a minimum of 2 times the cubic yards needed for construction be confirmed and sampled.



Bryan S. Moffatt, PG 2887
State Geologist
USDA/NRCS
Fort Worth, Texas

Attachments

Seismic

- 1a) Earthquake Hazard map
- 1b) Probability of Exceedance, Magnitude 5.0, 50 years
- 1c) Probability of Exceedance, Magnitude 5.0, 5,000 years
- 1d) Probability of Exceedance, Magnitude 5.0, 10,000 years
- 1e) Deaggregation Plot 2% Probability of Exceedance in 50 Years
- 1f) Deaggregation Plot 2% Probability of Exceedance in 100 Years
- 1g) Deaggregation Plot 2% Probability of Exceedance in 200 Years

Sample Logs

- 2a) Auxiliary Spillway
- 2b) Principal Spillway
- 2c) Toe Drain

Maps

- 3a) Geologic Outcrop map
- 3b) Aerial Photo
- 3c) Hole Location Plat

Profiles

- 4a) Auxiliary Spillway
- 4b) Downstream Toe

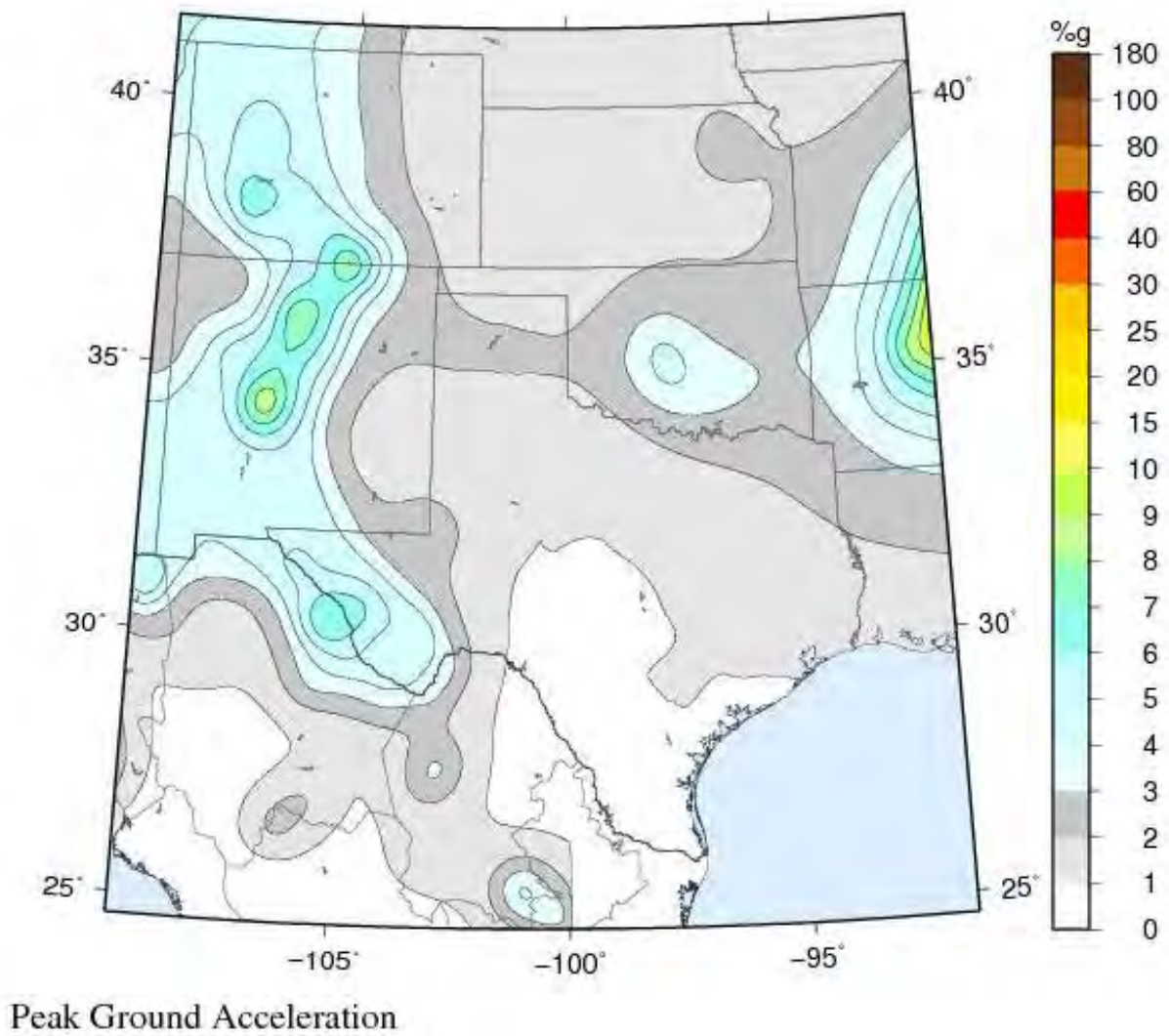
Sample Data

- 5a) Sample List
- 5b) Index Tests
- 5c) Shear Tests Page 1 and 2

Rising Head Tests

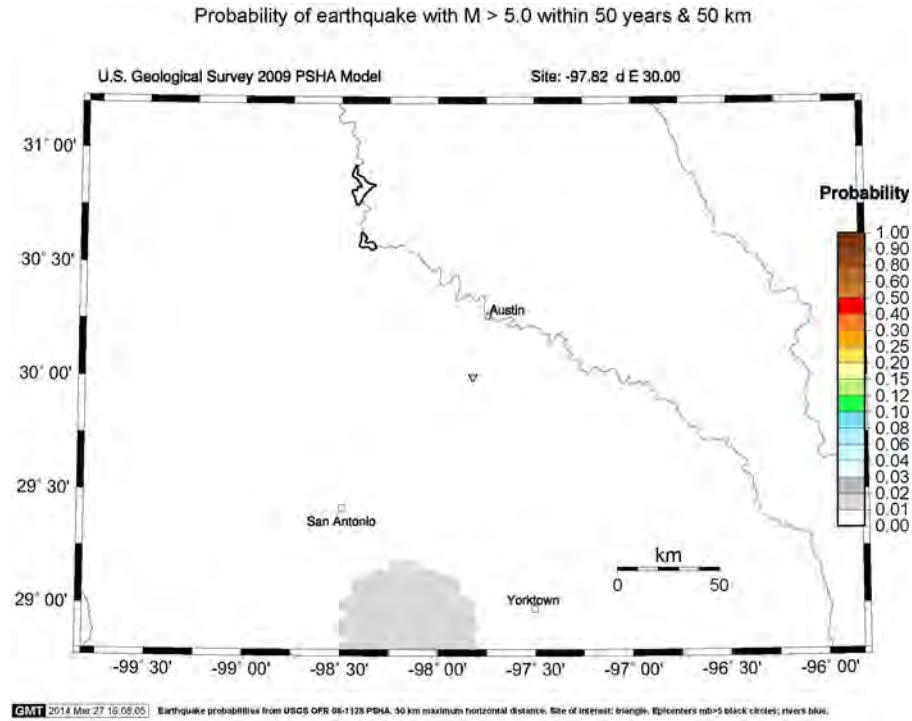
- 6a) Hole 801
- 6b) Hole 803
- 6c) Hole 804
- 6d) Hole 805
- 6e) Hole 806

Attachment 1a
Earthquake Hazard Map



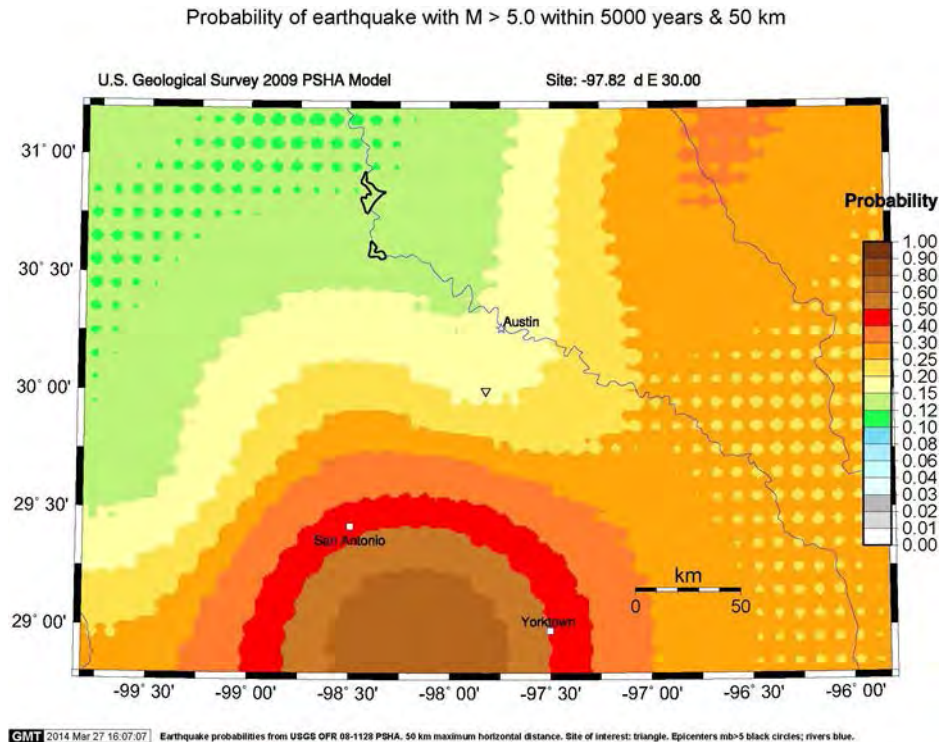
Attachment 1b

Probability of Exceedance, Magnitude 5.0, 50 years



Attachment 1c

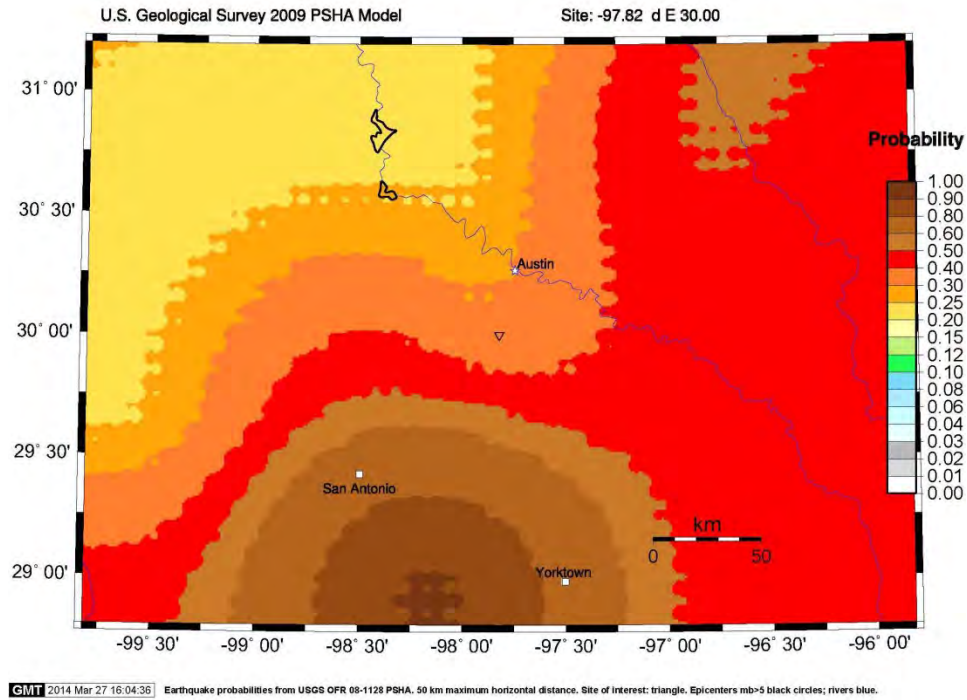
Probability of Exceedance, Magnitude 5.0, 5,000 years



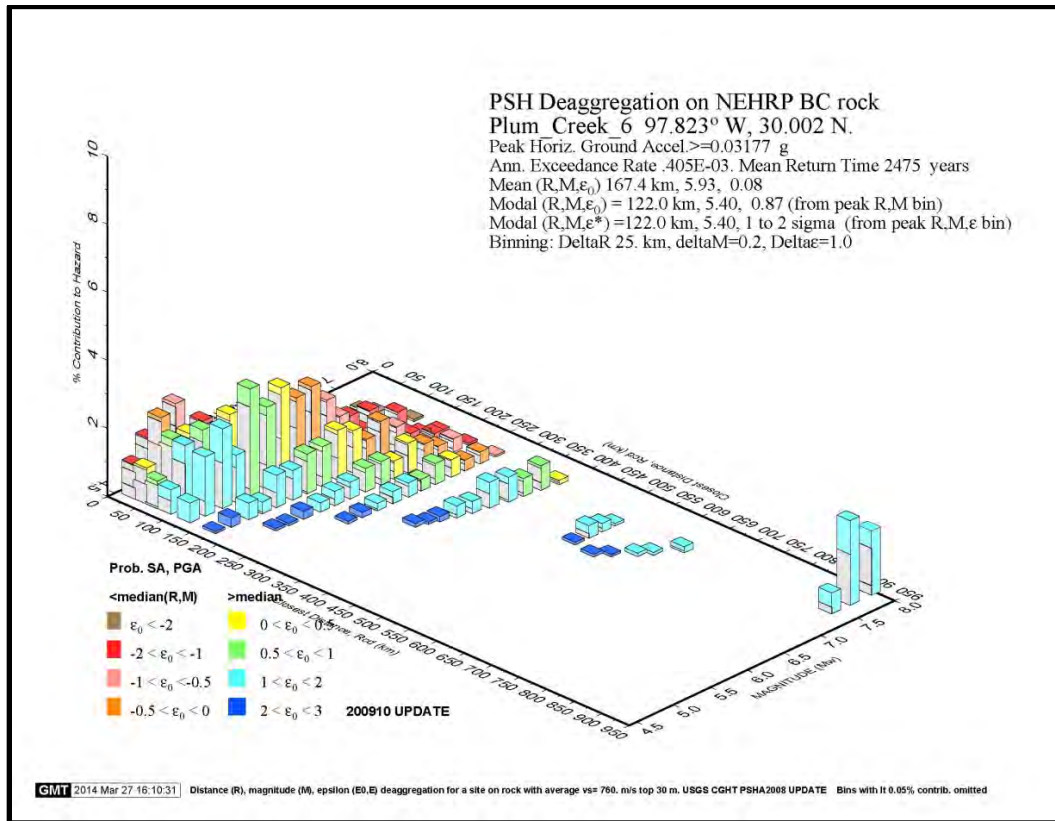
Attachment 1d

Probability of Exceedance, Magnitude 5.0, 10,000 years

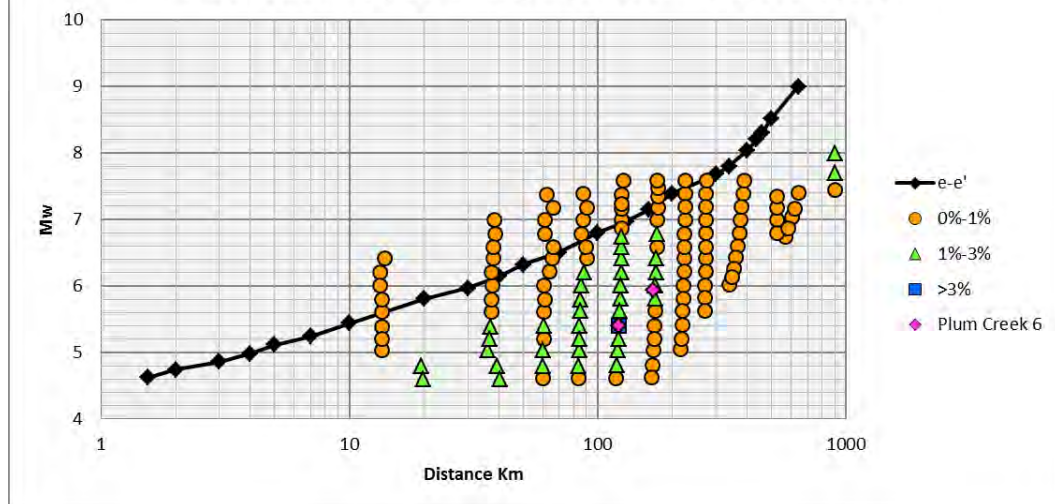
Probability of earthquake with $M > 5.0$ within 10000 years & 50 km



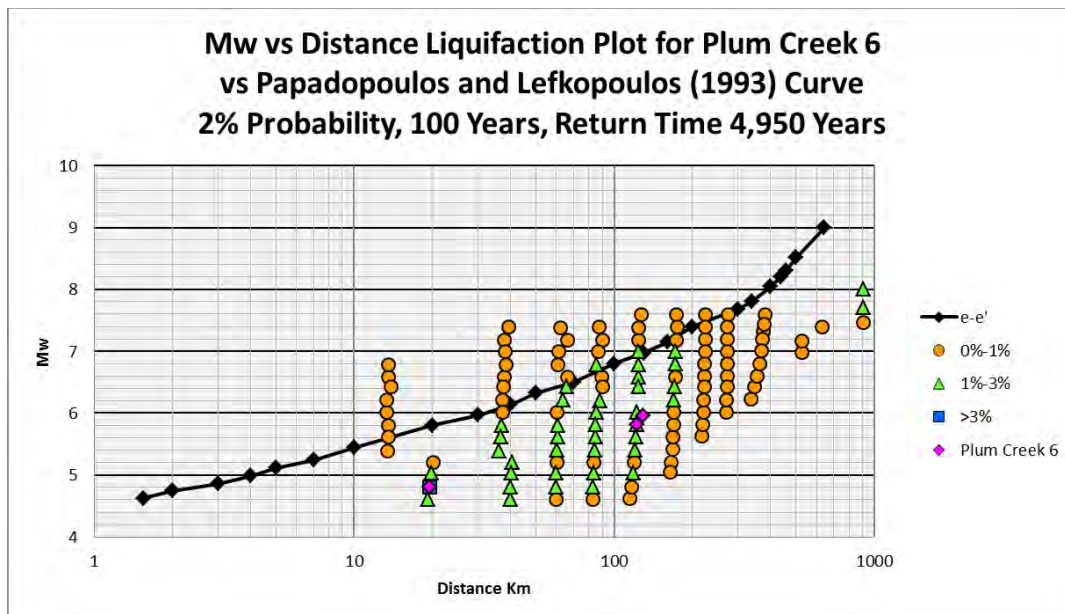
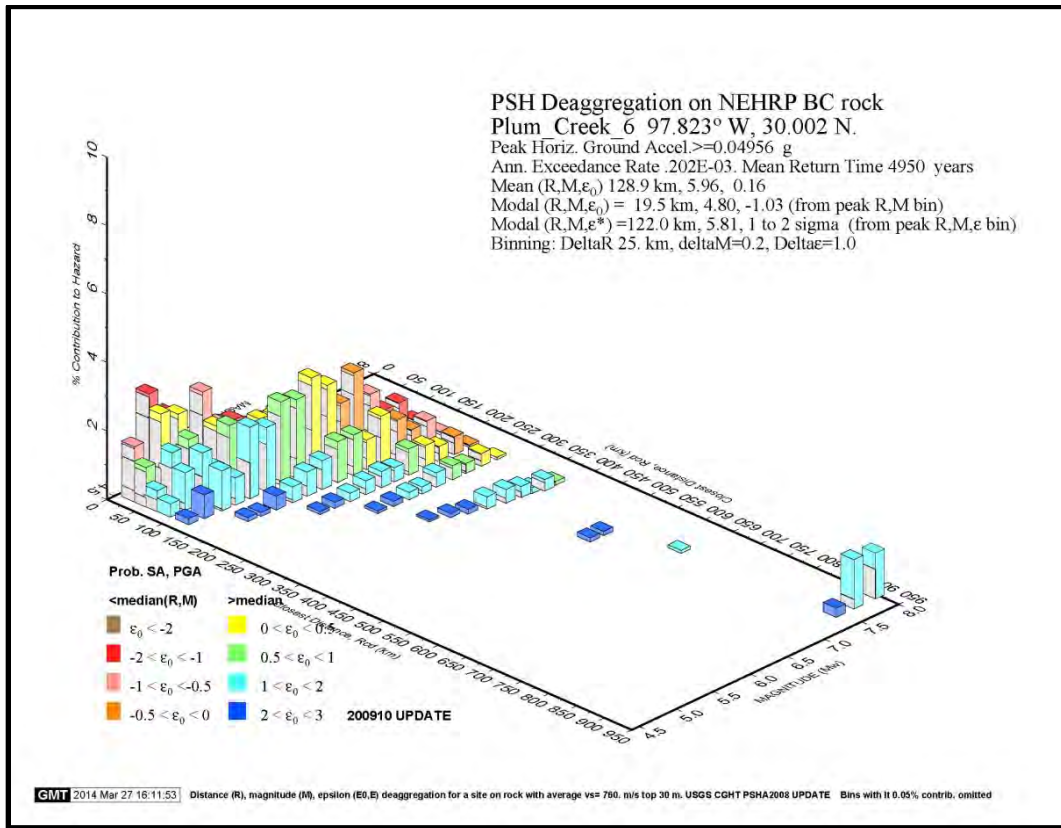
Attachment 1e **Plum Creek 6 Deaggregation Plot** **2% Probability of Exceedance in 50 Years**



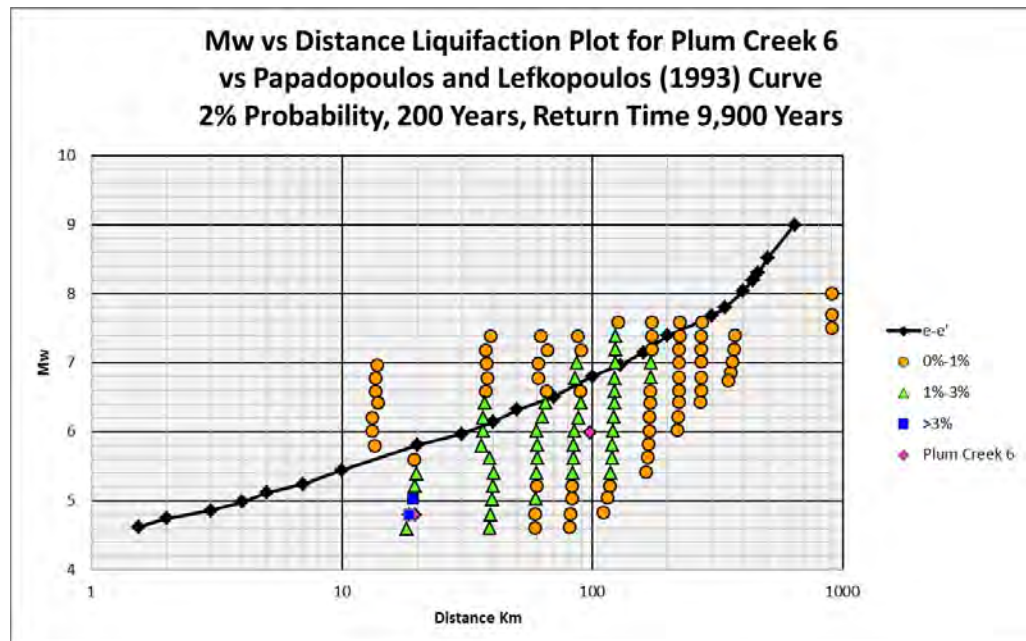
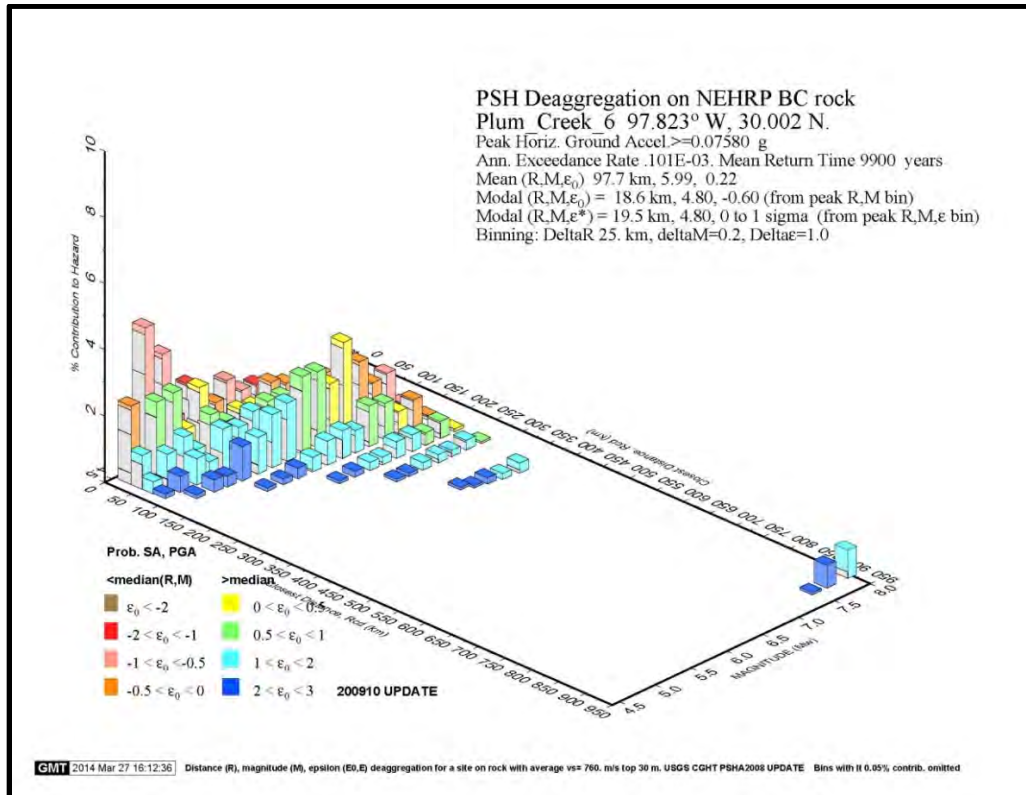
Mw vs Distance Liquifaction Plot for Plum Creek 6 **vs Papadopoulos and Lefkopoulos (1993) Curve** **2% Probability, 50 Years, Return Time 2,475 Years**



Attachment 1f **Plum Creek 6 Deaggregation Plot** **2% Probability of Exceedance in 100 Years**



Attachment 1g **Plum Creek 6 Deaggregation Plot** **2% Probability of Exceedance in 200 Years**



Attachments 1a-1f from <http://earthquake.usgs.gov/hazards/apps/#deaggint> Papadopoulos and Lefkopoulos data from Magnitude-Distance Relations for Liquefaction in Soil from Earthquakes, Bulletin of the Seismological Society of America, Vol. 83, June 1993

LOG OF TEST HOLES

WATERSHED: Plum Creek				SITE NO: 6				PAGE 1					
LOCATION: Auxiliary Spillway				COUNTY: Hays				STATE: Texas					
LOGGED BY: York				DATE: 08/02/2010									
DRILLING EQUIPMENT: Simco Power Auger				LOCATION OF HOLES:				N 30.001564 W -97.821463 NAD 83 UTM Zone 14					
HOLE NO.	STA. & ELEV.	HOLE DEPTH		DESCRIPTIONS OF MATERIAL	NUMBER BLOWS	USCS	TYPE BIT USED	SAMPLE					FIELD DISP. DEPTH VALUE
		FROM FT.	TO FT.					NO.	TYPE	FROM FT.	TO FT.	TEST	
201	5+00 CL AS 175' RT	0.0	1.0	Clay, silty, dry to sl/moist, stiff, hi/pl, brown		CH	CF	201.1	3" Push	0.0	2.0		1/1
	636.9	1.0	23.5	Claystone, hi/weathered blocky, silty, sl/moist, tb-lam, gyp and fe stain, light brown, breaks down to hi/pl clay CH, sl/sand @ 15', gyp filled fe/stain frac 16'-17', 19'-20'		CS		201.2	3" Push	10.0	11.0		2-23/1
		23.5	35.0	Claystone, sl non-weathered, silty, tb-lam, moist, breaks down to mod-hi/pl clay, dark gray, gyp and fe stain frac 34'-35'				201.3	Small	30.0	35.0		24-35/1
				08/03/2010 @ 7:57 no water									
				08/04/2010 @ 8:17 no water									
				Location projected from as-built, elevation estimated from design survey 06/26/1998									

Identification of soils and assignment of group names and symbols based on the Unified Soil Classification System are based on visual-manual procedures (AST M D 2488-84)

Identification of soils and assignment of group names and symbols based on the Unified Soil Classification System are based on visual-manual procedures (ASTM D 2488-84)

Attachment 2a
Hole 201

LOG OF TEST HOLES

WATERSHED: Plum Creek				SITE NO: 6				PAGE 1					
LOCATION: Auxiliary Spillway				COUNTY: Hays				STATE: Texas					
LOGGED BY: York				DATE: 08/03/2010									
DRILLING EQUIPMENT: Sinco Power Auger				LOCATION OF HOLES:				N 30.001278 W -97.821188 NAD 83 UTM Zone 14					
HOLE NO.	STA. & ELEV.	HOLE DEPTH		DESCRIPTIONS OF MATERIAL	NUMBER BLOWS	USCS	TYPE BIT USED	SAMPLE					
		FROM FT.	TO FT.					NO.	TYPE	FROM FT.	TO FT.	TEST	FIELD DISP. DEPTH VALUE
202	8+00 CL AS 175' RT	0.0	1.0	Clay, silty, dry to sl/moist, stiff, hi/pl, brown		CH	CF	201.1	3" Push	5.0	7.0		1/1
		1.0	27.0	Claystone, hi/weathered blocky, silty, sl/moist, tb-lam, gyp and fe stain, light brown, breaks down to hi/pl clay CH, gyp filled fe/stain frac 5'-7', 9.5'-10', 13'-14', 1/4" gyp crystals @ 14', weathered and sl-nonweathered layers 18' to 27' transitional contact		CS		202.2	3" Push	10.0	11.0		2-27/1
		27.0	35.0	Claystone, sl-non-weathered, silty, tb-lam, moist, breaks down to mod-hi/pl clay CL to CH, dark gray, gyp and fe stain frac 29'		CS		202.3	3" Push	15.0	16.0		28-35-1
								202.4	small	19.0	20.0		
				08/03/10 @ 10:00 no water				202.5	3" Push	20.0	20.5		
				08/05/10 @ 16:14 no water									
				Location projected from as-built, elevation estimated from design survey 06/26/1998									

Identification of soils and assignment of group names and symbols based on the Unified Soil Classification System are based on visual-manual procedures (ASTM D 2488-84)

Identification of soils and assignment of group names and symbols based on the Unified Soil Classification System are based on visual-manual procedures (ASTM D 2488-84)

Attachment 2a
Hole 202

LOG OF TEST HOLES

PAGE 1

WATERSHED: Plum Creek	SITE NO: 6	
LOCATION: Auxiliary Spillway	COUNTY: Hays	STATE: Texas
LOGGED BY: York	DATE: 08/03/2010	
DRILLING EQUIPMENT: Sinco Power Auger	LOCATION OF HOLES: N 30.001106 W -97.821562 NAD 83 UTM Zone 14	

HOLE NO.	STA. & ELEV.	HOLE DEPTH		DESCRIPTIONS OF MATERIAL	NUMBER BLOWS	USCS	TYPE BIT USED	SAMPLE					FIELD DISP. DEPTH / VALUE
		FROM FT.	TO FT.					NO.	TYPE	FROM FT.	TO FT.	TEST	
203	11+50 CLAS 175' RT	0.0	0.5	Clay, silty, dry to sl/moist, stiff, hi/pl, brown		CH	CF	203.1	small	17.0	19.0		
		0.5	30.0	Claystone, hi/weathered blocky, silty, sl/moist, tb-lam, gyp and fe stain, light brown, breaks down to hi/pl clay CH, gyp filled fe/stain frac 6', Mg stain and gyp 9', 12' 1/4" gyp crystals @ 19', 9.5'-10', 13'-14', 1/4" gyp crystals @ 14' and 29', Gyp and fe frac @ 19' weathered and sl-nonweathered layers 25' to 29' transitional contact		CS		203.2	small	24.0	25.0		1-30/1
		30.0	35.0	Claystone, sl-non-weathered, silty, tb-lam, moist, breaks down to mod-hi/pl clay CL to CH, dark gray, gyp and fe stain along fracs		CS							31-35/1
				08/03/10 @ 12:59 no water									
				08/04/10 @ 8:26 no water									
				Location projected from as-built, elevation estimated from design survey 06/26/1998									

Attachment 2a
Hole 203

LOG OF TEST HOLES

WATERSHED: Plum Creek	SITE NO: 6	PAGE 1
LOCATION: Auxiliary Spillway	COUNTY: Hays	STATE: Texas
LOGGED BY: York	DATE: 08/03/2010	
DRILLING EQUIPMENT: Sinco Power Auger	LOCATION OF HOLES: N 30.001150 W -97.821980 NAD 83 UTM Zone 14	

HOLE NO.	STA. & ELEV.	HOLE DEPTH		DESCRIPTIONS OF MATERIAL	NUMBER BLOWS	USCS	TYPE BIT USED	SAMPLE					FIELD DISP. DEPTH / VALUE
		FROM FT.	TO FT.					NO.	TYPE	FROM FT.	TO FT.	TEST	
204	12+84 CL AS 175' Rt	0.0	2.0	Clay, silty, dry to sl/moist, stiff, hi/pl, brown		CH	CF						1-2/1
	630.5	2.0	25.0	Claystone, hi/weathered blocky, silty, sl/moist, tb-lam, gyp and fe stain, light brown, breaks down to hi/pl clay CH, gyp filled fe/stain frac 12'-15', 1/4" gyp crystals @19', gyp filled and fe stain frac @ 21', 23', 24'		CS							3-25/1
		25.0	30.0	Claystone, sl-non-weathered, silty, tb-lam, moist, breaks down to mod-hi/pl clay CL to CH, dark gray, gyp and fe stain along fracs		CS							26-30/1
				08/03/10 @ 15:02 no water									
				08/04/10 @ 8:27 no water									
				Location projected from as-built, elevation estimated from design survey 06/26/1998									

Identification of soils and assignment of group names and symbols based on the Unified Soil Classification System are based on visual-manual procedures (ASTM D 2488-84)

Attachment 2a
Hole 204



United States Department of Agriculture

Natural Resources Conservation Service

LOG OF TEST HOLES

WATERSHED: Plum Creek				SITE NO: 6				PAGE 1			
LOCATION: Auxiliary Spillway				COUNTY: Hays				STATE: Texas			
LOGGED BY: York				DATE: 08/03/2010							
DRILLING EQUIPMENT: Simco Power Auger				LOCATION OF HOLES:				N 30.001128 W -97.822477 NAD 83 UTM Zone 14			

HOLE NO.	STA. & ELEV.	HOLE DEPTH		DESCRIPTIONS OF MATERIAL	NUMBER BLOWS	USCS	TYPE BIT USED	SAMPLE					FIELD DISP. DEPTH / VALUE	
		FROM FT.	TO FT.					NO.	TYPE	FROM FT.	TO FT.	TEST		
205	14+50 CL AS 175' Rt	0.0	6.5	Clay, silty, moist - sat., stiff, hi/pl, sl/fg gravel 2.5'-3', sl/sandy, brown, alluvium		CH	CF							1-6/1
	619.8	6.5	15.0	Claystone, silty, tb-lam, hi/weathered, blocky, fe/stain and gyp in frac breaks down to mod-hi/pl clay CL-CH, brown		CS								7-15/1
				08/03/10 @ 15:45 no water										
				08/04/10 @ 8:33 no water										
				Location projected from as-built, elevation estimated from design survey 06/26/1998										

Identification of soils and assignment of group names and symbols based on the Unified Soil Classification System are based on visual-manual procedures (ASTM D 2488-84)

Attachment 2a
Hole 205



United States Department of Agriculture

Natural Resources Conservation Service

LOG OF TEST HOLES

WATERSHED: Plum Creek	SITE NO: 6	PAGE 1
LOCATION: Auxiliary Spillway	COUNTY: Hays	STATE: Texas
LOGGED BY: York	DATE: 08/03/2010	
DRILLING EQUIPMENT: Simco Power Auger	LOCATION OF HOLES:	N 30.001146 W -97.822958 NAD 83 UTM Zone 14

HOLE NO.	STA. & ELEV.	HOLE DEPTH		DESCRIPTIONS OF MATERIAL	NUMBER BLOWS	USCS	TYPE BIT USED	SAMPLE					FIELD DISP. DEPTH / VALUE
		FROM FT.	TO FT.					NO.	TYPE	FROM FT.	TO FT.	TEST	
206	16+00 CLAS 175' Rt	0.0	7.0	Clay, silty, moist - sat, stiff, hi/pl carbonate concretions, brown, alluvium		CH	CF						1-7/1
	613.8	7.0	15.0	Claystone, silty, tb-lam, soft to v/soft rock, hi/weathered, blocky, fe/stain and gyp in frags breaks down to mod-hi/pl clay CL-CH brown		CS							8-15/1
				08/03/10 no water									
				08/04/10 @ 8:36 no water									
				Location projected from as-built, elevation estimated from design survey 06/26/1998									

Identification of soils and assignment of group names and symbols based on the Unified Soil Classification System are based on visual-manual procedures (ASTM D 2488-84)

Attachment 2a
Hole 206

LOG OF TEST HOLES

WATERSHED: Plum Creek				SITE NO: 6				PAGE 1					
LOCATION: Plunge Basin Offset				COUNTY: Hays				STATE: Texas					
LOGGED BY: York				DATE: 08/03/2010									
DRILLING EQUIPMENT: Simco Power Auger				LOCATION OF HOLES:				N 30.001770 W -97.823071 NAD 83 UTM Zone 14					
HOLE NO.	STA. & ELEV.	HOLE DEPTH		DESCRIPTIONS OF MATERIAL	NUMBER BLOWS	USCS	TYPE BIT USED	SAMPLE					FIELD DISP. DEPTH / VALUE
		FROM FT.	TO FT.					NO.	TYPE	FROM FT	TO FT	TEST	
301	15+00 CL Dam 170' DS	0.0	1.0	Clay, silty, carbonaceous concretions, sl/fg gravel, hi/pl, brown		CH	CF						1/1
	611.3	1.0	4.0	Clay, reworked claystone, sl/moist, hi/pl, stiff, brown, fill		CH							2-4/1
		4.0	14.0	Clay, silty, carbonaceous concretions, sl/fg gravel, mod-hi/pl, brown		CL-CH		301.1	3" Push	14.0	16.0		4-14/1
		14.0	16.0	Claystone, Hd1-2 silty, moist, hi/weathered, blocky, fractured, fe stain and gyp in fractures, breaks down to hi/pl clay brown		CS							
				08/03/10 no water									
				08/04/10 no water									
				Location projected from as-built, elevation estimated from design survey 06/26/1998									

Identification of soils and assignment of group names and symbols based on the Unified Soil Classification System are based on visual-manual procedures (ASTM D 2488-84)

Identification of soils and assignment of group names and symbols based on the Unified Soil Classification System are based on visual-manual procedures (ASTM D 2488-84)

Attachment 2b
Hole 301

LOG OF TEST HOLES

WATERSHED: Plum Creek				SITE NO: 6				PAGE 1			
LOCATION: Downstream Toe				COUNTY: Hays				STATE: Texas			
LOGGED BY: York				DATE: 08/04/10							
DRILLING EQUIPMENT: Simco Power Auger				LOCATION OF HOLES:				N 30.001685 W -97.822549 NAD 83 UTM Zone 14			

HOLE NO.	STA. & ELEV.	HOLE DEPTH		DESCRIPTIONS OF MATERIAL	NUMBER BLOWS	USCS	TYPE BIT USED	SAMPLE					FIELD DISP. DEPTH / VALUE
		FROM FT.	TO FT.					NO.	TYPE	FROM FT.	TO FT.	TEST	
801	13+80 CL Dam 70' DS	0.0	0.5	Clay, silty, dry to sl/moist, stiff, hi/pl, sl/carb. conc., dark brown		CH	CF						1/0
	617.0	0.5	6.0	Clay, reworked claystone, sl/moist, hi/pl, stiff, brown, fill		CH							2-6/0
		6.0	12.0	Clay, silty, moist - sat., stiff, hi/pl, sl/fg gravel, sl/sandy, brown		CH							6-12/0
		12.0	13.0	Gravel, fine to coarse, clay, silty, sat., stiff, hi/pl, brown		GC							13/0
		12.0	25.0	Claystone, silty, weathered, blocky, tb-lam, fractured w/fe stain and gyp., breaks down to hi/pl CH, light brown		CS							12-25/0
		25.0	30.0	Claystone, silty, non-weathered, tb-lam, fractured w/gyp and fe stain, breaks down to hi/pl clay, dark gray,		CS							25-30/0
				Water Level 25.0' @ 18:10 08/05/10									
				Water Level 11.4' @ 8:53 08/06/10									
				Water Level 3.7' @ 15:00 08/11/10									
				Water Level 3.5' @ 9:05 8/13/10									
				Location projected from as-built, elevation estimated from design survey 06/26/1998									

Attachment 2c
Hole 801

LOG OF TEST HOLES

WATERSHED: Plum Creek				SITE NO: 6				PAGE 1			
LOCATION: Downstream Toe				COUNTY: Hays				STATE: Texas			
LOGGED BY: York				DATE: 08/04/2010							
DRILLING EQUIPMENT: Simco Power Auger				LOCATION OF HOLES: N 30.001998 W -97.822877 NAD 83 UTM Zone 14							

HOLE NO.	STA. & ELEV.	HOLE DEPTH		DESCRIPTIONS OF MATERIAL	NUMBER BLOWS	USCS	TYPE BIT USED	SAMPLE					FIELD DISP. DEPTH / VALUE
		FROM FT.	TO FT.					NO.	TYPE	FROM FT.	TO FT.	TEST	
802	15+10 CL Dam 70' DS	0.0	1.5	Clay, silty, dry to sl/moist, stiff, hi/pl, sl/carb. conc., dark brown		CH	CF						1/0
		1.5	7.0	Clay, reworked claystone, sl/moist, hi/pl, stiff, brown, fill		CH							2-7/0
		7.0	15.5	Clay, silty, moist - sat., stiff, hi/pl, sl/fg gravel, sl/sandy, brown		CH		0.1	3" Push	7.0	8.5		7-15/0
		15.5	16.0	Gravel, fine to coarse, clay, silty, sat., stiff, hi/pl, brown		GC							16/0
		16.0	31.0	Claystone, silty, weathered, blocky, tb-lam, fractured w/fe stain and gyp., breaks down to hi/pl CH, light brown		CS							16-31/0
		31.0	40.0	Claystone, silty, non-weathered, tb-lam, fractured w/gyp and fe stain, breaks down to hi/pl clay, dark gray,		CS							32-40/0
				Water Level 3.0' @ 18:09 08/05/10									
				Water Level 2.1' @ 8:30 08/06/10									
				Water Level 1.5' @ 9:07 08/13/10									
				Location projected from as-built, elevation estimated from design survey 06/26/1998									

Identification of soils and assignment of group names and symbols based on the Unified Soil Classification System are based on visual-manual procedures (ASTM D 2488-84)

Attachment 2c
Hole 802

LOG OF TEST HOLES

WATERSHED: Plum Creek				SITE NO: 6				PAGE 1			
LOCATION: Downstream Toe				COUNTY: Hays				STATE: Texas			
LOGGED BY: York				DATE: 08/04/2010							
DRILLING EQUIPMENT: Simco Power Auger				LOCATION OF HOLES:				N 30.002211 W -97.823154 NAD 83 UTM Zone 14			

HOLE NO.	STA. & ELEV.	HOLE DEPTH		DESCRIPTIONS OF MATERIAL	NUMBER BLOWS	USCS	TYPE BIT USED	SAMPLE					FIELD DISP. DEPTH / VALUE
		FROM FT.	TO FT.					NO.	TYPE	FROM FT.	TO FT.	TEST	
803	16+65 CL Dam 70' DS	0.0	1.0	Clay, silty, dry to sl/moist, stiff, hi/pl, sl/carb. conc., dark brown		CH	CF						1/0
	616.6	1.0	5.5	Clay, reworked claystone, sl/moist, hi/pl, stiff, brown, fill		CH							2-5/0
		5.5	11.0	Clay, silty, moist - sat., stiff, hi/pl, sl/fg gravel, sl/sandy, brown		CH		0.1	3" Push	7.0	9.5		6-11/0
		11.0	15.0	Clay, silty, moist - sat., stiff, hi/pl, sl/fg-cg gravel, sl/sandy, brown w/ some fe stain		CH							12-15/0
		15.0	21.0	Claystone, silty, weathered, blocky, tb-lam, fractured w/fe stain and gyp., breaks down to hi/pl CH, light brown		CS							
		21.0	50.0	Claystone, silty, non-weathered, tb-lam, fractured w/gyp and fe stain, breaks down to hi/pl clay, dark gray,		CS							
				Water Level 43.9 @ 14:29 08/04/10									
				Water Level 5.1' @ 8:10 08/05/10									
				Water Level 4.9" @ 9:10 08/13/10									
				Location projected from as-built, elevation estimated from design survey 06/26/1998									

Identification of soils and assignment of group names and symbols based on the Unified Soil Classification System are based on visual-manual procedures (ASTM D 2488-84)

Attachment 2c
Hole 803

LOG OF TEST HOLES

WATERSHED: Plum Creek				SITE NO: 6				PAGE 1						
LOCATION: Downstream Toe				COUNTY: Hays				STATE: Texas						
LOGGED BY: York				DATE: 08/05/2010										
DRILLING EQUIPMENT: Simco Power Auger				LOCATION OF HOLES:				N 30.002514 W -97.823490 NAD 83 UTM Zone 14						
HOLE NO.	STA. & ELEV.	HOLE DEPTH		DESCRIPTIONS OF MATERIAL	NUMBER BLOWS	USCS	TYPE BIT USED	SAMPLE					FIELD DISP. DEPTH / VALUE	
		FROM FT.	TO FT.					NO.	TYPE	FROM FT.	TO FT.	TEST		
804	18+15 CL Dam	0.0	0.5	Clay, silty, dry to sl/moist, stiff, hi/pl, sl/carb. conc., dark brown		CH	CF							1/0
	70' DS	0.5	5.0	Clay, reworked claystone, sl/moist, hi/pl, stiff, brown, fill		CH								2-5/0
	617.2	5.0	12.0	Clay, silty, moist - sat., stiff, hi/pl, sl/fg gravel, sl/sandy, brown		CH								6-12/0
		12.0	23.0	Claystone, silty, weathered, blocky, tb-lam, fractured w/fe stain and gyp., breaks down to hi/pl CH, light brown		CS								13-23/0
		23.0	30.0	Claystone, silty, non-weathered, tb-lam, fractured w/gyp and fe stain, breaks down to hi/pl clay, dark gray,		CS								
				Water level 28.0' @ 12:45 08/05/10										
				Water level 24.0' @ 18:05 08/05/10										
				Water Level 18.5' @ 8:44 08/06/10										
				Water level 6.0' @ 15:16 08/11/10										
				Water level 5.5' @ 9:12 08/13/10										
				Location projected from as-built, elevation estimated from design survey 06/26/1998										

Identification of soils and assignment of group names and symbols based on the Unified Soil Classification System are based on visual-manual procedures (ASTM D 2488-84)

Attachment 2c
Hole 804

LOG OF TEST HOLES

WATERSHED: Plum Creek				SITE NO: 6				PAGE 1			
LOCATION: Downstream Toe				COUNTY: Hays				STATE: Texas			
LOGGED BY: York				DATE: 08/05/2010							
DRILLING EQUIPMENT: Simco Power Auger				LOCATION OF HOLES:				N 30.002794 W -97.823811 NAD 83 UTM Zone 14			

HOLE NO.	STA. & ELEV.	HOLE DEPTH		DESCRIPTIONS OF MATERIAL	NUMBER BLOWS	USCS	TYPE BIT USED	SAMPLE					FIELD DISP. DEPTH / VALUE
		FROM FT.	TO FT.					NO.	TYPE	FROM FT.	TO FT.	TEST	
805	19+70 CL Dam 70' DS	0.0	2.0	Clay, silty, dry to sl/moist, stiff, hi/pl, sl/carb. conc., dark brown		CH	CF						1-2/0
	617.5	2.0	5.0	Clay, reworked claystone, sl/moist, hi/pl, stiff, brown, fill		CH							3-5/0
		5.0	12.0	Clay, silty, moist - sat., stiff, hi/pl, sl/fg gravel, sl/sandy, brown		CH							6-12/0
		12.0	16.0	Claystone, silty, weathered, blocky, tb-lam, fractured w/fe stain and gyp., breaks down to hi/pl CH, light brown		CS							13-16/0
		16.0	30.0	Claystone, silty, non-weathered, tb-lam, fractured w/gyp and fe stain, breaks down to hi/pl clay, dark gray,		CS							17-30/0
				Water level 29' @ 16:36 08/05/10									
				Water level 24.3' @ 8: 52 08/06/10									
				Water Level 7.7' @15:21 08/11/10									
				Water level 6.9' @ 9:15 08/13/10									
				Location projected from as-built, elevation estimated from design survey 06/26/1998									

Identification of soils and assignment of group names and symbols based on the Unified Soil Classification System are based on visual-manual procedures (ASTM D 2488-84)

Attachment 2c
Hole 805

LOG OF TEST HOLES

WATERSHED: Plum Creek				SITE NO: 6				PAGE 1			
LOCATION: Downstream Toe				COUNTY: Hays				STATE: Texas			
LOGGED BY: York				DATE: 08/05/2010							
DRILLING EQUIPMENT: Simco Power Auger				LOCATION OF HOLES:				N 30.003098 W -97.824152 NAD 83 UTM Zone 14			

HOLE NO.	STA. & ELEV.	HOLE DEPTH		DESCRIPTIONS OF MATERIAL	NUMBER BLOWS	USCS	TYPE BIT USED	SAMPLE					FIELD DISP. DEPTH / VALUE	
		FROM FT.	TO FT.					NO.	TYPE	FROM FT.	TO FT.	TEST		
806	21+15 CL Dam 70' DS	0.0	1.5	Clay, silty, dry to sl/moist, stiff, hi/pl, sl/carb. conc., dark brown		CH	CF							1/1
	618.4	1.5	3.0	Clay, reworked claystone, sl/moist, hi/pl, stiff, brown, fill		CH								2-3/1
		3.0	7.0	Clay, silty, moist - sat., stiff, hi/pl, sl/fg gravel, sl/sandy, brown		CH								4-7/1
		7.0	28.0	Claystone, silty, weathered, blocky, tb-lam, fractured w/fe stain and gyp., breaks down to hi/pl CH, light brown		CS								8-28/1
		28.0	35.0	Claystone, silty, non-weathered, tb-lam, fractured w/gyp and fe stain, breaks down to hi/pl clay, dark gray,		CS								29-35/1
				Water level 29.0 @18:20 08/05/10										
				Water Level 1.08' @ 8:57 08/06/10										
				Water Level 5.6' 08/11/10										
				Water Level 6.5' @ 08/13/10										
				Location projected from as-built, elevation estimated from design survey 06/26/1998										

Identification of soils and assignment of group names and symbols based on the Unified Soil Classification System are based on visual-manual procedures (ASTM D 2488-84)

Attachment 2c
Hole 806

LOG OF TEST HOLES

PAGE 1

WATERSHED: Plum Creek	SITE NO: 6	
LOCATION: Downstream Toe	COUNTY: Hays	STATE: Texas
LOGGED BY: York	DATE: 08/12/2010	
DRILLING EQUIPMENT: Simco Power Auger	LOCATION OF HOLES:	N 30.003378 W -97.824484 NAD 83 UTM Zone 14

HOLE NO.	STA. & ELEV.	HOLE DEPTH		DESCRIPTIONS OF MATERIAL	NUMBER BLOWS	USCS	TYPE BIT USED	SAMPLE					FIELD DISP. DEPTH / VALUE
		FROM FT.	TO FT.					NO.	TYPE	FROM FT.	TO FT.	TEST	
807	22+65 CL Dam 70' DS	0.0	2.5	Clay, silty, dry to sl/moist, stiff, hi/pl, sl/carb. conc., dark brown		CH	CF						1-2/1
	619.4	2.5	3.5	Clay, silty, moist - sat., stiff, hi/pl, sl/fg gravel, brown		CH							3/1
		3.5	26.0	Claystone, silty, weathered, blocky, tb-lam, fractured w/fe stain and gyp., breaks down to hi/pl CH, light brown		CS							4-26/1
		26.0	30.0	Claystone, silty, non-weathered, tb-lam, fractured w/gyp and fe stain, breaks down to hi/pl clay, dark gray,		CS							27-30/1
				No Water 08/12/10									
				Water level 9.15 08/13/10									
				Location projected from as-built, elevation estimated from design survey 06/26/1998									

Attachment 2c
Hole 807

Identification of soils and assignment of group names and symbols based on the Unified Soil Classification System are based on visual-manual procedures (ASTM D 2488-84)

LOG OF TEST HOLES

WATERSHED: Plum Creek				SITE NO: 6				PAGE 1			
LOCATION: Downstream Toe				COUNTY: Hays				STATE: Texas			
LOGGED BY: York				DATE: 08/12/2010							
DRILLING EQUIPMENT: Simco Power Auger				LOCATION OF HOLES:				N 30.003701 W -97.824826 NAD 83 UTM Zone 14			

HOLE NO.	STA. & ELEV.	HOLE DEPTH		DESCRIPTIONS OF MATERIAL	NUMBER BLOWS	USCS	TYPE BIT USED	SAMPLE					FIELD DISP. DEPTH / VALUE
		FROM FT.	TO FT.					NO.	TYPE	FROM FT.	TO FT.	TEST	
808	24+15 CL Dam 70' DS	0.0	0.5	Sand, silty, clayey, dry to sl/moist, medium, fine to coarse, brown		SC - SM							
	620.6	0.5	4.0	Clay, silty, moist, stiff, hi/pl, shiney, brown		CH							1-4/1
		4.0	5.0	Gravel, fg-mg, clay, moist, stiff, hi/pl, brown		GC							5/1
		5.0	7.0	Clay, silty, moist, stiff, hi/pl, shiney, brown		CH							6-7/1
		7.0	23.0	Claystone, silty, weathered, blocky, tb-lam, fractured w/fe stain and gyp, breaks down to hi/pl CH, light brown		CS							8-23/1
		23.0	25.0	Claystone, silty, non-weathered, tb-lam, fractured w/gyp and fe stain, breaks down to hi/pl clay, dark gray.		CS							24-25/1
				No Water 08/13/10									
				Location projected from as-built, elevation estimated from design survey 06/26/1998									

Identification of soils and assignment of group names and symbols based on the Unified Soil Classification System are based on visual-manual procedures (ASTM D 2488-84)

Attachment 2c
Hole 808

LOG OF TEST HOLES

WATERSHED: Plum Creek				SITE NO: 6				PAGE 1			
LOCATION: Downstream Toe				COUNTY: Hays				STATE: Texas			
LOGGED BY: York				DATE: 08/12/2010							
DRILLING EQUIPMENT: Simco Power Auger				LOCATION OF HOLES:				N 30.003981 W -97.825130 NAD 83 UTM Zone 14			

HOLE NO.	STA. & ELEV.	HOLE DEPTH		DESCRIPTIONS OF MATERIAL	NUMBER BLOWS	USCS	TYPE BIT USED	SAMPLE					FIELD DISP. DEPTH / VALUE
		FROM FT.	TO FT.					NO.	TYPE	FROM FT	TO FT	TEST	
809	25+65 CL Dam 70' DS	0.0	0.5	Clay, silty, dry to sl/moist, stiff, hi/pl, sl/carb. conc., dark brown		CH	CF						
	621.8	0.5	7.0	Clay, silty, moist - sat., stiff, hi/pl, sl/fg gravel, brown		CH							1-7/1
		7.0	9.5	Gravel, fg-mg, clay, moist, stiff, hi/pl, brown		GC							8-9/1
		9.5	20.0	Claystone, silty, weathered, blocky, tb-lam, fractured w/fe stain and gyp., breaks down to hi/pl CH, light brown		CS							10-20/1
		20.0	25.0	Claystone, silty, non-weathered, tb-lam, fractured w/gyp and fe stain, breaks down to hi/pl clay, dark gray,		CS							21-25/1
				No water 08/13/10									
				Location projected from as-built, elevation estimated from design survey 06/26/1998									

Identification of soils and assignment of group names and symbols based on the Unified Soil Classification System are based on visual-manual procedures (ASTM D 2488-84)

Attachment 2c
Hole 809

LOG OF TEST HOLES

WATERSHED: Plum Creek				SITE NO: 6				PAGE 1					
LOCATION: Downstream Toe				COUNTY: Hays				STATE: Texas					
LOGGED BY: Moffatt				DATE: 08/18/2010									
DRILLING EQUIPMENT: Simco Power Auger				LOCATION OF HOLES: N 30.004284 W -97.825461 NAD 83 UTM Zone 14									
HOLE NO.	STA. & ELEV.	HOLE DEPTH		DESCRIPTIONS OF MATERIAL	NUMBER BLOWS	USCS	TYPE BIT USED	SAMPLE					FIELD DISP. DEPTH / VALUE
		FROM FT.	TO FT.					NO.	TYPE	FROM FT	TO FT	TEST	
810	27+15 CL Dam 70' DS	0.0	1.5	Clay, silty, lm streaks, sl/fg gravel, sl/moist, stiff, hi/pl, dark gray - black reworked material		CH	CF						
	622.9	1.5	6.0	Clay, silty, sl/moist - moist, stiff, hi/pl, dark gray w/ light gray mottle		CH							
		6.0	10.5	Clay, silty, sl/fg chert gravel, moist, fe stain, hi/pl - pl, light brown mottled light gray		CH							
		10.5	11.0	Gravel, fg -cg, chert, multi colored, clay, silty, moist, fe stain, hi/pl - pl, light brown mottled light gray		GC							
		11.0	22.5	Claystone, hi/weathered, tb-lam, soft to very soft rock, fe stain frac 12'-13', 20'-21', light brown mottled light gray, breaks down to hi/pl stiff clay		CS							
		22.5	25.0	Claystone, silty, tb-lam, fe stain and gyp filled frac 23'-24', moist, soft rock, sl-non-weathered, dark gray to black		CS							
				No water 08/18/10									
				Hole plugged for safety, nearby house.									
				Location projected from as-built, elevation estimated from design survey 06/26/1998									

Identification of soils and assignment of group names and symbols based on the Unified Soil Classification System are based on visual-manual procedures (ASTM D 2488-84)

Attachment 2c
Hole 810

LOG OF TEST HOLES

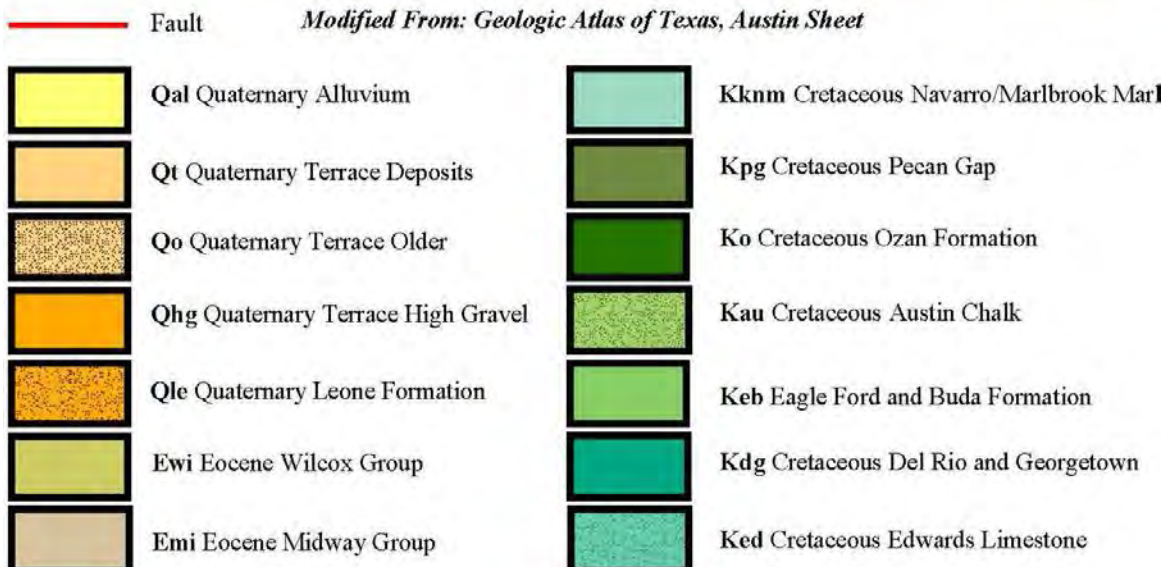
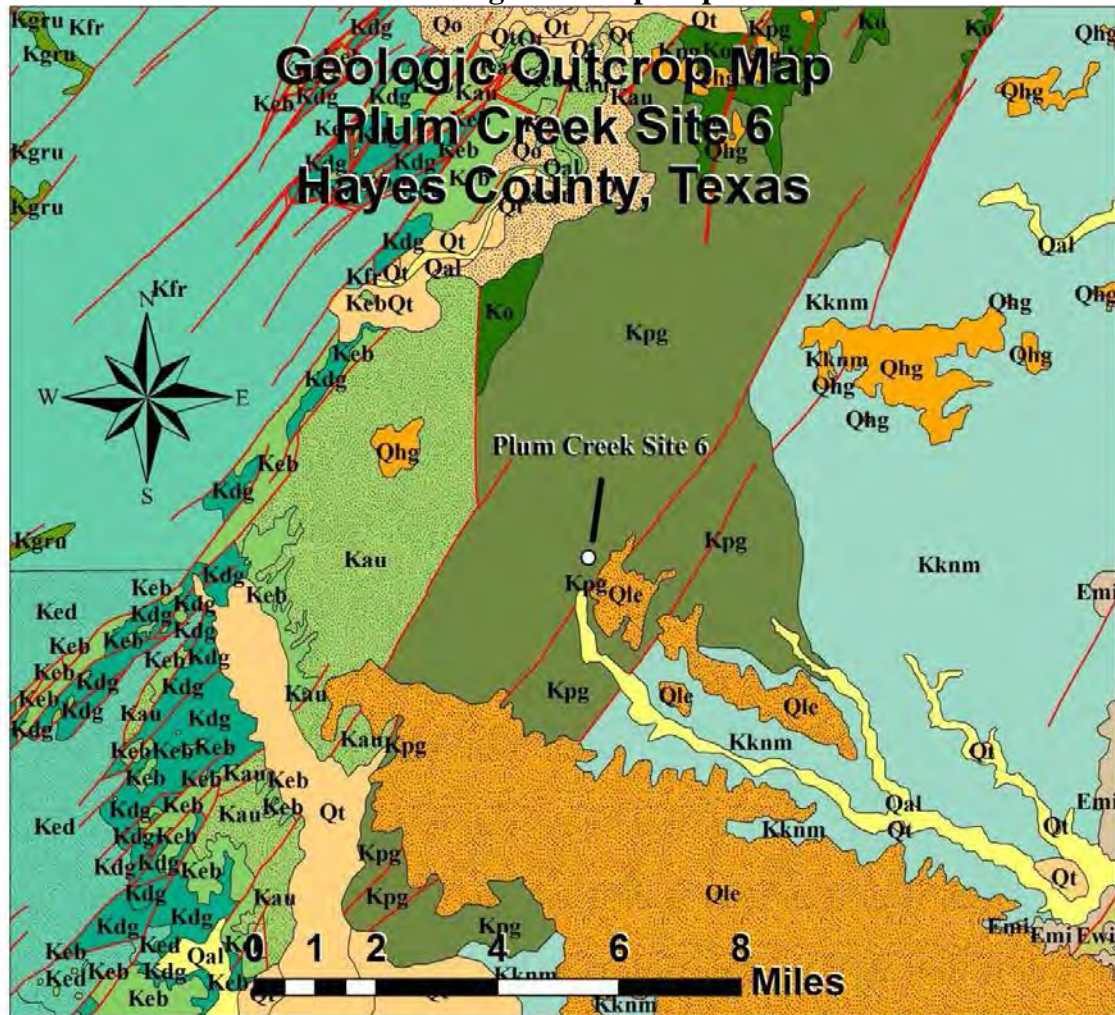
WATERSHED: Plum Creek				SITE NO: 6				PAGE 1			
LOCATION: Downstream Toe				COUNTY: Hays				STATE: Texas			
LOGGED BY: Moffatt				DATE: 08/18/2010							
DRILLING EQUIPMENT: Simco Power Auger				LOCATION OF HOLES:				N 30.004579 W -97.825798 NAD 83 UTM Zone 14			

HOLE NO.	STA & ELEV	HOLE DEPTH		DESCRIPTIONS OF MATERIAL	NUMBER BLOWS	USCS	TYPE BIT USED	SAMPLE					FIELD DISP. DEPTH / VALUE
		FROM FT.	TO FT.					NO.	TYPE	FROM FT.	TO FT.	TEST	
811	28+65 CL Dam 70' DS	0.0	2.0	Clay, silty, stiff, sl/moist, hi/pl, sl/carbonate, black		CH	CF						
	624.4	2.0	6.0	Clay silty, stiff, sl/moist - moist, sl vfg sand, hi/pl to pl, gray		CL-CH							
		6.0	7.5	Clay, silty, sl/fg chert gravel, moist, stiffmod-hi/pl, light w/slfe stain		CL-CH							
		7.5	11.0	Gravel, med-cg, chert, clay, silty, moist - saturated, abundant fe stain 7.5'-9', mod/pl, stiff, light brown		GC							
		11.0	24.5	Claystone, hi/weathered, tb-lam, soft to very soft rock, fe stain and gyp filled frac 13'-14', 14'-15', 17'-18', 23'-24', light brown mottled light gray, breaks down to hi/pl stiff clay		CS							
		24.5	25.0	Claystone, silty, tb-lam, moist, soft rock, sl-non-weathered, dark gray to black		CS							
				No Water 08/18/10									
				Hole plugged for safety, nearby house.									
				Location projected from as-built, elevation estimated from design survey 06/26/1998									

Identification of soils and assignment of group names and symbols based on the Unified Soil Classification System are based on visual-manual procedures (ASTM D 2488-84)

Attachment 2c
Hole 811

Attachment 3a
Geologic Outcrop map

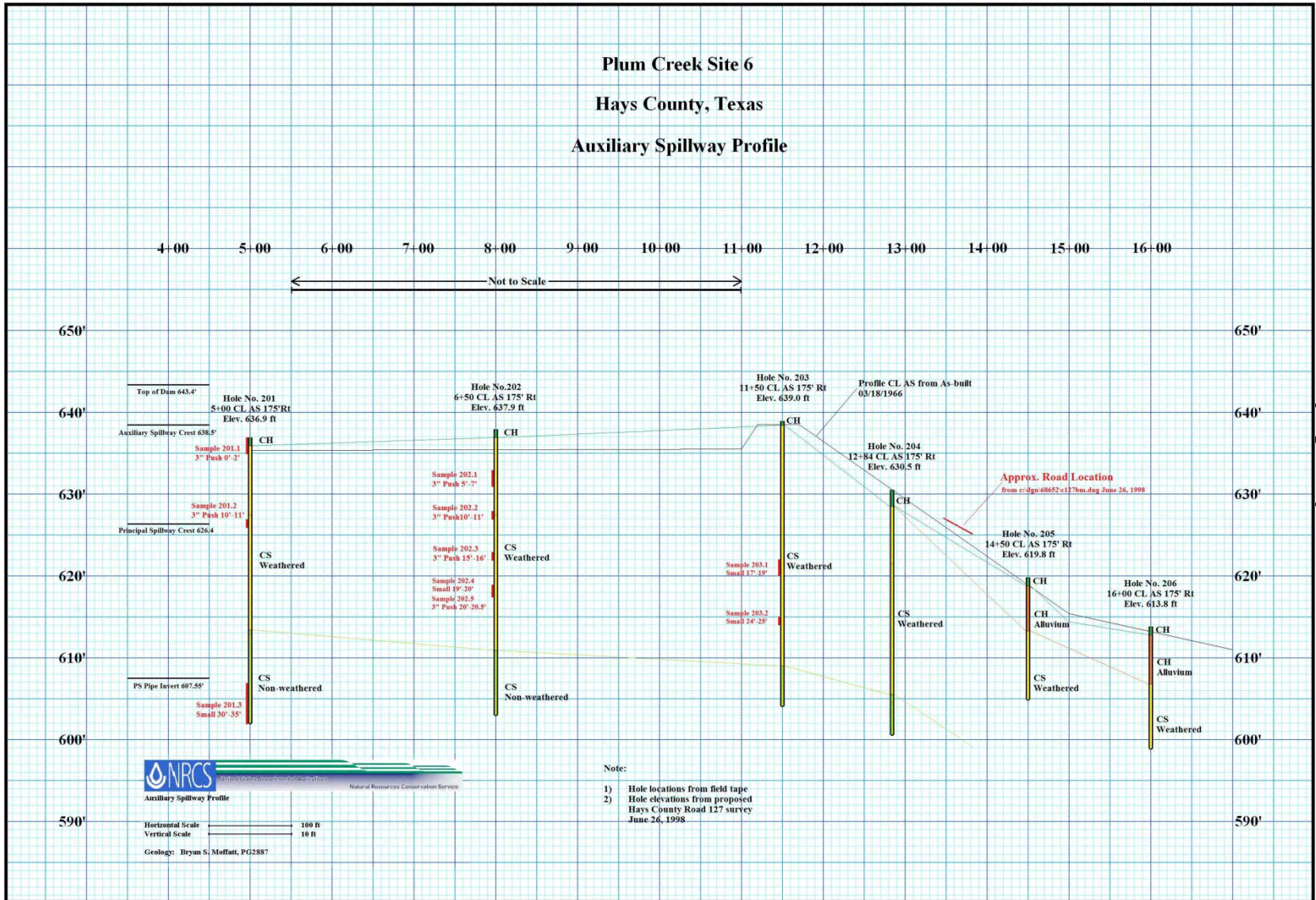


Attachment 3b
Aerial Photo



Attachment 3c
Hole Location Map





Attachment 4b

Downstream Toe Profile



Attachment 5a Sample List

SAMPLE LIST FOR SOIL MECHANICS LABORATORY													
STATE:	TX	COUNTY:	Hays										
SITE : Plum Creek Site 6													
PROJECT TYPE: Dam Rehab				PROGRAM (Source of Funds):									
CONTACT PERSON: William York, Geologist													
PHONE/FAX: 817.233.6267													
Index Tests = gradation, water content, LL, PI, Crumb, Double Hydrometer, Gs													
Lab Sample No.	Field Sample No.	Description or Location	Depth (ft)	Sample Size/Type	Field Crumb	Tests Requested						Field Sample No.	
						Index	DW	Comp-ol.	Shear	Pinhole	Salt		Other Tests or Other Notes
	201.1	Inside Cut Auxiliary Spillway Approx. Sta. 5+00 AS	0'-2'	3" PT	x	x	x		x		x	gypsum, compaction, complex testing as needed	201.1
	201.2	Inside Cut Auxiliary Spillway Approx. Sta. 5+00 AS	10'-11'	3" PT	x	x	x		x		x	gypsum, compaction, complex testing as needed	201.2
	201.3	Inside Cut Auxiliary Spillway Approx. Sta. 5+00 AS	30'-35'	ss	x	x					x	gypsum, compaction, complex testing as needed	201.3
	202.1	Inside Cut Auxiliary Spillway Approx. Sta. 8+00 AS	5'-7'	3" PT	x	x			x		x	gypsum, compaction, complex testing as needed	
	202.2	Inside Cut Auxiliary Spillway Approx. Sta. 8+00 AS	10'-11'	3" PT	x	x			x		x	gypsum, compaction, complex testing as needed	202.2
	202.3	Inside Cut Auxiliary Spillway Approx. Sta. 8+00 AS	15'-16'	3" PT	x	x			x		x	gypsum, compaction, complex testing as needed	202.3
	202.4	Inside Cut Auxiliary Spillway Approx. Sta. 8+00 AS	19'-20'	ss	x	x					x	gypsum, compaction, complex testing as needed	202.4
	202.5	Inside Cut Auxiliary Spillway Approx. Sta. 8+00 AS	20'-20.5'	3" PT	x	x			x		x	gypsum, compaction, complex testing as needed	202.5
	203.1	Inside Cut Auxiliary Spillway Approx. Sta. 11+50 AS	17'-19'	ss	x	x					x	gypsum, compaction, complex testing as needed	203.1
	203.2	Inside Cut Auxiliary Spillway Approx. Sta. 11+50 AS	24'-25'	ss	x	x					x	gypsum, compaction, complex testing as needed	203.2
	301.1	Outlet Basin Left DS Approx. Sta. 15+00 CL Dam 176' DC	14'-16'	5" PT	x	x			x			gypsum, compaction, complex testing as needed	301.1
	803.1	DS Berm Approx. Sta. 16+65 CL Dam 70' DS	7'-9.5'	3" PT	x	x			x			gypsum, compaction, complex testing as needed	803.1
	802.1	DS Berm Approx. Sta. 15+10 CL Dam 70' DS	7'-8.5'	3" PT	x	x			x			gypsum, compaction, complex testing as needed	802.1

Attachment 5b Index Tests

8/9/10		TX		Mechanical Analysis																Atterberg Limits		Unified Classification	Soluble Salts %	Natural Moisture (%)	Percent Saturation	Dispersion			Moisture-Density		G _M	% Absorp- tion	pH																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
				Grain Size Distribution Expressed as Percent Finer by Dry Weight						Sand		Gravel														Double Hydrometer	Crumb Test	Pinhole	ASTM D588	Max % (pcf)				W _p %																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
Lab. Sample No.	Field Sample No.	Location and Description		Depth (ft)	Sample Type	0.002 mm	0.005 mm	0.02 mm	0.075 mm	#10 mm	#20 mm	#40 mm	#60 mm	0.075 mm	0.15 mm	0.25 mm	0.425 mm	0.6 mm	0.85 mm	1.18 mm	1.75 mm	2.0 mm	2.5 mm	3.0 mm	3.75 mm	4.75 mm	6.0 mm	7.5 mm	9.5 mm	12.5 mm	15.0 mm	19.0 mm	25.0 mm	30.0 mm	37.5 mm	47.5 mm	60.0 mm	75.0 mm	100.0 mm																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
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Attachment 5c
Shear Tests Page 1

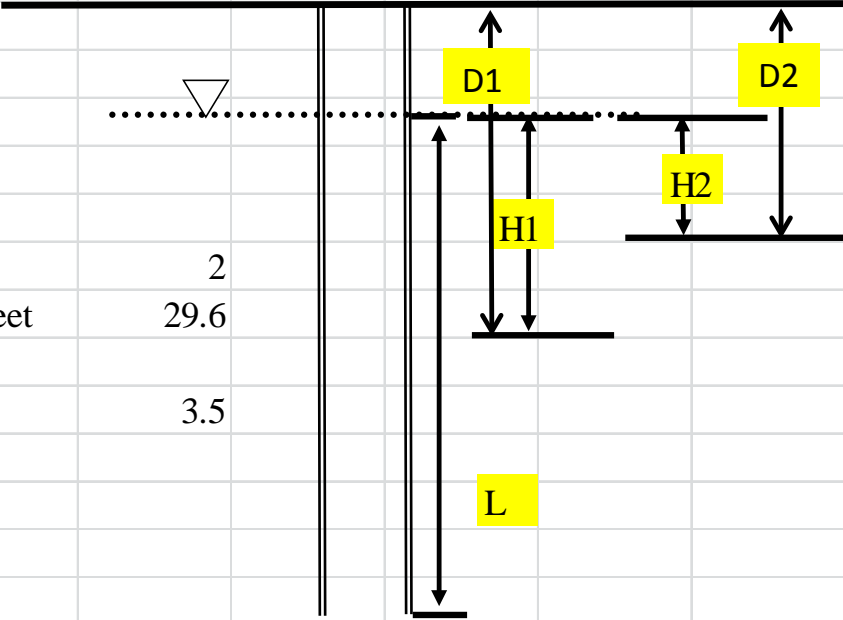
[illegible]

Date Reported: Initials:

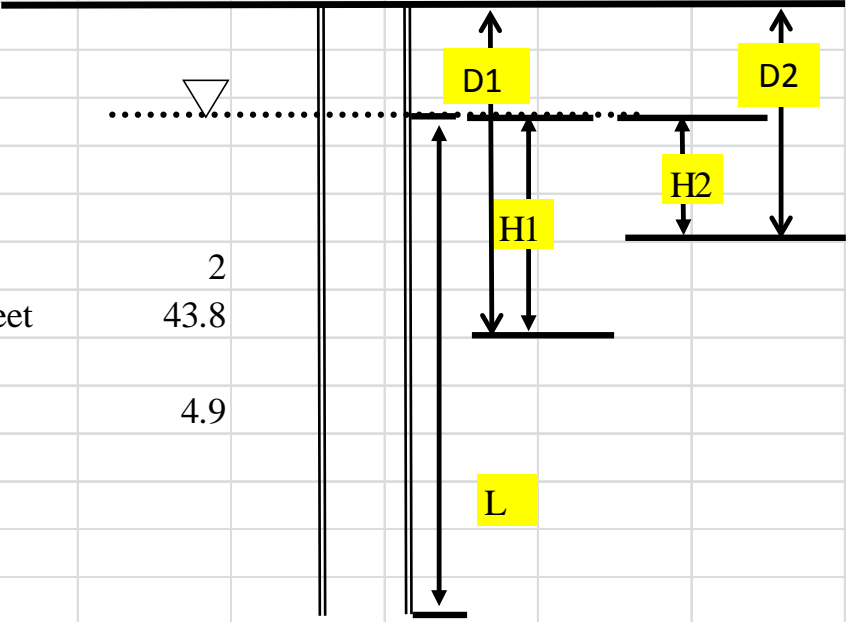
Attachment 5c
Shear Tests Page 2

4/20/11		TEXAS (WF-07)		Mechanical Analysis Grain Size Distribution Expressed as Percent Finer by Dry Weight		Grain Size Distribution Expressed as Percent Finer by Dry Weight												Atterberg Limits		Unified Classification		Crumb 1 hr / 4 hr		Dispersion %		Moisture-Density Relationships □ Standard □ Modified				Undisturbed Sample Data		Gs		Special Tests																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
Lab. Sample No.	Field Number	Location and Description		Sample Type	Depth ft.	Fines						Sand						Gravel						L.L.	P.I.	CH	1/1	7	Curve No.	Max γ _d p.c.f	γ _d w ₀ % gloc	w _N %	φ = 0.0° c = 3425 psf	φ = 22.0° c = 335 psf φ = 30.5° c = 315 psf	φ = 18.0° c = 510 psf φ = 30.0° c = 365 psf	Unconfined Comp. q _u /2 = c _u = 400 psf Vacuum Saturated																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
11-		Plum Creek Site 6				0.002 mm	0.005 mm	0.02 mm	0.075 mm	#20 mm	#140 mm	#60 mm	#40 mm	#40 mm	#10 mm	#4 mm	3/8" mm	1/2" mm	3/4" mm	1" mm	1 1/2" mm	3" mm	77														53	CH	1/1	7	1.53	28.6	2.74	CU	UU																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
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**Attachment 6a
Hole 801**

Field Permeability Testing by Rising Head Test				
Hole 801				
Definition Sketch				
				
Well Dimensions				
Radius of boring, inches	2			
Length of Test Section, feet	29.6			
Depth to Water Table	3.5			
Readings				
Depth 1	25	H1	21.5	
Depth 2	11.4	H2	7.9	
Time, minutes	863			
Depth 1	0	H1	0	
Depth 2	0	H2	0	
Time, minutes	0			
Depth 1	0	H1	0	
Depth 2	0	H2	0	
Time, minutes	0			
K1, ft/day	0.00406			

**Attachment 6b
Hole 803**

Field Permeability Testing by Rising Head Test				
Hole 803				
Definition Sketch				
				
Well Dimensions				
Radius of boring, inches		2		
Length of Test Section, feet		43.8		
Depth to Water Table		4.9		
Readings				
Depth 1		43.9	H1	39
Depth 2		38.9	H2	34
Time, minutes		200		
Depth 1		0	H1	18.5
Depth 2		0	H2	13
Time, minutes		0		
Depth 1		0	H1	0
Depth 2		0	H2	0
Time, minutes		0		
K1, ft/day		0.001745		

**Attachment 6c
Hole 804**

Field Permeability Testing by Rising Head Test				
Hole 804				
Definition Sketch				
Well Dimensions				
Radius of boring, inches	2			
Length of Test Section, feet	22.5			
Depth to Water Table	5.5			
Readings				
Depth 1	28	H1	22.5	
Depth 2	24	H2	18.5	
Time, minutes	320			
Depth 1	24	H1	18.5	
Depth 2	18.5	H2	13	
Time, minutes	884			
Depth 1	0	H1	0	
Depth 2	0	H2	0	
Time, minutes	0			
K1, ft/day	0.002667			
K2, ft.day	0.00174			

Attachment 6d

Hole 805

Field Permeability Testing by Rising Head Test				
Hole 805				
Definition Sketch				
Well Dimensions				
Radius of boring, inches				
Length of Test Section, feet		29.5		
Depth to Water Table		6.9		
Readings				
Depth 1		29	H1	22.1
Depth 2		24.3	H2	17.4
Time, minutes		857		
Depth 1		0	H1	0
Depth 2		0	H2	0
Time, minutes		0		
Depth 1		0	H1	0
Depth 2		0	H2	0
Time, minutes		0		
K1, ft/day		0.000979		

**Attachment 6e
Hole 806**

Field Permeability Testing by Rising Head Test				
Hole 806				
Definition Sketch				
Well Dimensions				
Radius of boring, inches	2			
Length of Test Section, feet	25.6			
Depth to Water Table	5.6			
Readings				
Depth 1	29	H1	23.4	
Depth 2	18	H2	12.4	
Time, minutes	877			
Depth 1	0	H1	0	
Depth 2	0	H2	0	
Time, minutes	0			
Depth 1	0	H1	0	
Depth 2	0	H2	0	
Time, minutes	0			
K1, ft/day	0.002848			