



Hansen and Associates, Inc.
Consulting Engineers & Land Surveyors

April 19, 2012

Michael Tuttle
Weber Center
2380 Washington Blvd., Suite 240
Ogden, UT 84401

Subject: The Sanctuary – Retaining Walls Analysis

Dear Mr. Tuttle,

Earthtec Engineering, Inc. and Hansen and Associates have analyzed the stability of the retaining walls at the main entrance to The Sanctuary development. A copy of the project drawings and Earthtec's global stability analysis are included. Earthtec concluded the walls, as constructed, are stable. The project drawings show the addition of planters in areas where the walls exceeds the maximum recommended height. With the construction of these planters, it is our opinion that the walls will be in compliance with manufacturer's installation requirements.

Respectfully;
Hansen and Associates, Inc.

A handwritten signature in blue ink, appearing to read 'Matthew Meyer', is written over the typed name.

Matthew Meyer, PE
Job No. 07-129





Earthtec Engineering, Inc.

133 North 1330 West
Orem, Utah - 84057
Phone (801) 225-5711
Fax (801) 225-3363

1596 W. 2650 S. #108
Ogden, Utah - 84401
Phone (801) 399-9516
Fax (801) 399-9842

April 3, 2012

Tim Charlwood
PO Box 980400
Park City, UT 84098

**Re: Global Stability Analysis
The Sanctuary
Huntsville, Utah
Project No. 12-0086G**

Mr. Charlwood:

As you requested, we have completed our global stability analysis for the existing Redi-Rock walls for the subject site. Our scope of work included review of drawings provided by Hansen Associates, engineering analyses, and the preparation of this report.

Plan Review and Information Gathering

Based on our review of the drawings provided by Hansen and Associates, the existing Redi-Rock walls at the entrance to the Sanctuary Subdivision consist of a single tier about 9 to 12 feet high with a batter angle of 4 degrees. The walls retain an approximately 30% to 45% slope up to approximately 1000 feet high. The walls are embedded a minimum of 12 inches into the soils, and we understand that some areas are planned to receive rock facing or planter boxes in front of the walls approximately 2 to 3 feet high. A water storage tank is located above the wall at approximately Station 25+65.

A geotechnical report¹ was previously prepared for the subdivision by Earthtec Testing and Engineering, P.C., dated August 23, 2007. This report was reviewed as part of our analysis. Based on the referenced report, the soils retained by the walls consist of silt with sand (ML). A direct shear test was performed on this material as part of the referenced study.

Stability Analyses

Our engineering analyses focused on evaluating the global stability of the existing Redi-Rock walls. Based on tests performed by the Earthtec Testing and Engineering, P.C. contained within the referenced geotechnical study, the silt with sand has an internal friction angle of 33 degrees and a cohesion value of 205 psf. Accordingly, we estimated the following parameters for use in the stability analyses:

¹ "Geotechnical Study, Golden Eagle Ranch, Huntsville, Utah," ETE Job No. 07-1950, August 23, 2007.

Material	Internal Friction Angle (degrees)	Apparent Cohesion (psf)	Saturated Unit Weight (pcf)
On-Site Silt with Sand	33	205	136
Redi-Rock Blocks	0 (or 45)	9000 (or 0)	150

For the seismic (pseudostatic) analysis, a peak horizontal ground acceleration of 0.33g for the 2% probability of exceedance in 50 years was obtained for site (grid) locations of 41.284 degrees north latitude and -111.723 degrees west longitude. To model sustained accelerations at the site, one-third to one-half of this value is typically employed. Accordingly, a value of 0.18g was used as the pseudostatic coefficient for the stability analysis.

We evaluated the global stability of the wall using the computer program *XSTABL*. This program uses a limit equilibrium (Bishop's modified) method for calculating factors of safety against sliding on an assumed failure surface and evaluates numerous potential failure surfaces, with the most critical failure surface identified as the one yielding the lowest factor of safety of those evaluated. The wall configuration and topography at Station 25+65 was utilized for our analysis, including a 1000 psf load for the water storage tank. The configuration analyzed consisted of a 10 foot tall Redi-Rock wall retaining a 30% to 45% slope extending 1000 feet above the wall. Typically, the required global minimum factors of safety are 1.5 for static conditions and 1.1 for seismic (pseudostatic) conditions. The results of our analyses indicate that the existing Redi-Rock wall meets these requirements. The slope stability data is attached as Figures 1 and 2.

Conclusions and Recommendations

Based on the results of our analyses, the Redi-Rock walls at this site are globally stable as configured. Note that wall movements or even failure can occur if the walls are undermined or the backfill soils become saturated. Therefore, we recommend that irrigation lines not be placed within the backfill or directly on top of the wall. Surface drainage at the bottom and top of the walls should also be directed away from the wall. The property owner and the owner's representatives should be made aware of the risks should these or other conditions occur that could saturate or erode/undermine the soil behind the wall.

Closure

The conclusions and recommendations presented in this report are based on the information provided, our experience with similar conditions, and assumptions made by Earthtec Testing and Engineering, P.C. at the time of the referenced geotechnical study, which we assume to be accurate and correct. If conditions are different during construction than presented herein, please advise us so that any appropriate modifications can be made. Our observations, analyses, conclusions and recommendations were conducted within the limits prescribed by our client, with the usual thoroughness and competence of the engineering profession in the area. No other warranty or representation, either expressed or implied, is intended in our proposals, contracts or reports.

Global Stability Analysis
The Sanctuary
Huntsville, Utah
Project No. 12-0086G

Page 3

We appreciate the opportunity of providing our services on this project. If we can answer questions or be of further service, please call.

Respectfully;

EARTHTEC ENGINEERING, INC.



Andrew M. Harris, P.E.
Engineering Manager



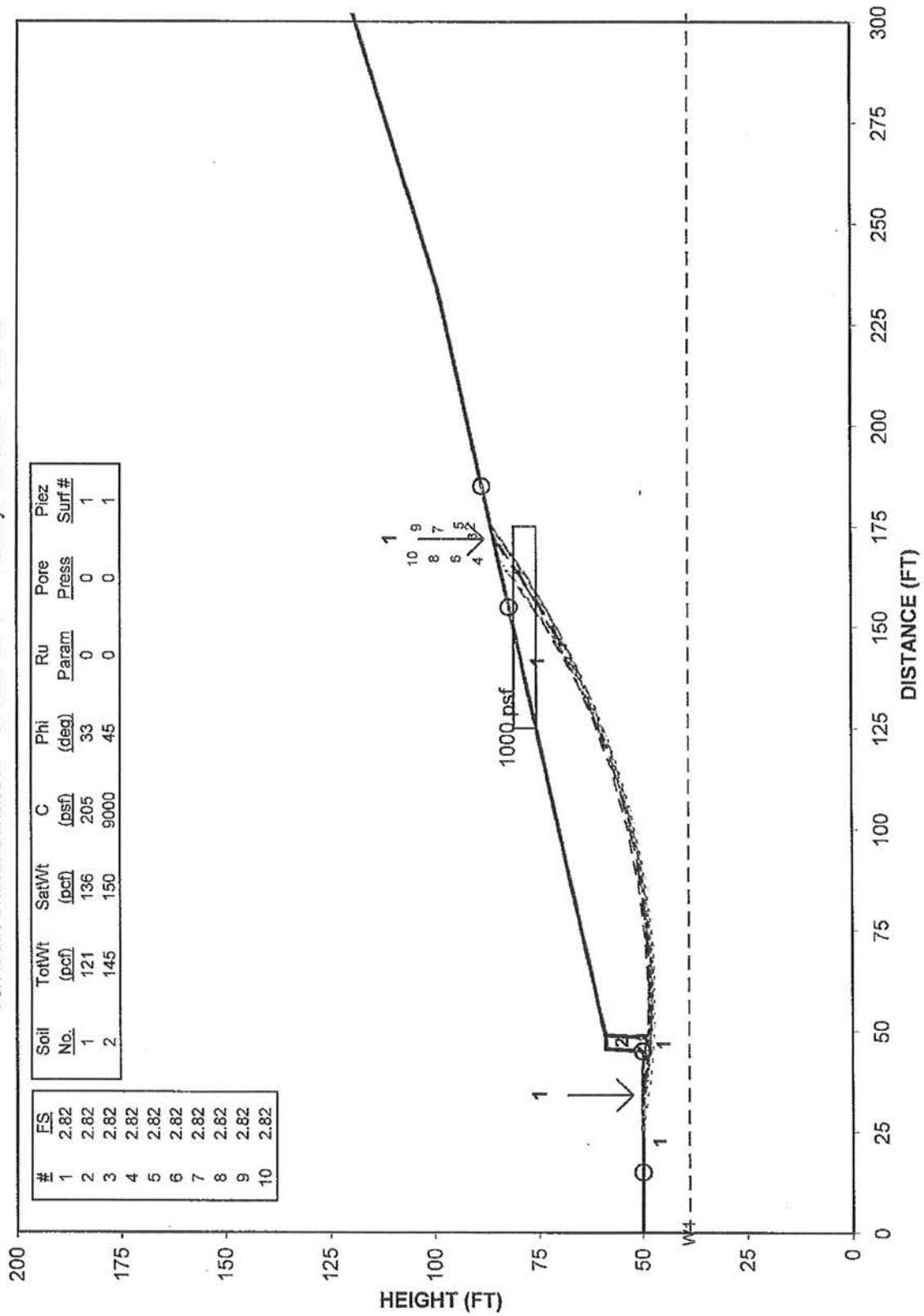
Attachments: Figures 1 and 2, Stability Results

Earthtec

Professional Engineering Services ~ Geotechnical Engineering ~ Drilling Services ~ Construction Materials Inspection / Testing ~ Non-Destructive Examination ~ Failure Analysis
ICBO ~ ACI ~ AWS

The Sanctuary Static

Ten Most Critical Surfaces. 071950 .OPT Run By: Earthtec 4-02-12

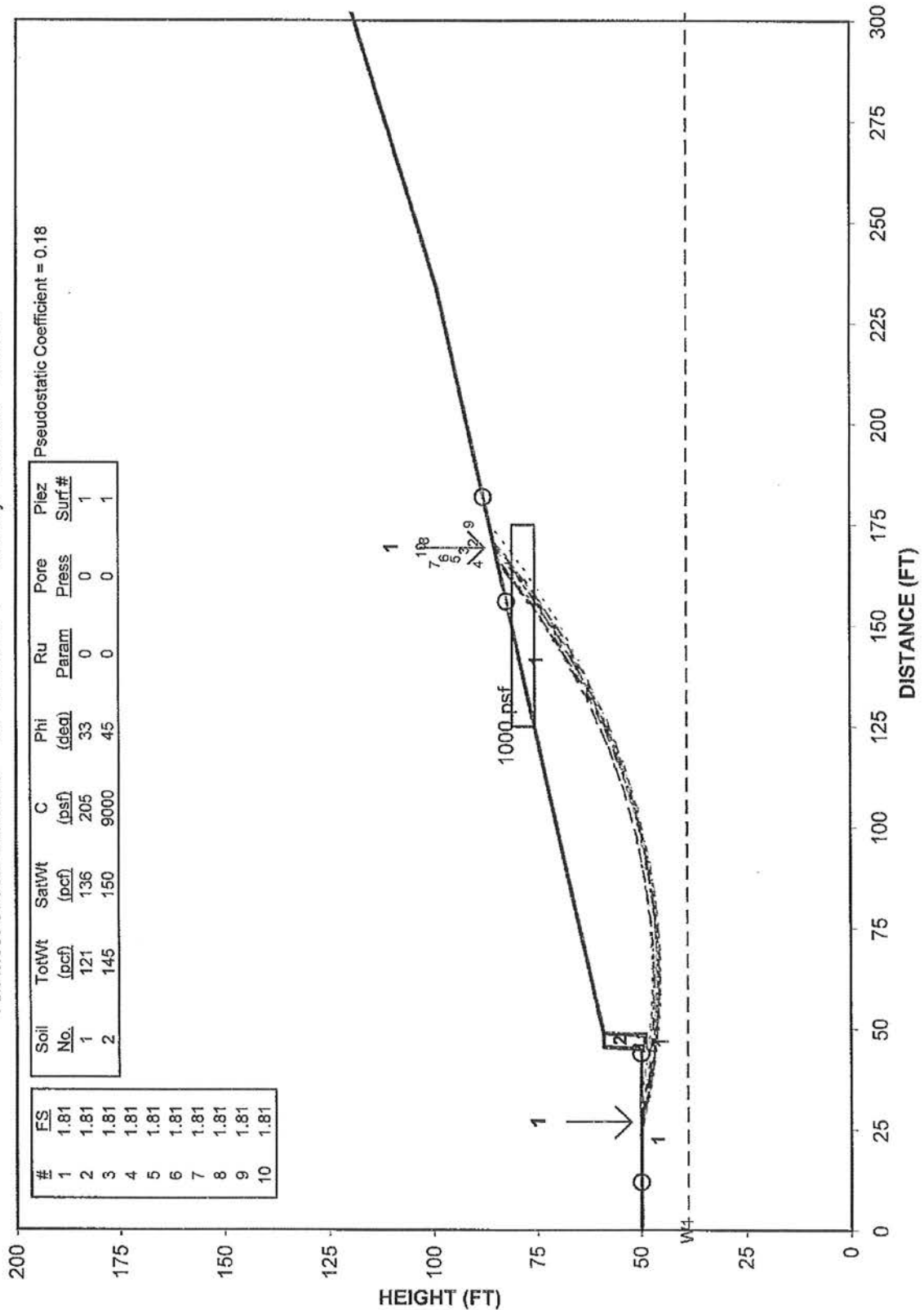


Earthtec Engineering Inc.

FIGURE NO.: 1

STABILITY RESULTS

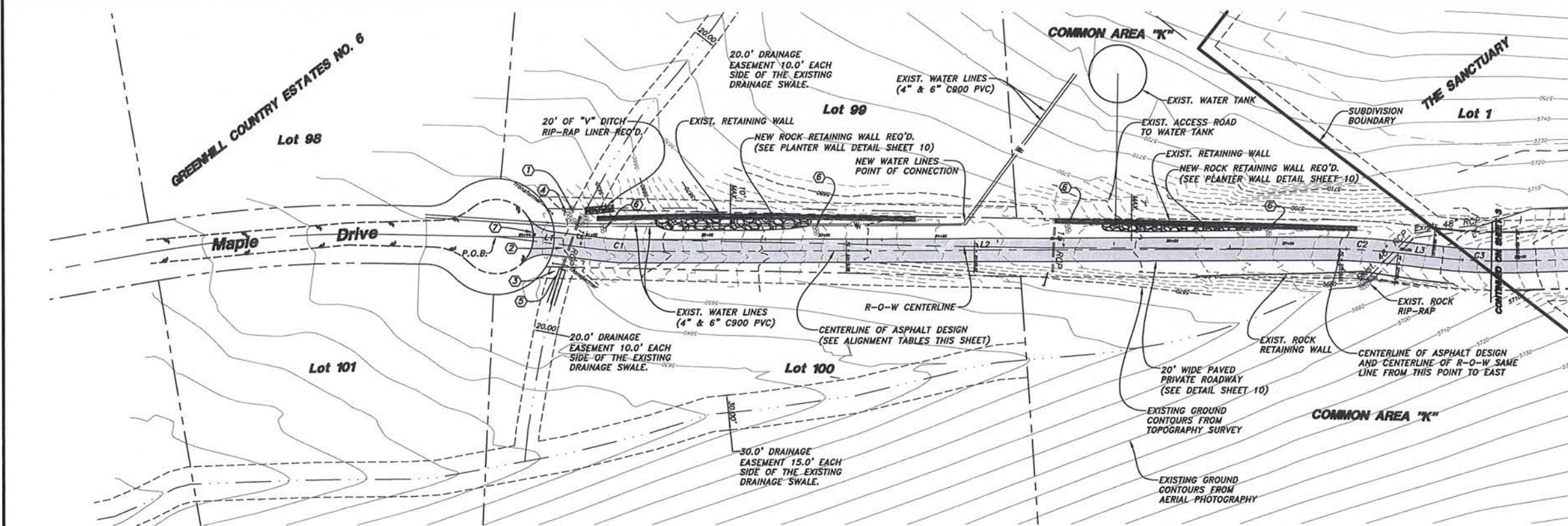
The Sanctuary Seismic
Ten Most Critical Surfaces. 071950S.OPT Run By: Earthtec 4-02-12



PROJECT NO.: 12-0086G



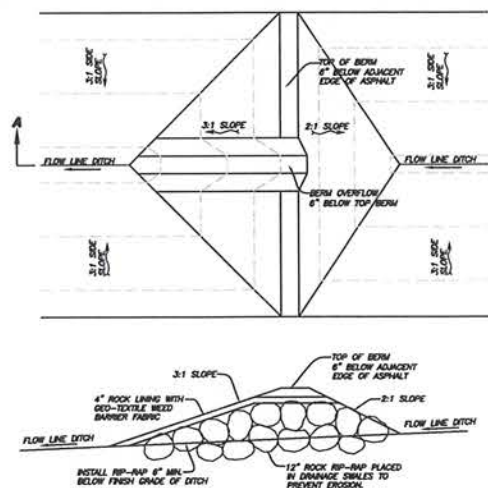
FIGURE NO.: 2



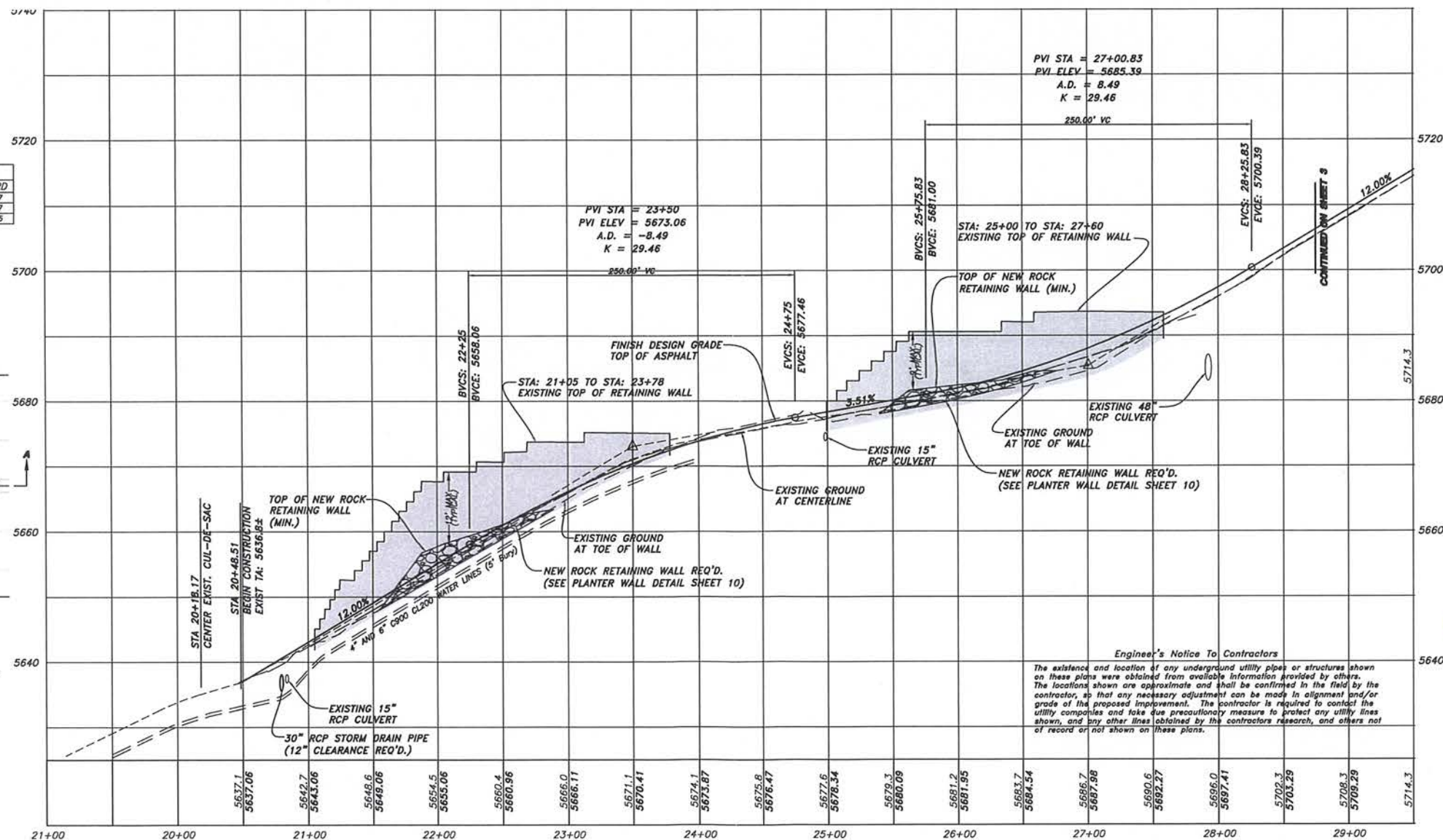
CENTERLINE OF ASPHALT DESIGN
P.O.B. CENTER OF CUL-DE-SAC

LINE	BEARING	LENGTH
L1	S60°40'10"W	90.00
L2	S53°27'16"W	592.24
L3	S60°39'07"W	28.90
L4	S52°10'13"W	173.58

CURVE	DELTA ANGLE	LENGTH	RADIUS	CHORD DIRECTION	CHORD
C1	7°13'04"	31.49	250.00	N57°03'48"E	31.47
C2	7°11'51"	62.81	500.00	S57°03'11"W	62.77
C3	8°28'54"	74.02	500.00	N56°24'40"E	73.95



TYPICAL ROCK
CHECK DAM DETAIL
SCALE: NONE



Engineer's Notice To Contractors


The existence and location of any underground utility pipe or structures shown on these plans were derived from available records as provided by others. The locations shown are approximate and shall be confirmed in the field by the contractor, so that any necessary adjustment can be made in alignment and/or grade of the proposed improvement. The contractor is required to contact the utility companies and take due precautionary measures to protect any utility lines shown, and any other lines obtainable from the contractors research, and others not of record or not shown on these plans.

KEYED NOTES:

- ① 30"x48" O.D. CONC. CATCH BASIN
TOP OF GRATE: 5641.41
FL OUT: 5637.45
(MATCH NEW 30" RCP TOP OF PIPE
TO EXISTING 15" RCP TOP OF PIPE.)
- ② INSTALL 50 LF OF 30" RCP STORM
DRAIN PIPE @ 7.4% SLOPE.
- ③ INSTALL 30" CONC. PIPE END SECTION.
MODIFY EXISTING RECEIVING DRAINAGE
CHANNEL AS REQ'D TO ACCOMMODATE NEW
PIPE. RIP-RAP ALL NEW DISTURBED
CHANNEL WITH LARGE ROCK (2' DIA. MIN.)
FL 30" RCP 5633.75±
- ④ PROVIDE A 6' WIDE x 8' LONG x 4' DEEP
(INSIDE DIM.) STILLING BASIN TO SLOW OFF
SITE STORM RUNOFF. LINE STILLING BASIN
WITH LARGE RIP-RAP (2' - 3' DIA. MIN.)
- ⑤ PROVIDE RIP-RAP FROM END OF "V" DITCH
TO OPEN DRAINAGE CHANNEL.
- ⑥ INSTALL ROADWAY CHECK DAMS
(SEE DETAIL ON THIS SHEET)
- ⑦ SAW-CUT EXISTING ASPHALT PAVING 1'
FROM EDGE. PROVIDE SMOOTH TRANSITION
FROM EXISTING TO NEW ASPHALT PAVING.



SCALE: 1" = 50' HORIZ.
1" = 10' VERT.



Scale in Feet

L E G E N D:

-
- PROPERTY BOUNDARY LINE
 LOT LINE
 CENTERLINE
 EASEMENT
 BUILDING SETBACK
 STORM DRAIN PIPE
 LAND DRAIN PIPE
 EXISTING 10' CONTOUR
 EXISTING 10' CONTOUR
 EXISTING 2' CONTOUR
 STREET MONUMENT
 INLET BOX
 PREFERRED BUILDABLE AREA
 PROPOSED ASPHALT PAVEMENT
 PROPOSED PRIVATE DRIVE



NOTICE!

EXISTING UTILITIES ARE SHOWN ON PLANS FOR THE CONVENIENCE OF THE CONTRACTOR ONLY. THE CONTRACTOR IS RESPONSIBLE FOR THE PROTECTION OF ALL UTILITIES. THE ENGINEER BEARS NO RESPONSIBILITY FOR UTILITIES NOT SHOWN OR SHOWN INCORRECTLY.

Call
BEFORE YOU
Die

PLAN & PROFILE FOR
THE SANCTUARY
A PART OF SECTION 3 & 4, T6N, R2E, AND
A PART OF SECTION 34, T7N, R2E, SLB&M
WEBER COUNTY, UTAH

SHEET
2
OF
10
SHEETS

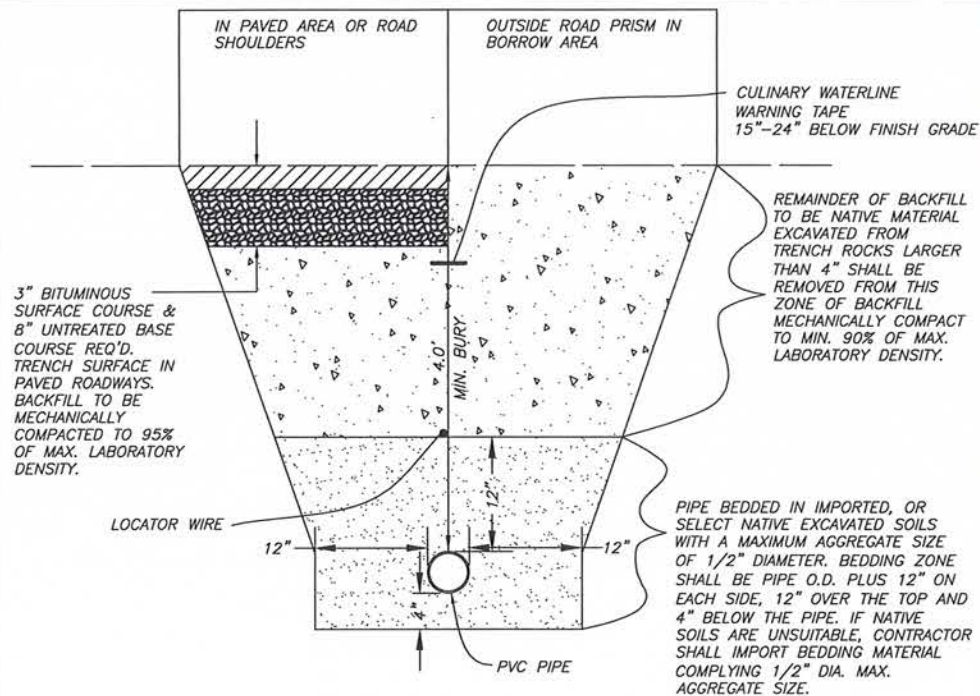
Drawn By: MBJ Date: 9/29/2010
Designed By: MBJ
Checked By: _____
Approved By: _____
Scale: 1"=50' HORZ 1"=10' VERT
Drawing File: 07-129PP.dwg
JOB NUMBER: 07-129

HANSEN & ASSOCIATES, INC.
Consulting Engineers and Land Surveyors

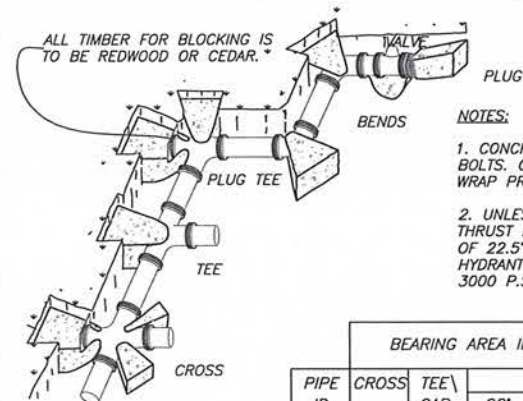
538 North Main	Brigham City, Utah	84302	Logan	(435) 752-8197
67 East 100 North	Logan, Utah	84321	Ogden	(435) 752-8272
Brigham City				(801) 399-4905
(435) 723-3481				
(435) 723-7663				

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N:\2007\07-129 Sanctuary\drawings\07-129ppp REV 4-10-12 - 7.dwg, 4/19/2012 9:21:17 AM, 1:107.288, 117

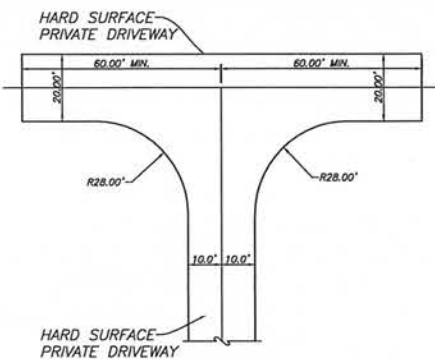


TYPICAL TRENCH SECTION
SCALE: NONE

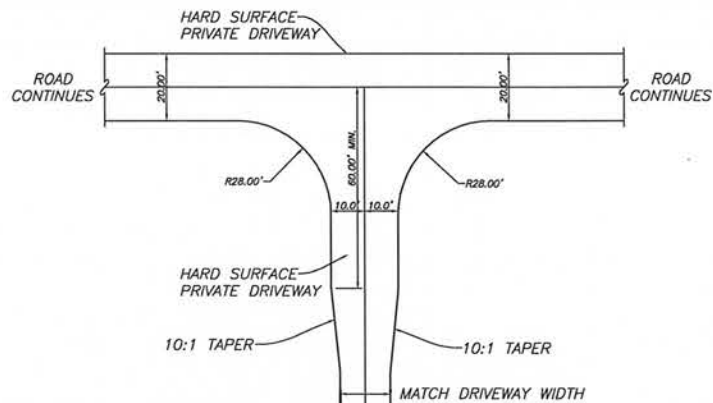


THRUST BLOCKING DETAIL
SCALE: NONE

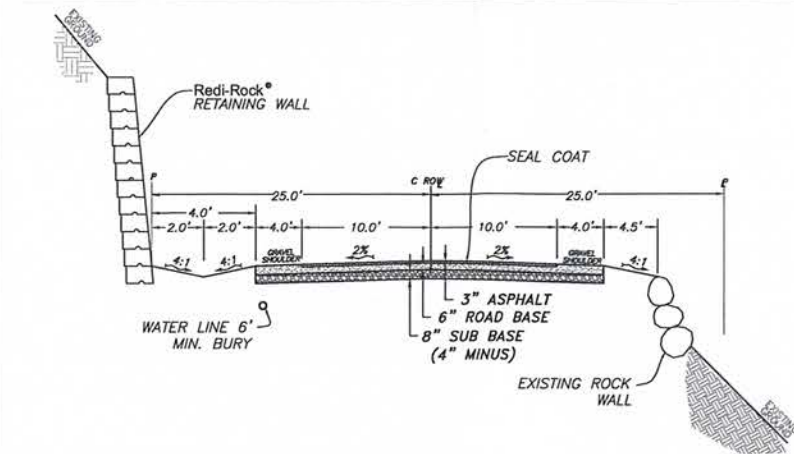
		BEARING AREA IN SQUARE FEET						CONC./CU. YDS.		
PIPE ID	CROSS	TEE CAP	BENDS				BENDS			
			90°	45°	22.5°	11.25°	45°	22.5°	11.25°	
4"	2	2	2	1	1	1	1.0	0.5	0.5	
6"	2	3	4	2	1	1	1.5	1.0	0.5	
8"	3	5	7	4	2	1	2.5	1.5	1.0	
10"	4	8	10	6	3	1	4.0	2.5	1.5	
12"	5	10	14	8	4	2	5.0	3.0	1.5	
16"	10	20	24	12	7	4	8.5	4.5	2.5	
18"	12	24	30	16	10	5	11.0	6.0	3.0	
20"	14	28	40	20	12	6	14.0	8.0	4.0	



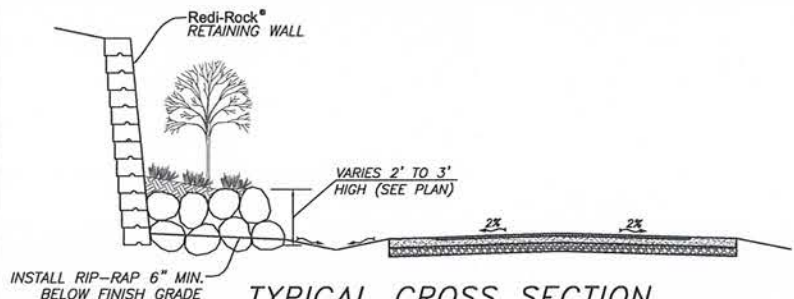
DEAD END HAMMER HEAD
NOT TO SCALE



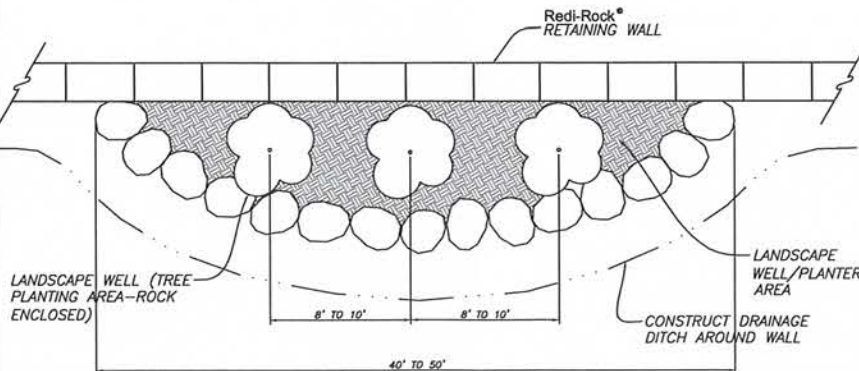
STANDARD ROADWAY HAMMER HEAD
NOT TO SCALE



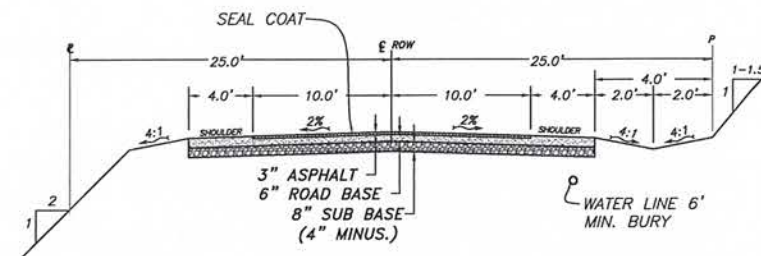
TYPICAL STREET SECTION DETAIL
W/Redi-Rock WALL DETAIL
SCALE: NONE Not for Construction



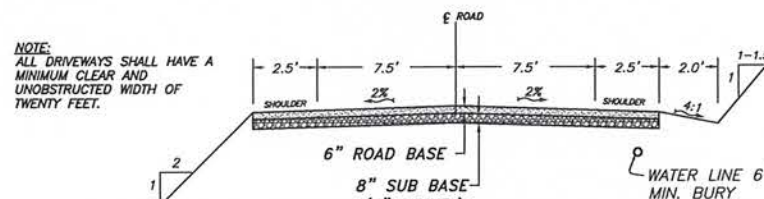
TYPICAL CROSS SECTION
PLANTER WALL DETAIL
SCALE: NONE



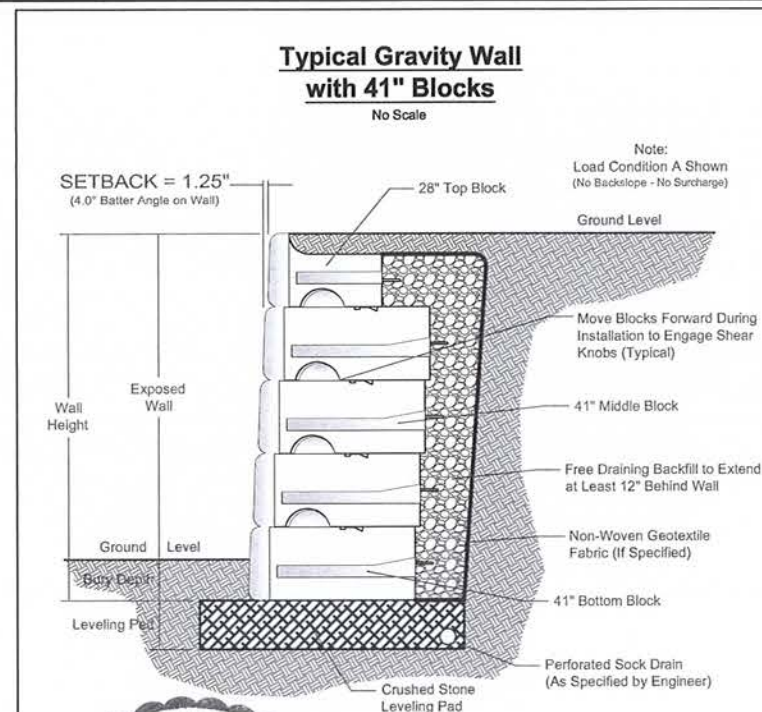
TYPICAL PLAN VIEW
PLANTER WALL DETAIL
SCALE: NONE



TYPICAL PRIVATE ROADWAY SECTION
MAXIMUM SLOPE = 12%
SCALE: NONE



20' WIDE PRIVATE DRIVEWAY
TYPICAL STREET SECTION
MAXIMUM SLOPE = 15%
SCALE: NONE



See Redi-Rock.com for Detailed Section Drawings of Each Condition Shown in the Design Charts

DESIGNED BY	J. JOHNSON	12/08/06	Redi-Rock® International, LLC
CHECKED BY			
APPROVED BY			
SCALE	NO SCALE		
SHEET NO.	1 OF 1		

Professional Engineer Seal for Matthew R. Meyer, State of Utah, No. 275259, dated 4/19/12.

Drawn By: MJB Date: 9/19/2010

Designed By: SM

Checked By: KIS

Approved By: KIS

Scale: NTS

Drawing File: 07-129PP.dwg

JOB NUMBER: 07-129

PLAN & PROFILE FOR

THE SANCTUARY

A PART OF SECTION 3 & 4, T6N, R2E, AND

A PART OF SECTION 34, T7N, R2E, SLB&M

WEBER COUNTY, UTAH

SHEET

10

OF

10

SHEETS