



# Staff Report for Administrative Approval Hillside Review – Notice of Conditional Approval

Weber County Planning Division

## Synopsis

### Application Information

**Application Request:** Consideration and action on a request to approve a Hillside Review for the LaStayo residence located on Lot 44 in the Big Sky Estates No. 1.  
**Applicant:** Paul and Linda LaStayo  
**Authorized Representative:** Bill Arthur  
**File Number:** HSR 2016-10

### Property Information

**Approximate Address:** 4075 Bluebell Drive, Liberty, Ut  
**Project Area:** 0.183608 acres  
**Zoning:** DRR-1  
**Existing Land Use:** Vacant  
**Proposed Land Use:** Townhomes  
**Parcel ID:** 22-335-0001  
**Township, Range, Section:** 7N 2E Sec 08

### Adjacent Land Use

<b>North:</b> Residential	<b>South:</b> Residential/Forest
<b>East:</b> Forest	<b>West:</b> Residential

### Staff Information

**Report Presenter:** Ronda Kippen  
[rkippen@co.weber.ut.us](mailto:rkippen@co.weber.ut.us)  
801-399-8768  
**Report Reviewer:** RG

## Applicable Ordinances

- Weber County Land Use Code Title 108 (Standards) Chapter 14 (Hillside Development Review)
- Weber County Land Use Code Title 104 (Zones) Chapter 27 (Natural Hazards Overlay District)

## Background

It was determined during the building permit review process by the County Engineering Division that due to the potential of a geologic hazard being located on the site, the property would be subject to a Hillside Review. The property owner hired Western GeoLogic and GSH Geotechnical, Inc. to perform the required geologic and geotechnical investigation to determine if there is a geologic hazard located on the site in order to better design the home for safety purposes. Information related to the construction of the dwelling including a site plan, landscape plans, grading plans, the geologic and geotechnical reports, were distributed to the Hillside Review Board for comment. The plans have been reviewed and conditionally approved by all applicable review agencies.

## Planning Division Review

The Planning Division Staff has determined that the requirements and standards provided by the Hillside Review Chapter have been met for the excavation and construction of the dwelling. The following submittals were required:

1. Approved Plans (see Exhibit A)
2. Geotechnical Investigation Report (see Exhibit B)
3. Geologic Investigation Report (see Exhibit C)
4. Utah Pollution Discharge Elimination system (UPDES) Permit with Storm water Pollution Prevention Plan (See Building Permit Application Packet for UPDES and SWPPP)

## Weber County Hillside Review Board comments

The Weber County Hillside Review Board, on this particular application, made comments related to the following:

Weber County Engineering Division: The Engineering Division granted approval on August 23, 2016. The approval is subject to the applicant following all recommendations found in the applicable Geotechnical and Geological Investigation Reports. Subsequent recommendations may be necessary if additional geologic hazards are exposed during the excavation and construction phase of the dwelling.

Weber Fire District: The Fire district has granted an approval on August 24, 2016 subject to construction of the home complying with the IR3 category of the Wildland Urban Interface Code.

Weber County Building Inspection Department: The Building Inspection Office has granted an approval due to the applicant's ability to satisfy all requirements provided in their review dated August 25, 2016 based on the condition that the Geotechnical Engineer will need to approve the footing soil prior to placement of footings.

Weber-Morgan Health Department: The Health Department has reviewed the proposal and has made the following comment:

*"This lot, lot 44 of Big Sky Estates #1, has considerable engineering issues and may not be suitable for the installation of even the most advanced alternative onsite wastewater treatment system/septic system. Our office the Weber-Morgan Health Department has never issued a letter of feasibility for this lot, nor made statement that a septic system could be installed on the lot. After an extensive history of evaluation a spatially limited area with suitable soils was identified. The following correspondence between our office and the property owner/ geotechnical consultant placed the burden of proof that a code compliant onsite wastewater treatment system including both the original and replacement drainfield could be engineered for the lot. The engineering recently reviewed by our office provided additional evidence that this may not be achievable. The system designed for a 3 bedroom home spanned areas with slope in excess of the permissible 25 percent as well as drainfield(s) encroached or overlapping areas known to have non permissible soils.*

*At this time the proof that an onsite wastewater treatment system can be engineered that meets both the Utah Administrative Code R317-4 and the Weber-Morgan Health Department Onsite Wastewater Treatment System Regulation has not be provided."*

The applicant will need to address and meet all of the Weber-Morgan Health Department concerns prior to receiving approval of a building permit for Lot 44. The Hillside Review approval will be subject to and conditioned upon receiving approval from the Weber-Morgan Health Department.

Weber County Planning Division: The Planning Division has granted approval subject to the applicant complying with all Board requirements and conditions. This approval is also subject to the applicant strictly adhering to the recommendations outlined in both the geologic and geotechnical reports. The geologic report dated June 4, 2016 provided by Western GeoLogic includes the following recommendations:

- The home location being placed as shown on Figure 3C.
- The excavation for the home is inspected by a licensed engineering geologist to confirm that no deformation is present, and to ensure that any differing conditions are not present that could affect the performance of the planned structure on Lot 44 and that if the structure will be located over an excavated area.
- No footings or structure should be founded over the excavations unless the backfill removed and replaced with structural fill, if the fill is to support a structure.

The geotechnical report dated July 8, 2016 provided by GSH includes the following recommendations:

- The location of the home must be planned to avoid mass movement deposits at the site.
- A foundation sub-drain and cutoff drain system must be installed as outlined in section 5.8 on page 15 of the geotechnical report.
- The on-site soils are not appropriate to be used as structural site grading fill, however, they may be used as general grading fill in landscape areas.
- A geotechnical engineer from GSH will need to verify that all mass movement deposit soils, fill material (if encountered) and topsoil/disturbed soils have been completely removed and suitable natural soils encountered prior to the placement of structural site grading fills, floor slabs, foundations, or rigid pavements.
- Landscaping at the site should be planned to utilize drought resistant plants that require minimal watering. Plants

or lawn may be placed on the slope, with plants using direct drip systems targeted only for each plant, and any lawn areas watered using sprinklers placed in a manner in such that watering is a minimum of 30 feet back from the crest of the slope. Saturation of soils at the site may result in slope movement or failure; therefore, no irrigation lines should be placed on the slope as recommended in section 5.9 on page 16 of the geotechnical report.

### Planning Division Recommendations

Based on site inspections and review agency comments, the Planning Division Staff has determined that it is necessary to impose additional requirements and conditions as part of approving HSR #2016-10. The recommendation for approval is based on the following conditions:

1. The home location being placed as shown on Figure 3C.
2. The excavation for the home is inspected by a licensed engineering geologist to confirm that no deformation is present, and to ensure that any differing conditions are not present that could affect the performance of the planned structure on Lot 44 and that if the structure will be located over an excavated area.
3. No footings or structure should be founded over the excavations unless the backfill removed and replaced with structural fill, if the fill is to support a structure.
4. The location of the home must be planned to avoid mass movement deposits at the site.
5. A foundation sub-drain and cutoff drain system must be installed as outlined in section 5.8 on page 15 of the geotechnical report.
6. The on-site soils are not appropriate to be used as structural site grading fill, however, they may be used as general grading fill in landscape areas.
7. A geotechnical engineer from GSH will need to verify that all mass movement deposit soils, fill material (if encountered) and topsoil/disturbed soils have been completely removed and suitable natural soils encountered prior to the placement of structural site grading fills, floor slabs, foundations, or rigid pavements.
8. Landscaping at the site should be planned to utilize drought resistant plants that require minimal watering. Plants or lawn may be placed on the slope, with plants using direct drip systems targeted only for each plant, and any lawn areas watered using sprinklers placed in a manner in such that watering is a minimum of 30 feet back from the crest of the slope. Saturation of soils at the site may result in slope movement or failure; therefore, no irrigation lines should be placed on the slope as recommended in section 5.9 on page 16 of the geotechnical report.
9. The geotechnical engineer will need to approve the footing soil prior to placement of footings.
10. All conditions and requirements of the Weber-Morgan Health Department will be addressed prior to receiving an approved building permit.

The recommendation is based on the following findings:

1. The application was submitted and with the required conditions, has been deemed complete.
2. The requirements and standards found in the Hillside Development Review Procedures and Standards Chapter have been met or will be met during the excavation and construction phase of the dwelling.
3. The Hillside Review Board members reviewed the application individually and have provided their comments.
4. The applicant has met or will meet, as part of the building permit process and/or during the excavation and construction phase of the dwelling, the requirements and conditions set forth by the Hillside Review Board. As a condition it is understood, by the applicant and his geo-technical engineer and geologist, that if any geologic hazards are revealed during the excavation and construction phase of the dwelling, work on Lot 44 will cease pending the development of appropriate mitigation measures and subsequent approval by the County.
5. The Planning Division Staff has determined that the proposed improvements have been sited within the required setbacks for the FV-3 zone with the exception of the driveway and retaining wall(s).

### Administrative Approval

Administrative approval of Lot 44 Hillside Review (HR#2016-10), is hereby granted based upon its compliance with the Weber County Land Use Code. This approval is subject to the requirements of applicable review agencies and is based on the recommendations, conditions and findings listed in this staff report.

Date of Administrative Approval: August 29, 2016

  
Rick Grover

**Exhibits**

- A. Approved Plans
- B. Geotechnical Investigation Report
- C. Geologic Report

**Map 1**



**A NEW RESIDENCE  
FOR  
Paul and Linda LaStayo  
4015 Bluebell Drive  
Liberty, UT**

**GEOLOGY**

Western Geologic, LLC  
700 West  
Salt Lake City, UT 84106  
Bill Black, P.E.  
(801) 359-1722

**GEOTECH**

GSI Geotechnical, Inc.  
1000  
Ogden, UT 84403  
Andrew Harris, P.E.  
(801) 866-5148

**ARCHITECT**

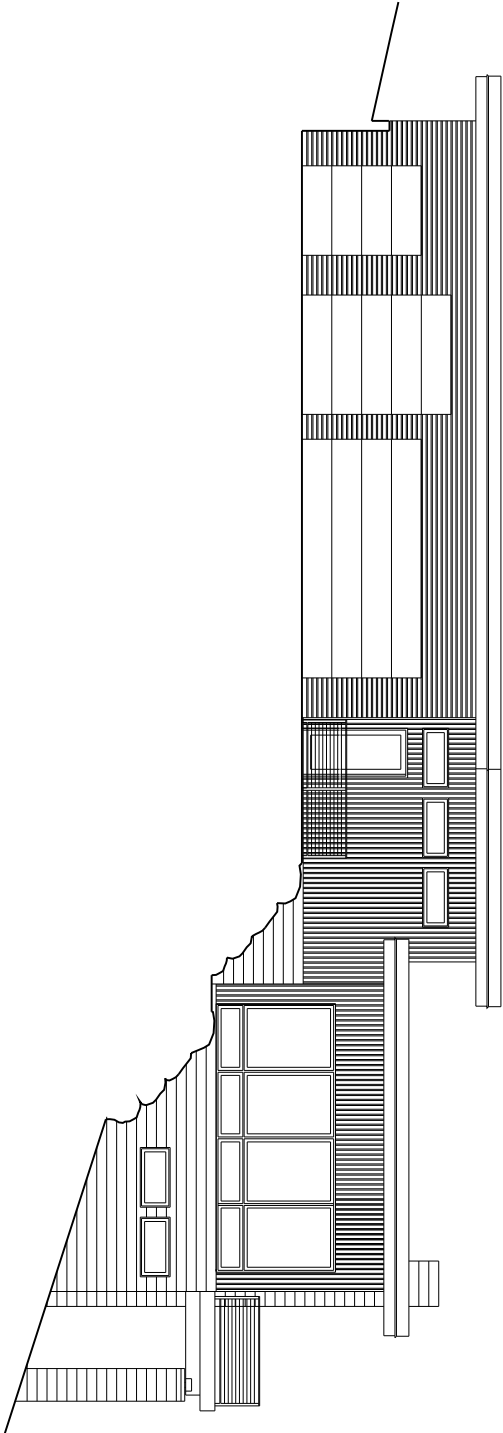
Coltace Inc.  
2000  
Salt Lake City, Utah 84103  
(801) 718-5838  
Bill Artyr, AIA  
bill@coltacearchitecture.com

**STRUCTURAL ENGINEER**

Jarratt Engineers  
2000  
Park City, Utah 84098  
(35) 555-9551  
Felix Jarratt - Project Engineer  
fjarratt@questoffice.net

**SURVEY/  
WASTEWATER**

Johnson Engineering  
2000  
Salt Lake City, UT 84118  
Nathan Basilio  
(801) 860-8740



**Index of Drawings**

A0-1	Index of Drawings	5/27/16									
A0-2	General Notes, Symbol Legend	5/27/16	A3-1	South and East Elevation	5/27/16	911	Structural General Notes	5/27/16	MP-0	Plumbing Notes, Equipment, Schedule	5/27/16
A1-1	Site Plan	5/27/16	A3-2	North and West	5/27/16	93-1	Footings and Foundation Plan	5/27/16	MP-1	Garage Level Electrical Plan	5/27/16
A1-2	Stormwater Pollution Prevention Plan	5/27/16	A4-1	Building Sections	5/27/16	93-2	Main Level Framing Plan	5/27/16	MP-2	Main Level Mechanical and Plumbing Plan	5/27/16
C-1	Grading Plan	5/27/16	A4-2	Building Sections	5/27/16	92-1	Upper Level and Tenth Floor Framing Plan	5/27/16	MP-3	Lower Level Mechanical and Plumbing Plan	5/27/16
C-2	Wastewater System Details	12/11/15	A4-4	Building Section	5/27/16	92-2	Upper Roof Framing Plan	5/27/16	E-0	Light Fixture Schedule	5/27/16
C-3	Wastewater System Details	12/11/15	A5-1	Wall Sections	5/27/16	93-1	Structural Details	5/27/16	E-1	Garage Level Electrical Plan	5/27/16
A2-1	Garage Level Floor Plan	5/27/16	A5-2	Wall Sections, Stair Section	5/27/16	93-2	Structural Details	5/27/16	E-2	Main Level Electrical Plan	5/27/16
A2-2	Main Level Floor Plan	5/27/16	A5-3	Wall Sections	5/27/16				AR-1	Garage Level Areas	5/27/16
A2-3	Lower Level Floor Plan	5/27/16	A7-1	Window Door Schedules	5/27/16				AR-2	Main Level Areas	5/27/16
A2-3	Roof Plan	5/27/16							AR-3	Lower Level Areas	5/27/16

**A New Residence for  
Paul and Linda LaStayo  
4015 Bluebell Drive  
Liberty, Utah**



Date: 5/27/16  
Revisions:

Coltace Inc.  
2000  
Salt Lake City, Utah 84118  
(801) 718-5838  
www.coltace.com

Project No.: 1501  
Sheet: A0 1  
Index of Drawings  
Scale: NTS

**PROJECT GENERAL NOTES:**

1. ALL WORK SHALL BE IN ACCORDANCE WITH THE CONSTRUCTION CODES AND ORDINANCES OF THE CITY OF SALT LAKE COUNTY.
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**ENERGY NOTES:**

1. GENERAL INSULATION NOTES:
  - A. ALL INSULATION SHALL BE INSTALLED TO A MINIMUM OF 2" ABOVE CEILING JOINTS.
  - B. ALL INSULATION SHALL BE INSTALLED TO A MINIMUM OF 2" ABOVE WALL JOINTS.
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**APPLICABLE CODES**

- 2012 INTERNATIONAL RESIDENTIAL CODE
- 2012 INTERNATIONAL PLUMBING CODE
- 2012 INTERNATIONAL ENERGY CONSERVATION CODE
- 2012 INTERNATIONAL FUEL GAS CODE
- 2012 INTERNATIONAL FIBER CODE
- 2012 INTERNATIONAL FIBER CODE
- 2012 NATIONAL ELECTRICAL CODE

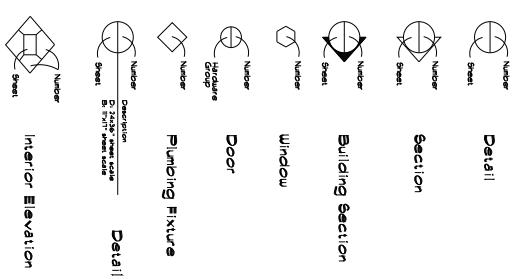
**DEFERRED SUBMITTALS:**

Pre-manufactured Roof and Floor Trusses

**GENERAL NOTES:**

1. NOTES ON DRAWINGS ARE TYPICAL FOR SIMILAR CONDITIONS UNLESS NOTED OTHERWISE.
2. DIMENSIONS ARE NOT TO BE SCALED.
3. CONTRACTOR IS RESPONSIBLE FOR OBTAINING ANY AND ALL PERMITS THAT ARE REQUIRED DURING THE CONSTRUCTION PROCESS AND SHALL BE REQUIRED TO OBTAIN ALL PERMITS PRIOR TO COMMENCEMENT OF WORK.
4. THE CONTRACTOR SHALL CAREFULLY READ AND STUDY THE DRAWINGS AND SPECIFICATIONS FOR ALL TRADES. COORDINATION BETWEEN TRADES WILL BE THE CONTRACTOR'S RESPONSIBILITY. ANY QUESTIONS THAT ARISE SHALL BE ADDED PRIOR TO CONSTRUCTION.
5. THE CONTRACTOR SHALL NOTIFY THE ARCHITECT OF ANY DISCREPANCIES ON THE DRAWINGS OR ANY FIELD CONDITIONS THAT MAY AFFECT THE PROGRESS AND COMPLETION OF THE PROJECT PRIOR TO CONSTRUCTION THAT DIFFERS FROM THE CONSTRUCTION DOCUMENTS.
6. ALL SHOP DRAWINGS OF PRODUCTS LISTED SHALL BE SUBMITTED TO THE ARCHITECT FOR REVIEW PRIOR TO ERECTION OF WORK. ALLOW APPROPRIATE LEAD TIME FOR REVIEW AND APPROVAL. CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE SPECIFICATIONS AND SHOP DRAWINGS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DESIGN AND CONSTRUCTION OF ALL SHOP DRAWINGS.
7. ALL SHOP DRAWINGS SHALL BE SUBMITTED TO THE ARCHITECT FOR REVIEW AND APPROVAL PRIOR TO CONSTRUCTION.
8. SEE OTHER NOTES ON THIS SHEET FOR ADDITIONAL INFORMATION.

**SYMBOL LEGEND:**



**BUILDING SUMMARY**

Area	Area
Great Living Space	386 sq. ft.
High Level	341 sq. ft.
Lower Level	308 sq. ft.
Total	1035 sq. ft.
Overall Footprint	2389 sq. ft.
Overall Building Footprint	2389 sq. ft.
Overall Building Footprint	2389 sq. ft.

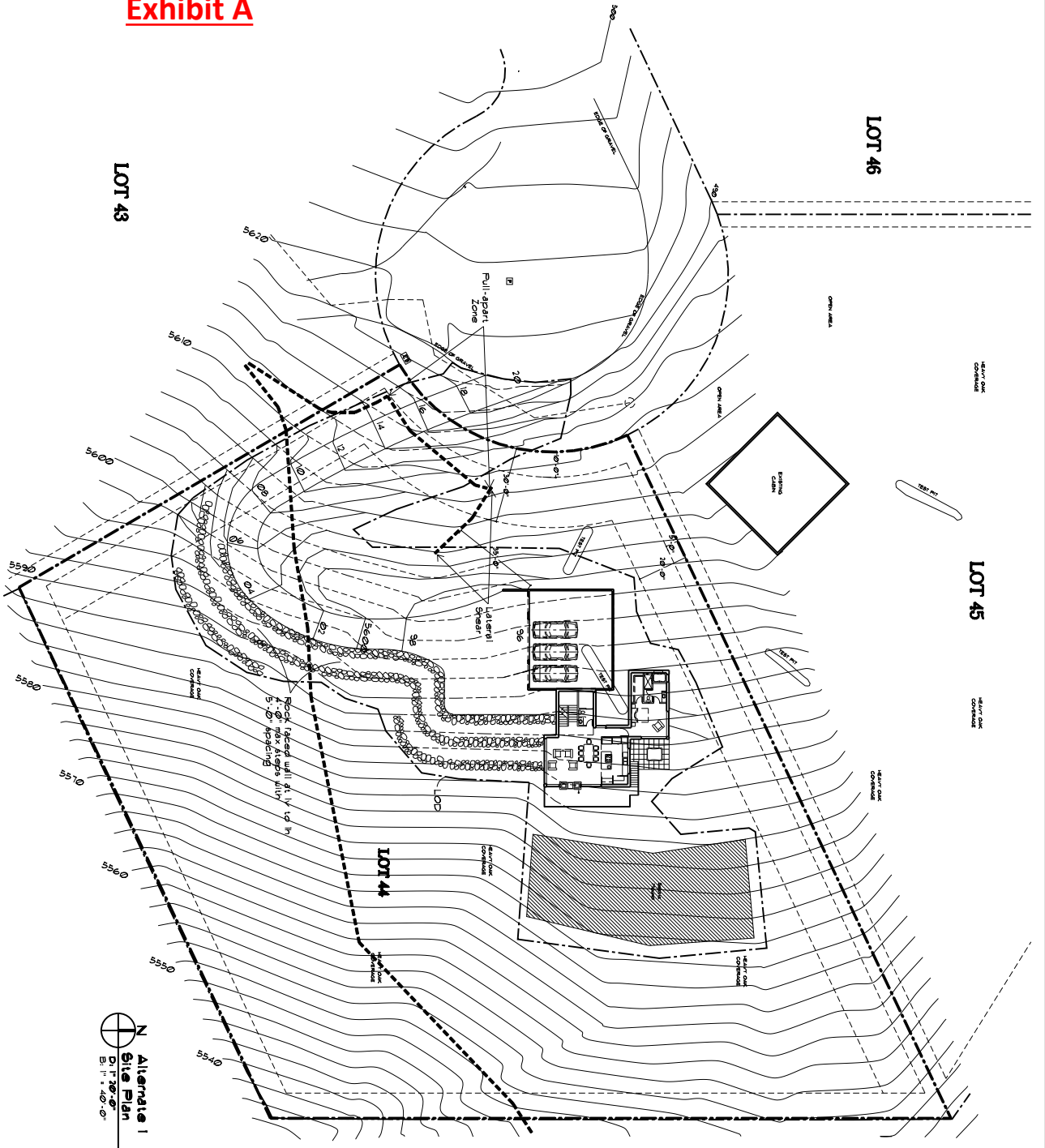
Occupancy Group R - Division 3

Project No.: **1501**  
 Sheet: **AO 2**  
 General Notes:  
 Legend:  
 Scale:  
 NTS

A New Residence for  
**Paul and Linda LaStayo**  
 4015 Bluebell Drive  
 Liberty, Utah

Date: 5/7/16  
 Revisions:

5415 200th St, Suite 100  
 Denver, CO 80230  
 Phone: 303.733.8888  
 Fax: 303.733.8889  
 Website: www.csi.com



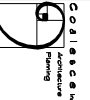
N  
 Site Plan  
 DT 100-0  
 Bl. 11-140-0

**A New Residence for  
 Paul and Linda LaStayo**  
 4075 Bluebell Drive  
 Liberty, Utah

Date: 5/27/16  
 Revisions:  
 5/22/16  
 8/15/16  
 8/19/16

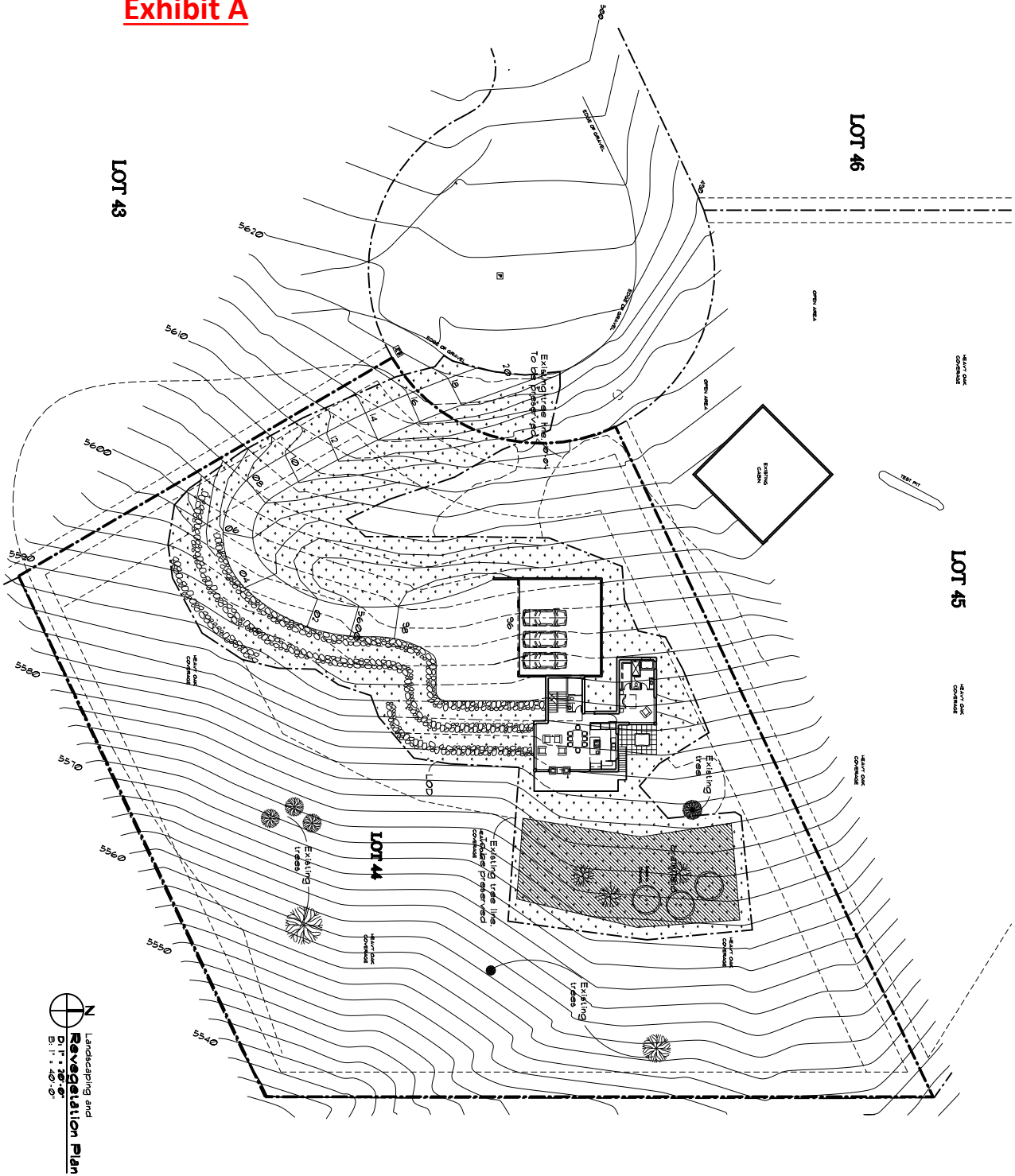


36222 David L. Smith  
 State of Utah  
 License No. 36222  
 05/27/2016



Project No.: 1507  
 Sheet: A1 1  
 Scale:  
 D: 1" = 10'-0"  
 B: 1" = 40'-0"

Site Plan



**Landscaping and  
Revegetation Plan**  
D.P. = 1/20'-0"  
S.P. = 1/40'-0"

**Seed Mix:**

Species	Amount per pound
Western Wheatgrass	275
Big Bluestem	275
Indian Ricegrass	2
(Oxyopsis hymenoides aka. Adenanthum hymenoides)	2
Slender wheatgrass	2
(Vadogalum)	2
Sheep fescue	05
(Festuca ovina)	05
Sandberg Bluegrass	05
(Poa sandbergii)	05
Hard fescue	275
(Festuca harringtonii)	275

- Hydro-seeding notes:**
- Seed disturbed areas with mix shown below. Do not use on erodible erosion blanket. Fill in place and cut around trees.
  - Use a broadcast rate of 2000 sq. ft. of disturbed area.
  - Do not hydro-seed until final grading of the site has been completed.
  - Maintain a watering schedule until the new vegetation has been established.

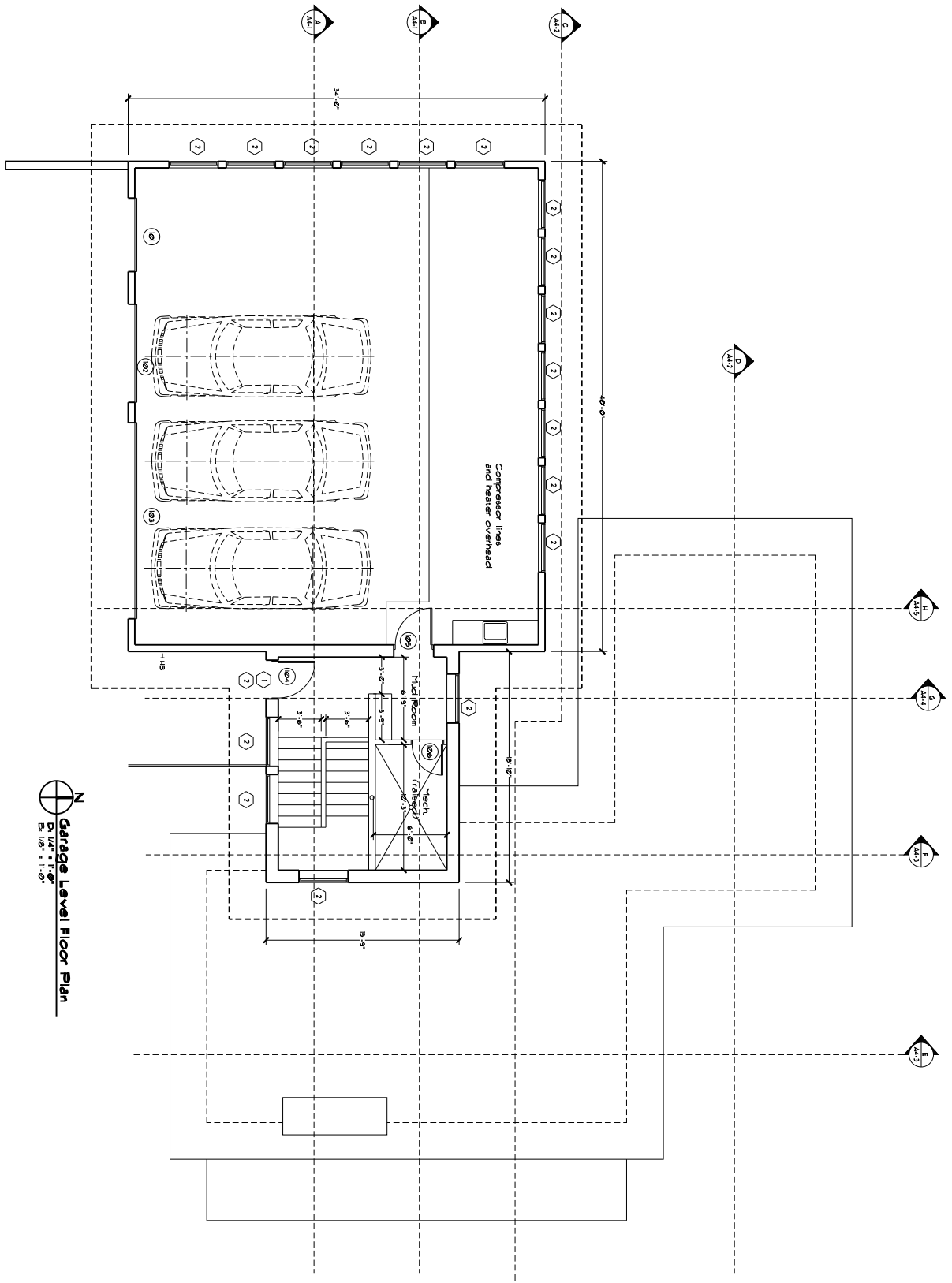
- Legend:**
- (4) Mountain maple or Poplar
  - (4) Ailanthus
  - (20) Oak Brush (1 gal)
  - Hydro-seeded area (20000 sq. ft. +/-)

**NOTES:**

- New trees shown will be irrigated by drip irrigation.
- All seeded areas shall have 80% germination coverage with a minimum of 3-6 inches of growth or re-seeding shall be required. Supply temporary irrigation.

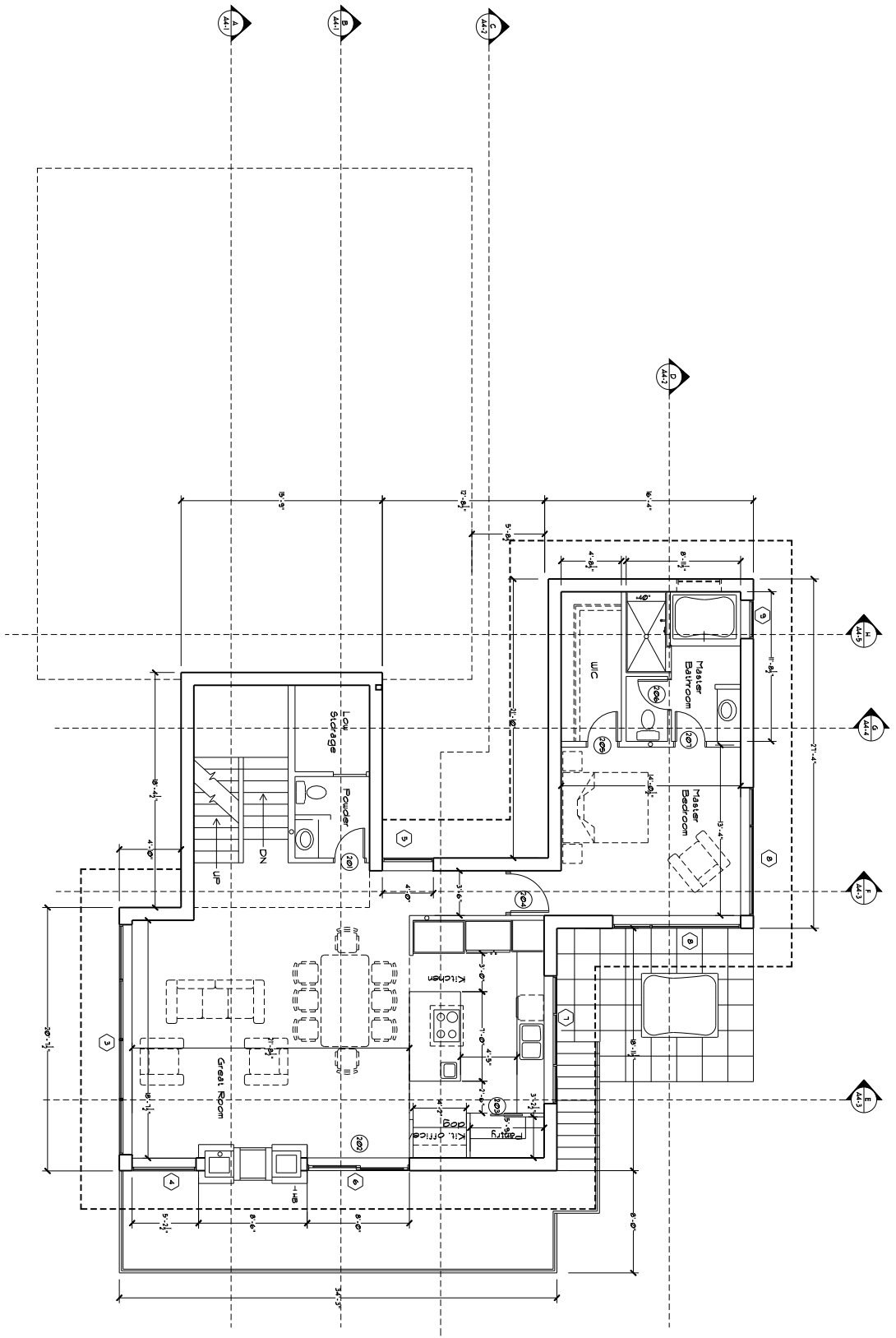
	Date: 5/27/6 Revisions: 8/24/6	<p><b>A New Residence for</b>  <b>Paul and Linda Lastayo</b>                  4075 Bluebell Drive                  Liberty, Utah</p>	Project No.: 1501 Sheet: 1	Landscaping and Revegetation Scale: D.P. = 1/20'-0" S.P. = 1/40'-0"
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**Garage Level Floor Plan**  
 D: 1/4" = 1'-0"  
 B: 1/8" = 1'-0"

	<p>Paul LaStayo, P.E.          1234 Main Street          Salt Lake City, Utah 84143          (801) 555-1234</p>	<p>Date: 5/2/16</p>	<p>Revisions:</p>	<p><b>A New Residence for</b>  <b>Paul and Linda LaStayo</b>          4015 Bluebell Drive          Liberty, Utah</p>	<p>Project No.:          1501          Elevation:  <b>A2 1</b></p>	<p>Garage Level          Plan          Scale:          D: 1/4" = 1'-0"          B: 1/8" = 1'-0"</p>
--	---	---------------------	-------------------	--	--	---



**Main Floor Plan**  
 Scale: 1/8" = 1'-0"

**A New Residence for**  
**Paul and Linda LaStayo**  
 4015 Bluebell Drive  
 Liberty, Utah

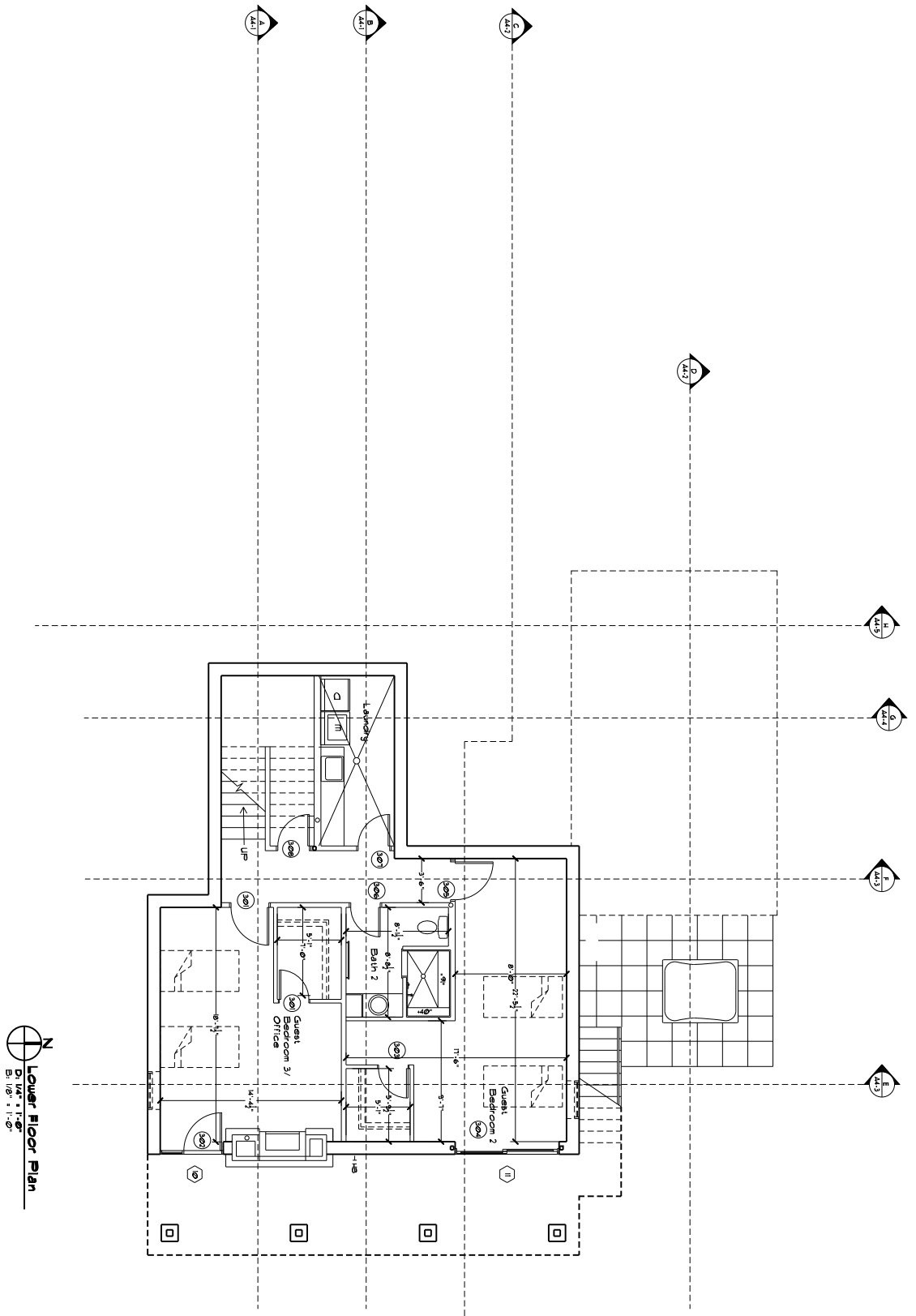
Project No.:  
 1501  
 Sheet:  
**A2 2**

Main Floor  
 Plan  
 Scale:  
 D: 1/4" = 1'-0"  
 E: 1/8" = 1'-0"



Date: 5/7/16  
 Revisions:

C & L S & S Inc.  
 1001 W. 1000 N.  
 Salt Lake City, Utah 84119  
 (801) 462-1234  
 www.candls.com



**Lower Floor Plan**  
 D: 1/4" = 1'-0"  
 E: 1/8" = 1'-0"

**A New Residence for**  
**Paul and Linda LaStayo**  
 4015 Bluebell Drive  
 Liberty, Utah

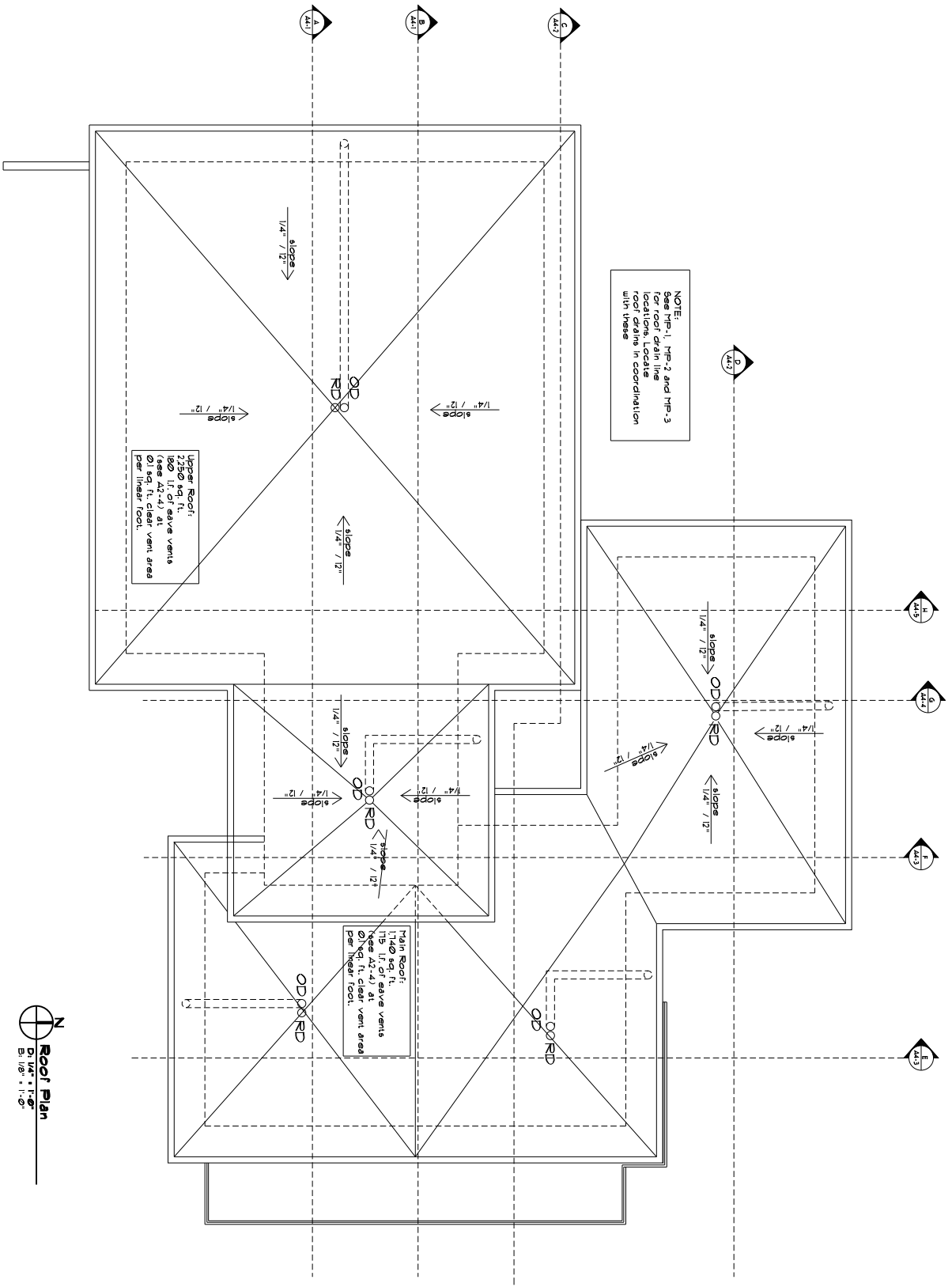
Date: 5/2/16  
 Revisions:



363 S. 2000 W., Suite 100  
 Salt Lake City, Utah 84119  
 (801) 462-1234  
 www.cedarsc.com  
 CedarS & Associates  
 Professional Engineers  
 License No. 12345

Project No.:  
 15071  
 Sheet:  
**A2 3**

Lower Floor Plan  
 Scale:  
 D: 1/4" = 1'-0"  
 E: 1/8" = 1'-0"



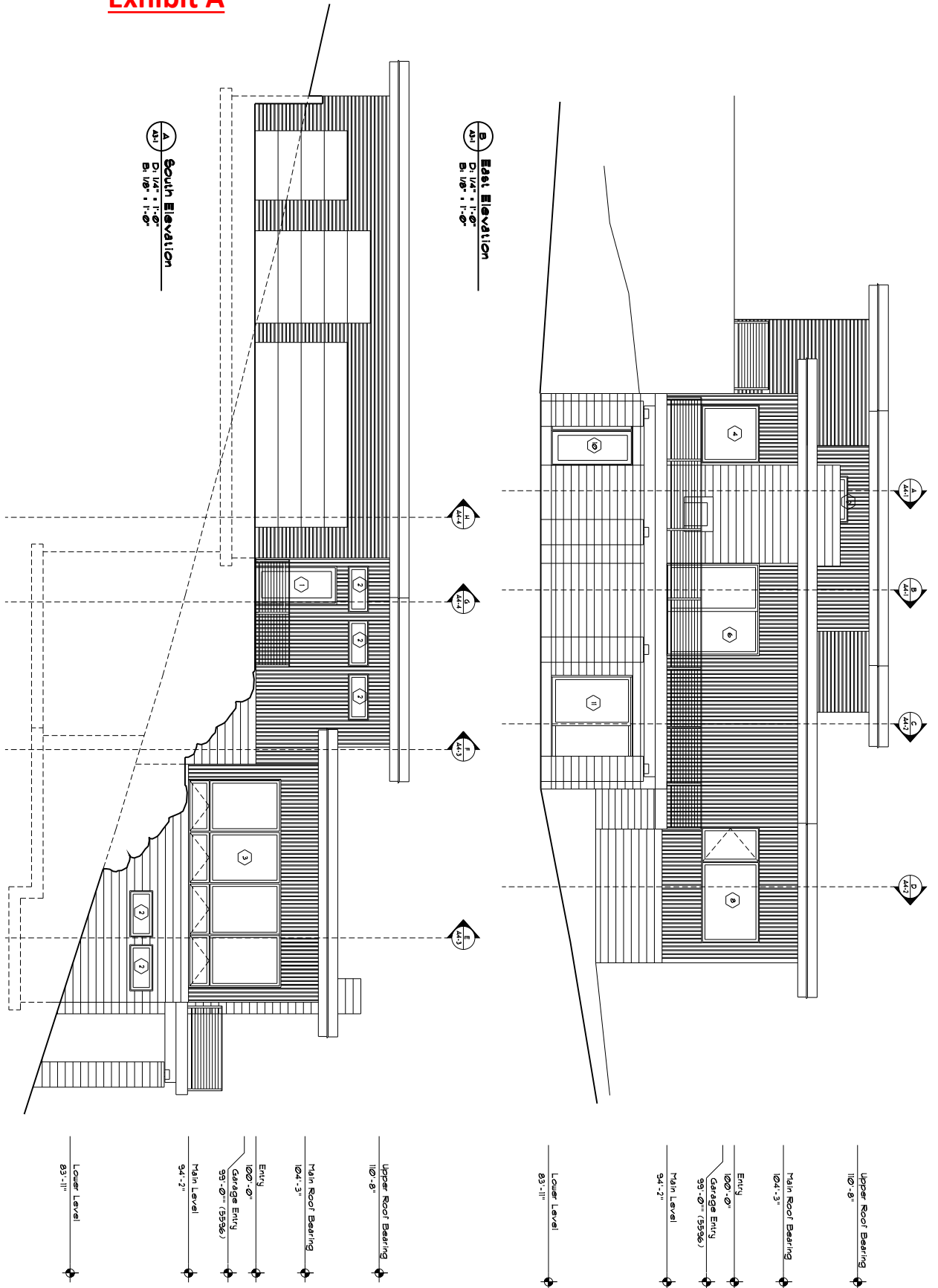
NOTE:  
See MP-1, MP-2 and MP-3  
for roof drain line  
locations. These  
roof drains in coordination  
with these

Upper Roof:  
1500 sq. ft.  
1/2" Ø 1/2" slope vents  
(see A2-4) at  
Ø1 sq. ft. clear vent area  
per linear foot.

Main Roof:  
1140 sq. ft.  
1/2" Ø 1/2" slope vents  
(see A2-4) at  
Ø1 sq. ft. clear vent area  
per linear foot.

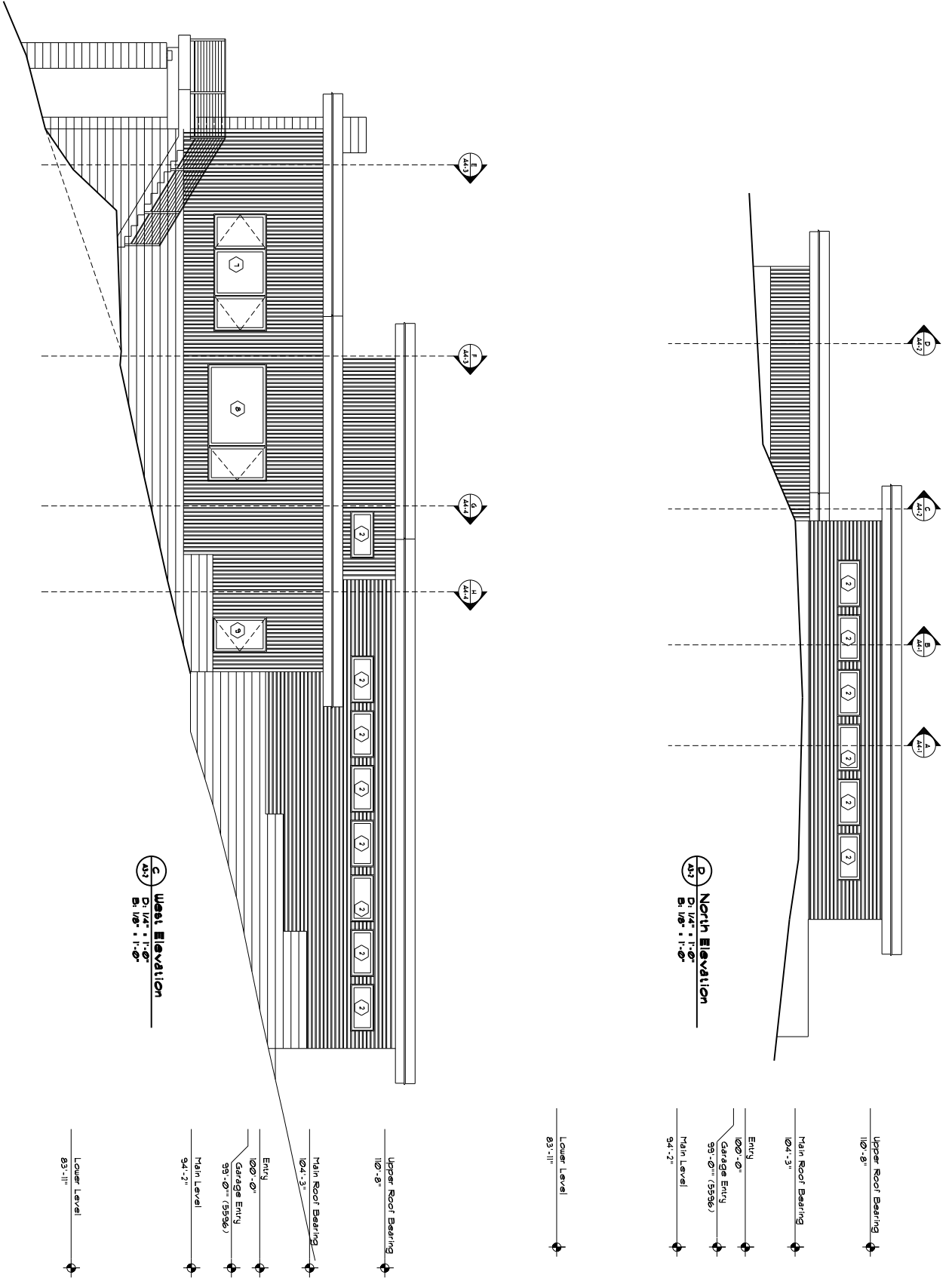
**Roof Plan**  
Scale: 1/8" = 1'-0"

	<p>363 S 1000 E, Suite 100 Salt Lake City, Utah 84143 (801) 462-1234 www.paulalastayo.com</p>	<p>Date: 5/2/16 Revisions:</p>	<p><b>A New Residence for Paul and Linda LaStayo</b> 4015 Bluebell Drive Liberty, Utah</p>	<p>Project No.: ISO1 Sheet: <b>A2 4</b> Roof Plan Scale: D: 1/4" = 1'-0" E: 1/8" = 1'-0"</p>
--	---	------------------------------------	--	--



<p>Scale: D: 1/4" = 1'-0" E: 1/8" = 1'-0"</p>	<p>Building Sections</p>	<p><b>A3 1</b></p>	<p>Project No.: 1501 Sheet: A3 1</p>	<p><b>A New Residence for</b> <b>Paul and Linda LaStayo</b> 4015 Bluebell Drive Liberty, Utah</p>	<p>Revisions:</p>	<p>Date: 5/2/16</p>		<p>301 S. 1000 E., Suite 100 West Valley City, Utah 84115 (801) 963-1999 www.dlsdesign.com Copyright © 2016 David L. Smith All Rights Reserved</p>	
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# Exhibit A

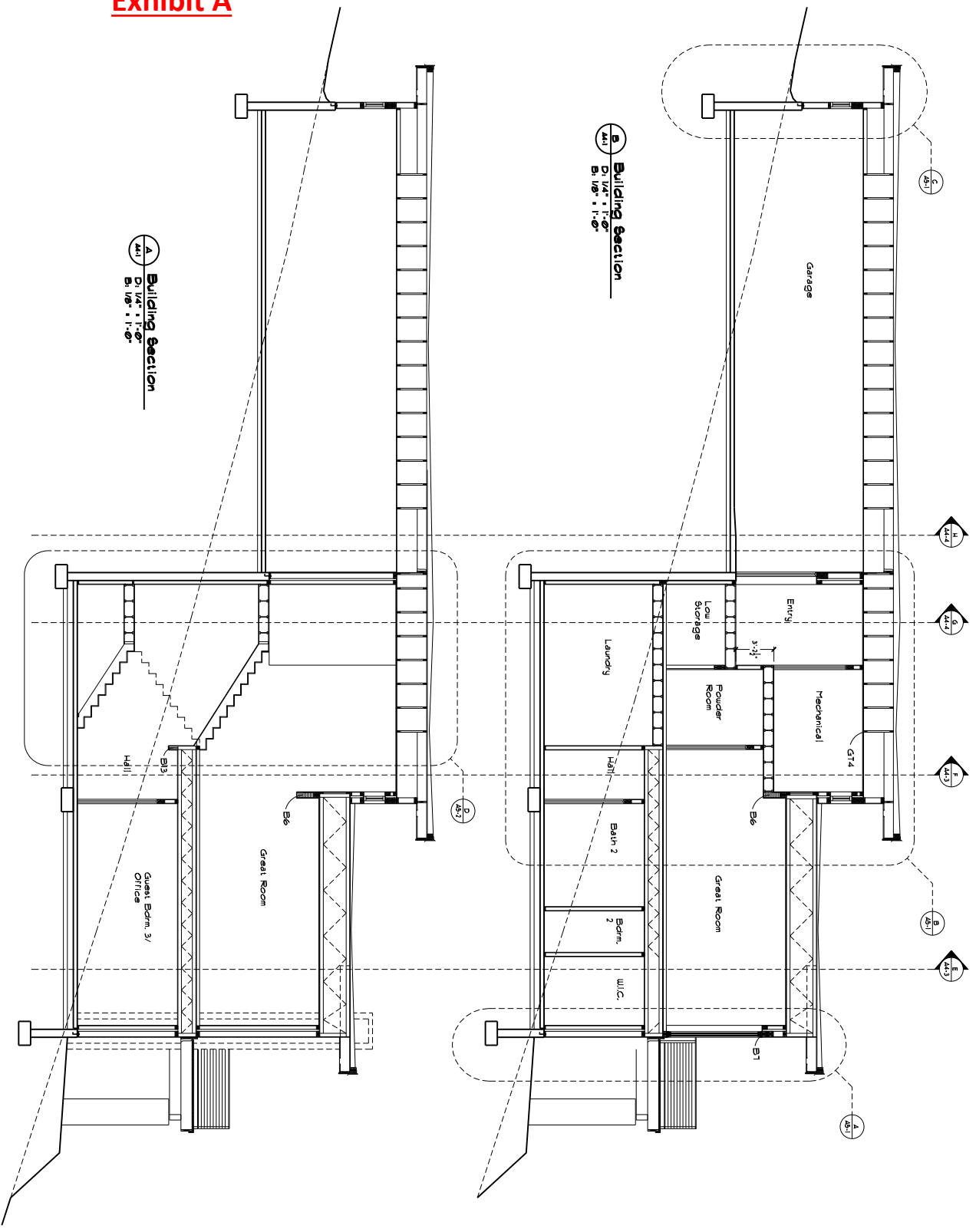


**C**  
 West Elevation  
 D: 1/4" = 1'-0"  
 B: 1/8" = 1'-0"

**D**  
 North Elevation  
 D: 1/4" = 1'-0"  
 B: 1/8" = 1'-0"

	<p>3d 12:00:00          3d 12:00:00          100% 100% 100%          100% 100% 100%</p>		<p>Date: 5/2/16          Revisions:</p>	<p><b>A New Residence for</b>  <b>Paul and Linda LaStayo</b>          4015 Bluebell Drive          Liberty, Utah</p>	<p>Project No.: 1501          Sheet: <b>A3 2</b>          Scale:          D: 1/4" = 1'-0"          B: 1/8" = 1'-0"</p>
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**Exhibit A**



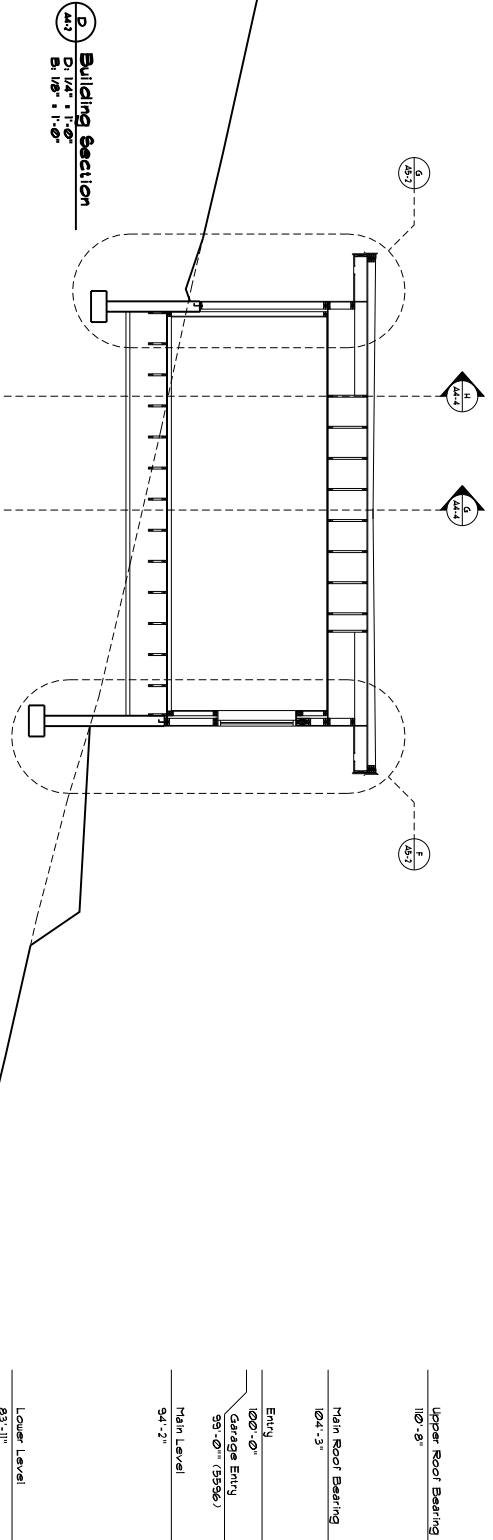
**A**  
 Building Section  
 D: 1/4" = 1'-0"  
 B: 1/8" = 1'-0"

**B**  
 Building Section  
 D: 1/4" = 1'-0"  
 B: 1/8" = 1'-0"

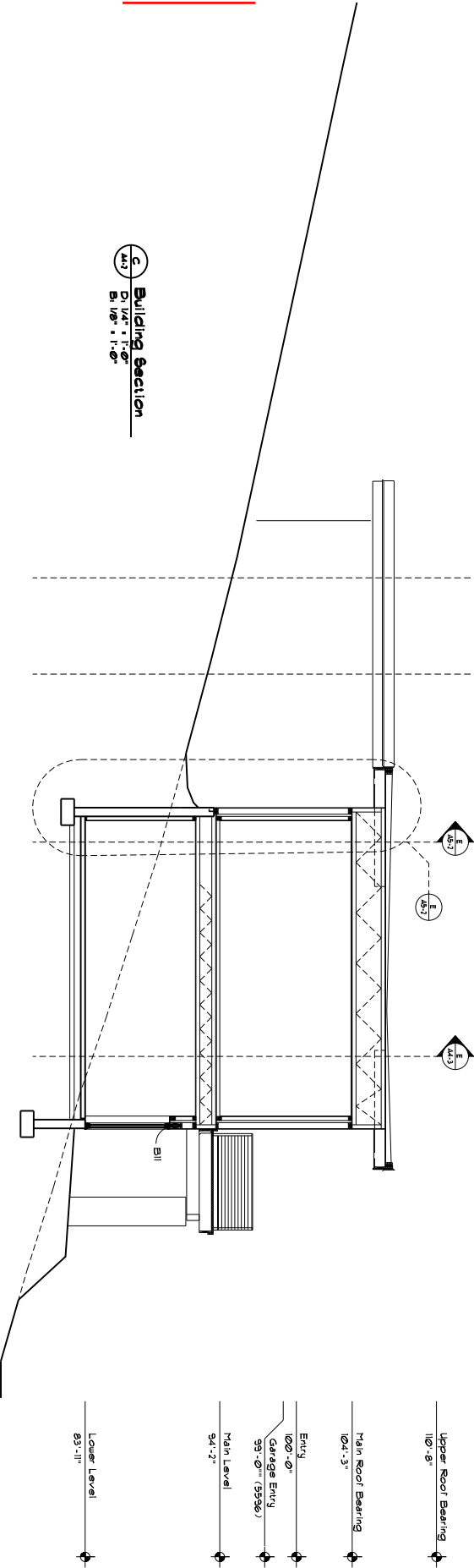
- Upper Roof Bearing 110'-8"
  - Main Roof Bearing 104'-5"
  - Entry 100'-0"
  - Garage Entry 99'-0" (5596)
  - Main Level 94'-2"
  - Lower Level 83'-11"
- 
- Upper Roof Bearing 110'-8"
  - Main Roof Bearing 104'-3"
  - Entry 100'-0"
  - Garage Entry 99'-0" (5596)
  - Main Level 94'-2"
  - Lower Level 83'-11"

	Date: 5/2/16 Revisions:	<b>A New Residence for</b> <b>Paul and Linda LaStayo</b> 4015 Bluebell Drive Liberty, Utah	<b>Project No.:</b> 1501 <b>Drawn:</b> A4 1	<b>Scale:</b> D: 1/4" = 1'-0" B: 1/8" = 1'-0"
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# Exhibit A



Page 16 of 102



**A New Residence for**  
**Paul and Linda LaStayo**  
 4015 Bluebell Drive  
 Liberty, Utah

Project No.:  
 1501  
 A4  
 2

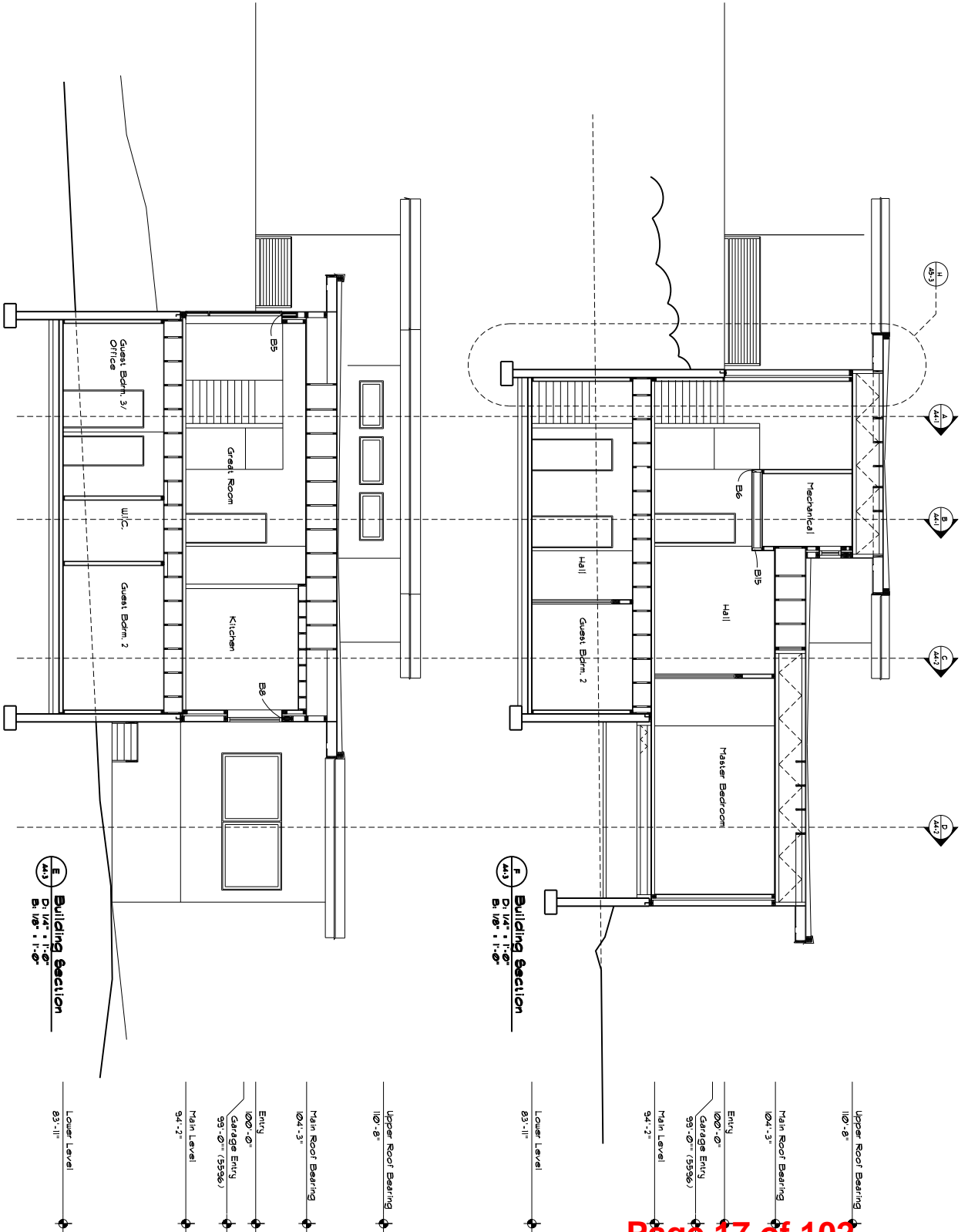
Scale:  
 D: 1/4" = 1'-0"  
 B: 1/8" = 1'-0"

Jason M. Smith  
 License No. 36867  
 State of Utah  
 Professional Engineer

Date: 5/2/16  
 Revisions:

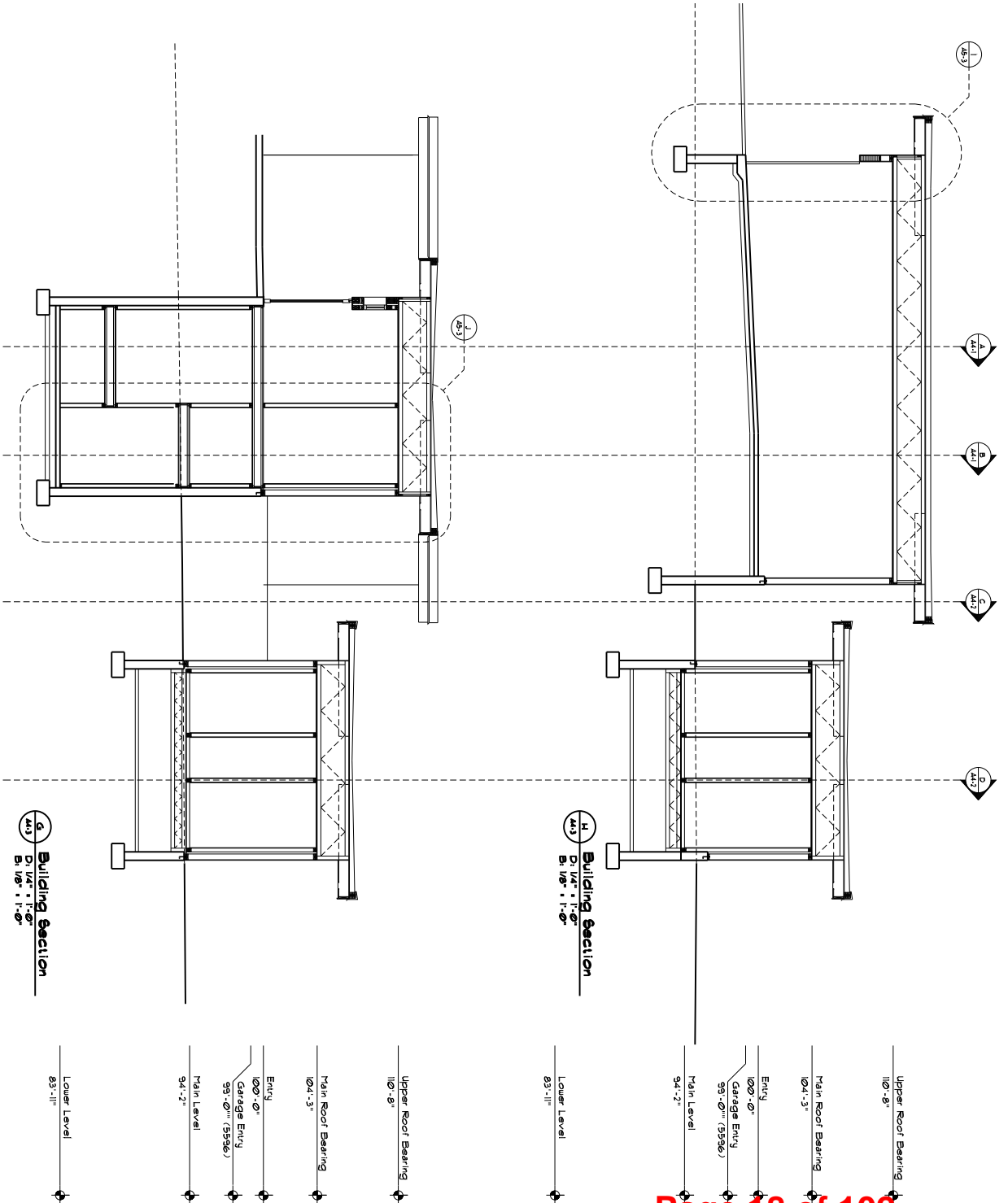


**Exhibit A**



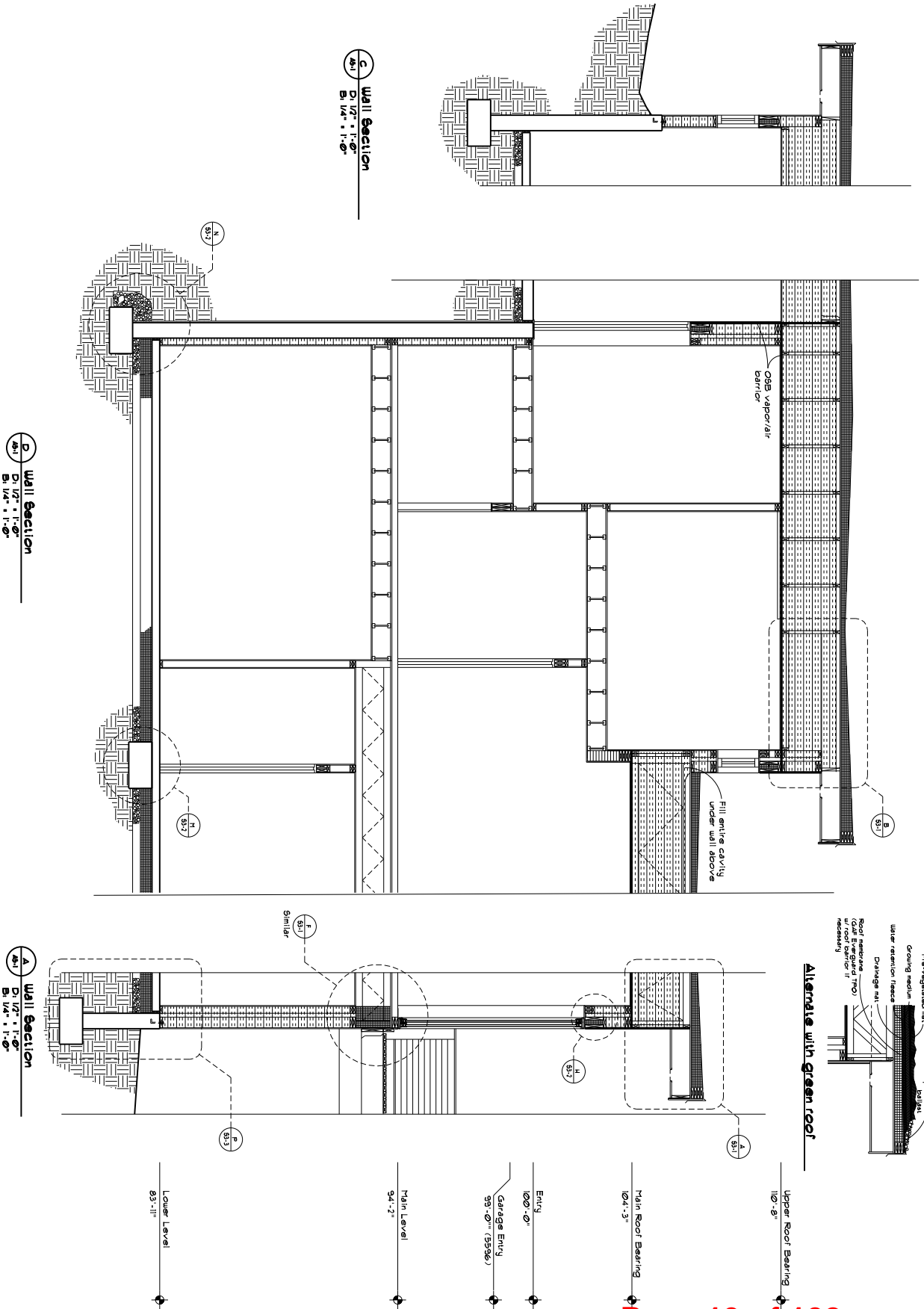
	<p>As of 5/2/16, 5:00 PM          1001 Main Street, Suite 400          Salt Lake City, Utah 84101          (801) 462-1999          www.jmsmithpe.com</p>	<p>Date: 5/2/16          Revisions:</p>	<p><b>A New Residence for</b>  <b>Paul and Linda LaStayo</b>          4015 Bluebell Drive          Liberty, Utah</p>	<p>Project No.:          1501          Elevation:  <b>A4</b>  <b>3</b></p>	<p>Building Sections          Scale:          D: 1/4" = 1'-0"          E: 1/8" = 1'-0"</p>
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# Exhibit A



Page 18 of 102

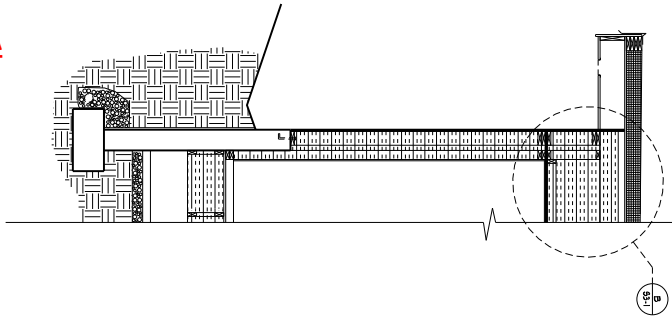
# Exhibit A



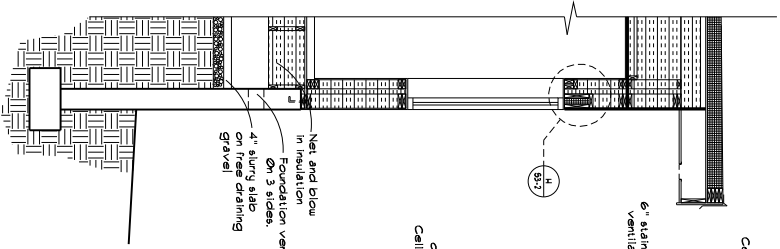
	No. 13,000 1/2" x 1/2" x 1/2" (100) 100-100-1000 100-100-1000 100-100-1000 100-100-1000		Date: 5/2/16 Revisions:	<p><b>A New Residence for</b>  <b>Paul and Linda LaStayo</b>                  4015 Bluebell Drive                  Liberty, Utah</p> <p>Project No.:                  1501                  Sheet:  <b>A5 1</b></p> <p>Wall Sections                  Scale:                  D: 1/2" = 1'-0"                  B: 1/4" = 1'-0"</p>
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# Exhibit A

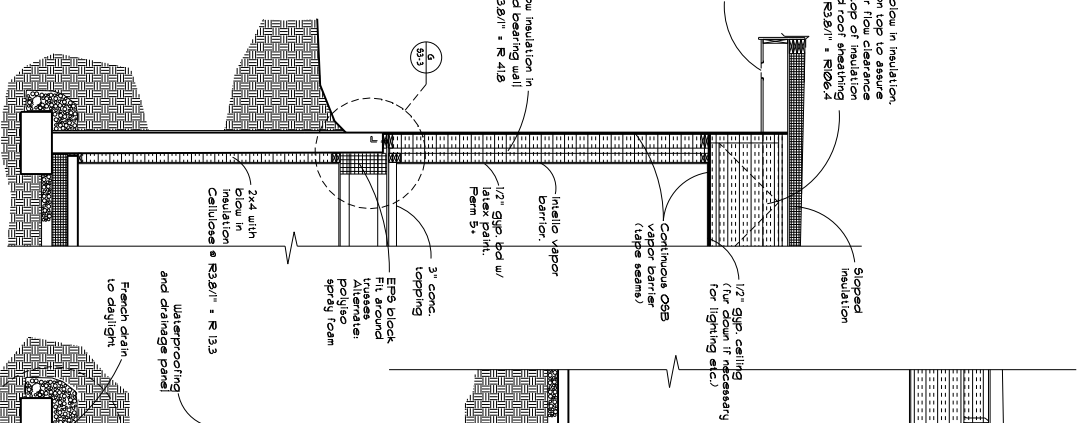
**D** Wall Section  
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 B: 1/4" = 1'-0"



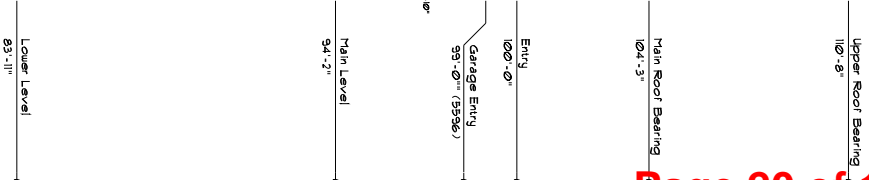
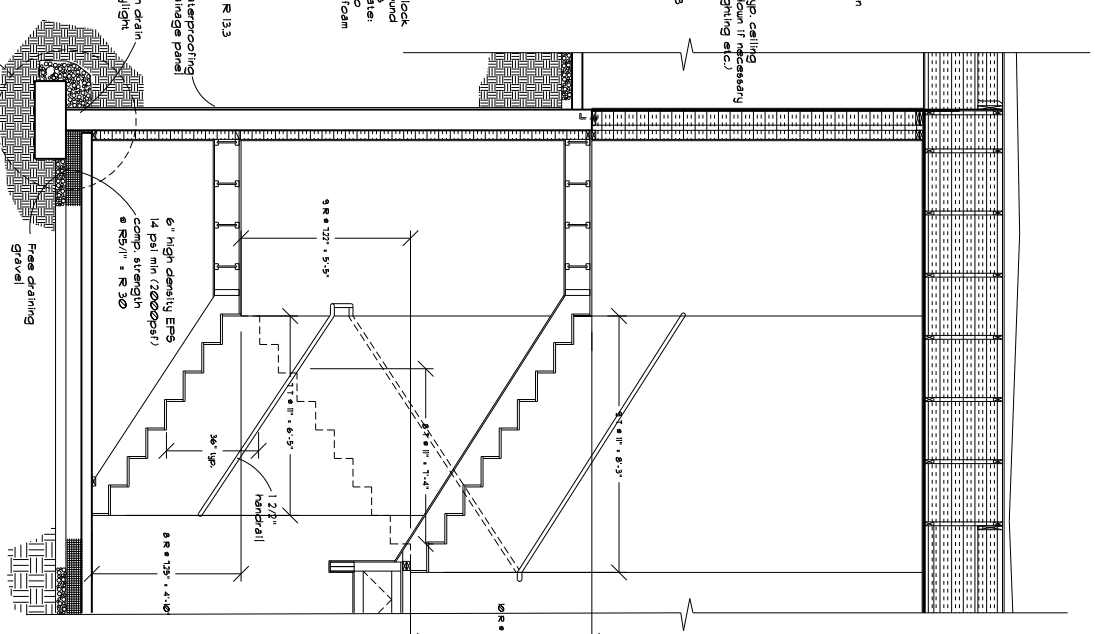
**E** Wall Section  
 E: 1/2" = 1'-0"  
 B: 1/4" = 1'-0"



**F** Wall Section  
 F: 1/2" = 1'-0"  
 B: 1/4" = 1'-0"



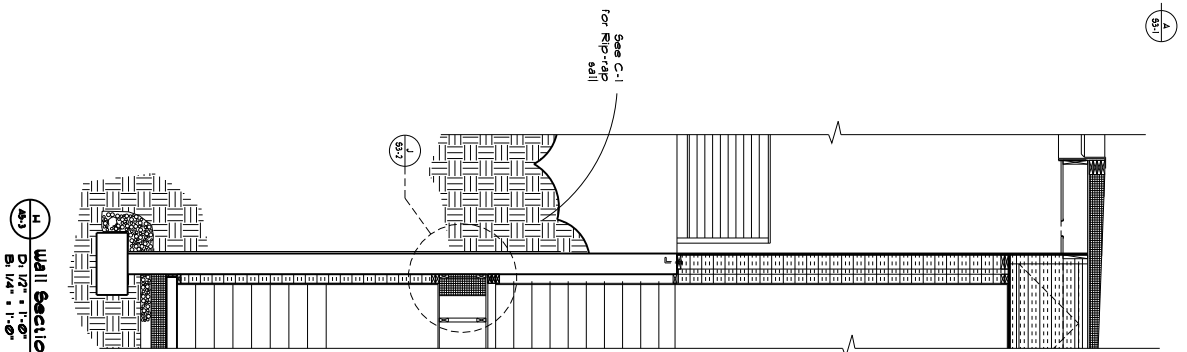
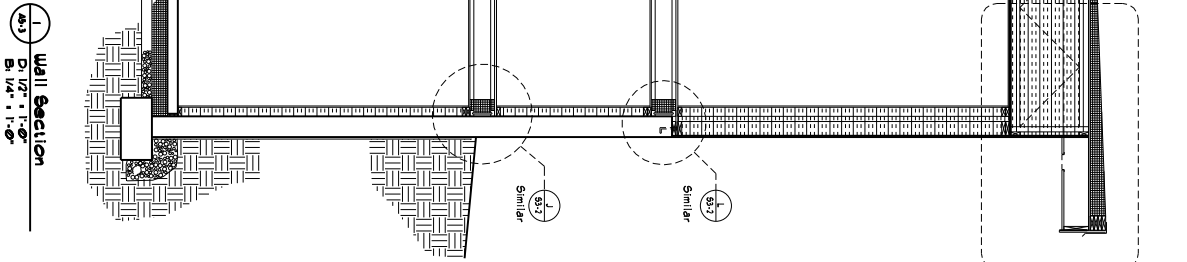
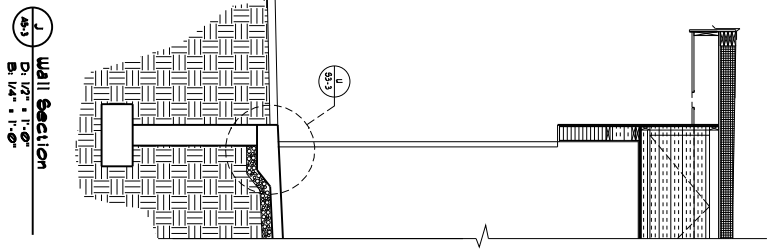
**D** Wall Section  
 D: 1/2" = 1'-0"  
 B: 1/4" = 1'-0"



**A New Residence for**  
**Paul and Linda LaStayo**  
 4015 Bluebell Drive  
 Liberty, Utah

**AS 2**  
 Project No.: 1501  
 Drawn: [Signature]

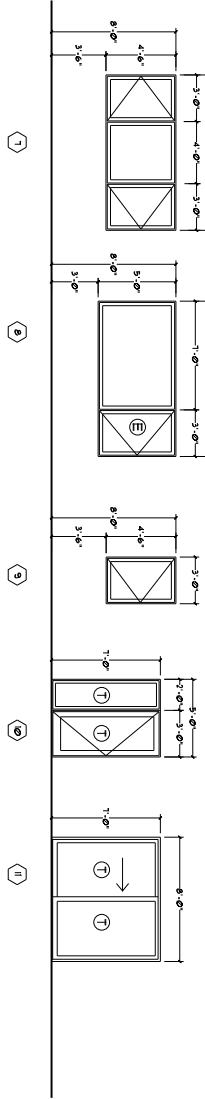
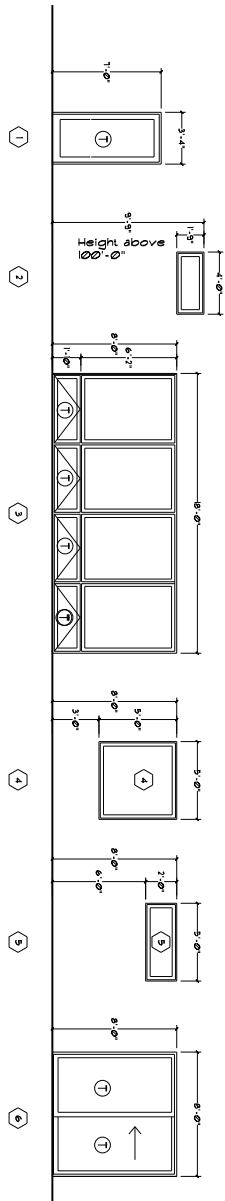
Date: 5/2/16  
 Revisions:  
 Scale:  
 Wall Sections  
 D: 1/2" = 1'-0"  
 B: 1/4" = 1'-0"



- Upper Roof Bearing 110'-0"
- Main Roof Bearing 104'-3"
- Entry 100'-0"
- Garage Entry 93'-0" (1536)
- Main Level 94'-2"
- Lower Level 83'-11"

<p><b>AS 3</b></p> <p>Wall Sections</p> <p>Scale:</p> <p>D: 1/2" = 1'-0"</p> <p>E: 1/4" = 1'-0"</p>	<p>Project No:</p> <p>1501</p> <p>Sheet:</p> <p>AS 3</p>	<p><b>A New Residence for</b></p> <p><b>Paul and Linda LaStayo</b></p> <p>4015 Bluebell Drive Liberty, Utah</p>	<p>Date: 5/2/16</p> <p>Revisions:</p>		
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**Window Schedule**



- NOTES:**
- Base bid: Marvin Contemporary/ Square Sticking
  - Door type 3 is Ultimate Multi-slide
  - Operable units are Tile and Turn
  - ① Tempered glass
  - ② Egress window

**DOOR SCHEDULE**

NO.	DOOR NUMBER	WIDTH	HEIGHT	DOOR SIZE	MAT.	TYPE	FINISH	MAT.	WALL TYPE	ROUND BRICKWORK	REMARKS
001	UD	3'-0"	8'-0"	UD	F	OV	FRFR	D5			
002	UD	6'-0"	8'-0"	UD	F	FRFR	FRFR	D5			
003	UD	6'-0"	8'-0"	UD	F	FRFR	FRFR	D5			
004	UD	3'-0"	6'-10"	UD	F	UDU	FRFR	D5			
005	UD	3'-0"	6'-10"	UD	F	UDU	FRFR	D5			
006	UD	7'-4"	7'-0"	UD	F	UDU	FRFR	D5			10' MIN. DOOR PER IBC 309.3
007	UD	7'-4"	7'-0"	UD	F	UDU	FRFR	D5			
008	UD	3'-4"	7'-0"	UD	F	UDU	FRFR	D5			
009	UD	3'-0"	8'-0"	UD	F	UDU	FRFR	D5			
010	UD	3'-0"	8'-0"	UD	F	UDU	FRFR	D5			
011	UD	3'-0"	8'-0"	UD	F	UDU	FRFR	D5			
012	UD	3'-0"	8'-0"	UD	F	UDU	FRFR	D5			
013	UD	3'-0"	8'-0"	UD	F	UDU	FRFR	D5			
014	UD	3'-0"	8'-0"	UD	F	UDU	FRFR	D5			
015	UD	3'-0"	8'-0"	UD	F	UDU	FRFR	D5			
016	UD	3'-0"	8'-0"	UD	F	UDU	FRFR	D5			
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018	UD	3'-0"	8'-0"	UD	F	UDU	FRFR	D5			
019	UD	3'-0"	8'-0"	UD	F	UDU	FRFR	D5			
020	UD	3'-0"	8'-0"	UD	F	UDU	FRFR	D5			
021	UD	3'-0"	8'-0"	UD	F	UDU	FRFR	D5			
022	UD	3'-0"	8'-0"	UD	F	UDU	FRFR	D5			
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036	UD	3'-0"	8'-0"	UD	F	UDU	FRFR	D5			
037	UD	3'-0"	8'-0"	UD	F	UDU	FRFR	D5			
038	UD	3'-0"	8'-0"	UD	F	UDU	FRFR	D5			
039	UD	3'-0"	8'-0"	UD	F	UDU	FRFR	D5			
040	UD	3'-0"	8'-0"	UD	F	UDU	FRFR	D5			
041	UD	3'-0"	8'-0"	UD	F	UDU	FRFR	D5			
042	UD	3'-0"	8'-0"	UD	F	UDU	FRFR	D5			
043	UD	3'-0"	8'-0"	UD	F	UDU	FRFR	D5			
044	UD	3'-0"	8'-0"	UD	F	UDU	FRFR	D5			
045	UD	3'-0"	8'-0"	UD	F	UDU	FRFR	D5			
046	UD	3'-0"	8'-0"	UD	F	UDU	FRFR	D5			
047	UD	3'-0"	8'-0"	UD	F	UDU	FRFR	D5			
048	UD	3'-0"	8'-0"	UD	F	UDU	FRFR	D5			
049	UD	3'-0"	8'-0"	UD	F	UDU	FRFR	D5			
050	UD	3'-0"	8'-0"	UD	F	UDU	FRFR	D5			

**LEGEND:**

- |      |                         |      |      |    |
|------|-------------------------|------|------|----|
| UD   | Wood                    | FRFR | FRFR | D5 |
| FRFR | Painted                 | UDU  | FRFR | D5 |
| F    | Flush (Hinged)          | UDU  | FRFR | D5 |
| FO   | Pocket Door (Flush)     | UDU  | FRFR | D5 |
| UDW  | See Window Schedule     | UDU  | FRFR | D5 |
| OV   | Sectional overhead door | UDU  | FRFR | D5 |
| D5   | Exterior wall           | UDU  | FRFR | D5 |
| FRFR | Manufacturer standard   | UDU  | FRFR | D5 |

**Hardware:**

- 1 Entry Door
- 2 Private
- 3 Egress
- 4 Egress
- 5 Egress
- 6 Egress
- 7 Egress
- 8 Egress

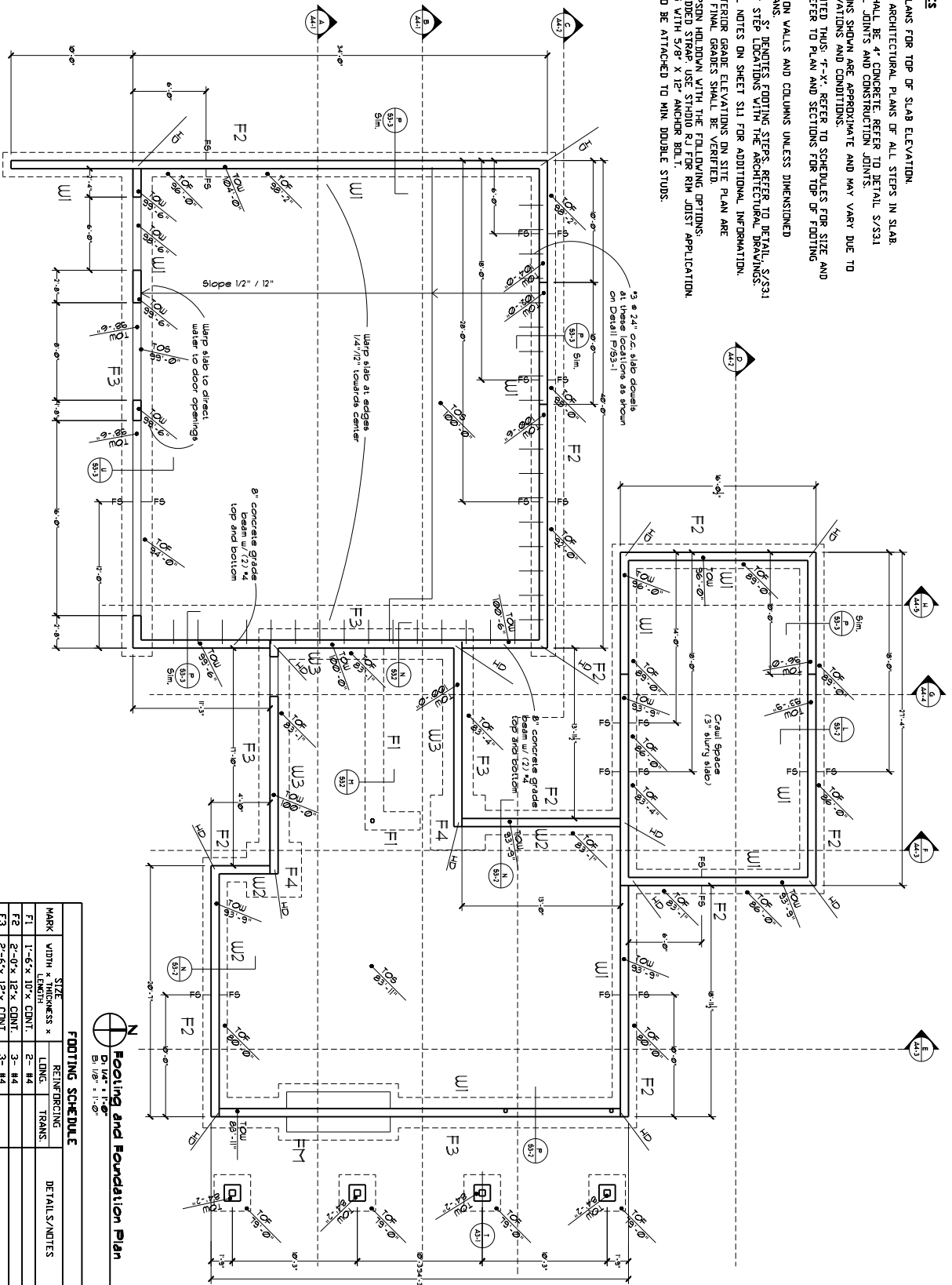
**NOTES:**

1. Window door dimensions are for the entire unit. These window dimensions include the door dimensions with the rough opening assumed as 2" additional in each direction. Garage doors have the clear opening dimensioned.

	<p><b>A New Residence for</b>  <b>Paul and Linda LaStayo</b>          4015 Bluebell Drive          Liberty, Utah</p>	<p>Project No.:          1501</p>	<p>Scale:          NTS</p>
<p>Project No.:          1501</p>	<p>Scale:          NTS</p>	<p>Project No.:          1501</p>	<p>Scale:          NTS</p>



- FOUNDATION PLAN NOTES**
- REFER TO ARCH. PLANS FOR TOP OF SLAB ELEVATION.
  - VERIFY WITH THE ARCHITECTURAL PLANS OF ALL STEPS IN SLAB FOR SLAB ON GRADE SHALL BE 4" CONCRETE. REFER TO DETAIL S/S31 FOR SLAB CONTROL JOINTS AND CONSTRUCTION JOINTS.
  - FOOTING ELEVATIONS SHOWN ARE APPROXIMATE AND MAY VARY DUE TO ACTUAL SITE ELEVATIONS AND CONDITIONS.
  - FOOTING TYPES NOTED THIS "F-X" REFER TO SCHEDULES FOR SITE AND REINFORCEMENT. REFER TO PLAN AND SECTIONS FOR TOP OF FOOTING ELEVATION.
  - CENTER FOOTINGS ON WALLS AND COLUMNS UNLESS DIMENSIONED OTHERWISE ON PLANS.
  - "S" DENOTES FOOTING STEPS. REFER TO DETAIL S/S31 FOR COORDINATE EXACT STEP LOCATIONS WITH THE ARCHITECTURAL DRAWINGS.
  - REFER TO GENERAL NOTES ON SHEET S11 FOR ADDITIONAL INFORMATION.
  - CONTIGUOUS AND EXTERIOR GRADE ELEVATIONS ON SITE PLAN ARE APPROXIMATE. ALL FINAL GRADES SHALL BE VERIFIED.
  - "HP" DENOTES SWIRLED HOLLOW WITH THE FOLLOWING OPTIONS:
    2. HOUR-SIZES WITH 5/8" X 12" ANCHOR BOLT.
    - ALL HOLLOW STUDS TO BE ATTACHED TO MIN. DOUBLE STUDS.



**Footing and Foundation Plan**

FOOTING SCHEDULE			
MARK	SIZE	REINFORCING	DETAILS/NOTES
	WIDTH x THICKNESS x LENGTH	LONG. TRANS.	
F1	1'-6" x 10" x CONT.	3- #4	
F2	2'-0" x 12" x CONT.	3- #4	
F3	2'-6" x 12" x CONT.	3- #4	
F4	4'-6" x 12" x 4'-0"	3- #4	

**A New Residence for**  
**Paul and Linda LaStayo**  
 4015 Bluebell Drive  
 Liberty, Utah

Project No.:  
 1501  
 Scale:  
 D: 1/4" = 1'-0"  
 E: 1/8" = 1'-0"

Scale:  
 Footing and Foundation Plan  
 D: 1/4" = 1'-0"  
 E: 1/8" = 1'-0"

David L. Smith  
 Professional Engineer  
 License No. 1501  
 State of Utah

Date: 5/2/16  
 Rev/Iss/Cons:

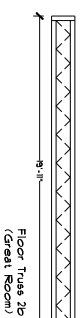
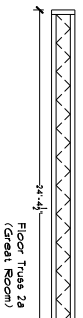
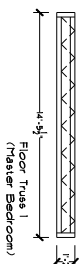
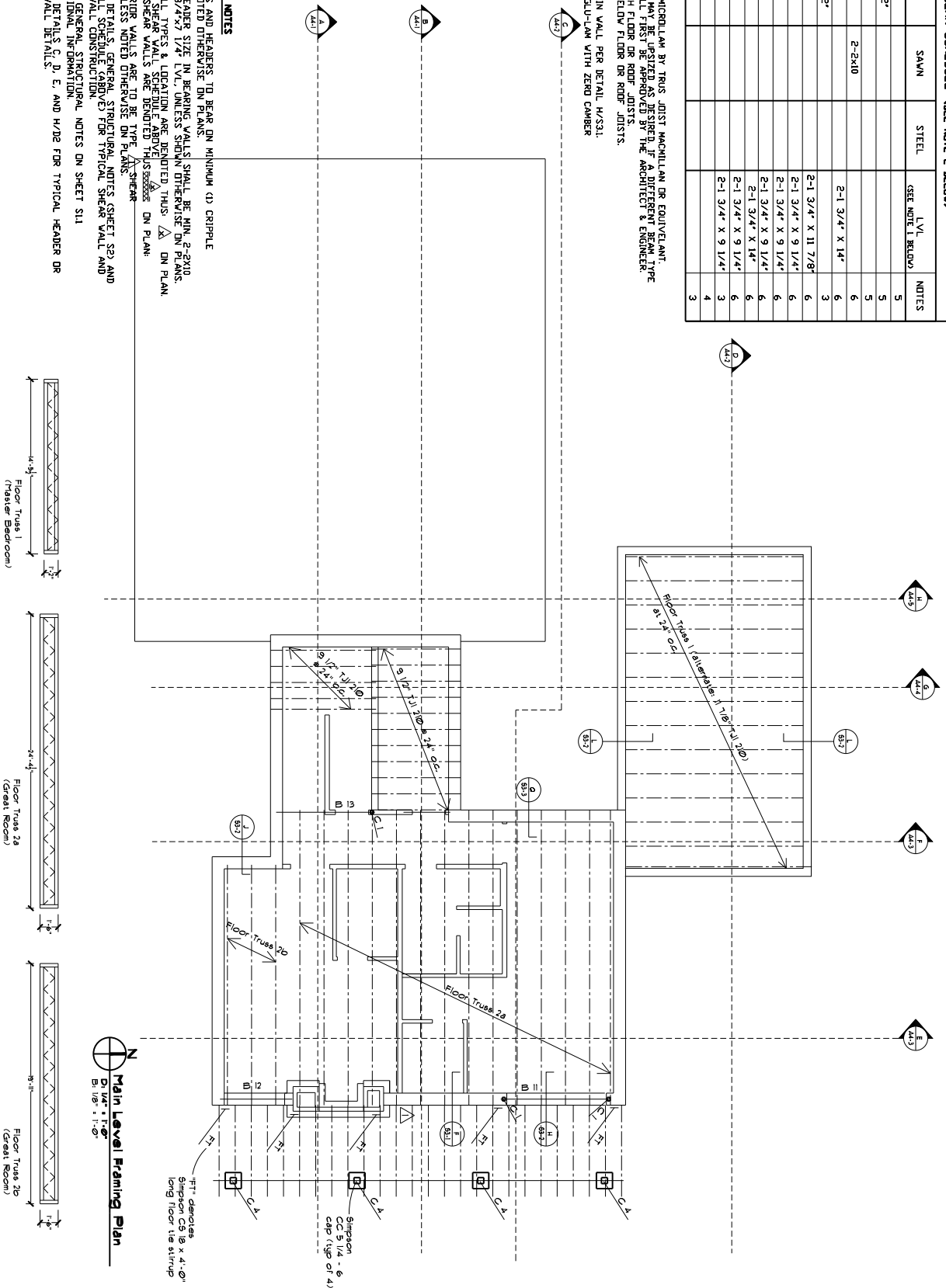


BEAM SCHEDULE (SEE NOTE 2 BELOW)					
MARK	GLU LAM	SAVN	STEEL	LVL (SEE NOTE 1 BELOW)	NOTES
B1	5 1/2" X 18"				5
B2	5 1/2" X 10 1/2"				5
B3	5 1/2" X 9"				5
B4		2-2x10			6
B5				2-1 3/4" X 14"	6
B6	5 1/2" X 16 1/2"			2-1 3/4" X 11 7/8"	6
B7				2-1 3/4" X 9 1/4"	6
B8				2-1 3/4" X 9 1/4"	6
B9				2-1 3/4" X 9 1/4"	6
B10				2-1 3/4" X 14"	6
B11				2-1 3/4" X 14"	6
B12				2-1 3/4" X 9 1/4"	6
B13	5 1/2" X 9"			2-1 3/4" X 9 1/4"	3
B14	5 1/2" X 18"				4
B15	5 1/2" X 18"				3

- BEAM SCHEDULE NOTES:  
 1. LVL DIMENSIONS TYPE NICKELLAM BY TRUS JOIST MANUFACTURER OR EQUIVALENT.  
 2. BEAM SIZES SHOWN MAY BE UP-SIZED AS DESIRED IF A DIFFERENT BEAM TYPE IS DESIRED. IT SHALL FIRST BE APPROVED BY THE ARCHITECT & ENGINEER.  
 3. BEAM IS FLUSH WITH FLOOR OR ROOF JOISTS.  
 4. BEAM IS EXPOSED BELOW FLOOR OR ROOF JOISTS.  
 5. INSULATED HEADER IN WALL PER DETAIL H/331.  
 6. USE GRADE 24FV8 GLU-LAM WITH ZERO CAMBER.

**FRAMING PLAN NOTES**

1. ALL BEAMS AND HEADERS TO BEAR ON MINIMUM (1) CRIPPLE UNLESS NOTED OTHERWISE ON PLANS.
2. MINIMUM HEADER SIZE IN BEARING WALLS SHALL BE MIN. 2-2X10.
3. SHEAR WALL TYPES A, L, AND TONES ARE DENOTED THUS:  $\Delta$  ON PLAN. INTERIOR SHEAR WALLS ARE DENOTED THUS:  $\Delta$  ON PLAN.
4. ALL EXTERIOR WALLS ARE TO BE TYPE A SHEAR.
5. REFER TO DETAILS, GENERAL STRUCTURAL NOTES (SHEET SP) AND BEARING WALL CONSTRUCTION FOR TYPICAL SHEAR WALL AND BEARING WALL CONSTRUCTION.
6. REFER TO GENERAL STRUCTURAL NOTES ON SHEET S11 FOR ADDITIONAL INFORMATION.
7. REFER TO DETAILS C, D, E, AND H/20 FOR TYPICAL HEADER OR BEAM IN WALL DETAILS.

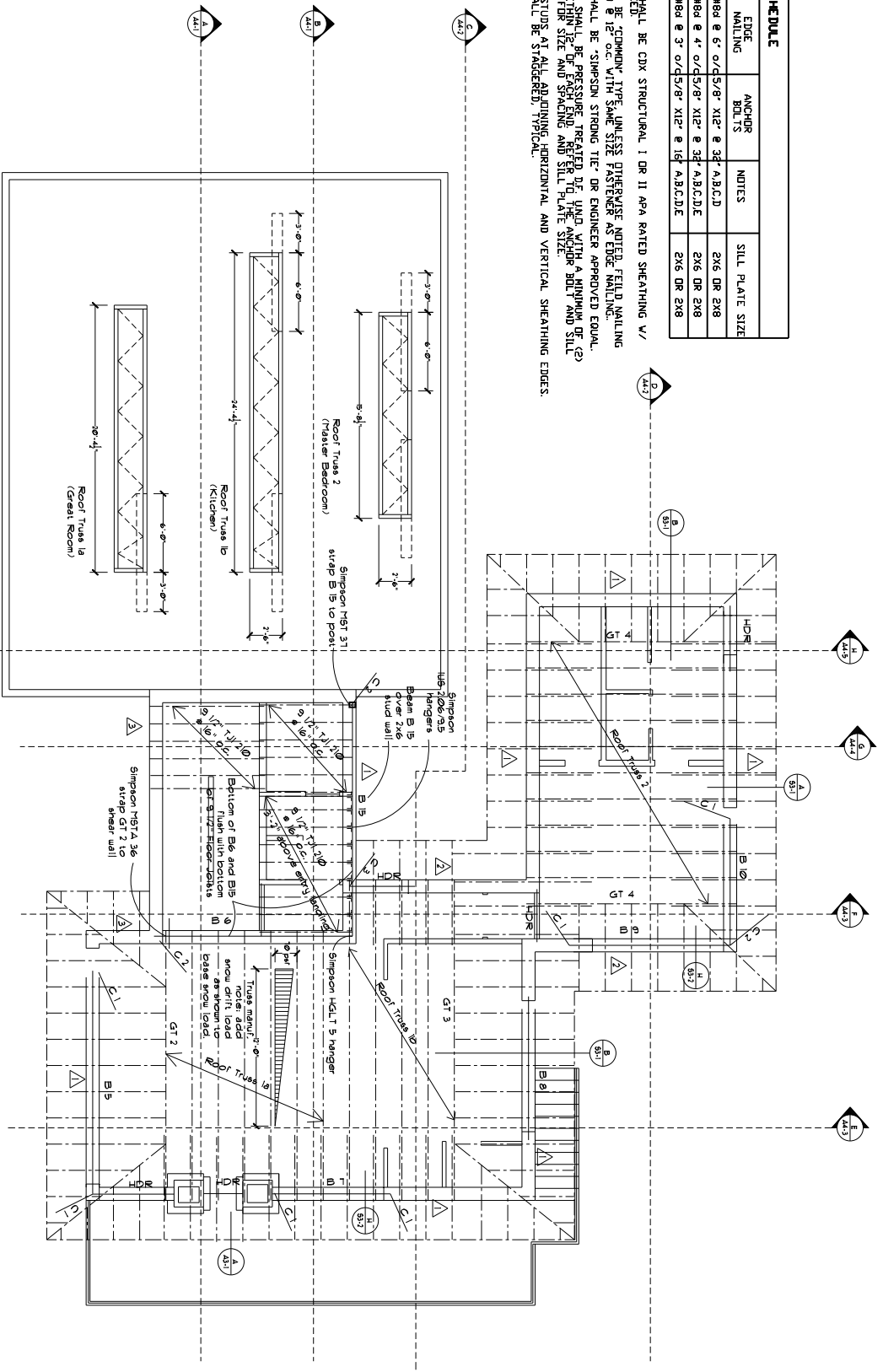


**Main Level Framing Plan**  
 Scale: 1/8" = 1'-0"

	<p><b>A New Residence for</b>  <b>Paul and Linda LaStayo</b>          4015 Bluebell Drive          Liberty, Utah</p>	<p>Date: 5/2/16          Rev./Revisions:</p>	<p>341 S. 1000 E., Suite 100          Salt Lake City, Utah 84143          (801) 462-7828          Fax: (801) 462-7899          www.la-stayo.com          Copyright © 2016          All Rights Reserved</p>
<p>Project No.:          1501</p>	<p>Scale:          D: 1/4" = 1'-0"          E: 1/8" = 1'-0"</p>	<p>Project Name:          1501</p>	<p>Scale:          D: 1/4" = 1'-0"          E: 1/8" = 1'-0"</p>

SHEAR WALL SCHEDULE					
TYPE	SHEATHING MATERIAL	EDGE NAILING	ANCHOR BOLTS	NOTES	SILL PLATE SIZE
Δ	7/16" APA	#8d @ 6" o/c	5/8" x12" @ 3d	A,B,C,D	2x6 DR 2x8
Δ	7/16" APA	#8d @ 4" o/c	5/8" x12" @ 3d	A,B,C,D,E	2x6 DR 2x8
Δ	7/16" APA	#8d @ 3" o/c	5/8" x12" @ 1d	A,B,C,D,E	2x6 DR 2x8

- NOTES
- ALL SHEATHING SHALL BE CDX STRUCTURAL I OR II APA RATED SHEATHING W/ ALL EDGES BLOCKED.
  - ALL NAILS SHALL BE "COMMON" TYPE UNLESS OTHERWISE NOTED. FIELD NAILING SHALL BE SPACED @ 12" O.C. WITH SAME SIZE PASTEREN AS EDGE NAILING.
  - ALL HARDWARE SHALL BE SIMPSON STRONG TIE OR ENGINEER APPROVED EQUAL.
  - ALL SILL PLATES SHALL BE PRESSURE TREATED DF UNDO WITH A MINIMUM OF (2) PLAYS SCHEDULE FOR SIZE AND SPACING AND SILL PLATE SIZE SHALL BE AS SCHEDULED.
  - USE MINIMUM 3x STUDS AT ALL ADJOINING HORIZONTAL AND VERTICAL SHEATHING EDGES. EDGE NAILING SHALL BE STAGGERED, TYPICAL.

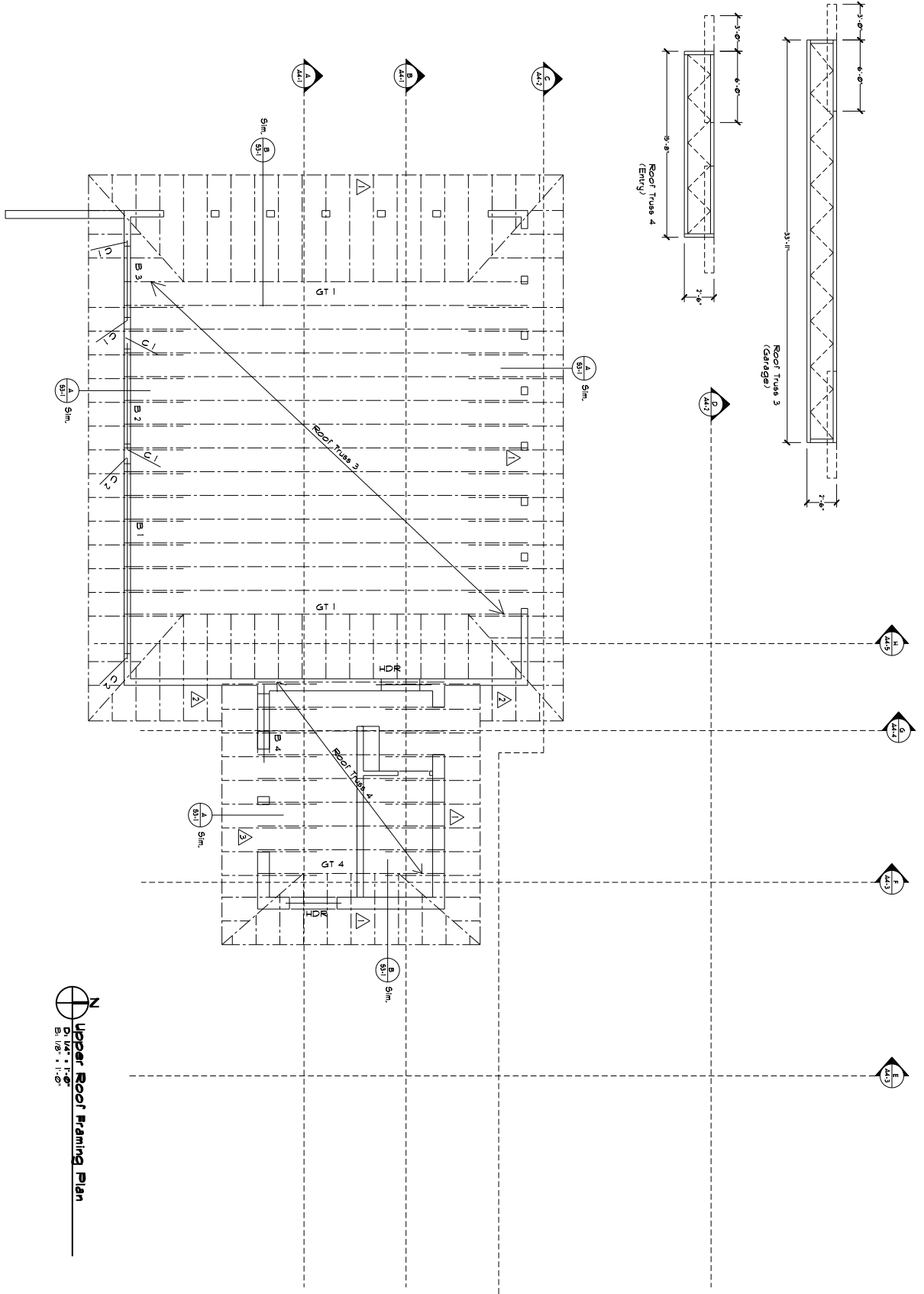


COLUMN SCHEDULE		
MARK	SIZE	NOTES
C1	2-2x6, 2-2x4	MATCH STUD WALL SIZE
C2	3-2x6, 3-2x4	MATCH STUD WALL SIZE
C3	4-2x6, 4-2x4	MATCH STUD WALL SIZE
C4	6x6	

NOTES  
 K.P. DENOTES KING POST.  
 P.A. DENOTES POST ABOVE.

**Entry Level and Main Roof Framing Plan**  
 Date: 5/7/16  
 Drawn: [Signature]

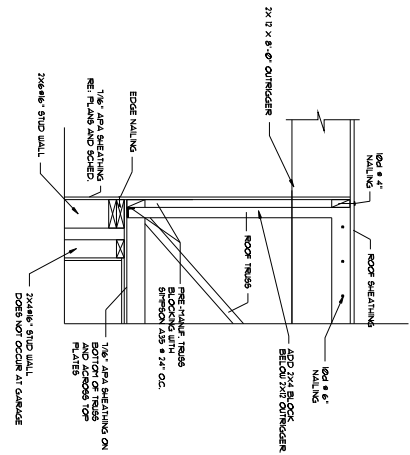
	Project No.: 1501 Project Name: A New Residence for <b>Paul and Linda LaStayo</b> 4015 Bluebell Drive Liberty, Utah	Date: 5/7/16 Revisions:	Scale: Entry and Main Floor: 1/4" = 1'-0" Roof Plan: 1/8" = 1'-0"
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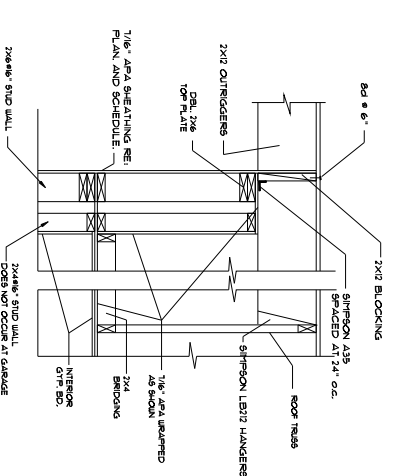
**Upper Roof Framing Plan**  
 Scale: 1/8" = 1'-0"  
 Date: 5/7/16

<p>C &amp; S Engineering, Inc.          1001 S. 1000 E., Suite 100          Salt Lake City, Utah 84143          (801) 467-1234          www.candse.com</p>	<p>Date: 5/7/16          Revisions:</p>	<p><b>A New Residence for</b>  <b>Paul and Linda LaStayo</b>          4015 Bluebell Drive          Liberty, Utah</p>	<p>Project No.:          IS01          Sheet:  <b>S2 4</b>          Upper Roof Framing Plan          Scale:          D: 1/4" = 1'-0"          E: 1/8" = 1'-0"</p>
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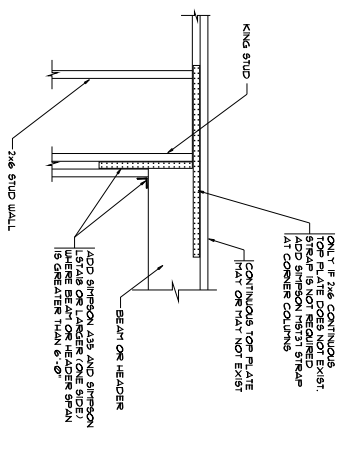
# Exhibit A



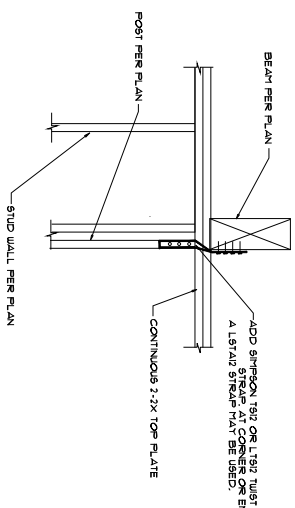
**A** TYP. ROOF TRUSS BEARING DETAIL  
531 NO SCALE



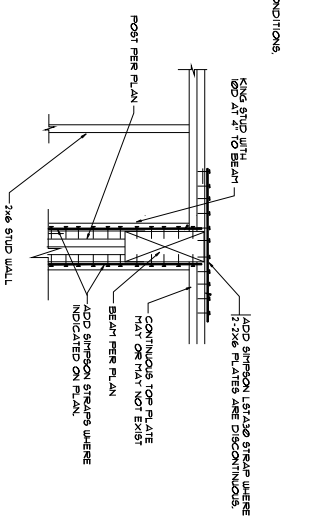
**B** TYP. GABLE WALL DETAIL  
531 NO SCALE



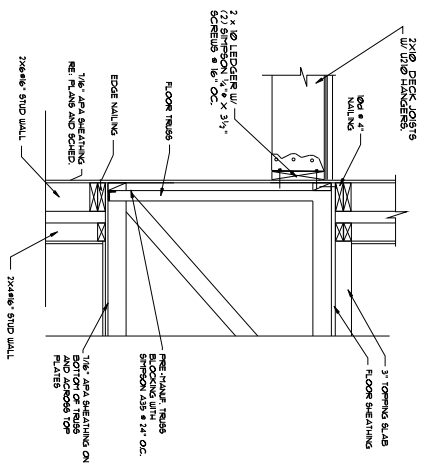
**C** TYP. BEAM OR HEADER IN WALL DETAIL  
531 NO SCALE



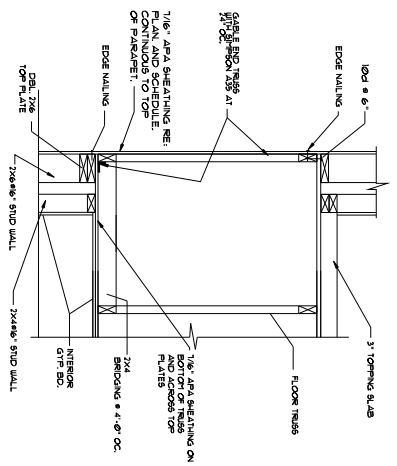
**D** TYP. BEAM TO WALL DETAIL  
531 NO SCALE



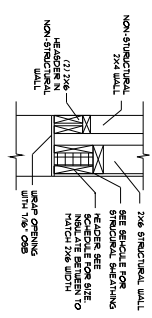
**E** TYP. BEAM TO WALL DETAIL  
531 NO SCALE



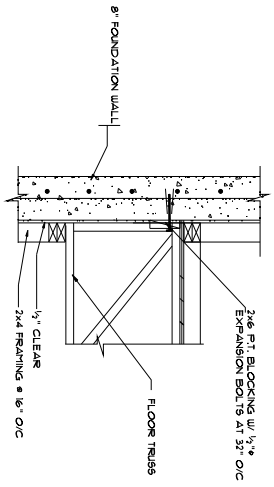
**F** TYP. FLOOR TRUSS BEARING DETAIL  
531 NO SCALE



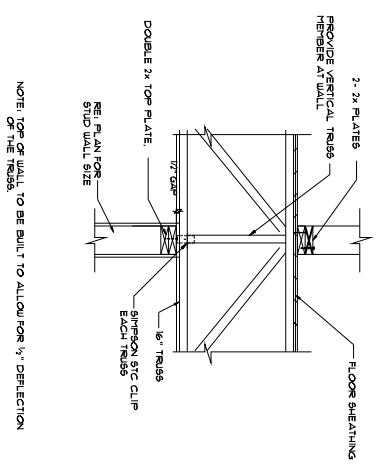
G TYP. GABLE WALL DETAIL  
532 NO SCALE



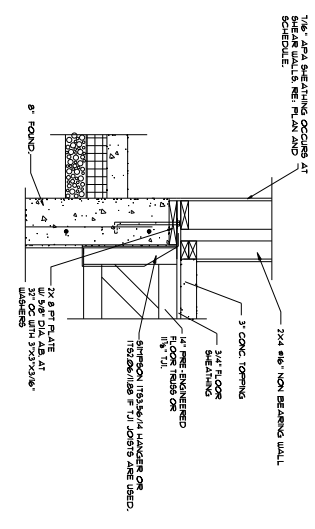
H TYP. INSULATED HEADER  
532 NO SCALE



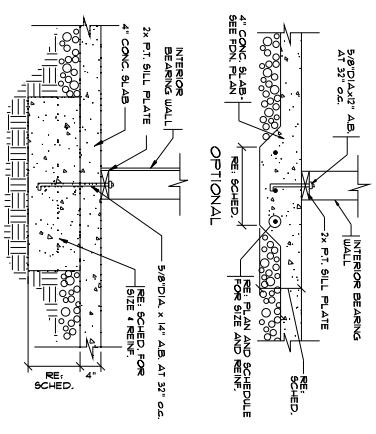
J FLOOR TRUSS BEARING DETAIL  
532 NO SCALE



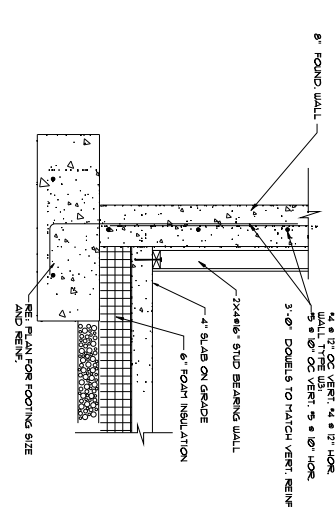
K TYP. INTERIOR NON BEARING WALL DETAIL  
532 NO SCALE



L TOP OF FOUNDATION WALL DETAIL  
532 NO SCALE



M TYP. INTERIOR FOOTING DETAIL  
532 NO SCALE



N TYP. FOUND WALL TYPES W2 AND W3  
532 NO SCALE

**Exhibit A**



**PLUMBING GENERAL NOTES**

1. CODES  
 CONFORM WITH THE CURRENT PLUMBING CODE AND ALL LOCAL CODES AND REGULATIONS FOR PLUMBING ON THIS PROJECT.  
 ALL WORK AND MATERIALS SHALL CONFORM TO ALL APPLICABLE LOCAL AND STATE CODES, LAWS, AND REGULATIONS, AND ALL UTILITY COMPANY REGULATIONS.
2. SOIL AND WASTE PIPING:  
 A. VERTICAL DRAIN LINES, INCLUDING ROOF DRAINS, TO BE SERVICE WEIGHT NO-HUB CAST IRON SOIL PIPE WITH STEEL COUPLERS AND NEOPRENE GASKETS  
 B. VERTICAL WASTE PIPING TO CONFLUENT WITH APPLICABLE CODES.
4. DOMESTIC WATER PIPING:  
 WIRBRO AQUAFLEX OR EQUAL
5. WATER CLOSETS SHALL USE 1/4 GAL. OR LESS PER FLUSH. SHOWER HEADS SHALL HAVE A FLOW OF 2.5 GPM OR LESS.
6. TRAPS: PROVIDE TRAPS ON ALL FIXTURES EXCEPT FIXTURES WITH INTEGRAL TRAPS. EXPOSED TRAPS TO GAUGE CHROMIUM PLATED BRASS TUBING.
7. CAULK AROUND ALL PLUMBING FIXTURES AT FLOORS AND WALLS WITH WHITE FLEXIBLE CAULKING COMPOUND.
8. TEST ALL PLUMBING PER PLUMBING CODE, AND ACCORDING TO LOCAL AUTHORITIES.
9. UPON COMPLETION OF ALL TESTS AND REPAIRS, ALL DOMESTIC WATER PIPING SHALL BE DISINFECTED IN ACCORDANCE WITH THE REQUIREMENTS OF THE UTAH STATE BOARD OF HEALTH.
10. INSTALL A PLUMBING VENT PIPE OPEN AIR ABOVE THE ROOF. NO PLUMBING VENT SHALL TERMINATE LESS THAN 10" HORIZONTALLY OR 3" ABOVE ANY GRAVITY OR FLOW AIR INLET. CONSOLIDATE VENTS WHERE POSSIBLE TO MINIMIZE ROOF PENETRATIONS.
11. NOT USED
12. BATHROOM VENTILATION  
 IS SHOWN ON MECHANICAL PLANS
13. SEE CASEWORK EVALUATIONS FOR LOCATION OF FIXTURES IN CASEWORK
14. PROVIDE A RECIRCULATING SYSTEM FOR DOMESTIC HOT WATER
15. FURNISH WRITTEN GUARANTEE TO OWNER FOR PERIOD OF ONE YEAR COVERING ALL DEFECTS IN MATERIAL AND WORKMANSHIP PROVIDING LABOR AND MATERIALS.

**PLUMBING FIXTURE SCHEDULE**

NO.	FIXTURE	MANUF. # CATALOG NO.	COLOR	ACCESSORY	MANUF. # CATALOG NO.	FINISH	REMARKS
1	TOILET	-	-	Seat	-	White	
2	WAD-1	-	-	Faucet	-		
3	WAD-2	-	-	Faucet	-		
5	Shower Faucet	-	-	Faucet	-		
6	Kitchen Sink	-	-	Faucet	-		
7	Dishwasher	-	-	-	-		
8	Water Heater	-	-	-	-		
9	Water Purifier	-	-	-	-		
10	Bathtub	-	-	Faucet	-		
11	Bathtub	-	-	Faucet	-		
13	Water Heater	-	-	-	-		Provide Static Strapping per ISC

**NOTES:**

1. Verify that all showers are finished to a height of 1'0" above the drain inlet with a non-absorbent material.
2. Tank type toilets shall have a flow rate of 16 gpm or less.
3. All shower heads shall have a flow rate of 2.5 gpm or less.
4. All shower and bath faucets shall have anti-scaled devices.

**APPLIANCE SCHEDULE**

NO.	APPLIANCE	MANUF. # CATALOG NO.
1	Refrigerator	-
2	Stove/Range	-
3	Exhaust Hood	Recirculating
4	Washing Machine	-
5	Dishwasher	-
6	Water Heater	-
7	Water	-

**NOTES:**

BY OWNER (SEE ALLOWANCE)



**Corporation**  
PLUMBING

3611 South 1900 West  
Salt Lake City, Utah 84119  
(801) 487-1234

Contracted under license  
No. 123456789

**A New Residence for**  
**Paul and Linda LaStayo**  
 4015 Bluebell Drive  
 Liberty, Utah

Project No.:  
 1501  
 Sheet:  
**MP 0**

Mechanical and  
 Plumbing  
 Notes  
 Scale:  
 NTS

Date: 5/7/16

Revisions:

**Plan Notes:** #

- 1 Direct Vent Natural Gas Fireplace Provide fans and thermostat operation
- 2 Zander 350 HVEY w/ pre-heat
- 3 Provide tee in potable water line for landscape irrigation prior to water softener. Install 1" stop valve inside Mechanical area.
- 4 Install 1" double check valve backflow preventer .
- 5 All hose bibs are to have backflow preventers.
- 6 Mitsubishi wall unit
- 7 Mitsubishi 42000 BTU 18 seer quad zone 9.9.9.15
- 8 Natural Gas Heater
- 9 Supply At owner's option a gas line for a Natural Gas heater at the ceiling
- 10 Install a Nexenz 120 V heating cable with a programmable thermostat under the floor finish in the entry and landing.

**Legend**

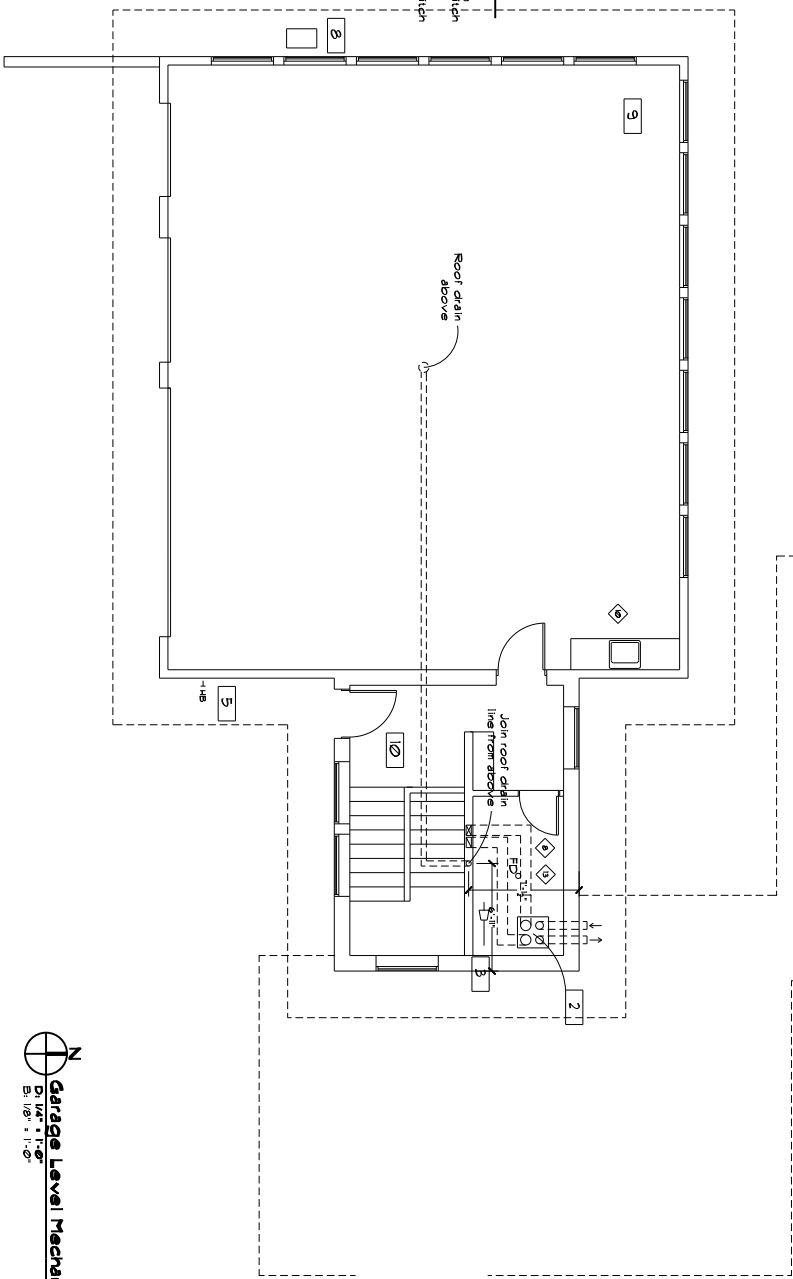
- ▬ Vertical duct: return
- ▬ Vertical duct: supply
- ←-C- Supply register
- >-C- Return register
- ◆ Plumbing fixture. See schedule on MP-0
- ⊕ Appliance . See schedule on MP-0
- +H Hose Bib
- FD Floor drain
- RD Roof drain lines

**HVEY Air Flow Rates:**

- |   |   |
|---|---|
| 1 Exhaust 12 cfm with 0.3364 booster switch | 6 Exhaust 24 cfm with 0.3364 booster switch |
| 2 Exhaust 24 cfm with 0.3364 booster switch | 7 Exhaust 12 cfm with 0.3364 booster switch |
| 3 Exhaust 12 cfm with 0.3364 booster switch | 8 Supply 18 cfm                             |
| 4 Supply 36 cfm                             | 11 Supply 18 cfm                            |
| 5 Supply 12 cfm                             |   |

**General Notes:**

1. See additional notes on MP-0
2. See casework elevations and enlarged plans for location of fixtures in casework.
3. Provide a recirculating system for domestic hot water.
4. Toilet locations are dimensioned to the centerline of the toilet and the face of the stud bearing. Floor drains are dimensioned to the centerline. Dimensions are from the face of the foundation wall or face of the stud.
5. Insulate vertical roof drain lines for sound
6. Group all plumbing vents together as much as possible
7. All HVEY ducting is to be sealed and tested for leaks. Use rigid ducting for straight runs.



**Exhibit A**

**Garage Level Mechanical and Plumbing Plan**  
 Scale: 1/8" = 1'-0"

	<p><b>A New Residence for</b>  <b>Paul and Linda LaStayo</b>                  4015 Bluebell Drive                  Liberty, Utah</p>	<p>Date: 5/2/16                  Revisions:</p>	<p>Project No.:                  15071                  Drawn:  <b>MP 1</b></p>
<p>Garage Level Mechanical / Plumbing Plan                  Scale: D: 1/4" = 1'-0"                  E: 1/8" = 1'-0"</p>			



**Plan Notes:** #

- 1 Direct Vent Natural Gas Fireplace Provide fans and thermostat operation
- 2 Zenside 350 HEV w/ pre-heat Provide use in possible water line for landscape irrigation prior to water softener. Install 1" stop valve inside Mechanical area.
- 4 Install 1" double check valve backflow preventer.
- 5 All hose bibs are to have backflow preventers.
- 6 Mitsubishi wall unit.
- 7 Mitsubishi 42000 BTU 18 seer
- 8 Mitsubishi 42000 BTU 18 seer
- 9 Supply at owner's option a gas line for a Natural Gas heater at the ceiling
- 10 Install a Nexenz 120 V heating cable with a programmable thermostat under the floor finish in the entry and landing.

**Legend**

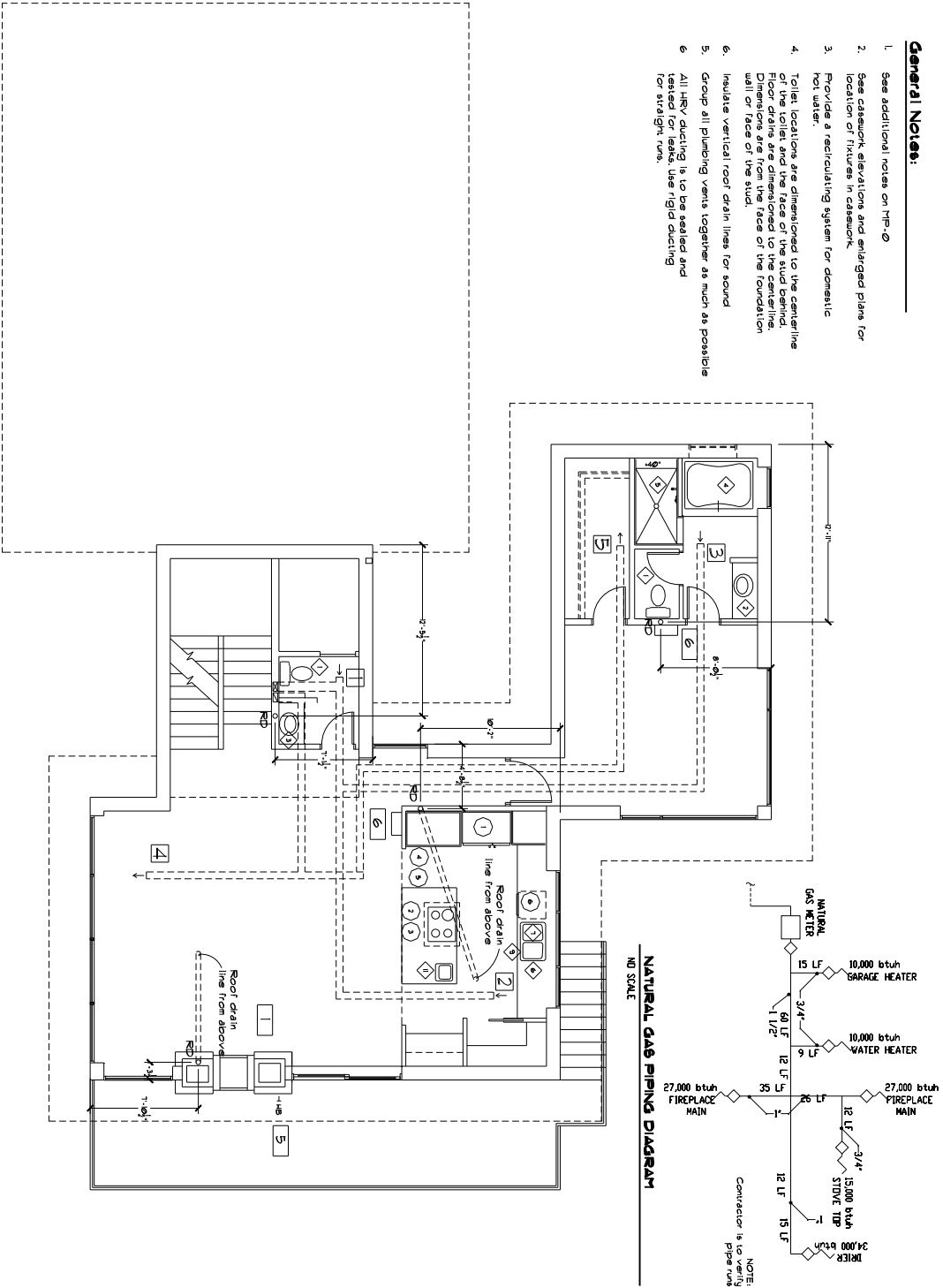
- ⊞ Vertical duct: return
- ⊞ Vertical duct: supply
- ←C→ Supply register
- C← Return register
- ⊞ Plumbing fixture. See schedule on MP-0
- ⊞ Appliance . See schedule on MP-0
- +H Hose Bib
- FD Floor drain
- RD Roof drain lines

**HEV air flow rates:**

- |   |   |
|---|---|
| 1 Exhaust 12 cfm with 0.3364 booster switch | 7 Exhaust 24 cfm with 0.3364 booster switch |
| 2 Exhaust 24 cfm with 0.3364 booster switch | 8 Exhaust 12 cfm with 0.3364 booster switch |
| 3 Exhaust 12 cfm with 0.3364 booster switch | 9 Supply 18 cfm                             |
| 4 Supply 36 cfm                             | 11 Supply 18 cfm                            |
| 5 Supply 12 cfm                             |   |

**General Notes:**

- 1 See additional notes on MP-0
- 2 See casework elevations and enlarged plans for location of fixtures in casework.
- 3 Provide a recirculating system for domestic hot water.
- 4 Toilet locations are dimensioned to the centerline of the toilet and the face of the stud behind. Floor drains are dimensioned to the centerline. Dimensions are from the face of the foundation wall or face of the stud.
- 5 Insulate vertical roof drain lines for sound
- 6 Group all plumbing vents together as much as possible
- 7 All HEV ducting is to be sealed and tested for leaks, use rigid ducting for straight runs.



**Main Level Mechanical and Plumbing Plan**  
 Scale: E: 1/8" = 1'-0"

**Plan Notes:** #

- 1 Direct Vent Natural Gas Fireplace Provide fans and thermostat operation
- 2 Zander 350 HRY w/ pre-heat
- 3 Provide tee in potable water line for landscape irrigation prior to water softener. Install 1" stop valve inside Mechanical area.
- 4 Install 1" double check valve backflow preventer.
- 5 All hose bibs are to have backflow preventers.
- 6 Mitsubishi wall unit
- 7 Mitsubishi 42000 BTU 18 seer
- 8 Quad zone 9.1-9.1-5
- 9 Natural Gas Heater
- 10 Supply At owner's option a gas line for a Natural Gas heater at the ceiling
- 11 Install a Nexenz 120 V heating cable with a programmable thermostat under the floor finish in the entry and landing.

**Legend**

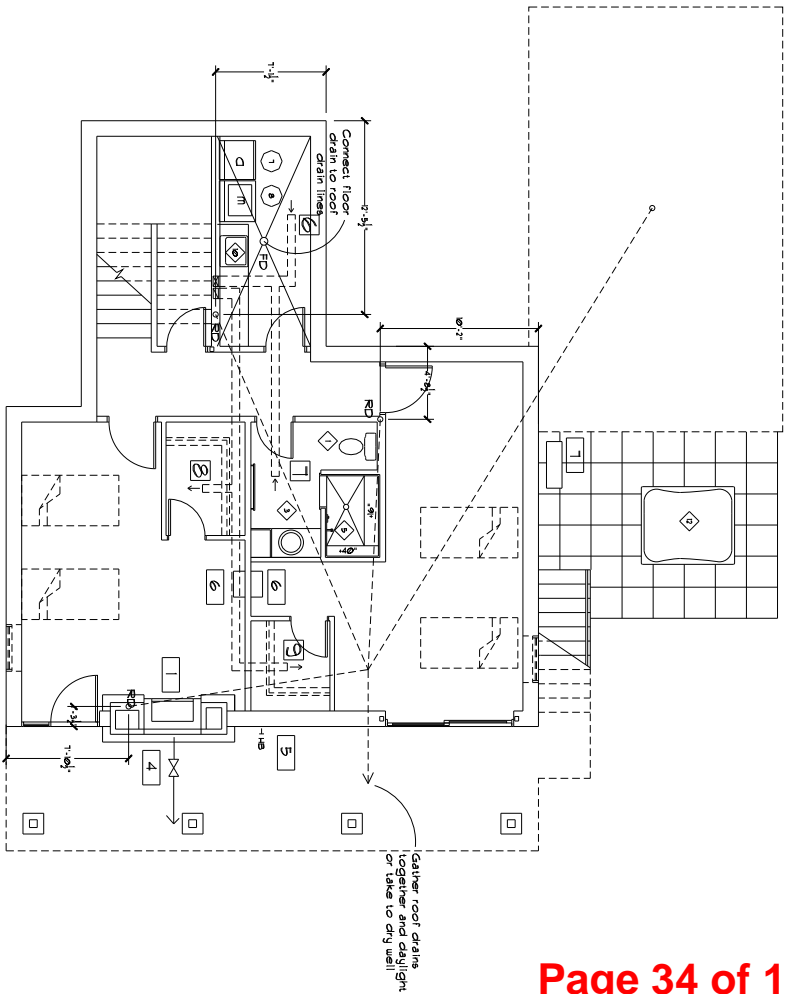
- ▬ Vertical duct: return
- ▬ Vertical duct: supply
- ←C→ Supply register
- C← Return register
- ◆ Plumbing fixture. See schedule on MP-0
- ⊗ Appliance . See schedule on MP-0
- +H Hose Bib
- RD Floor drain
- RD Roof drain lines

**HRV Air Flow Rates:**

- |  |  |
|--|--|
| 1 Exhaust 12 cfm with 03364 booster switch | 7 Exhaust 24 cfm with 03364 booster switch |
| 2 Exhaust 24 cfm with 03364 booster switch | 8 Exhaust 12 cfm with 03364 booster switch |
| 3 Exhaust 12 cfm with 03364 booster switch | 9 Supply 18 cfm                            |
| 4 Supply 36 cfm                            | 11 Supply 18 cfm                           |
| 5 Supply 12 cfm                            |  |

**General Notes:**

1. See additional notes on MP-0
2. See casework elevations and enlarged plans for location of fixtures in casework.
3. Provide a recirculating system for domestic hot water.
4. Toilet locations are dimensioned to the centerline of the toilet and the face of the stud bearing. Floor drains are dimensioned to the centerlines. Dimensions are from the face of the foundation wall or face of the stud.
5. Insulate vertical roof drain lines for sound
6. Group all plumbing vents together as much as possible
7. All HRV ducting is to be sealed and tested for leaks, use rigid ducting for straight runs.



**Exhibit A**

**Lower Level Mechanical and Plumbing Plan**

**ELECTRICAL NOTES:**

1. ALL WORK DONE BY ELECTRICAL CONTRACTOR SHALL COMPLY WITH THE REQUIREMENTS OF THE NATIONAL ELECTRICAL CODE (NEC) AND THE ELECTRICAL CODES OF THE STATE OF UTAH. THE CONTRACTOR SHALL PERFORM ALL WORK IN CONFORMANCE WITH THESE REGULATIONS WHETHER OR NOT SUCH WORK IS SPECIFICALLY SHOWN ON DRAWINGS.
  2. THE EXTENT OF WORK SHALL BE AS SHOWN ON DRAWINGS. PERFORMANCE SHALL MEET THE REQUIREMENTS OF THE SPECIFICATIONS. THE WORK CONSISTS OF THE FOLLOWING:
    - A. FINISH AND INSTALL PANEL BOARDS, RELAY BRANCH CIRCUIT BREAKERS, CIRCUITS, WIRING, AND METER BASE AS SHOWN ON DRAWINGS.
    - B. FINISH AND INSTALL COMPLETE WIRING FOR MOTORS, EXHAUST FAN AS SPECIFIED OR REQUIRED.
    - C. FINISHING AND INSTALLING LINE VOLTAGE CONNECTIONS FOR HEATING AND AIR CONDITIONING EQUIPMENT.
    - D. INSTALLING SPECIALTY LIGHTING FIXTURES SPECIFIED AND FINISHED BY OWNER. ELECTRICAL CONTRACTOR SHALL PROVIDE 4-BOX AT CEILING.
    - E. FINISH AND INSTALL GFI/RCI BOXES, COVER PLATES, WALL SWITCHES, FUSES AND RECEPTACLES.
  3. ELECTRICAL SERVICE CAPACITY AND SIZE SHALL BE COMPLETED BY METHODS INDICATED IN THE NATIONAL ELECTRICAL CODE.
  4. PANELS OR CABINETS ENCLOSING FUSES, CIRCUIT BREAKERS, SWITCHES OR OTHER ELECTRICAL SERVICE EQUIPMENT SHALL BE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE. THE CONTRACTOR SHALL COMPLY WITH N.E.C. 110-16. COORDINATE WITH PROJECT GENERAL NOTES.
3. ELECTRICAL METER BASE SHALL BE LOCATED IN AN AREA THAT IS PROTECTED FROM OUTSIDE WEATHER. CONNECTION TO EQUIPMENT.
    - A. ELECTRICAL CONTRACTOR SHALL INSTALL REMAINT LIGHTING MANUFACTURER OF FIXTURES.
    - B. ALL FIXTURES SHALL HAVE A UL LABEL LISTING. IF NOT UL LISTED, FIXTURE SHALL NOT BE INSTALLED.
    - C. HEIGHT OF LIGHT FIXTURES FROM FINISH FLOOR TO TOP OF SIMONN LOCATIONS SHALL BE APPROVED PRIOR TO COMMENCEMENT OF WORK. BOXES SHALL BE INSTALLED FOR APPROVAL OF LOCATION.
    - D. ALL RECESSED DOWNLIGHTS TO BE THERMAL RATED, AND ALL OAST IN PLACE TO BE INCLUDED IN BID BO.
    - E. ALL SPECIALTY LIGHTING TO BE COORDINATED WITH ARCHITECT FOR POWER REQUIREMENTS BY ELECTRICAL CONTRACTOR.
    - F. ALL RECESSED DOWNLIGHTS TO BE INCLUDED IN BID BO WITH ARCHITECT/INTERIOR DESIGNER.
    - G. ALL LIGHTS IN CLUSTERS SHALL BE AS SHOWN ON DRAWINGS AND FINISH SCHEDULE. FIXTURES SHALL MEET ALL REQUIREMENTS OF 2002 N.E.C. -
  7. RECEPTACLE OUTLETS
    - A. EXCEPT WHERE OTHERWISE SHOWN ON DRAWINGS, THE MOUNTING FROM THE FLOOR TO CENTER OF OUTLET SHALL BE 17".
    - B. ALL OUTLETS WITHIN SWIMMING POOL WIPING CABINETS SHALL BE 6'-0" OF CENTER IN GARDENS. AND ALL OUTLET OUTLETS TO BE 24" ABOVE FLOOR FINISH.
    - C. UNLESS NOTED OTHERWISE ON DRAWINGS, LOCATE AND INSTALL ONE (1) WEATHER PROTECTED GRADE LEVEL RECEPTACLE AND RECEPTACLE OUTLET AT SOUTH AT EACH EXTERIOR DOOR.
    - D. FLUSH MOUNT ALL RECEPTACLES.
  8. VENTS (WHERE SHOWN AS SPECIFIED BY ELECTRICAL)
    - A. PROVIDE MECHANICAL VENTILATION FOR ALL BATHROOMS AND FOR THE LAUNDRY AREA AS SHOWN DIRECTLY TO THE EXTERIOR THROUGH THE (3) AIR CHANGES PER HOUR.
    - B. VENT THE BIERER DIRECTLY TO THE EXTERIOR WITH A 1" x 1" MINIMUM RAIN AND (2) 90 DEGREE ANGLES MINIMUM.
    - C. BATH AND LAUNDRY OUTLETS MUST BE A MINIMUM OF THREE FEET FROM OPENINGS INTO THE BUILDING.
    - D. ELECTRICAL CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING AND WIRING ALL FANS, FAN MOTORS, AS REQUIRED. ALL CONNECTIONS SHALL BE IN ACCORDANCE WITH N.E.C.
  9. SMOKE DETECTORS
    10. CONTRACTOR SHALL COORDINATE WITH MECHANICAL CONTRACTOR FOR ALL POWER REQUIREMENTS. ELECTRICAL CONTRACTOR SHALL BE RESPONSIBLE FOR ELECTRICAL SERVICES FOR MECHANICAL ROOM.
    11. ALL DRAWINGS INDICATE LOCATIONS AS DIMENSIONALLY. LOCATIONS SHALL BE PER APPROPRIATE CODES. CONTRACTOR TO COORDINATE.
    12. ELECTRICAL CONTRACTOR SHALL COORDINATE HIS WORK WITH THE WORK OF OTHER TRADES AND HAVE HIS WORK SCHEDULED SO AS NOT TO DELAY THE WORK OF OTHER TRADES.
    13. THE ELECTRICAL CONTRACTOR SHALL BE RESPONSIBLE FOR INSPECTION AND FOR FINAL ACCEPTANCE OF THE COMPLETE ELECTRICAL INSTALLATIONS BY LOCAL ELECTRICAL INSPECTORS. ELECTRICAL CONTRACTOR SHALL PERFORM ALL TESTS AS REQUIRED.
    14. ELECTRICAL CONTRACTOR SHALL BE RESPONSIBLE FOR CLEAN UP OF ALL WORK.
    15. EXCEPT LIGHT FIXTURES, ELECTRICAL CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING AND WIRING ALL FANS, FAN MOTORS, AS REQUIRED. ALL CONNECTIONS SHALL BE IN ACCORDANCE WITH N.E.C.

**General Notes:**

1. A pre-meeting shall be held between the Owner, Electrical contractor and Architect before any work begins.
2. Substitutions for recessed light fixtures and utility fixtures will be allowed with approval by Architect.

**LIGHT FIXTURE SCHEDULE**

MARK	NAME	CATALOG *	LAMP	PAINTING	COLOR	DESCRIPTION / REMARKS
E1A	X	X	LED	recessed	white	Standard recessed downlight
E1B	X	X	LED	Surface mounted	white	Surface mounted utility light
E1C	X	X	LED	recessed	white	Standard recessed downlight
E1D	X	X	LED	recessed	white	Standard recessed downlight
E1E	X	X	LED	recessed	white	Standard recessed downlight
E1F	X	X	LED	recessed	white	Standard recessed downlight
E1G	X	X	LED	recessed	white	Standard recessed downlight
E1H	X	X	LED	recessed	white	Standard recessed downlight
E1I	X	X	LED	recessed	white	Standard recessed downlight
E1J	X	X	LED	recessed	white	Standard recessed downlight
E1K	X	X	LED	recessed	white	Standard recessed downlight
E1L	X	X	LED	recessed	white	Standard recessed downlight
E1M	X	X	LED	recessed	white	Standard recessed downlight
E1N	X	X	LED	recessed	white	Standard recessed downlight
E1O	X	X	LED	recessed	white	Standard recessed downlight
E1P	X	X	LED	recessed	white	Standard recessed downlight
E1Q	X	X	LED	recessed	white	Standard recessed downlight
E1R	X	X	LED	recessed	white	Standard recessed downlight
E1S	X	X	LED	recessed	white	Standard recessed downlight
E1T	X	X	LED	recessed	white	Standard recessed downlight
E1U	X	X	LED	recessed	white	Standard recessed downlight
E1V	X	X	LED	recessed	white	Standard recessed downlight
E1W	X	X	LED	recessed	white	Standard recessed downlight
E1X	X	X	LED	recessed	white	Standard recessed downlight
E1Y	X	X	LED	recessed	white	Standard recessed downlight
E1Z	X	X	LED	recessed	white	Standard recessed downlight
E1AA	X	X	LED	recessed	white	Standard recessed downlight
E1AB	X	X	LED	recessed	white	Standard recessed downlight
E1AC	X	X	LED	recessed	white	Standard recessed downlight
E1AD	X	X	LED	recessed	white	Standard recessed downlight
E1AE	X	X	LED	recessed	white	Standard recessed downlight
E1AF	X	X	LED	recessed	white	Standard recessed downlight
E1AG	X	X	LED	recessed	white	Standard recessed downlight
E1AH	X	X	LED	recessed	white	Standard recessed downlight
E1AI	X	X	LED	recessed	white	Standard recessed downlight
E1AJ	X	X	LED	recessed	white	Standard recessed downlight
E1AK	X	X	LED	recessed	white	Standard recessed downlight
E1AL	X	X	LED	recessed	white	Standard recessed downlight
E1AM	X	X	LED	recessed	white	Standard recessed downlight
E1AN	X	X	LED	recessed	white	Standard recessed downlight
E1AO	X	X	LED	recessed	white	Standard recessed downlight
E1AP	X	X	LED	recessed	white	Standard recessed downlight
E1AQ	X	X	LED	recessed	white	Standard recessed downlight
E1AR	X	X	LED	recessed	white	Standard recessed downlight
E1AS	X	X	LED	recessed	white	Standard recessed downlight
E1AT	X	X	LED	recessed	white	Standard recessed downlight
E1AU	X	X	LED	recessed	white	Standard recessed downlight
E1AV	X	X	LED	recessed	white	Standard recessed downlight
E1AW	X	X	LED	recessed	white	Standard recessed downlight
E1AX	X	X	LED	recessed	white	Standard recessed downlight
E1AY	X	X	LED	recessed	white	Standard recessed downlight
E1AZ	X	X	LED	recessed	white	Standard recessed downlight
E1BA	X	X	LED	recessed	white	Standard recessed downlight
E1BB	X	X	LED	recessed	white	Standard recessed downlight
E1BC	X	X	LED	recessed	white	Standard recessed downlight
E1BD	X	X	LED	recessed	white	Standard recessed downlight
E1BE	X	X	LED	recessed	white	Standard recessed downlight
E1BF	X	X	LED	recessed	white	Standard recessed downlight
E1BG	X	X	LED	recessed	white	Standard recessed downlight
E1BH	X	X	LED	recessed	white	Standard recessed downlight
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E1FK	X	X	LED	recessed	white	Standard recessed downlight
E1FL	X	X	LED	recessed	white	Standard recessed downlight
E1FM	X	X	LED	recessed	white	Standard recessed downlight
E1FN	X	X	LED	recessed	white	Standard recessed downlight
E1FO	X	X	LED	recessed	white	Standard recessed downlight
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E1FQ	X	X	LED	recessed	white	Standard recessed downlight

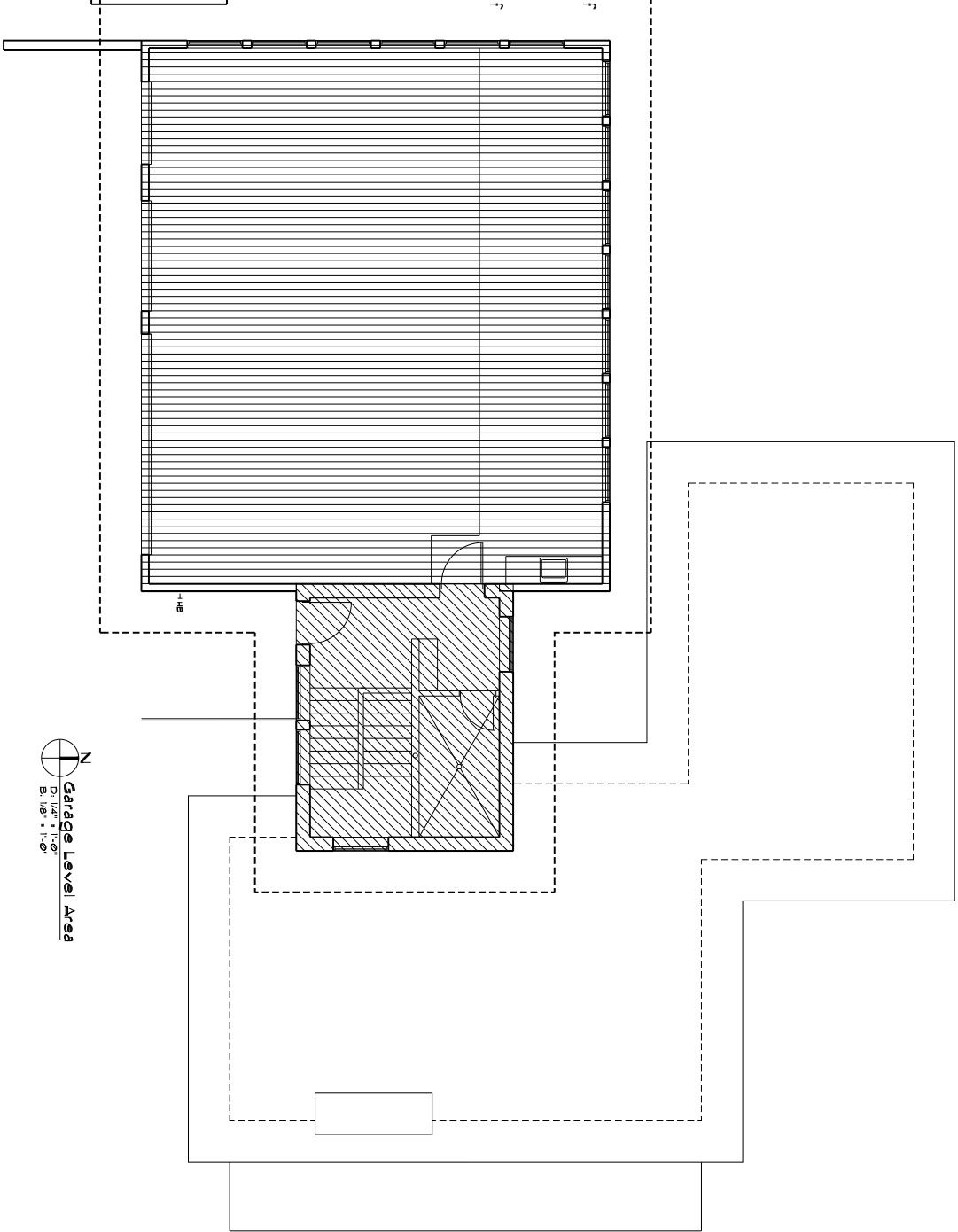
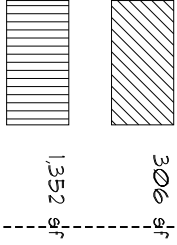






**Exhibit A**

Total Square Footage:  
 Living: 2868  
 Garage: 1352  
 Deck: 306



Garage Level Area  
 D: 1/4" = 1'-0"  
 B: 1/8" = 1'-0"

A New Residence for  
**Paul and Linda LaStayo**  
 4015 Bluebell Drive  
 Liberty, Utah

Project No:  
 1501  
 Sheet:  
**AR 1**

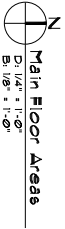
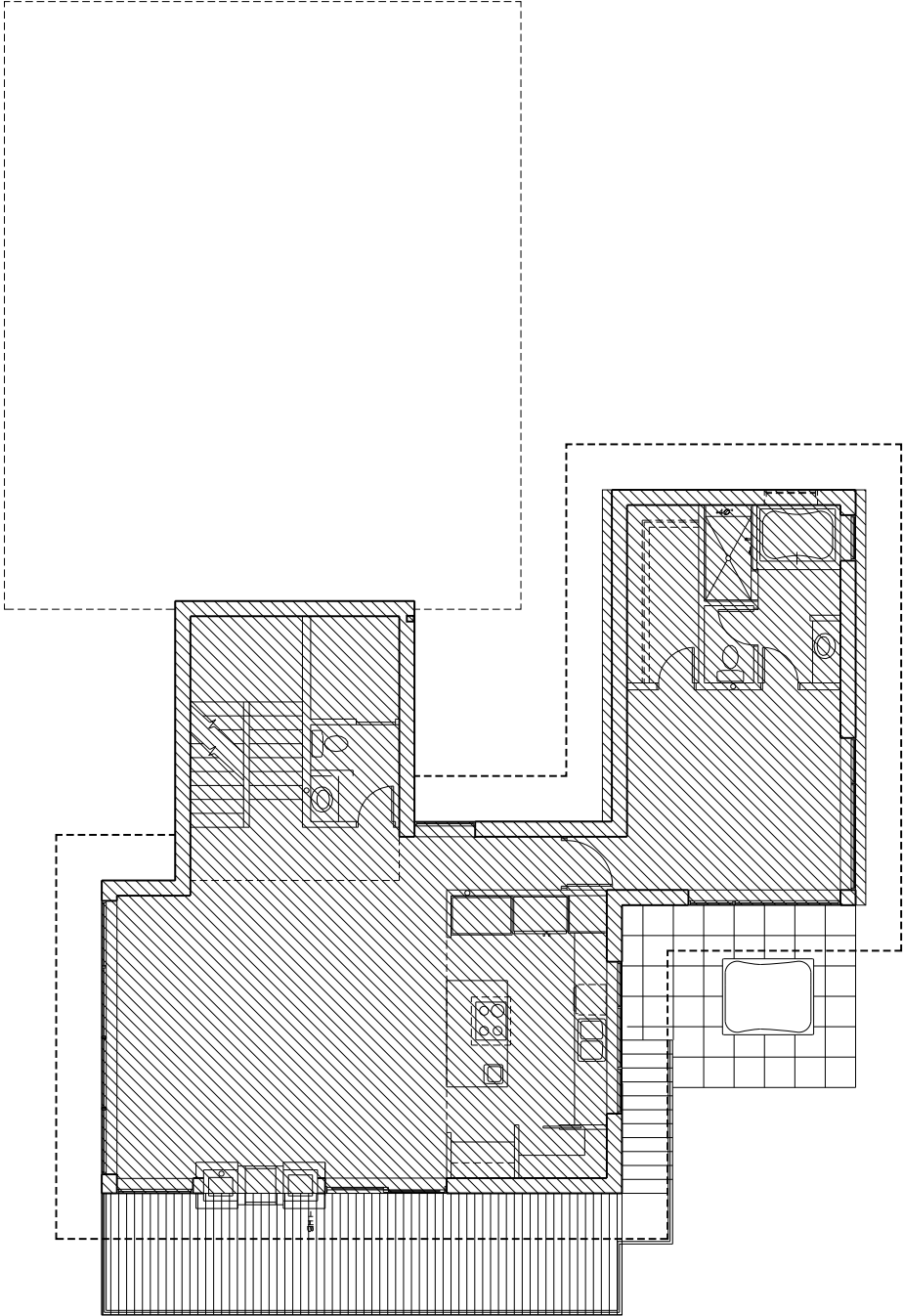
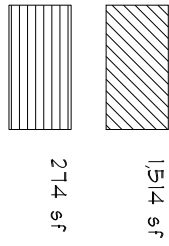
Garage Level Area  
 Scale:  
 D: 1/4" = 1'-0"  
 B: 1/8" = 1'-0"



Date: 5/7/16  
 Revisions:

Colias & Co.  
 Registered Professional Engineer  
 No. 12201, State of Utah  
 501 East 21st Street, Suite 200  
 Salt Lake City, Utah 84143  
 (801) 462-7899  
 www.colias.com/utah/engines

# Exhibit A

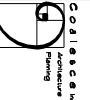


A New Residence for  
**Paul and Linda LaStayo**  
 4015 Bluebell Drive  
 Liberty, Utah

Date: 5/7/16  
 Revisions:



DAVID L. LASTAYO  
 12345  
 12345  
 12345



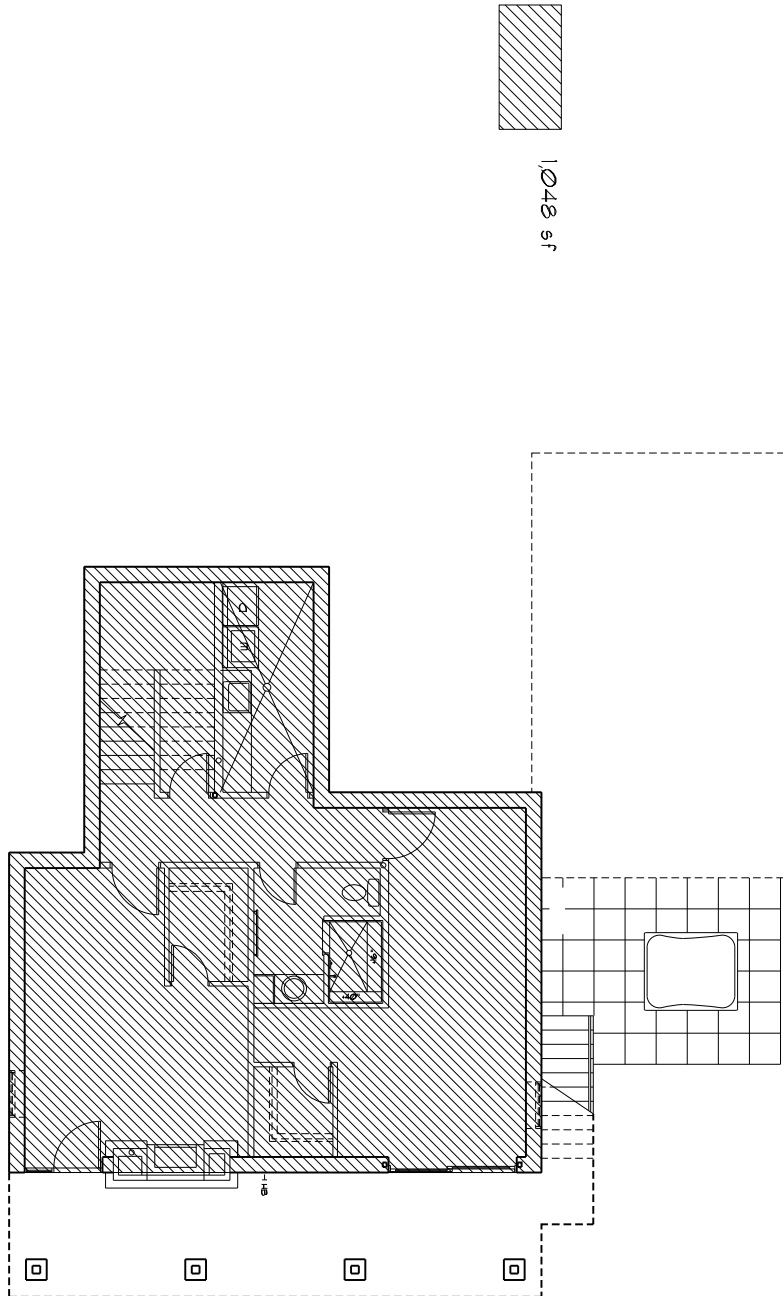
Scale:  
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 B: 1/8" = 1'-0"

Project No.:  
 1501  
 Sheet:  
**AR 2**

Main Floor Areas



N  
 Lower Floor Areas  
 D: 1/4" = 1'-0"  
 B: 1/8" = 1'-0"

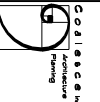


**A New Residence for**  
**Paul and Linda LaStayo**  
 4015 Bluebell Drive Liberty, Utah

Date: 5/7/16  
 Revisions:



363 S. 2000 E., Suite 100  
 Salt Lake City, Utah 84119  
 (801) 973-1234  
 www.cadcorp.com  
 CAD CORP. ARCHITECTURE



Project No.:  
 15071  
 Sheet:  
**AR 3**  
 Lower Floor Areas  
 Scale:  
 D: 1/4" = 1'-0"  
 B: 1/8" = 1'-0"

**REPORT  
GEOTECHNICAL STUDY  
LOT 44 BIG SKY ESTATES  
4075 BLUEBELL DRIVE  
NEAR LIBERTY, WEBER COUNTY, UTAH**

Submitted To:

Coalesce Architecture  
Attention: Mr. Bill Arthur  
163 West 200 South, #509  
Salt Lake City, Utah

Submitted By:

GSH Geotechnical, Inc.  
1596 West 2650 South  
Ogden, Utah 84401

July 8, 2016

Job No. 1041-04N-16

July 8, 2016  
Job No. 1041-04N-16

Coalesce Architecture  
Attention: Mr. Bill Arthur  
163 West 200 South, #509  
Salt Lake City, Utah 84101

Re: Report  
Geotechnical Study  
Lot 44 Big Sky Estates  
4075 Bluebell Drive  
Near Liberty, Weber County, Utah  
(41.2981° N; 111.8497° W)

## **1. INTRODUCTION**

### **1.1 GENERAL**

This report presents the results of our geotechnical study performed for Lot 44 Big Sky Estates located at 4075 Bluebell Drive near Liberty in Weber County, Utah. The general location of the site with respect to major roadways, as of 2014, is presented on Figure 1, Vicinity Map. A more detailed layout of the site showing the proposed improvements is presented on Figure 2, Site Plan. The locations of the test pits excavated and boring drilled in conjunction with this study are also presented on Figure 2.

### **1.2 OBJECTIVES AND SCOPE**

The objectives and scope of our study were planned in discussions among Mr. Bill Arthur of Coalesce Architecture, Mr. Bill Black of Western Geologic, and Mr. Andrew Harris of GSH Geotechnical, Inc. (GSH).

In general, the objectives of this study were to:

1. Define and evaluate the subsurface soil and groundwater conditions across the site.

## **Exhibit B**

Coalesce Architecture  
Job No. 1041-04N-16  
Geotechnical Study – Lot 44 Big Sky Estates  
July 8, 2016



2. Provide appropriate foundation, earthwork, and slope stability recommendations as well as geoseismic information to be utilized in the design and construction of the proposed home.

In accomplishing these objectives, our scope has included the following:

1. A field program consisting of the excavating, logging, and sampling of 3 test pits and the drilling, logging and sampling 1 boring.
2. A laboratory testing program.
3. An office program consisting of the correlation of available data, engineering analyses, and the preparation of this summary report.

### **1.3 AUTHORIZATION**

Authorization was provided by returning a signed copy of our Professional Services Agreement No. 16-0344Nrev5 dated April 15, 2016.

### **1.4 PROFESSIONAL STATEMENTS**

Supporting data upon which our recommendations are based are presented in subsequent sections of this report. Recommendations presented herein are governed by the physical properties of the soils encountered in the exploration test pits/boring, projected groundwater conditions, and the layout and design data discussed in Section 2, Proposed Construction, of this report. If subsurface conditions other than those described in this report are encountered and/or if design and layout changes are implemented, GSH must be informed so that our recommendations can be reviewed and amended, if necessary.

Our professional services have been performed, our findings developed, and our recommendations prepared in accordance with generally accepted engineering principles and practices in this area at this time.

## **2. PROPOSED CONSTRUCTION**

The proposed project consists of constructing a single-family residence on Lot 44 Big Sky Estates near Liberty in Weber County, Utah. Construction will likely consist of cast-in-place drilled piers combined with reinforced concrete grade beam and basement foundation walls supporting 1 to 2 wood-framed levels above grade. Projected maximum column and wall loads are on the order of 10 to 25 kips and 1 to 3 kips per lineal foot, respectively.

Site development will require a moderate amount of earthwork in the form of site grading. We estimate in general that maximum cuts and fills to achieve design grades will be on the order of 2 to 8 feet. Larger cuts and fills may be required in isolated areas and must be planned to maintain stability of the site slopes.

## **Exhibit B**

Coalesce Architecture  
Job No. 1041-04N-16  
Geotechnical Study – Lot 44 Big Sky Estates  
July 8, 2016



### **3. INVESTIGATIONS**

#### **3.1 FIELD PROGRAM**

In order to define and evaluate the subsurface soil and groundwater conditions at the site, 1 boring was drilled to a depth of about 46.5 feet below existing grade. The boring was drilled using a truck-mounted drill rig equipped with hollow-stem augers. Additionally, 3 test pits were excavated to depths of about 10.5 to 12.0 feet below existing grade. The test pits were excavated using a track-mounted excavator. Test pit and boring locations are presented on Figure 2.

The field portion of our study was under the direct control and continual supervision of an experienced member of our geotechnical staff. During the course of the excavating and drilling operations, a continuous log of the subsurface soil conditions encountered was maintained. In addition, samples of the typical soils encountered were obtained for subsequent laboratory testing and examination. The soils were classified in the field based upon visual and textural examination. These classifications have been supplemented by subsequent inspection and testing in our laboratory. Detailed graphical representation of the subsurface conditions encountered is presented on Figure 3A, Boring Log, and on Figures 4A through 4C, Test Pit Log. Soils were classified in accordance with the nomenclature described on Figure 5, Key to Boring Log (USCS) and on Figure 6, Key to Test Pit Log (USCS).

A 3.0-inch outside diameter, 2.42-inch inside diameter drive sampler (Dames & Moore) and a 2.0-inch outside diameter, 1.38-inch inside diameter drive sampler (SPT) were utilized in the subsurface soil sampling at select locations. The blow counts recorded on the boring logs were those required to drive the sampler 12 inches with a 140-pound hammer dropping 30 inches.

A 2.42-inch inside diameter thin-wall drive sampler was utilized in the subsurface sampling of the test pits at the site.

Following completion of drilling and excavation operations, one and one-quarter-inch diameter slotted PVC pipe was installed in boring B-1 and test pit TP-3 in order to provide a means of monitoring the groundwater fluctuations. The boring was backfilled with auger cuttings. Following completion of excavating and logging, each test pit was backfilled. Although an effort was made to compact the backfill with the trackhoe, backfill was not placed in uniform lifts and compacted to a specific density. Consequently, the backfill soils must be considered as non-engineered and settlement of the backfill with time is likely to occur.

#### **3.2 LABORATORY TESTING**

##### **3.2.1 General**

In order to provide data necessary for our engineering analyses, a laboratory testing program was performed. The program included moisture, density, Atterberg limits, partial gradations, consolidation, direct shear, and residual direct shear tests. The following paragraphs describe the tests and summarize the test data.

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### 3.2.2 Moisture and Density

To provide index parameters and to correlate other test data, moisture and density tests were performed on selected samples. The results of these tests are presented on the boring log, Figure 3A, and on the test pit logs, Figure 4A through 4C.

### 3.2.3 Atterberg Limit Tests

To aid in classifying the soils, Atterberg limit tests were performed on samples of the fine-grained cohesive soils. Results of the test are tabulated on the following table:

Boring/ Test Pit No.	Depth (feet)	Liquid Limit (percent)	Plastic Limit (percent)	Plasticity Index (percent)	Soil Classification
B-1	5.0	86	52	34	MH
B-1	7.5	30	14	16	CL
B-1	30.0	41	21	20	CL
TP-1	3.0	75	63	12	MH
TP-3	2.5	68	46	22	MH
TP-3	5.0	59	53	6	MH

### 3.2.4 Partial Gradation Tests

To aid in classifying the granular soils, partial gradation tests were performed. Results of the tests are tabulated below:

Boring/ Test Pit No.	Depth (feet)	Percent Passing No. 200 Sieve	Soil Classification
B-1	5.0	43.0	MH/SM
B-1	7.5	44.6	CL/SC
B-1	30.0	41.8	ML/SM
B-1	40.0	47.1	ML/SM
TP-1	3.0	47.6	MH/SM
TP-3	2.5	47.6	MH/SM
TP-3	5	43.0	MH/SM

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### 3.2.5 Laboratory Direct Shear Test

To determine the shear strength of the soils encountered at the site, laboratory direct shear tests were performed on samples of the onsite soils. The results of the tests are tabulated below:

Test Pit/Boring No.	Depth (feet)	Soil Type	In-Situ Moisture Content (percent)	Dry Density (pcf)	Internal Friction Angle (degrees)	Apparent Cohesion (psf)
TP-2	2.5	MH/SM	---	---	30	150
B-1	40.0	ML/SM	39	73	34	500

### 3.2.6 Laboratory Residual Direct Shear Test

To determine the residual shear strength of the soils encountered at the site, laboratory residual direct shear tests were performed on samples of the onsite soils. The results of the test are tabulated below:

Test Pit/Boring No.	Depth (feet)	Soil Type	In-Situ Moisture Content (percent)	Dry Density (pcf)	Internal Friction Angle (degrees)	Apparent Cohesion (psf)
TP-2	2.5	MH/SM	---	---	18	115
B-1	40.0	ML/SM	39	73	29	210

## 4. SITE CONDITIONS

### 4.1 GEOLOGIC SETTING

A geologic hazards reconnaissance study<sup>1</sup> dated June 4, 2016 was prepared for the subject property by Western Geologic, LLC, and a copy of that report is included in the attached Appendix.

### 4.2 SURFACE

The subject property is a vacant, irregularly-shaped lot located at 4075 Bluebell Drive near Liberty in Weber County, Utah. The topography of the site slopes downward to the west at grades of about 5.5H:1V (Horizontal:Vertical) to 2H:1V (Horizontal:Vertical) with an overall

<sup>1</sup> "Report, Geologic Hazards Evaluation, Lot 44 Big Sky Estates No.1, 4075 Bluebell Drive, Liberty, Weber County, Utah," Western Geologic, LLC, June 4, 2016.

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change in elevation of about 105 feet across the site. Vegetation at the site consists primarily of native weeds, grasses, brush, and numerous mature trees. The site is bordered on the north and south by residential development, on the east by undeveloped property, and on the west by Bluebell Drive.

### **4.3 SUBSURFACE SOIL**

Subsurface conditions encountered at the test pit and boring locations varied slightly across the site. Topsoil and disturbed soils were observed in the upper 3 to 12 inches at the test pit and boring locations. In test pits TP-1 and TP-2 and boring B-1, natural soils were observed beneath the topsoil/disturbed soils to the full depth penetrated, about 10.5 to 46.5 feet below surrounding grades and consisted of silty clay with varying fine to coarse sand content, fine sandy silt, fine to coarse sand with varying amounts of silt, weathered bedrock (weathered sandstone/claystone/siltstone), and occasional mixture of these soils. In boring B-1 between about 25.0 and 40.0 feet, organic material and deformed bedding was noted in the samples collected, indicating previous movement of the subsurface soils within this zone. In test pit TP-3, mass movement soil deposits were encountered below the topsoil and disturbed soils extending to the full depth explored of about 12.0 feet below surrounding site grades. The mass movement deposits were comprised of a mixture of silty sand, clayey silt, silty clay, and degraded/weathered sandstone/siltstone.

The natural granular soils encountered were very dense, slightly moist to moist, light yellowish-brown to gray in color, and will generally exhibit moderately high strength and low compressibility characteristics under the anticipated vertical loading.

The natural silt/clay soils encountered were medium stiff to hard, slightly moist to moist, brown to gray in color, and will generally exhibit moderate strength and compressibility characteristics under the anticipated vertical loading.

For a more detailed description of the subsurface soils encountered, please refer to Figure 3A, Boring Log, and Figures 4A through 4C, Test Pit Log. The lines designating the interface between soil types on the test pit logs generally represent approximate boundaries. In-situ, the transition between soil types may be gradual.

### **4.4 GROUNDWATER**

Static groundwater was measured in boring B-1 at 29.9 feet below existing site grades. Additionally, water resulting from recent precipitation was observed seeping into the test pits at about 4 feet below existing site grades. Seasonal and longer-term groundwater fluctuations of 1 to 2 feet shall be anticipated. The highest seasonal levels will generally occur during the late spring and summer months. Landscape irrigation on this and surrounding areas may also create additional seasonal groundwater fluctuations. The limitations of landscape irrigation at the site are discussed further in Section 5.9, Site Irrigation, and measures to reduce infiltration of surface water at the site are discussed further in Section 5.8, Subdrains. The contractor must be prepared to dewater excavations as needed.



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## **5. DISCUSSIONS AND RECOMMENDATIONS**

### **5.1 SUMMARY OF FINDINGS**

The results of our analyses indicate that the proposed structure may be supported upon conventional spread and/or continuous wall foundations established upon a minimum of 2 feet of granular structural fill extending to suitable natural soils.

The most significant geotechnical aspects of the site are the expansive potential of the near surface silts/clays, the proximity of the proposed structure to mass movement soil deposits, and maintaining stability of the slope at the rear of the property.

The location of the home must be planned to avoid mass movement deposits at the site. If this is not feasible, GSH must be contacted to provide additional recommendations for foundation support.

A subdrain system must be installed upslope of the home and near the head of the mass movement deposit soils below the home to reduce the potential for surface water infiltration, as discussed further within this report.

The on-site soils are not appropriate to be used as structural site grading fill, however, they may be used as general grading fill in landscape areas.

A geotechnical engineer from GSH will need to verify that all mass movement deposit soils, fill material (if encountered) and topsoil/disturbed soils have been completely removed and suitable natural soils encountered prior to the placement of structural site grading fills, floor slabs, foundations, or rigid pavements.

In the following sections, detailed discussions pertaining to earthwork, foundations, lateral pressure and resistance, floor slabs, slope stability, and the geoseismic setting of the site are provided.

### **5.2 EARTHWORK**

#### **5.2.1 Site Preparation**

The location of the home must be planned to avoid mass movement deposits at the site. If this is not feasible, GSH must be contacted to provide additional recommendations for foundation support.

Initial site preparation will consist of the removal of surface vegetation, topsoil, and other deleterious materials from beneath an area extending out at least 3 feet from the perimeter of the proposed building, pavements, and exterior flatwork areas.

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Additional site preparation will consist of the removal of existing non-engineered fills (if encountered) from an area extending out at least 3 feet from the perimeter of residential structures and 1 foot beyond rigid pavements.

Non-engineered fills may remain in asphalt pavement and sidewalk areas as long as they are properly prepared. Below rigid pavements non-engineered fills must be removed. Additionally, the surface of any existing engineered fills must be prepared prior to placing additional site grading fills.

Proper preparation shall consist of scarifying, moisture conditioning, and re-compacting the upper 12 inches to the requirements for structural fill. Fine-grained soils will require that very close moisture control be maintained for recompacting, which will be very difficult, if not impossible, to recompact during wet and cold periods of the year. As an option to proper preparation and recompaction, the upper 12 inches of non-engineered fill (where encountered) may be removed and replaced with granular subbase. Even with proper preparation, pavements established overlying non-engineered fills may encounter some long-term movements unless the non-engineered fills are completely removed.

Subsequent to stripping and prior to the placement of structural site grading fill, pavements, driveway, and parking slabs on grade, the prepared subgrade must be proofrolled by passing moderate-weight rubber tire-mounted construction equipment over the surface at least twice. If excessively soft or loose soils are encountered, they must be removed to a maximum depth of 2 feet and replaced with structural fill. Beneath footings, all loose and disturbed soils must be totally removed. Fill soils must be handled as described above.

Surface vegetation, debris, and other deleterious materials shall generally be removed from the site. Topsoil, although unsuitable for utilization as structural fill, may be stockpiled for subsequent landscaping purposes.

A representative of GSH must verify that suitable natural soils and/or proper preparation of existing fills have been encountered/met prior to placing site grading fills, footings, slabs, and pavements.

### **5.2.2 Excavations**

For granular (cohesionless) soils, construction excavations above the water table, not exceeding 4 feet, shall be no steeper than one-half horizontal to one vertical (0.5H:1V). For excavations up to 8 feet, in granular soils and above the water table, the slopes shall be no steeper than one horizontal to one vertical (1H:1V). Excavations encountering saturated cohesionless soils will be very difficult and will require very flat sideslopes and/or shoring, bracing and dewatering. Excavations deeper than 8 feet are not anticipated at the site.

Temporary excavations up to 8 feet deep in fine-grained cohesive soils (if encountered), above or below the water table, may be constructed with sideslopes no steeper than one-half horizontal to one vertical (0.5H:1V).

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To reduce disturbance of the natural soils during excavation, it is recommended that smooth edge buckets/blades be utilized.

All excavations must be inspected periodically by qualified personnel. If any signs of instability or excessive sloughing are noted, immediate remedial action must be initiated.

### **5.2.3 Structural Fill**

Structural fill will be required as site grading fill, as backfill over foundations and utilities, and possibly as replacement fill beneath some footings. All structural fill must be free of sod, rubbish, construction debris, frozen soil, and other deleterious materials.

Structural site grading fill is defined as fill placed over fairly large open areas to raise the overall site grade. The maximum particle size within structural site grading fill should generally not exceed 4 inches; although, occasional particles up to 6 to 8 inches may be incorporated provided that they do not result in “honeycombing” or preclude the obtainment of the desired degree of compaction. In confined areas, the maximum particle size should generally be restricted to 2.5 inches.

Only granular soils are recommended in confined areas such as utility trenches, below footings, etc. Generally, we recommend that all imported granular structural fill consist of a well-graded mixture of sands and gravels with no more than 20 percent fines (material passing the No. 200 sieve) and less than 30 percent retained on the 3/4 inch sieve. The plasticity index of import fine-grained soil shall not exceed 18 percent.

To stabilize soft subgrade conditions or where structural fill is required to be placed closer than 1.0 foot above the water table at the time of construction, a mixture of coarse gravels and cobbles and/or 1.5- to 2.0-inch gravel (stabilizing fill) should be utilized. It may also help to utilize a stabilization fabric, such as Mirafi 600X or equivalent, placed on the native ground if 1.5- to 2.0-inch gravel is used as stabilizing fill.

On-site soils are not recommended as structural fill but may be used as non-structural grading fill in landscape areas. Non-structural site grading fill is defined as all fill material not designated as structural fill and may consist of any cohesive or granular soils not containing excessive amounts of degradable material.

### **5.2.4 Fill Placement and Compaction**

All structural fill shall be placed in lifts not exceeding 8 inches in loose thickness. Structural fills shall be compacted in accordance with the percent of the maximum dry density as determined by the ASTM<sup>2</sup> D-1557 (AASHTO<sup>3</sup> T-180) compaction criteria in accordance with the table on the following page.

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<sup>2</sup> American Society for Testing and Materials

<sup>3</sup> American Association of State Highway and Transportation Officials

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<b>Location</b>	<b>Total Fill Thickness (feet)</b>	<b>Minimum Percentage of Maximum Dry Density</b>
Beneath an area extending at least 5 feet beyond the perimeter of the structure	0 to 8	95
Site Grading Fills outside area defined above	0 to 5	90
Site Grading Fills outside area defined above	5 to 8	95
Trench Backfill	--	96
Pavement granular base/subbase	--	96

Structural fills greater than 8 feet thick are not anticipated at the site.

Subsequent to stripping and prior to the placement of structural site grading fill, the subgrade shall be prepared as discussed in Section 5.2.1, Site Preparation, of this report. In confined areas, subgrade preparation shall consist of the removal of all loose or disturbed soils.

If utilized for stabilizing fill, coarse gravel and cobble mixtures should be end-dumped, spread to a maximum loose lift thickness of 15 inches, and compacted by dropping a backhoe bucket onto the surface continuously at least twice. As an alternative, the fill may be compacted by passing moderately heavy construction equipment or large self-propelled compaction equipment at least twice. Subsequent fill material placed over the coarse gravels and cobbles shall be adequately compacted so that the “fines” are “worked into” the voids in the underlying coarser gravels and cobbles.

### 5.2.5 Utility Trenches

All utility trench backfill material below structurally loaded facilities (flatwork, floor slabs, roads, etc.) shall be placed at the same density requirements established for structural fill. If the surface of the backfill becomes disturbed during the course of construction, the backfill shall be proofrolled and/or properly compacted prior to the construction of any exterior flatwork over a backfilled trench. Proofrolling may be performed by passing moderately loaded rubber tire-mounted construction equipment uniformly over the surface at least twice. If excessively loose or soft areas are encountered during proofrolling, they must be removed (to a maximum depth of 2 feet below design finish grade) and replaced with structural fill.

Most utility companies and City-County governments are now requiring that Type A-1-a/A-1-b (AASHTO Designation – basically granular soils with limited fines) soils be used as backfill over utilities. These organizations are also requiring that in public roadways the backfill over major utilities be compacted over the full depth of fill to at least 96 percent of the maximum dry

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density as determined by the AASHTO T-180 (ASTM D-1557) method of compaction. We recommend that as the major utilities continue onto the site that these compaction specifications are followed.

Natural or imported silt/clay soils are not recommended for use as trench backfill, particularly in structurally loaded areas.

### 5.3 SLOPE STABILITY

#### 5.3.1 Parameters

The properties of the soils at this site were estimated using the results of our laboratory testing, published correlations, and our experience with similar soils. Accordingly, we estimated the following parameters for use in the stability analyses:

Material	Internal Friction Angle (degrees)	Apparent Cohesion (psf)	Saturated Unit Weight (pcf)
Claystone Bedrock	28	150	120
Altered Siltstone	28	260	120
Siltstone Bedrock	34	500	120
Landslide	18	115	120

For the seismic analysis, a peak horizontal ground acceleration of 0.263 using IBC 2012 guidelines and adjusted for Site Class effects (for Site Class C soils) was obtained for site (grid) locations of 41.2981 degrees latitude (north) and 111.8497 degrees longitude (west). To model sustained accelerations at the site, one-half of this value is typically used. Accordingly, a value of 0.132 was used as the pseudostatic coefficient in the seismic analyses.

#### 5.3.2 Stability Analyses

We evaluated the global stability of the existing slope using the computer program *SLIDE*. This program uses a limit equilibrium (Simplified Bishop) 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. We analyzed the following configuration based on cross-sections provided in the referenced geologic study (see geological study in appendix for cross-section information and location):

- Slopes between 5.5H:1V (Horizontal:Vertical) to 2H:1V (Horizontal:Vertical) with an overall change in elevation of about 105 feet across the site. To simulate the load imposed on the slope by the proposed home, a load of 1,500 psf was modeled over the proposed building area. In addition, a phreatic surface was included in our analysis.

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account for potential seasonal perched water and effluent water from the proposed on-site septic system.

Typically, the required minimum factors of safety are 1.5 for static conditions and 1.0 for seismic (pseudostatic) conditions. The results of our analyses indicate that the existing slope configurations analyzed will meet both these requirements provided our recommendations are followed (see Figures 7 and 8).

Slope movements or even failure can occur if the slope soils are undermined or become saturated. Groundwater was not encountered during the course of our field investigation; however saturation of the slope soils can adversely affect the stability of the slope. Measures must be implemented to reduce the potential for saturation of the soils at the site. Surface drainage at the bottom and top of the slope should be directed to prevent ponding at the toe or crest of the slope, and a cut-off drain on the slope above the home is recommended to reduce the potential for infiltration of surface water at the site, as discussed further in Section 5.8, Subdrains. Landscape irrigation on this and surrounding areas may also create additional seasonal groundwater fluctuations. The limitations of landscape irrigation at the site are discussed further in Section 5.9, Site Irrigation. 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 slope soils.

Changes to the grading at the site and any retaining walls must be properly engineered to maintain stability of the slopes. GSH must review the final grading plans for the project prior to initiation of any construction.

## **5.4 SPREAD AND CONTINUOUS WALL FOUNDATIONS**

### **5.4.1 Design Data**

The proposed structure may be supported upon conventional spread and continuous wall foundations established upon a minimum of 2 feet of structural fill extending to suitable natural soils. For design, the following parameters are provided:

Minimum Recommended Depth of Embedment for Frost Protection	- 30 inches
Minimum Recommended Depth of Embedment for Non-frost Conditions	- 15 inches
Recommended Minimum Width for Continuous Wall Footings	- 16 inches
Minimum Recommended Width for Isolated Spread Footings	- 24 inches

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Recommended Net Bearing Pressure  
for Real Load Conditions

- 1,500 pounds  
per square foot

Bearing Pressure Increase  
for Seismic Loading

- 50 percent

The term “net bearing pressure” refers to the pressure imposed by the portion of the structure located above lowest adjacent final grade. Therefore, the weight of the footing and backfill to lowest adjacent final grade need not be considered. Real loads are defined as the total of all dead plus frequently applied live loads. Total load includes all dead and live loads, including seismic and wind.

### **5.4.2 Installation**

Footings shall not be installed upon soft or disturbed soils, mass movement soils, non-engineered fill, construction debris, frozen soil, or within ponded water. If the granular structural fill upon which the footings are to be established becomes disturbed, it shall be recompacted to the requirements for structural fill or be removed and replaced with structural fill.

The width of structural fill, where placed below footings, shall extend laterally at least 6 inches beyond the edges of the footings in all directions for each foot of fill thickness beneath the footings. For example, if the width of the footing is 2 feet and the thickness of the structural fill beneath the footing is 2.0 feet, the width of the structural fill at the base of the footing excavation would be a total of 4.0 feet, centered below the footing.

### **5.4.3 Settlements**

Maximum settlements of foundations designed and installed in accordance with recommendations presented herein and supporting maximum anticipated loads as discussed in Section 2, Proposed Construction, are anticipated to be 1 inch or less.

Approximately 40 percent of the quoted settlement should occur during construction.

## **5.5 LATERAL RESISTANCE**

Lateral loads imposed upon foundations due to wind or seismic forces may be resisted by the development of passive earth pressures and friction between the base of the foundations and the supporting soils. In determining frictional resistance, a coefficient of 0.40 should be utilized for foundations placed over granular structural fill. Passive resistance provided by properly placed and compacted granular structural fill above the water table may be considered equivalent to a fluid with a density of 300 pounds per cubic foot. Below the water table, this granular soil should be considered equivalent to a fluid with a density of 150 pounds per cubic foot.

A combination of passive earth resistance and friction may be utilized provided that the friction component of the total is divided by 1.5.

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### **5.6 LATERAL PRESSURES**

The lateral pressure parameters, as presented within this section, are for backfills which will consist of drained granular soil placed and compacted in accordance with the recommendations presented herein. The lateral pressures imposed upon subgrade facilities will, therefore, be basically dependent upon the relative rigidity and movement of the backfilled structure. For active walls, such as retaining walls which can move outward (away from the backfill), granular backfill may be considered equivalent to a fluid with a density of 35 pounds per cubic foot in computing lateral pressures. For more rigid walls (moderately yielding), generally not exceeding 8 feet in height, granular backfill may be considered equivalent to a fluid with a density of 45 pounds per cubic foot. The above values assume that the surface of the soils slope behind the wall is no steeper than 4 horizontal to 1 vertical and that the granular fill within 3 feet of the wall will be compacted with hand-operated compacting equipment.

For seismic loading, a uniform pressure shall be added. The uniform pressures based on different wall heights are provided in the following table:

<b>Wall Height (feet)</b>	<b>Seismic Loading Active Case (psf)</b>	<b>Seismic Loading Moderately Yielding (psf)</b>
4	25	55
6	40	85
8	55	115

### **5.7 FLOOR SLABS**

Floor slabs may be established upon a minimum of 2 feet of structural fill extending to suitable natural soils. Under no circumstances shall floor slabs be established over mass movement deposit soils, non-engineered fills, loose or disturbed soils, sod, rubbish, construction debris, other deleterious materials, frozen soils, or within ponded water. In order to provide a capillary break and facilitate curing of the concrete, it is recommended that floor slabs be directly underlain by 4 inches of “free-draining” fill, such as “pea” gravel or three-quarters- to one-inch minus clean gap-graded gravel.

Settlement of lightly loaded floor slabs (average uniform pressure of 100 to 150 pounds per square foot or less) is anticipated to be less than 1/4 inch.

The tops of all floor slabs in habitable areas must be established at least 4 feet above the highest anticipated normal water level or 1.5 feet above the maximum groundwater level controlled by land drains.



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### **5.8 SUBDRAINS**

#### **5.8.1 General**

We recommend that the perimeter foundation subdrains and a cutoff drain near the head of the mass movement deposit soils be installed as indicated below.

#### **5.8.2 Foundation Subdrains**

Foundation subdrains should consist of a 4-inch diameter perforated or slotted plastic or PVC pipe enclosed in clean gravel. The invert of a subdrain should be at least 2 feet below the top of the lowest adjacent floor slab. The gravel portion of the drain should extend 2 inches laterally and below the perforated pipe and at least 1 foot above the top of the lowest adjacent floor slab. The gravel zone must be installed immediately adjacent to the perimeter footings and the foundation walls. To reduce the possibility of plugging, the gravel must be wrapped with a geotextile, such as Mirafi 140N or equivalent. Above the subdrain, a minimum 4-inch-wide zone of “free-draining” sand/gravel should be placed adjacent to the foundation walls and extend to within 2 feet of final grade. The upper 2 feet of soils should consist of a compacted clayey cap to reduce surface water infiltration into the drain. As an alternative to the zone of permeable sand/gravel, a prefabricated “drainage board,” such as Miradrain or equivalent, may be placed adjacent to the exterior below-grade walls. Prior to the installation of the footing subdrain, the below-grade walls should be dampproofed. The slope of the subdrain should be at least 0.3 percent. The gravel placed around the drain pipe should be clean 0.75-inch to 1.0-inch minus gap-graded gravel and/or “pea” gravel. The foundation subdrains can be discharged into the area subdrains, storm drains, or other suitable down-gradient location.

We recommend final site grading slope away from the structures at a minimum 2 percent for hard surfaces (pavement) and 5 percent for soil surfaces within the first 10 feet from the structures.

#### **5.8.3 Cutoff Drain**

To reduce potential infiltration of surface water and groundwater into the subsurface soils at the site, a cutoff drain should be installed upslope of the home and near the head of the mass movement deposit soils below the home. The drain should consist of a perforated 4-inch minimum diameter pipe wrapped in fabric and placed near the bottom of a minimum 24 inch wide trench excavated to a depth of at least 15 feet below existing grade or to competent bedrock and lined in filter fabric. The pipe should daylight at one or both ends of the drain and discharge to an appropriate drainage device or area. Clean gravel up to 2 inches in maximum size, with less than 10 percent passing the No. 4 sieve and less than 5 percent passing the No. 200 sieve, should be placed around the drain pipe. A fabric, such as Mirafi 140N or equivalent, should be placed between the clean gravel and the adjacent soils. A zone of clean gravel wrapped in fabric at least 24 inches wide should also extend above the drain, to within 2 feet of the ground surface, with fabric placed over the top of the gravel. The upper 2 feet of soils should consist of a compacted clayey cap to reduce surface water infiltration into the drain.

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### **5.9 SITE IRRIGATION**

Proper site drainage is important to maintaining slope stability at the site. Saturation of soils at the site may result in slope movement or failure. Therefore, we recommend that no irrigation lines should be placed on the slope. Landscaping at the site should be planned to utilize drought resistant plants that require minimal watering. Plants or lawn may be placed on the slope, with plants watered using direct drip systems targeted only for each plant, and any lawn areas watered using sprinklers placed in a manner such that watering is a minimum of 30 feet back from the crest of the slope. Overwatering should be strictly avoided. The surface of the site should be graded to prevent the accumulation or ponding of surface water at the site. 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 slope soils.

To reduce the potential for saturation of the site soils, overwatering at the site should be strictly avoided. Watering at the site should be limited to a maximum equivalent rainfall of 0.5 inches per week. Irrigation at the site should be strictly avoided during periods of natural precipitation.

### **5.10 GEOSEISMIC SETTING**

#### **5.10.1 General**

Utah municipalities have adopted the International Building Code (IBC) 2012. The IBC 2012 code determines the seismic hazard for a site based upon 2008 mapping of bedrock accelerations prepared by the United States Geologic Survey (USGS) and the soil site class. The USGS values are presented on maps incorporated into the IBC code and are also available based on latitude and longitude coordinates (grid points).

The structure must be designed in accordance with the procedure presented in Section 1613, Earthquake Loads, of the IBC 2012 edition.

#### **5.10.2 Faulting**

Based upon our review of available literature, no active faults are known to pass through the site. The nearest active fault is the Wasatch Fault Zone Weber Section, approximately 4.3 miles west of the site.

#### **5.10.3 Soil Class**

For dynamic structural analysis, the Site Class C – Soft Bedrock Soil Profile as defined in Chapter 20 of ASCE 7 (per Section 1613.3.2, Site Class Definitions, of IBC 2012) can be utilized.

## Exhibit B

Coalesce Architecture  
Job No. 1041-04N-16  
Geotechnical Study – Lot 44 Big Sky Estates  
July 8, 2016



### 5.10.4 Ground Motions

The IBC 2012 code is based on 2008 USGS mapping, which provides values of short and long period accelerations for the Site Class B boundary for the Maximum Considered Earthquake (MCE). This Site Class B boundary represents average bedrock values for the Western United States and must be corrected for local soil conditions. The following table summarizes the peak ground and short and long period accelerations for the MCE event and incorporates the appropriate soil amplification factor for a Site Class C soil profile. Based on the site latitude and longitude (41.2981 degrees north and -111.8497 degrees west, respectively), the values for this site are tabulated below:

Spectral Acceleration Value, T	Site Class B	Site Coefficient	Site Class C	Design Values
	Boundary [mapped values] (% g)		[adjusted for site class effects] (% g)	
Peak Ground Acceleration	39.1	$F_a = 1.009$	39.5	26.3
0.2 Seconds (Short Period Acceleration)	$S_s = 97.8$	$F_a = 1.009$	$S_{MS} = 98.7$	$S_{DS} = 65.8$
1.0 Second (Long Period Acceleration)	$S_1 = 33.7$	$F_v = 1.463$	$S_{M1} = 49.3$	$S_{D1} = 32.9$

### 5.10.5 Liquefaction

The site is located in an area that has been identified by the Utah Geologic Survey as having “very low” liquefaction potential. Liquefaction is defined as the condition when saturated, loose, finer-grained sand-type soils lose their support capabilities because of excessive pore water pressure which develops during a seismic event. Clay soils, even if saturated, will generally not liquefy.

Liquefaction of the site soils is not anticipated during the design seismic event due to the unsaturated nature of the site soils.

## 5.11 SITE OBSERVATIONS

As stated previously, prior to placement of foundations, floor slabs, pavements, and site grading fills, a geotechnical engineer from GSH must verify that all mass movement deposit soils, non-engineered fill materials, topsoil, and disturbed soils have been removed and/or properly prepared and suitable subgrade conditions encountered. Additionally, GSH must observe fill placement and verify in-place moisture content and density of fill materials placed at the site.

## **Exhibit B**

Coalesce Architecture  
Job No. 1041-04N-16  
Geotechnical Study – Lot 44 Big Sky Estates  
July 8, 2016



### **5.12 CLOSURE**

If you have any questions or would like to discuss these items further, please feel free to contact us at (801) 393-2012.

Respectfully submitted,

**GSH Geotechnical, Inc.**

Handwritten signature of Andrew M. Harris in blue ink.

Andrew M. Harris, P.E.  
State of Utah No. 740456  
Senior Geotechnical Engineer



Reviewed by:

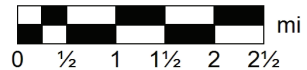
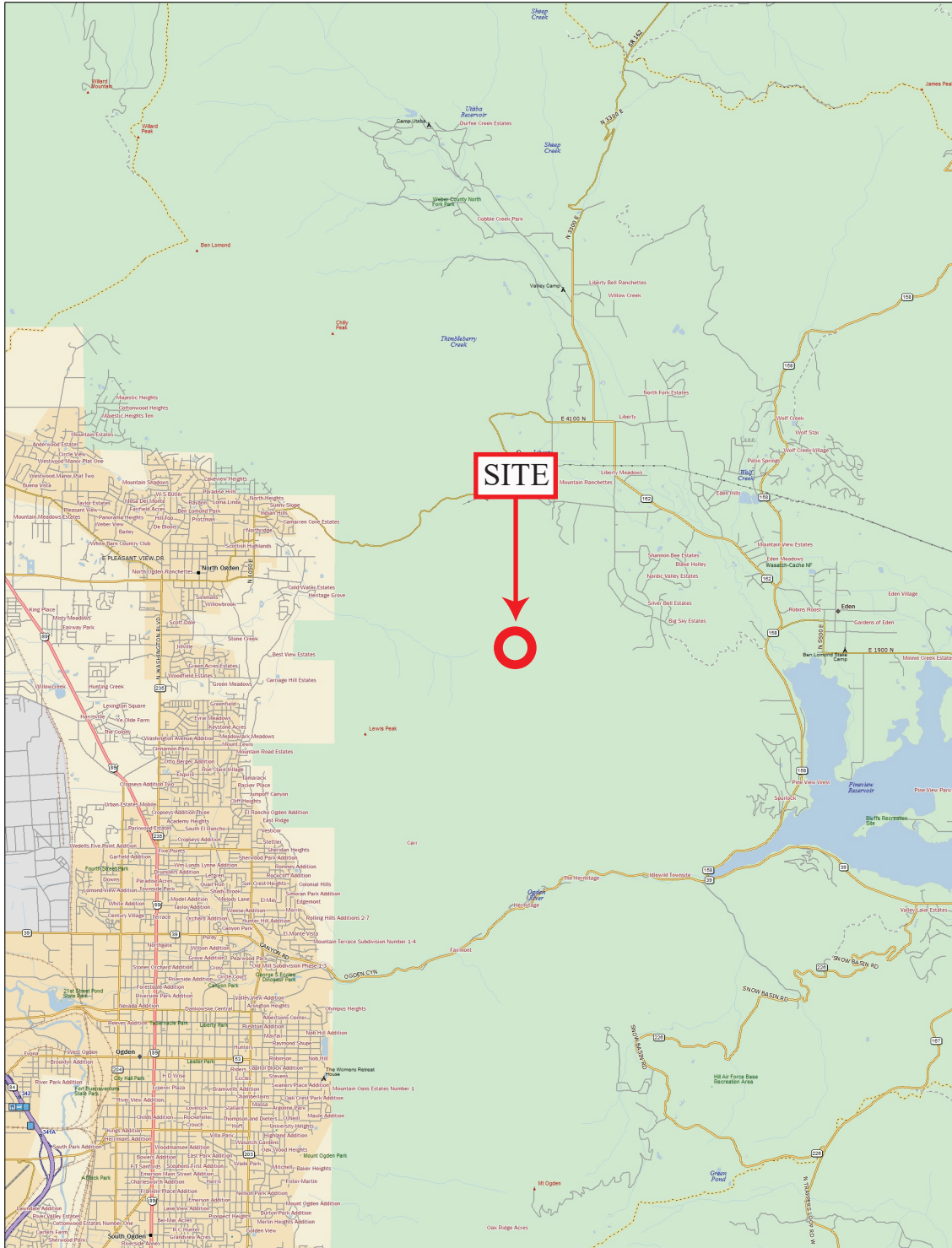
Handwritten signature of Michael S. Huber in blue ink.

Michael S. Huber, P.E.  
State of Utah No. 343650  
Senior Geotechnical Engineer

AMH/MSH:mmh

Encl. Figure 1, Vicinity Map  
Figure 2, Site Plan  
Figures 3A Boring Log  
Figures 4A through 4C, Test Pit Logs  
Figure 5, Key to Boring Log (USCS)  
Figure 6, Key to Test Pit Log (USCS)  
Figures 7 and 8, Stability Results  
Appendix, Geologic Hazards Reconnaissance Study

Addressee (email)



Data Zoom 12-0

# FIGURE 1

## VICINITY MAP

Page 61 of 102



REFERENCE:  
DE LORME STREET ATLAS

**Exhibit B**

COALESCE ARCHITECTURE  
JOB NO. 1041-04N-16





REFERENCE:  
ADAPTED FROM AERIAL PHOTOGRAPH  
DOWNLOADED FROM GOOGLE EARTH  
IMAGERY DATE: JUNE 16, 2015

KEY:  
Measured Groundwater depth (feet)

FIGURE 2  
SITE PLAN


**Exhibit B**

 <b>GSH</b>		<b>BORING LOG</b> Page: 1 of 2				<b>BORING: B-1</b>					
CLIENT: Coalesce Architecture					PROJECT NUMBER: 1041-04N-16						
PROJECT: Lot 44 Big Sky Estates					DATE STARTED: 5/2/16		DATE FINISHED: 5/2/16				
LOCATION: 4075 Bluebell Drive, near Liberty, Weber County, Utah					GSH FIELD REP.: AA						
DRILLING METHOD/EQUIPMENT: 3-3/4" ID Hollow-Stem Auger					HAMMER: Automatic		WEIGHT: 140 lbs		DROP: 30"		
GROUNDWATER DEPTH: Not Encountered (5/2/16)					ELEVATION: ---						
WATER LEVEL	U S C S	DESCRIPTION	DEPTH (FT.)	BLOW COUNT	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
		<b>Ground Surface</b>	0								slightly moist medium stiff
	MH/ SM	FINE SANDY SILT/SILTY FINE SAND with trace fine to coarse sand; major roots (topsoil); brown  reddish-brown		30	X						very stiff
			5	17	X	48		52	86	34	stiff
	CL	SILTY CLAY/CLAYEY SAND with trace fine to coarse sand; light brown		45	X	49		45	30	16	very stiff
			10	54	X						hard
				85	X						
			15	72	X						
	ML/ SM	SILT/SILTSTONE with fine to coarse sand; gray		50+	X						moist very dense
			20	50+	X						
				50+	X						
		trace organics	25		X						


 <b>GSH</b>		<b>BORING LOG</b> Page: 2 of 2				<b>BORING: B-1</b>					
CLIENT: Coalesce Architecture					PROJECT NUMBER: 1041-04N-16						
PROJECT: Lot 44 Big Sky Estates					DATE STARTED: 5/2/16		DATE FINISHED: 5/2/16				
WATER LEVEL	U S C S	DESCRIPTION	DEPTH (FT.)	BLOW COUNT	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
		trace organics; deformed bedding	25	99	X						
				50+	X						
		deformed bedding	30	82	X	27		42	41	20	
				50+	X						slightly moist
	SM	SILTY FINE TO COARSE SAND/SANDSTONE light yellowish-brown	35	50+	X						slightly moist very dense
		trace organics; deformed bedding		50+	X						
	ML/ SM	SILT/SILTSTONE with trace fine to coarse sand; gray	40	50+	X	36		47			slightly moist very dense
				50+	X						
			45	50+	X						
		End of Exploration at 46.5' No groundwater encountered at time of drilling Installed 1.25" diameter slotted PVC pipe to 45.0'									
			50								


See Subsurface Conditions section in the report for additional information.



 <b>GSH</b>		<b>TEST PIT LOG</b> Page: 1 of 1				<b>TEST PIT: TP-1</b>				
CLIENT: Coalesce Architecture			PROJECT NUMBER: 1041-04N-16							
PROJECT: Lot 44 Big Sky Estates			DATE STARTED: 4/29/16		DATE FINISHED: 4/29/16					
LOCATION: 4075 Bluebell Drive, near Liberty, Weber County, Utah						GSH FIELD REP.: HRW				
EXCAVATING METHOD/EQUIPMENT: JCB 214S - Backhoe										
GROUNDWATER DEPTH: Not Encountered (4/29/16)						ELEVATION: ---				
WATER LEVEL	U S C S	DESCRIPTION	DEPTH (FT.)	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
		<b>Ground Surface</b>	0							
	MH/ SM	FINE SANDY SILT/SILTY FINE SAND major roots (topsoil) to 8"; brown								moist medium stiff
					48		48	75	12	
			5							stiff
	CL	SILTY CLAY brown								very stiff
			10							
		End of Exploration at 10.5' No significant sidewall caving No groundwater encountered at time of excavation								
			15							
			20							
			25							

**Exhibit B**

		<h1 style="margin:0;">TEST PIT LOG</h1> <p style="margin:0;">Page: 1 of 1</p>				<h2 style="margin:0;">TEST PIT: TP-2</h2>				
CLIENT: Coalesce Architecture					PROJECT NUMBER: 1041-04N-16					
PROJECT: Lot 44 Big Sky Estates					DATE STARTED: 4/29/16		DATE FINISHED: 4/29/16			
LOCATION: 4075 Bluebell Drive, near Liberty, Weber County, Utah							GSH FIELD REP.: HRW			
EXCAVATING METHOD/EQUIPMENT: JCB 214S - Backhoe										
GROUNDWATER DEPTH: Not Encountered (4/29/16)							ELEVATION: ---			
WATER LEVEL	U S C S	DESCRIPTION	DEPTH (FT.)	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
		<b>Ground Surface</b>	0							moist medium stiff
	ML	SILT with some fine sand; major roots (topsoil) to 8"; brown	5	█						
		End of Exploration at 11.0' No significant sidewall caving No groundwater encountered at time of excavation	10	█						
			15							
			20							
			25							

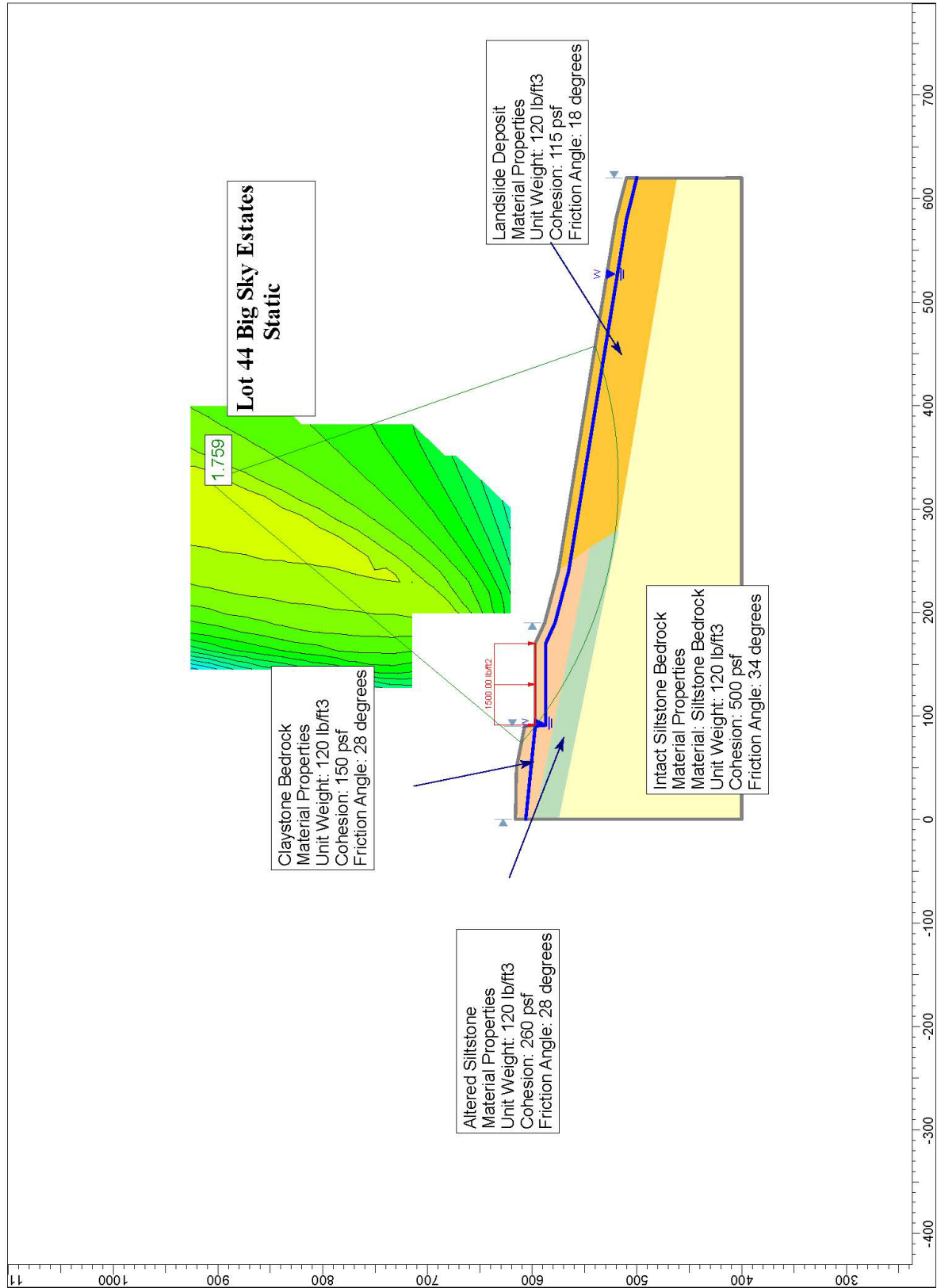
		<h1>TEST PIT LOG</h1>				<h2>TEST PIT: TP-3</h2>				
CLIENT: Coalesce Architecture		PROJECT NUMBER: 1041-04N-16								
PROJECT: Lot 44 Big Sky Estates		DATE STARTED: 4/29/16			DATE FINISHED: 4/29/16					
LOCATION: 4075 Bluebell Drive, near Liberty, Weber County, Utah		GSH FIELD REP.: HRW								
EXCAVATING METHOD/EQUIPMENT: JCB 214S - Backhoe										
GROUNDWATER DEPTH: Not Encountered (4/29/16)						ELEVATION: ---				
WATER LEVEL	U S C S	DESCRIPTION	DEPTH (FT.)	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
		<b>Ground Surface</b>	0							
	MH/ SM	FINE SANDY SILT/SILTY FINE SAND major roots (topsoil) to 8"; brown								moist medium stiff
				▲	60		48	68	22	
		pieces of weathered claystone	5	▲	43		43	59	6	stiff
	CL	SILTY CLAY brown								moist stiff
			10	▲						
		End of Exploration at 12.0' No significant sidewall caving No groundwater encountered at time of excavation Installed 1.25" diameter slotted PVC pipe to 12.0'	15							
			20							
			25							





# STABILITY RESULTS

## LOT 44 BIG SKY ESTATES





**R E P O R T**

**GEOLOGIC HAZARDS EVALUATION**

**LOT 44 BIG SKY ESTATES NO. 1**

**4075 BLUEBELL DRIVE**

**LIBERTY, WEBER COUNTY, UTAH**



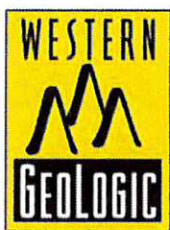
*Prepared for*

Carson Young  
Solitude Builders  
PO Box 529  
Eden, Utah 84310

June 4, 2016

*Prepared by*

Western GeoLogic, LLC  
2150 South 1300 East, Suite 500  
Salt Lake City, Utah 84106



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June 4, 2016

Carson Young  
Solitude Builders  
PO Box 529  
Eden, Utah 84310

**SUBJECT:** Geologic Hazards Evaluation  
Lot 44 Big Sky Estates No. 1  
4075 Bluebell Drive  
Liberty, Weber County, Utah

Dear Mr. Young:

This report presents results of an engineering geology and geologic hazards review and evaluation conducted by Western GeoLogic, LLC (Western GeoLogic) for Lot 44 in the Big Sky Estates No. 1 Subdivision at 4075 Bluebell Drive in Liberty, Weber County, Utah (Figure 1 – Project Location). The site is at the margin of northwestern Ogden Valley at the eastern base of the Wasatch Range in the SW1/4 Section 33, Township 7 North, Range 1 East (Salt Lake Base Line and Meridian; Figure 1). Elevation of the site ranges from about 5,545 feet to 5,610 feet above sea level. It is our understanding that the current intended site use is for development of one residential home in the central part of the site.

## **PURPOSE AND SCOPE**

The purpose and scope of this investigation is to identify and interpret geologic conditions at the site to identify potential risk from geologic hazards to the Project. This investigation is intended to: (1) provide geologic information and assessment of geologic conditions at the site; (2) identify potential geologic hazards that may be present and qualitatively assess their risk to the intended site use; and (3) provide recommendations for additional site- and hazard-specific studies or mitigation measures, as may be needed based on our findings. Such recommendations could require further multi-disciplinary evaluations, and/or may need design criteria that are beyond our professional scope.

The following services were performed in accordance with the above stated purpose and scope:

- A site reconnaissance conducted by an experienced certified engineering geologist to assess the site setting and look for adverse geologic conditions;
- Excavation and logging of three test pits on April 29, 2016 to evaluate subsurface conditions at the property;

- Review of readily-available geologic maps, reports, and air photos; and
- Evaluation of available data and preparation of this report, which presents the results of our study.

The engineering geology section of this report has been prepared in accordance with current generally accepted professional engineering geologic principles and practice in Utah, and meets specifications provided in Chapter 27 of the Weber County Land Use Code.

## **HYDROLOGY**

The U.S. Geological Survey (USGS) topographic map of the Huntsville Quadrangle shows the site is at the western margin of Ogden Valley between Pole Canyon and Coal Hollow Creeks, and is on southeast- to east-facing slopes slightly below a hilltop overlooking Ogden Valley to the east and Nordic Valley to the west and northwest (Figure 1). Pole Canyon Creek flows to the north about 1,950 feet west of the property, and Coal Canyon Creek flows to the northeast about 650 feet to the southeast. Nordic Valley Ski Area is about one mile to the northwest. No active drainages are shown crossing the site on Figure 1. However, one small drainage that may be seasonally active reportedly flows to the east across the property into Coal Canyon from slightly below the cul-de-sac bordering the site on the west (AGEC, 2014). No springs or seeps were observed at the site or are shown in the site area on Figure 1.

The site is the western margin of Ogden Valley about 1.1 miles northwest of the north arm of Pineview Reservoir. The valley bottom to the east is dominated by unconsolidated lacustrine and alluvial basin-fill deposits, whereas slopes in the site area are mainly in weathered Tertiary-age tuffaceous bedrock and landslide colluvium from a complex series of overlapping failures since Late Pleistocene time. The Utah Division of Water Rights Well Driller Database shows one water well about 2,000 feet southwest of the property that has a reported depth to static groundwater of 50 feet, but no site-specific groundwater information was available and no groundwater was encountered in the boring conducted by GSH at the property to its explored depth of 46.5 feet. Given all the above, we anticipate the depth to the shallow aquifer at the Project is somewhere between 50 and 100 feet. However, groundwater depths at the site likely vary seasonally from snowmelt runoff and annually from climatic fluctuations. Such variations would be typical for an alpine environment. Perched conditions above less-permeable, clay-rich bedrock layers may also be present in the subsurface that could cause locally shallower groundwater levels.

Avery (1994) indicates groundwater in Ogden Valley occurs under perched, confined, and unconfined conditions in the valley fill to depths of 750 feet or more. A well-stratified lacustrine silt layer forms a leaky confining bed in the upper part of the valley-fill aquifer. The aquifer below the confining beds is the principal aquifer, which is in primarily fluvial and alluvial-fan deposits. The principal aquifer is recharged from precipitation, seepage from surface water, and subsurface inflow from bedrock into valley fill along the valley margins (Avery, 1994). The confined aquifer is typically overlain by a shallow, unconfined aquifer recharged from surface

flow and upward leakage. Groundwater flow is generally from the valley margins into the valley fill, and then toward the head of Ogden Canyon (Avery, 1994). Based on topography, we expect groundwater flow at the site to be to the east-southeast toward Coal Canyon Creek.

## GEOLOGY

### Surficial Geology

The site is located on the northwestern margin of Ogden Valley, a sediment-filled intermontane valley within the Wasatch Range, a major north-south trending mountain range marking the eastern boundary of the Basin and Range physiographic province (Stokes; 1977, 1986). Surficial geology of the site is shown on unpublished, 1:24,000-scale, Utah Geological Survey (UGS) mapping from 2014 (Figure 2). The 2014 mapping is part of an ongoing surficial geologic mapping project for Ogden Valley that will be, in part, incorporated into an optimized update of Coogan and King (2001). The unpublished mapping was provided for this report since it represents the most-recent geologic information available for the area, although it will be replaced by the official optimized map.

Figure 2 shows the site in bedrock of the Norwood Formation, with possible landslide and slump deposits near the southeast site corner (units Tn and Qmc?, Figure 2). Descriptions of geologic units within 0.5 miles of the site from the adjoining Snow Basin Quadrangle (King and others, 2008) are as follows:

***Qaf*** – ***Alluvial-fan deposits, undivided (Holocene and Pleistocene)***. Mostly sand, silt, and gravel that is poorly bedded and poorly sorted; includes debris flows, particularly in drainages and at drainage mouths (fan heads); generally less than 60 feet (18 m) thick. Mapped where fan age uncertain or for composite fans where portions of fans with different ages cannot be shown separately at map scale.

***Qaf1, Qafy*** – ***Younger alluvial-fan deposits (Holocene and uppermost Pleistocene)*** - Mostly sand, silt, and gravel that is poorly bedded and poorly sorted; includes debris flows, particularly in drainages and at drainage mouths (fan heads); generally less than 40 feet (12 m) thick. Near late Pleistocene Lake Bonneville, deposits with suffixes 1 and y are younger than Lake Bonneville (mostly Holocene), are active, and impinge on present-day drainages like the Weber River and Cottonwood Creek; *Qafy* fans may be partly older than *Qaf1* fans, and may be as old as uppermost Pleistocene Provo shoreline.

***Qmdf*** – ***Debris- and mud-flow deposits (Holocene and uppermost Pleistocene)***. Poorly sorted, clay- to boulder-sized material, typically with distinct natural lateral levees, channels, and lack of vegetation; older deposits can be vegetated; 0 to 40 feet (0-12 m) thick.

***Qms, Qms1, Qmsy, Qmso – Landslide and slump deposits (Holocene and Pleistocene).*** Poorly sorted clay- to boulder-sized material; locally includes flow deposits; generally characterized by hummocky topography, main and internal scarps, and chaotic bedding in displaced blocks; composition depends on local sources; morphology becomes more subdued with time and amount of water in deposits; *Qms* may be in contact with *Qms* when two different slide/slumps abut; locally, unit involved in slide/slump is shown in parentheses where a nearly intact block is visible; *Qms* and *Qmso* queried (?) where bedrock block may be in place; thickness highly variable, boreholes in Rogers (1986) show thicknesses of about 20 to 30 feet (6-9 m) on small slides/flows. *Qms* without suffix is mapped where age uncertain (though likely Holocene and/or upper Pleistocene), where portions of slide/slump complexes have different ages but cannot be shown separately at map scale, or where boundaries between slides/slumps of different ages are not distinct. Estimated time of emplacement indicated by relative age number and letter suffixes with: 1 - likely emplaced in the last 80 to 150 years, mostly historical; y - post- Lake Bonneville in age and mostly pre-historic; and o – likely emplaced before Lake Bonneville transgression. Suffixes y (as well as 1) and o indicate probable Holocene and Pleistocene ages, respectively. *Qmso* typically mapped where rumpled morphology typical of mass movements has been diminished and/or younger surficial deposits cover or cut *Qmso*. These older deposits are as unstable as other landslides and slumps, and are easily reactivated with the addition of water, be it irrigation or septic tank drain fields.

***Qmc – Landslide and slump, and colluvial deposits, undivided (Holocene and Pleistocene).*** Mapped where landslides and slumps are difficult to distinguish from colluvium (slopewash and soil creep) and where mapping separate, small, intermingled areas of slides and slumps, and colluvial deposits is not possible at map scale; locally includes talus and debris flows; typically mapped where landslides and slumps are thin (“shallow”); also mapped where the blocky or rumpled morphology that is characteristic of landslides and slumps has been diminished (“smoothed”) by slopewash and soil creep; composition depends on local sources; 0 to 40 feet (0-12 m) thick. These deposits are as unstable as other landslides and slumps units (*Qms*).

***Qac – Alluvium and colluvium (Holocene and Pleistocene).*** Includes stream and fan alluvium, colluvium, and, locally, mass-movement deposits; 0 to 20 feet (0-6 m) thick.

***Qls – Lake Bonneville sand (upper Pleistocene).*** Mostly sand with some silt and gravel deposited nearshore in Morgan Valley; typically less than 20 feet (6 m) thick, but thicker in “bench” east of Cottonwood Creek in southeast corner of Snow Basin quadrangle.

***Qafp, Qafb, Qafo – Older alluvial-fan deposits (upper and middle(?) Pleistocene).*** Incised fans of mostly sand, silt, and gravel that is poorly bedded and poorly sorted; includes debris flows, particularly in drainages and at drainage mouths (fan heads); generally less than 60 feet (18 m) thick. Fans labeled *Qafp* and *Qafb* are graded to the Provo (and slightly lower) and Bonneville shorelines of late Pleistocene Lake Bonneville, respectively. Near Lake Bonneville, unit *Qafo* is older than (above and

*typically incised/eroded at) the Bonneville shoreline; upstream unit Qafo is topographically higher than fans graded to the Bonneville shoreline (Qafb). Elsewhere relative-age letters only apply to local drainages. Like Qa and Qat suffixes, ages are partly based on heights above present drainages (table 1), in this case heights at drainage-eroded edge of fan, with Qafp about 35 to 45 feet (10 to 12 m) above, Qafb 50 to 75 feet (15-23 m) above, and Qafo about 70 to 110 feet (20-35 m) above present drainages. Dates presented in Sullivan and Nelson (1992) imply Qafo to southeast in Morgan quadrangle considerably predates Lake Bonneville and is middle Pleistocene in age (300-600 ka). This means these older fans could be related to Pokes Point lake cycle (at about 200 ka, after McCoy, 1987) (Kansan continental glaciation?, 300-400 ka) and/or pre Pokes Point (Nebraskan continental glaciation?, > 500 ka); however, the Bonneville shoreline is obscure on this fan.*

**Tn – Norwood Formation (lower Oligocene and upper Eocene) -** Typically light-gray to light brown, altered tuff (claystone), tuffaceous siltstone, sandstone, and conglomerate; locally colored light shades of red and green; variable calcareous cement and zeolitization, that is less common to south of Snow Basin quadrangle; zeolite marker beds mapped as an aid to recognizing geologic structure; locally includes landslides and slumps that are too small to show at map scale.

*Upper Norwood Formation, as exposed on east margin of Snow Basin quadrangle and to east in Durst Mountain quadrangle, contains interbedded claystone (tuffaceous beds), fine- to coarse-grained sandstone, gray granule to small pebble conglomerate, with chert and carbonate clasts, as well as conglomerate interbeds with quartzite pebble clasts like those in unit Tcg; interbedded with more extensive quartzite-clast conglomerate, some mapped as Tcg, to east in Durst Mountain quadrangle (see Coogan and King, 2006); north of Wasatch Formation (Tw) knob on Snow Basin-Durst Mountain quadrangle boundary, the Norwood contains intermittent quartzite gravel (quartzite-richest exposures mapped as Tcg?); also, gravel-rich beds containing mostly chert and carbonate clasts are common north of the knob, and with quartzite-bearing beds, are involved in multiple landslides that obscure bedding and structure; these variations and disruptions make it difficult to map a consistent Tcg-Tn contact (see also unit Tcg description above and in Coogan and King, 2006); based on outcrop pattern, dip, and topography, Norwood is at least 7000 feet (2135 m) thick in Snow Basin quadrangle; it thins to the south, so is about 5000 feet (1525 m) thick north of Morgan, and only about 1500 feet (460 m) thick east of East Canyon Creek in the type area in Porterville quadrangle (Eardley, 1944) (not 2500+ feet [800+ m] inferred by Bryant and others, 1989, p. K6).*

*Zeolite beds mapped in the Norwood indicate a generally east-dipping homocline with minor faulting. A broad, north-south-oriented, doubly plunging syncline is superimposed on the homocline but the east limb of the syncline and companion anticline are obscured by landslide complexes. The common fold limb may dip steeply to the west. Also the zeolite beds become obscure to the east, due to the increased abundance of clastic sediment, making the zeolite beds thinner and less pure, and therefore less distinct. Norwood generally considered younger than the Fowkes Formation, but not well dated due to alteration. Corrected Norwood K-Ar ages are*

38.4 Ma (sanidine) from Norwood type area (Evernden and others, 1964) and 39.3 Ma (biotite) from farther south in East Canyon (Mann, 1974), while Fowkes  $^{40}\text{Ar}/^{39}\text{Ar}$  ages are 40.41 Ma and 38.78 Ma on biotite and hornblende, respectively, from Utah to east near Wyoming (Coogan and King, unpublished). To north in southern Cache Valley, basal part of unit similar to Fowkes and Norwood (“resting” on Wasatch and less than 600 feet [180 m] or about 1200 feet [260 m] thick) dated at  $44.2 \pm 1.7$  Ma and  $48.6 \pm 1.3$  Ma K-Ar on hornblende and biotite, respectively (Smith, 1997; King and Solomon, 2008); though the biotite date is suspect, its age is similar to older dates on the Fowkes Formation in Wyoming, which are:  $47.94 \pm 0.17$  Ma ( $^{40}\text{Ar}/^{39}\text{Ar}$ , sanidine) at the northeast end of the Crawford Mountains (Smith and others, 2008, p. 67), south of the Fowkes type area (see Oriol and Tracey, 1970); 49.1 Ma (biotite; recalculated; dated in 1977, but decay constant not reported, so may not need to be recalculated), reported as  $47.9 \pm 1.9$  Ma by Nelson (1979) and likely from near the base of the Fowkes near Evanston, Wyoming (Nelson, 1973); and 48.9 Ma K-Ar (hornblende; recalculated) from the Fowkes type area near Leefe, Wyoming ( $47.7 \pm 1.5$  Ma, Oriol and Tracey, 1970). The Norwood is different in the southern Peterson and Morgan quadrangles, near the type area (see Eardley, 1944), where it contains extensive unaltered tuff (hence the name Norwood Tuff), has cut-and-fill structures (fluvial), and includes volcanic-clast conglomerate; in the Morgan quadrangle, it also contains local limestone and silica-cemented rocks. Unit referred to here as Norwood Formation, rather than Norwood Tuff, because the type area includes only part of the formation (see thickness in following paragraph), the Norwood contains many lithologies, and this emphasizes that it is not tuffaceous away from the type area.

*Citations in the above unit descriptions are provided in King and others (2008).*

Figure 2 shows several strike and dip measurements in Norwood Formation in the site area. Those shown in black were measured by the UGS, whereas those in purple are from U.S. Geological Survey (USGS) data (Jon King, verbal communication, February 29, 2016). The nearest measurement is about 700 feet northwest of the property and shows a strike/dip of N46°W 40° NE. Several additional measurements are to the east and southeast that show generally northwest-trending strikes and dips generally between about 27 to 46 degrees to the northeast. Norwood Formation bedrock in the area has average dips of about 30 to 45 degrees, although this unit has local depositional variations that may produce lower and higher dips within a relatively short distance (Jon King, verbal communication, February 29, 2016).

### **Seismotectonic Setting**

The property is located at the western margin of Ogden Valley, a roughly 40-square mile back valley described by Gilbert (1928) as a structural trough similar to Cache and Morgan Valleys to the north and south, respectively. The back valleys of the northern Wasatch Range are in a transition zone between the Basin and Range and Middle Rocky Mountains provinces (Stokes, 1977, 1986). The Basin and Range is characterized by a series of generally north-trending elongate mountain ranges, separated by predominately alluvial and lacustrine sediment-filled valleys and typically bounded on one or both sides by major normal faults (Stewart, 1978). The boundary between the Basin and Range and Middle

Rocky Mountains provinces is the prominent, west-facing escarpment along the Wasatch fault zone at the base of the Wasatch Range. Late Cenozoic normal faulting, a characteristic of the Basin and Range, began between about 17 and 10 million years ago in the Nevada (Stewart, 1980) and Utah (Anderson, 1989) portions of the province. The faulting is a result of a roughly east-west directed, regional extensional stress regime that has continued to the present (Zoback and Zoback, 1989; Zoback, 1989). The back valleys are morphologically similar to valleys in the Basin and Range, but exhibit less structural relief (Sullivan and others 1988).

Ogden Valley occupies a structural trough created by up to 2,000 feet of vertical displacement on normal faults bounding the east and west sides of the valley. The Ogden Valley southwestern margin fault and North Fork fault (Black and others, 2003) are shown on Figure 2 trending northwestward about 900 feet to the southwest and 3,750 feet to the northeast, respectively. The most recent movement on these faults is pre-Holocene (Sullivan and others, 1986). The faults are concealed where mantled by Late Pleistocene and Holocene surficial deposits (Figure 2, dashed and dotted bold lines). Norwood Formation mapped in the site area (Figure 2, unit Tn) likely represents an in-place faulted block preserved between the faults (Jon King, verbal communication, February 29, 2016).

The site is also situated near the central portion of the Intermountain Seismic Belt (ISB). The ISB is a north-south-trending zone of historical seismicity along the eastern margin of the Basin and Range province which extends for approximately 900 miles from northern Arizona to northwestern Montana (Sbar and others, 1972; Smith and Sbar, 1974). At least 16 earthquakes of magnitude 6.0 or greater have occurred within the ISB since 1850, with the largest of these events the  $M_S$  7.5 1959 Hebgen Lake, Montana earthquake. However, none of these events have occurred along the Wasatch fault zone or other known late Quaternary faults in the region (Arabasz and others, 1992; Smith and Arabasz, 1991). The closest of these events to the site was the 1934 Hansel Valley ( $M_S$  6.6) event north of the Great Salt Lake and south of the town of Snowville.

### **Lake Bonneville History**

Lakes occupied nearly 100 basins in the western United States during late-Quaternary time, the largest of which was Lake Bonneville in northwestern Utah. The Bonneville basin consists of several topographically closed basins created by regional extension in the Basin and Range (Gwynn, 1980; Miller, 1990), and has been an area of internal drainage for much of the past 15 million years. Lake Bonneville consisted of numerous topographically closed basins, including the Salt Lake and Cache Valleys (Oviatt and others, 1992). Portions of Ogden Valley were inundated by Lake Bonneville at its highstand. Sediments from Lake Bonneville are not mapped at the site, but are shown at lower elevations to the east and northeast on Figure 2.

Timing of events related to the transgression and regression of Lake Bonneville is indicated by calendar age estimates of significant radiocarbon dates in the Bonneville Basin (Oviatt, 2015). Approximately 30,000 years ago, Lake Bonneville began a slow transgression (rise) to its highest level of 5,160 to 5,200 feet above mean sea level. The lake rise eventually slowed as water levels approached an external basin threshold in northern Cache Valley at Red Rock Pass near Zenda, Idaho. Lake Bonneville reached the Red Rock Pass threshold

and occupied its highest shoreline, termed the Bonneville beach, around 18,000 years ago. During the transgression and highstand, major drainages that emanate from within the Wasatch Range (such as the Weber River) formed large deltaic complexes in the lake at their canyon mouths. Headward erosion of the Snake River-Bonneville basin drainage divide then caused a catastrophic incision of the threshold and the lake level lowered by roughly 360 feet in fewer than two months (Jarrett and Malde, 1987; O’Conner, 1993). The Project is above the elevation for the lake highstand.

Following the Bonneville flood, the lake stabilized and formed a lower shoreline referred to as the Provo shoreline between about 16,500 and 15,000 years ago. Climatic factors then caused the lake to regress rapidly from the Provo shoreline, and by about 13,000 years ago the lake had eventually dropped below historic levels of Great Salt Lake. Oviatt and others (1992) deem this low stage the end of the Bonneville lake cycle. Great Salt Lake then experienced a brief transgression around 11,600 years ago to the Gilbert level at about 4,250 feet before receding to and remaining within about 20 feet of its historic average level (Lund, 1990). Drainages that fed Lake Bonneville began downcutting through stranded deltaic complexes and near-shore deposits as the lake receded.

## **SITE CHARACTERIZATION**

### **Empirical Observations**

On April 29, 2016, Mr. Bill D. Black of Western GeoLogic conducted a reconnaissance of the property. Weather at the time of the site reconnaissance was partly cloudy with temperatures in the 50’s (°F). The site is at the western margin of Ogden Valley on heavily vegetated east- to southeast-facing slopes slightly overlooking Ogden Valley to the east. Coal Canyon Creek is to the southeast of the site. Native vegetation appeared to consist of oak brush and mature trees. No active streams are mapped crossing the site or were observed, and no bedrock outcrops were evident at the site or in adjacent slopes. However, a small seasonal drainage reportedly once flowed to the east in a drainage easement crossing the lot from slightly below Bluebell Drive. The drainage channel was reportedly about 1.5 feet deep and 6 feet wide below the cul-de-sac in 2014 (AGEC, 2014).

### **Air Photo Observations**

High-resolution orthophotography from 2012 and 1-meter bare earth DEM LIDAR from 2011 available from the Utah AGRC (Figures 3A and 3B) were reviewed to obtain information about the geomorphology of the site area. Only the westernmost (upper) part of the small seasonal drainage reported by AGEC (2014) is evident on the 2012 photo (Figure 3A). Figures 3A and 3B also show the southeast part of the site straddles a landslide that appears to have originated to the southwest. Morphology of the landslide appears subdued or obscured, suggesting it may be an older feature (possibly latest Pleistocene to early Holocene in age). The landslide trends northeastward across the southeast corner of the lot and then turns downslope toward the east (Figures 3A and 3B).



Figure 3B shows a lineament that begins near the head of the landslide and trends into the property. We infer this lineament is a tension crack from a younger failure that is occurring on the margin of the older landslide (Figure 3B, Tension Crack). Below Bluebell Drive, the LIDAR imagery suggest that the crack may be widening as the younger landslide creeps downslope (Figure 3B, Pull-Apart Zone). The tension crack then makes an abrupt 90-degree turn to the southeast slightly southwest of the small seasonal drainage, travels downslope for a short distance, and then dies out. We infer this latter feature is a lateral shear on the northeastern margin of the younger failure (Figure 3B, Lateral Shear). The boring conducted by GSH at the site is about 24 feet to the southeast and topographically below the tension crack (Figure 3B), and reportedly encountered a disturbed/weak zone containing roots between 25 and 40 feet in depth. This confirms that the tension crack is not just a surficial feature and continues at depth. The roots are likely from large trees that have preferentially followed the tension crack because it is a zone of weakness and groundwater percolation. No evidence of other geologic hazards were observed on the air photos in the site area.

### **Subsurface Investigation**

Three test pits were excavated at the property in April 2016 to evaluate subsurface conditions. Test pit locations are shown on Figures 3A-3C, and were measured using a hand-held GPS unit and trend and distance methods from known points. The test pits were logged at a scale of 1 inch equals 5 feet (1:60). No complications were encountered that substantially impacted the subsurface investigation. The test pit exposures were digitally photographed at five-foot intervals to document subsurface conditions. The photos are not provided herein, but are available on request.

Test pits 1 and 2 (Figures 4A and 4B) both exposed a similar sequence of weathered Norwood Formation consisting of an upper clay-rich conglomerate overlying interbedded claystone and siltstone. Bedding in test pit 1 showed a strike/dip of N30°W 22° NE, whereas test pit 2 bedding showed a strike/dip of N36°W 20°NE. Both of these bedding strikes and dips appear similar to reported regional measurements, suggesting the sequence is intact bedrock. However, test pit 3 (Figure 4C) exposed a backtilted sequence of Norwood Formation that we infer is a rafted landslide block. Bedding in this test pit showed a strike/dip of N85°E 35°NW. East-west strikes are typical for deformed landslide blocks in the area on Figure 2. No other evidence of geologic hazards was exposed in the test pits, except for water seepage along the contact between the conglomerate and underlying claystone (units 1 and 2, Figure 4A) in test pit 1 that appeared to be from recent rainfall. This suggests that surface water percolating through the subsurface is perching on the less-permeable clay layers.

### **Cross Section**

Figure 5 shows a cross section across the slope south of the proposed home location at a scale of 1 inch equals 25 feet with no vertical exaggeration. The profile location is shown on Figure 3C (A-A', in blue). Units and contacts are inferred based on the subsurface data discussed above and our review of the log for the GSH boring in the western part of the site (which is not reproduced herein). We use an overall dip of 15 degrees for contacts within the Norwood Formation, which is corrected from an average of 21 degrees to account for the difference between the profile trend and dip direction. As

discussed above, the boring conducted by GSH at the site exposed a deformed zone containing roots at a depth of 25 to 40 feet below the ground surface that likely corresponds to the tension crack and pull-apart zone upslope from the boring. Given the above depths and distance between the boring and tension crack (24 feet), dip of the shear would be about 45 to 60 degrees. The area between the tension crack and existing landslide on the cross section appears to represent a smaller failure working its way downslope. The lateral shear along the margin of this failure (Figures 3B and 3C) is not displayed on the cross section because of difficulty representing it in two dimensions, although it would likely be subvertical and near where the pull-apart zone coalesces (85-90 feet on Figure 5).

**GEOLOGIC HAZARDS**

Assessment of potential geologic hazards and the resulting risks imposed is critical in determining the suitability of the site for development. Table 1 below shows a summary of the geologic hazards reviewed at the site, as well as a relative (qualitative) assessment of risk to the Project for each hazard. A “high” hazard rating (H) indicates a hazard is present at the site (whether currently or in the geologic past) that is likely to pose significant risk and/or may require further study or mitigation techniques. A “moderate” hazard rating (M) indicates a hazard that poses an equivocal risk. Moderate-risk hazards may also require further studies or mitigation. A “low” hazard rating (L) indicates the hazard is not present, poses little or no risk, and/or is not likely to significantly impact the Project. Low-risk hazards typically require no additional studies or mitigation. We note that these hazard ratings represent a conservative assessment for the entire site and risk may vary in some areas. Careful selection of development areas can minimize risk by avoiding known hazard areas.

**Table 1. Geologic hazards summary for Lot 44 Big Sky Estates No. 1.**

<b>Hazard</b>	<b>H</b>	<b>M</b>	<b>L</b>	<b>...Hazard Rating</b>
<b>Earthquake Ground Shaking</b>	<b>X</b>			
<b>Surface Fault Rupture</b>			<b>X</b>	
<b>Liquefaction and Lateral-spread Ground Failure</b>			<b>X</b>	
<b>Tectonic Deformation</b>			<b>X</b>	
<b>Seismic Seiche and Storm Surge</b>			<b>X</b>	
<b>Stream Flooding</b>			<b>X</b>	
<b>Shallow Groundwater</b>			<b>X</b>	
<b>Landslides and Slope Failures</b>	<b>X</b>			
<b>Debris Flows and Floods</b>			<b>X</b>	
<b>Rock Fall</b>			<b>X</b>	
<b>Problem Soil</b>		<b>X</b>		

**Earthquake Ground Shaking**

Ground shaking refers to the ground surface acceleration caused by seismic waves generated during an earthquake. Strong ground motion is likely to present a significant risk during moderate to large earthquakes located within a 60 mile radius of the project area (Boore and others, 1993). Seismic sources include mapped active faults, as well as a random or “floating” earthquake source on faults not evident at the surface. Mapped active faults within this distance include the East and West Cache fault zones; the Brigham City, Weber, Salt Lake, and Provo segments of the Wasatch fault zone; the East Great Salt Lake fault zone; the Morgan fault; the West Valley fault zone; the Oquirrh fault zone; and the Bear River fault zone (Black and others, 2003).

The extent of property damage and loss of life due to ground shaking depends on factors such as: (1) proximity of the earthquake and strength of seismic waves at the surface (horizontal motions are the most damaging); (2) amplitude, duration, and frequency of ground motions; (3) nature of foundation materials; and (4) building design (Costa and Baker, 1981). Based on 2012 IBC provisions, a site class of D (stiff soil), and a risk category of II, USGS calculated uniform-hazard and deterministic ground motion values with a 2% chance of exceedance in 50 years are as follows:

**Table 2.** *Seismic hazards summary for Lot 44 Big Sky Estates No. 1.  
 (Site Location: 41.298053° N, -111.849567° W)*

$S_s$	0.978 g
$S_1$	0.336 g
$S_{MS} (F_a \times S_s)$	1.084 g
$S_{M1} (F_v \times S_1)$	0.581 g
$S_{DS} (2/3 \times S_{MS})$	0.723 g
$S_{D1} (2/3 \times S_{M1})$	0.387 g
<b>Site Coefficient, <math>F_a</math></b>	<b>= 1.109</b>
<b>Site Coefficient, <math>F_v</math></b>	<b>= 1.727</b>

Given the above information, earthquake ground shaking poses a high risk to the site. The hazard from earthquake ground shaking can be adequately mitigated by design and construction of homes in accordance with appropriate building codes. The Project structural and/or geotechnical engineer, in conjunction with the developer, should confirm and evaluate the seismic ground-shaking hazard and provide appropriate seismic design parameters as needed.

**Surface Fault Rupture**

Movement along faults at depth generates earthquakes. During earthquakes larger than Richter magnitude 6.5, ruptures along normal faults in the intermountain region generally propagate to the surface (Smith and Arabasz, 1991) as one side of the fault is uplifted and the other side down dropped. The resulting fault scarp has a near-vertical slope. The surface rupture may be expressed as a large singular rupture or several smaller ruptures in a broad zone. Ground displacement from surface fault rupture can cause significant damage or even collapse to structures located on an active fault.

The nearest active fault to the site is the Weber segment of the WFZ about 4.2 miles to the west, and no evidence of active surface faulting is mapped or was evident at the site. Based on this, the hazard from surface faulting is rated as low.

**Liquefaction and Lateral-spread Ground Failure**

Liquefaction occurs when saturated, loose, cohesionless, soils lose their support capabilities during a seismic event because of the development of excessive pore pressure.

Earthquake-induced liquefaction can present a significant risk to structures from bearing-capacity failures to structural footings and foundations, and can damage structures and roadway embankments by triggering lateral spread landslides. Earthquakes of Richter magnitude 5 are generally regarded as the lower threshold for liquefaction. Liquefaction potential at the site is a combination of expected seismic (earthquake ground shaking) accelerations, groundwater conditions, and presence of susceptible soils.

No soils likely susceptible to liquefaction were observed in the test pit exposures at the site or were evident in the boring conducted by GSH. Based on this, the hazard from liquefaction and lateral spreading is rated as low.

**Tectonic Deformation**

Tectonic deformation refers to subsidence from warping, lowering, and tilting of a valley floor that accompanies surface-faulting earthquakes on normal faults. Large-scale tectonic subsidence may accompany earthquakes along large normal faults (Lund, 1990). Tectonic subsidence is believed to mainly impact those areas immediately adjacent to the downthrown side of a normal fault. No active faults are mapped in the site area. Based on this, the risk from tectonic subsidence is rated as low.

**Seismic Seiche and Storm Surge**

Earthquake-induced seiche presents a risk to structures within the wave-oscillation zone along the edges of large bodies of water, such as the Great Salt Lake. Given the elevation of the subject property and distance from large bodies of water, the risk to the subject property from seismic seiches is rated as low.

**Stream Flooding**

Stream flooding may be caused by direct precipitation, melting snow, or a combination of both. In much of Utah, floods are most common in April through June during spring snowmelt. High flows may be sustained from a few days to several weeks, and the potential for flooding depends on a variety of factors such as surface hydrology, site grading and drainage, and runoff.

No active drainages cross the site or were evident, and based on this the hazard from stream flooding should be low. However, there was a small seasonal drainage that reportedly had an easement crossing the site (AGEC, 2014). Site hydrology and runoff should therefore be addressed in the civil engineering design and grading plan for the Project.

**Shallow Groundwater**

No springs or seeps are shown on the topographic map for the site or were reported or observed, and no groundwater was encountered in the boring conducted by GSH. Given this, the depth to static groundwater is at least more than 46.5 feet. Based on the above, we rate the risk from shallow groundwater as low. However, proper site drainage should be maintained so that groundwater does not pose a future risk of slope instability. It is also possible that groundwater levels may fluctuate seasonally and following snowmelt or rainstorms, and may be perched locally over less permeable bedrock layers.

**Landslides and Slope Failures**

Slope stability hazards such as landslides, slumps, and other mass movements can develop along moderate to steep slopes where a slope has been disturbed, the head of a slope loaded, or where increased groundwater pore pressures result in driving forces within the slope exceeding restraining forces. Slopes exhibiting prior failures, and also deposits from large landslides, are particularly vulnerable to instability and reactivation.

The southeast part of the site is on what appears to be an older (latest Pleistocene to early Holocene) landslide that originated to the southwest of the property. A rafted block in this landslide was observed in test pit 3, but test pits 1 and 2 both exposed undeformed bedrock layers. A younger failure marked by a tension crack, pull-apart zone, and lateral shear appears to be forming on the north margin of the old landslide in the western part of the property (Figures 3B and 3C). The boring conducted by GSH downslope of the tension crack exposed a disturbed/weak zone between 25 and 40 feet in depth that likely corresponds to the basal shear of this younger landslide in the subsurface. The lateral shear for this failure appears to trend to near the southwest corner of the proposed home (Figure 3C).

Given all the above, we rate the hazard from landsliding as high. We recommend stability of the slopes be evaluated in a geotechnical engineering evaluation prior to building based on site specific data and subsurface information included in this report. Recommendations for reducing the risk from landsliding should be provided if factors of safety are determined to be unsuitable. The stability evaluation should take into account possible perched groundwater and fluctuating seasonal levels.

Additional exploration to determine if shearing may be present beneath the home footprint was considered outside the scope of our evaluation. Reducing risk to the structure and occupants is a significant concern given the site conditions described above. We therefore recommend that the proposed home location be moved at least 30 feet away from the presumed lateral shear location and that the excavation for the home be inspected by a licensed engineering geologist to confirm that no deformation is present. Relocating the home northward, as indicated on Figure 3C (and recommended above), would reduce the risk from landsliding and does not appear to pose a significant development constraint, although the proposed location for the septic system may also need to be moved to the northeast. Care should also be taken that site grading does not destabilize slopes in this area without prior geotechnical analysis and grading plans, and that proper drainage is maintained.

**Debris Flows**

Debris flow hazards are typically associated with unconsolidated alluvial fan deposits at the mouths of large range-front drainages, such as those along the Wasatch Front. Debris flows have historically significant damage in the Wasatch Front area. The site is not in any mapped alluvial-fan deposits, and no evidence of debris-flow channels, levees, or other debris-flow features was observed. Based on the above, we rate the hazard from debris flows at the site as low.

**Rock Fall**

No bedrock outcrops were observed at the site or in higher slopes that could present a source area for rock fall clasts. Based on the above, we rate the hazard from rock falls as low.

**Swelling and Collapsible Soils**

Surficial soils that contain certain clays can swell or collapse when wet. Given the subsurface soil conditions observed at the site, it is possible that clayey interbeds may be present in the subsurface that could pose a moderate risk from problem soils. A geotechnical engineering evaluation should therefore be performed to address soil conditions and provide specific recommendations for site grading, subgrade preparation, and footing and foundation design.

## CONCLUSIONS AND RECOMMENDATIONS

Geologic hazards posing a high relative risk to the site are earthquake ground shaking and landslides. Problem soils also pose a moderate-risk hazard. The following recommendations are provided with regard to the geologic characterizations in this report:

- ***Home Location and Excavation Inspection*** – To reduce the risk from landsliding, we recommend that the proposed home location be moved at least 30 feet away from the presumed lateral shear location as shown on Figure 3C, and that the excavation for the home be inspected by a licensed engineering geologist to confirm that no deformation is present, as well as to recognize any differing conditions that could affect the performance of the planned structure. The proposed location for the septic system may also need to be moved slightly to the northeast to accommodate this new location. If the home footing is located over the excavation for test pit 1, or any prior percolation test pits, care should also be taken that the backfilled material is removed and/or replaced by structural fill, as noted below.
- ***Geotechnical Investigation*** - A design-level geotechnical engineering study should be conducted prior to construction to: (1) address soil conditions at the site for use in foundation design, site grading, and drainage; (2) provide recommendations regarding building design to reduce risk from seismic acceleration; and (3) evaluate stability of slopes at the site, including providing recommendations for reducing the risk of landsliding if the factors of safety are deemed unsuitable, based on the geologic characterizations provided in this report and site-specific geotechnical data. The stability evaluation should account for possible perched groundwater and seasonal fluctuations. It is our understanding that GSH is in the process of preparing a geotechnical report for the site. Our report should be provided to them to assist with their evaluation.
- ***Excavation Backfill Considerations*** - The test pits may be in areas where structures could subsequently be placed. However, backfill may not have been replaced in the test pits in compacted layers. The fill could settle with time and upon saturation. Should structures be located over an excavated area, no footings or structure should be founded over the excavations unless the backfill has been removed and replaced with structural fill, if the fill is to support a structure.
- ***Availability of Report*** - The report should be made available to architects, building contractors, and in the event of a future property sale, real estate agents and potential buyers. This report should be referenced for information on technical data only as interpreted from observations and not as a warranty of conditions throughout the site. The report should be submitted in its entirety, or referenced appropriately, as part of any document submittal to a government agency responsible for planning decisions or geologic review. Incomplete submittals void the professional seals and signatures we provide herein. Although this report and the data herein are the property of the client, the report format is the intellectual property of Western Geologic and should not be copied, used, or modified without express permission of the authors.

## LIMITATIONS

This investigation was performed at the request of the Client using the methods and procedures consistent with good commercial and customary practice designed to conform to acceptable industry standards. The analysis and recommendations submitted in this report are based upon the data obtained from site-specific observations and compilation of known geologic information. This information and the conclusions of this report should not be interpolated to adjacent properties without additional site-specific information. In the event that any changes are later made in the location of the proposed site, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of this report modified or approved in writing by the engineering geologist.

This report has been prepared by the staff of Western GeoLogic for the Client under the professional supervision of the principal and/or senior staff whose seal(s) and signatures appear hereon. Neither Western GeoLogic, nor any staff member assigned to this investigation has any interest or contemplated interest, financial or otherwise, in the subject or surrounding properties, or in any entity which owns, leases, or occupies the subject or surrounding properties or which may be responsible for environmental issues identified during the course of this investigation, and has no personal bias with respect to the parties involved.

The information contained in this report has received appropriate technical review and approval. The conclusions represent professional judgment and are founded upon the findings of the investigations identified in the report and the interpretation of such data based on our experience and expertise according to the existing standard of care. No other warranty or limitation exists, either expressed or implied.

The investigation was prepared in accordance with the approved scope of work outlined in our proposal for the use and benefit of the Client; its successors, and assignees. It is based, in part, upon documents, writings, and information owned, possessed, or secured by the Client. Neither this report, nor any information contained herein shall be used or relied upon for any purpose by any other person or entity without the express written permission of the Client. This report is not for the use or benefit of, nor may it be relied upon by any other person or entity, for any purpose without the advance written consent of Western GeoLogic.

In expressing the opinions stated in this report, Western GeoLogic has exercised the degree of skill and care ordinarily exercised by a reasonable prudent environmental professional in the same community and in the same time frame given the same or similar facts and circumstances. Documentation and data provided by the Client, designated representatives of the Client or other interested third parties, or from the public domain, and referred to in the preparation of this assessment, have been used and referenced with the understanding that Western GeoLogic assumes no responsibility or liability for their accuracy. The independent conclusions represent our professional judgment based on information and data available to us during the course of this assignment. Factual information regarding operations, conditions, and test data provided by the Client or their representative has been assumed to be correct and complete. The conclusions presented are based on the data provided, observations, and conditions that existed at the time of the field exploration.



It has been a pleasure working with you on this project. Should you have any questions, please call.

Sincerely,  
Western GeoLogic, LLC

Reviewed by:



Bill. D. Black, P.G.  
Senior Engineering Geologist



A handwritten signature in black ink that reads "Craig V. Nelson".

Craig V. Nelson, P.G.  
Principal Engineering Geologist

**ATTACHMENTS**

- Figure 1. Location Map (8.5"x11")
- Figure 2. Geologic Map (8.5"x11")
- Figure 3A. 2012 Air Photo (8.5"x11")
- Figure 3B. 2011 LIDAR Image (8.5"x11")
- Figure 3C. Site Plan (8.5"x11")
- Figure 4A-C. Test Pit Logs (three 8.5"x11" sheets)
- Figure 5. Cross Section (11"x17")

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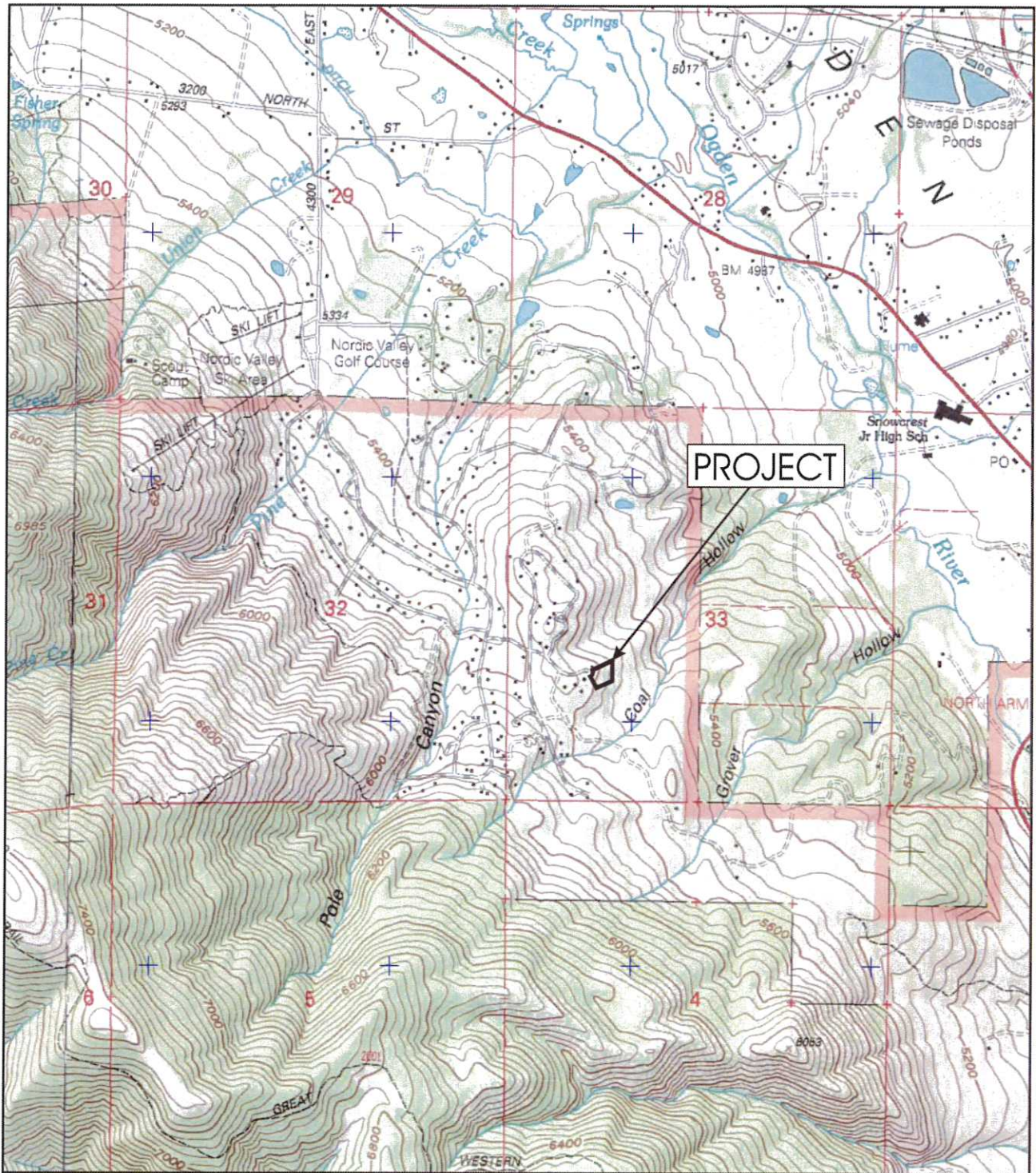
Western Geologic Project No. 4050

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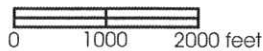
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Source: U.S. Geological Survey 7.5 Minute Series Topographic Maps, Utah - Huntsville, 1998;  
 Project location SW1/4, Section 33, T7N, R1E (SLBM); about 5,525 to 5,615 feet elevation (ASL).



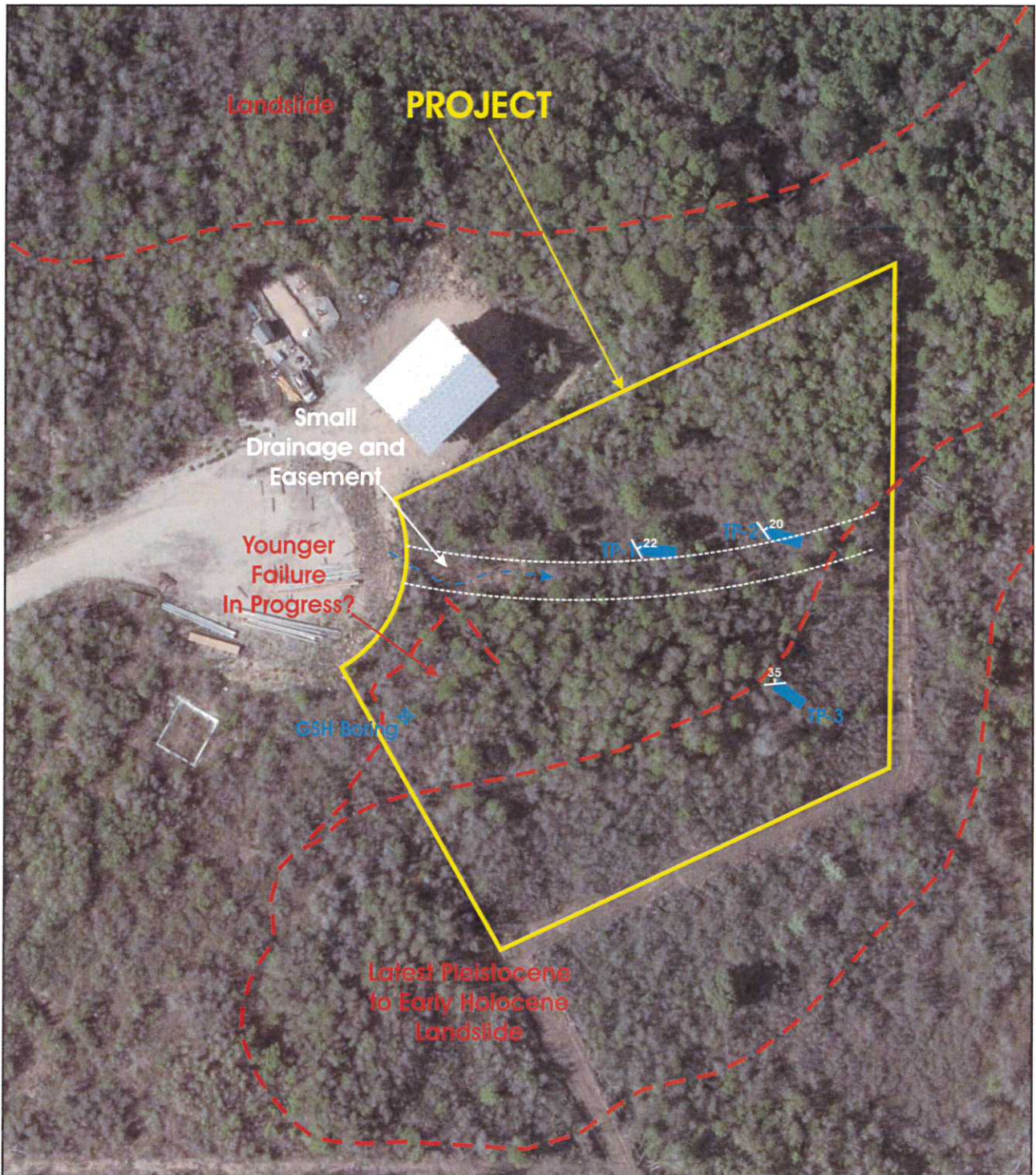
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**LOCATION MAP**

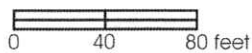
**GEOLOGIC HAZARDS EVALUATION**

Lot 44 Big Sky Estates No. 1  
 4075 Bluebell Drive  
 Liberty, Weber County, Utah





Source: Utah AGRC, 2012 High-Resolution Orthophoto, 6-inch resolution.



Scale 1:960  
(1 inch = 80 feet)

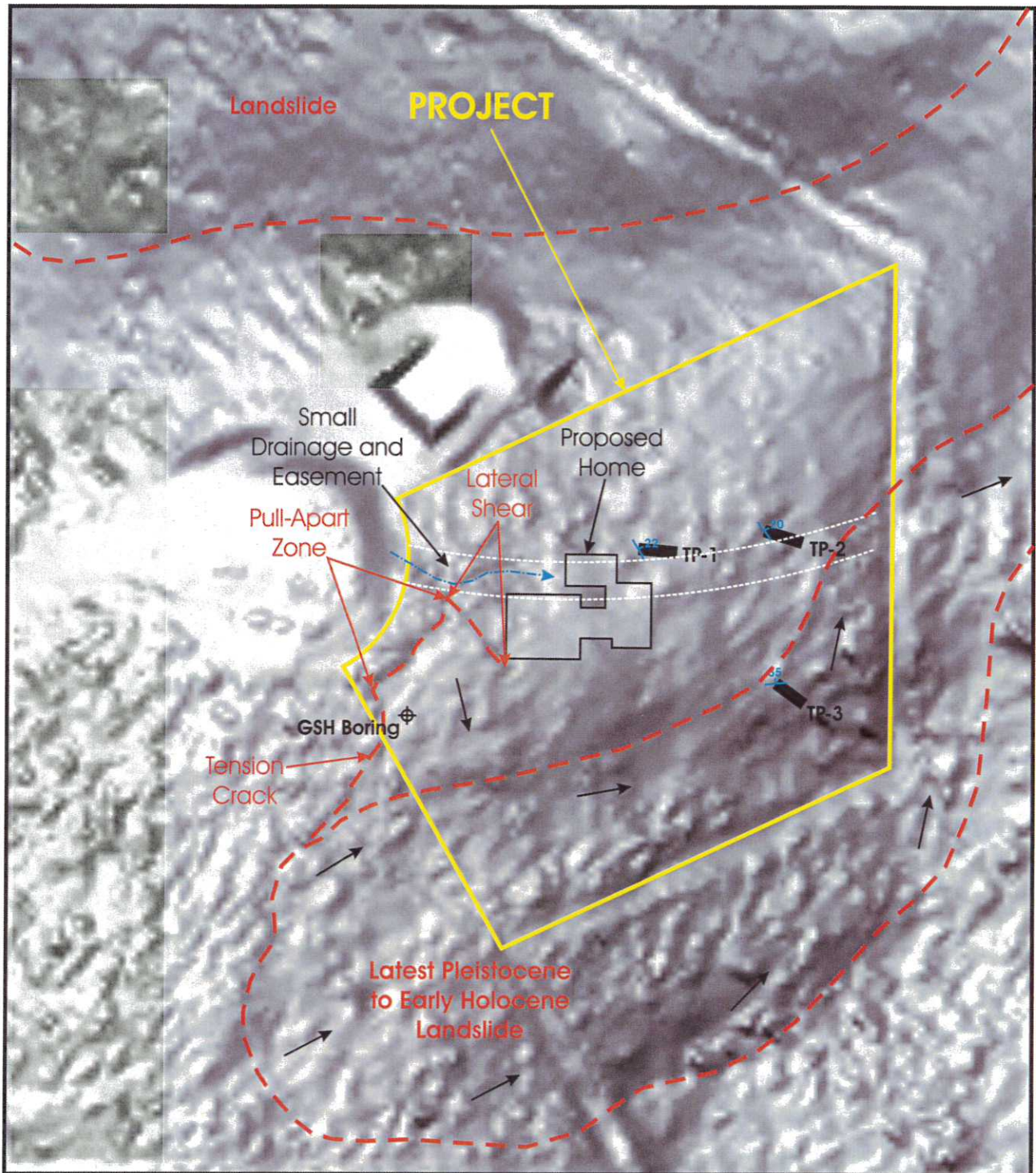
### 2012 AERIAL PHOTO

### GEOLOGIC HAZARDS EVALUATION

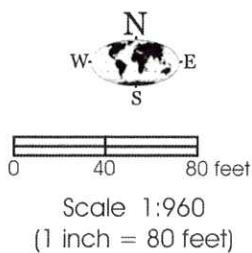
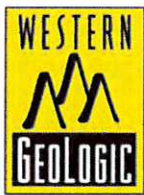
Lot 44 Big Sky Estates No. 1  
4075 Bluebell Drive  
Liberty, Weber County, Utah

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FIGURE 3A



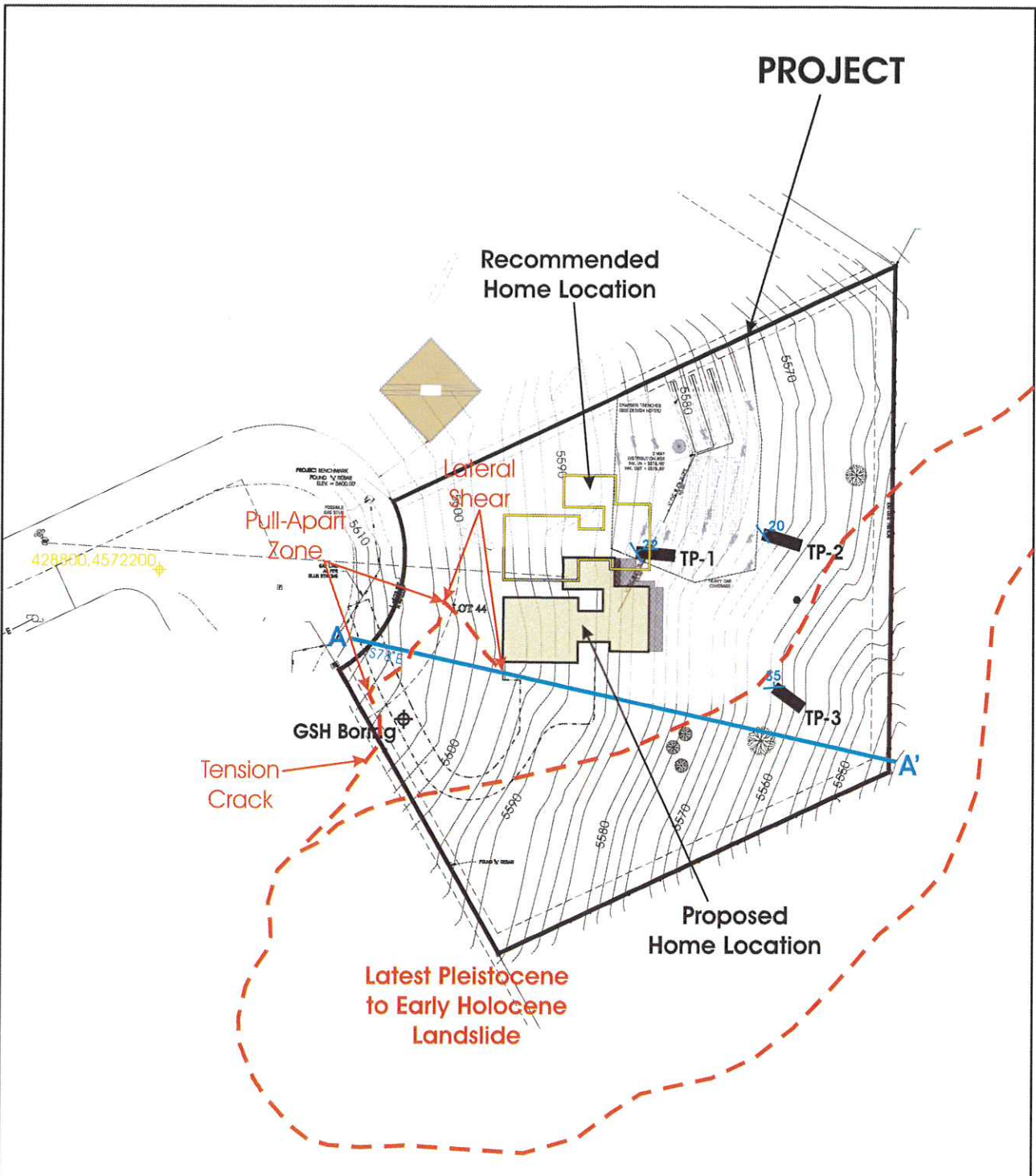
Source: Utah AGRC, 2011 LIDAR Bare Earth DEM.



2011 LIDAR IMAGE

GEOLOGIC HAZARDS EVALUATION

Lot 44 Big Sky Estates No. 1  
4075 Bluebell Drive  
Liberty, Weber County, Utah



Source: Utah AGRC, 2012 High-Resolution Orthophoto, 6-inch resolution.



Scale 1:960  
(1 inch = 80 feet)

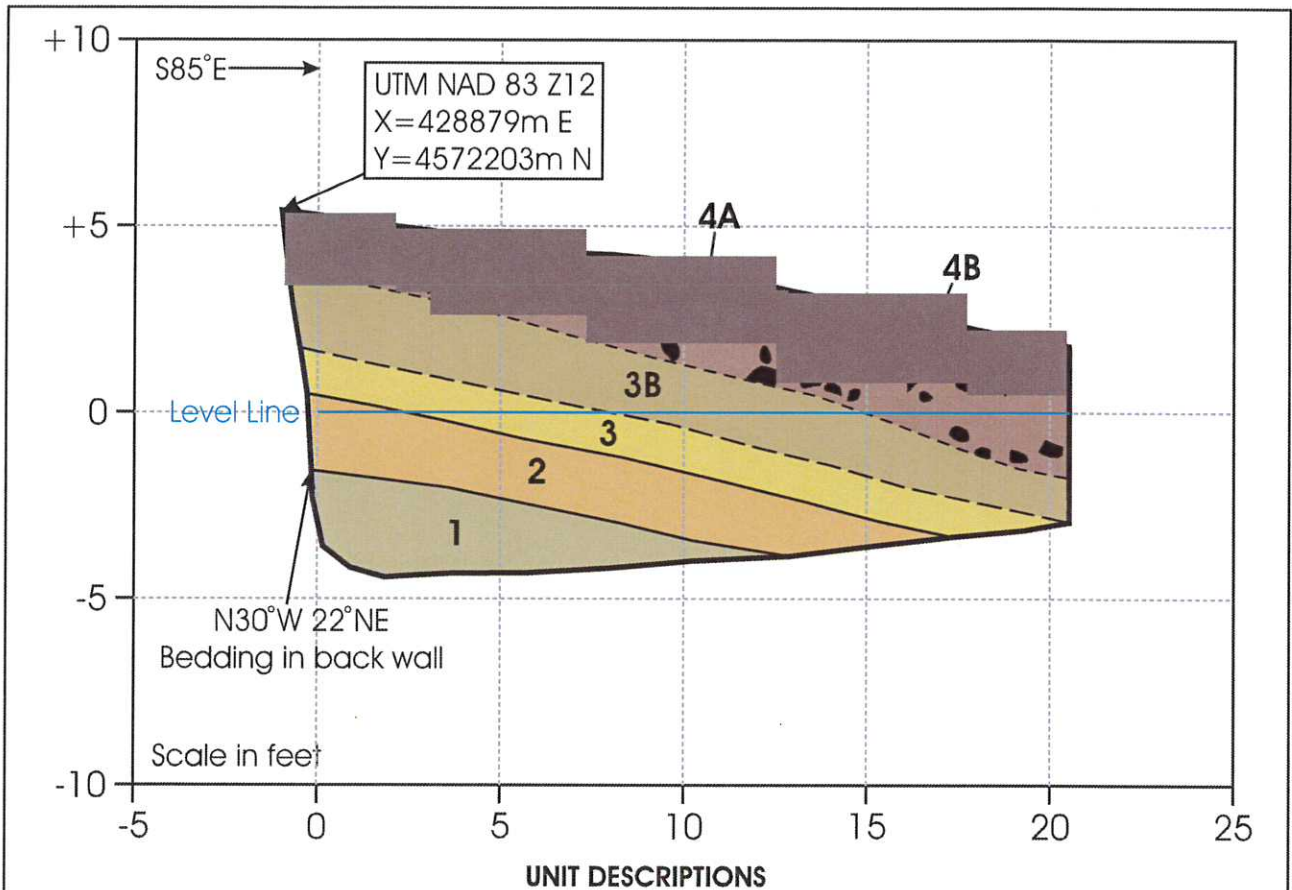
**SITE PLAN**

**GEOLOGIC HAZARDS EVALUATION**

Lot 44 Big Sky Estates No. 1  
4075 Bluebell Drive  
Liberty, Weber County, Utah



**Exhibit C**



**Unit 1.** *Tertiary Norwood Formation* - Weathered tuffaceous claystone comprised of olive- to reddish-brown, moderate to high density, poorly bedded, lean to fat clay (CL/CH).

**Unit 2.** *Tertiary Norwood Formation* - Weathered tuffaceous siltstone comprised of pale-brown to pink, moderate density, poorly bedded, carbonate-enriched, silt (ML).

**Unit 3.** *Tertiary Norwood Formation* - Weathered tuffaceous claystone comprised of olive- to reddish-brown, moderate density, poorly bedded, sandy lean to fat clay (CL/CH).

**3B.** Bt soil horizon formed in unit 3.

**Unit 4.** *Tertiary Norwood Formation* - Weathered tuffaceous conglomerate comprised of brown to dark brown, moderate density, poorly bedded to massive, root-penetrated, lean clay (CL) grading upward to clayey sand with cobbles (SC); clasts subangular to subround with stage II carbonate.

**4B.** Bt soil horizon formed in unit 4.

**4A.** Modern A-horizon soil formed in unit 4.

**TEST PIT 1 LOG**

**GEOLOGIC HAZARDS EVALUATION**

Lot 44 Big Sky Estates No. 1  
4075 Bluebell Drive  
Liberty, Weber County, Utah

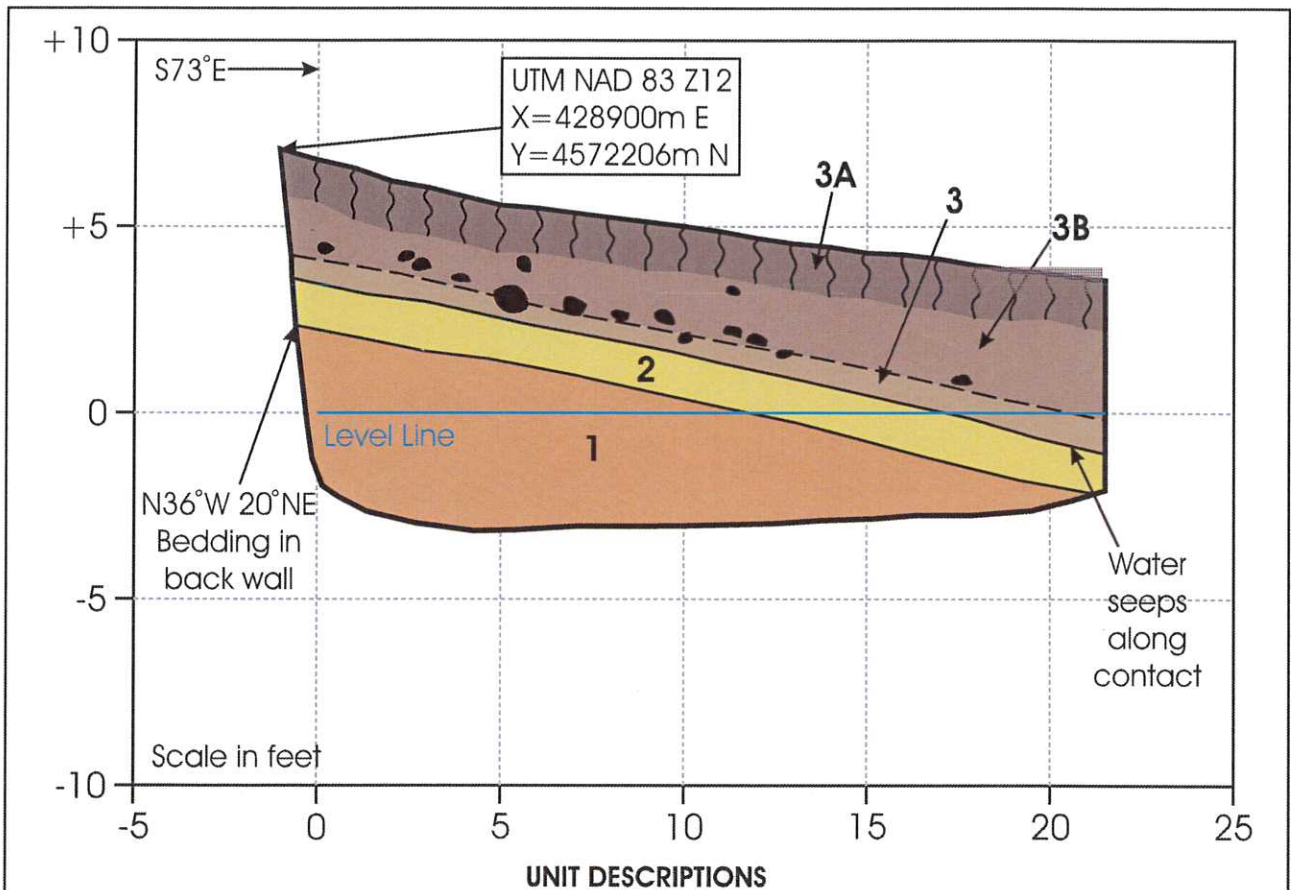
**Page 97 of 102**  
FIGURE 4A



SCALE: 1 inch = 5 feet  
(no vertical exaggeration)  
North Wall Logged, West to East

Logged by Bill D. Black, P.G.  
on April 29, 2016  
Reviewed by  
Craig V. Nelson, P.G.

# Exhibit C



**Unit 1.** *Tertiary Norwood Formation* - Weathered tuffaceous siltstone to claystone comprised of reddish-brown, moderate to high density, poorly bedded, carbonate-enriched silt to lean clay (ML/CL).

**Unit 2.** *Tertiary Norwood Formation* - Weathered tuffaceous claystone comprised of olive- to brownish-olive, moderate to high density, poorly bedded, lean to fat clay (CL/CH).

**Unit 3.** *Tertiary Norwood Formation* - Weathered tuffaceous conglomerate comprised of brown to dark brown, moderate density, poorly bedded to massive, root-penetrated, sandy clay (CL) with cobbles and trace gravel; clasts subangular to subround with stage II carbonate.

**3B.** Bt soil horizon formed in unit 3.

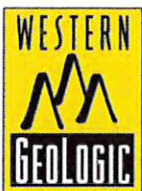
**3A.** Modern A-horizon soil formed in unit 3.

## TEST PIT 2 LOG

### GEOLOGIC HAZARDS EVALUATION

Lot 44 Big Sky Estates No. 1  
4075 Bluebell Drive  
Liberty, Weber County, Utah

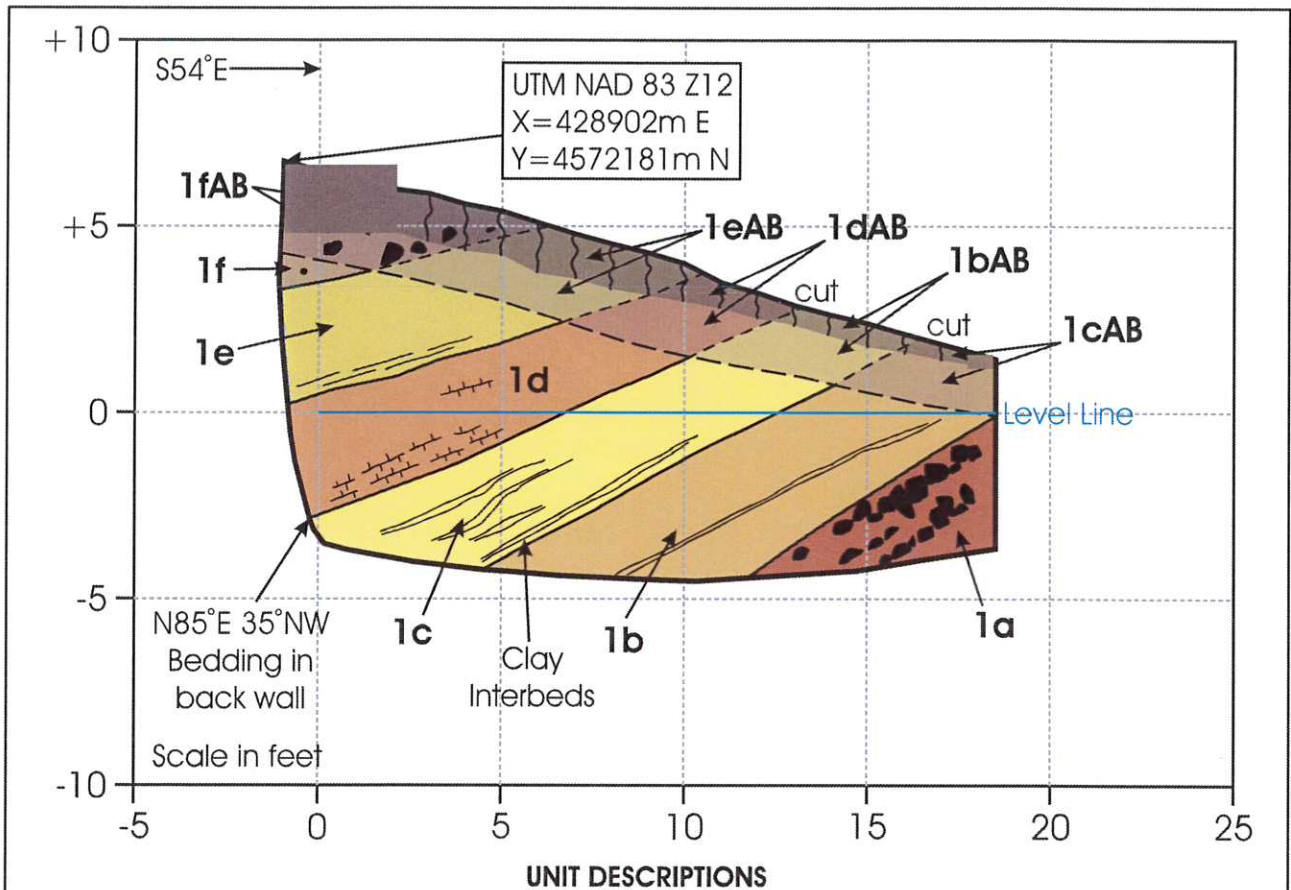
**Page 98 of 102**  
FIGURE 4B



SCALE: 1 inch = 5 feet  
(no vertical exaggeration)  
North Wall Logged, West to East

Logged by Bill D. Black, P.G.  
on April 29, 2016  
Reviewed by  
Craig V. Nelson, P.G.

# Exhibit C



**Unit 1.** Late Pleistocene to Holocene Landslide Colluvium - Rafted and backtilted block of Tertiary Norwood Formation.

**1a.** Moderate density, massive to poorly bedded, fractured claystone comprised of pale-gray clasts in a matrix of dark-reddish-brown lean to fat clay (CL/CH).

**1b.** Orange-olive, moderate density, poorly bedded, tuffaceous sandstone (SC).

**1bAB.** Bt and modern A-horizon soils formed in unit 1b.

**1c.** Pale-olive-brown, moderate density, poorly bedded, interbedded tuffaceous sandstone and claystone (SC/CH).

**1cAB.** Bt and modern A-horizon soils formed in unit 1c.

**1d.** Orange- to dark-reddish-brown, moderate to high density, well to poorly bedded, claystone (CL/CH).

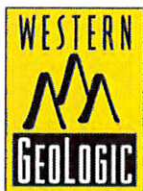
**1dAB.** Bt and modern A-horizon soils formed in unit 1d.

**1e.** Orange to olive, moderate to high density, well bedded, claystone (CL/CH).

**1eAB.** Bt and modern A-horizon soils formed in unit 1e.

**1f.** Reddish-brown, massive to poorly bedded, tuffaceous conglomerate comprised of sandy lean to fat clay (CL/CH) with cobbles and gravel.

**1fAB.** Bt and modern A-horizon soils formed in unit 1f.



SCALE: 1 inch = 5 feet  
(no vertical exaggeration)  
North Wall Logged, West to East

Logged by Bill D. Black, P.G.  
on April 29, 2016  
Reviewed by  
Craig V. Nelson, P.G.

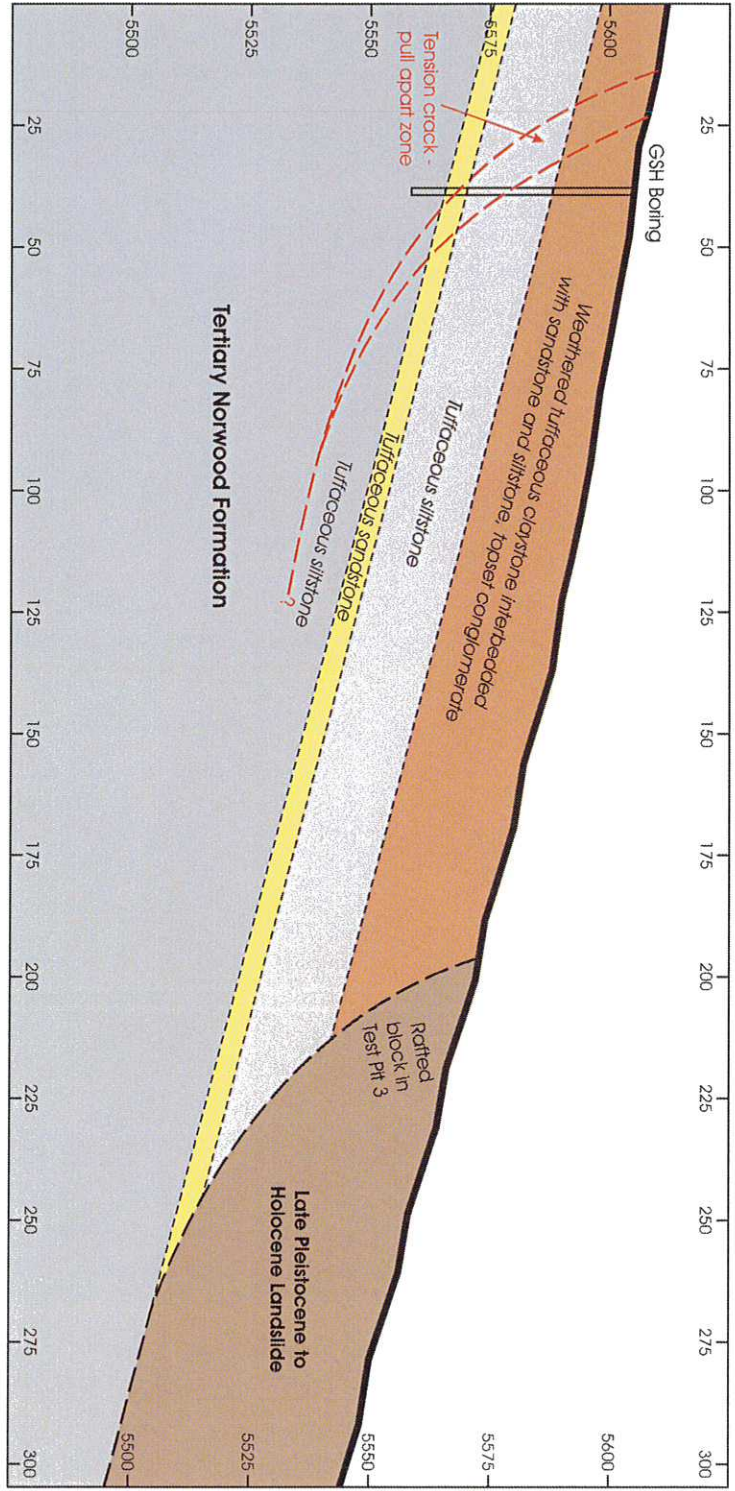
## TEST PIT 3 LOG

### GEOLOGIC HAZARDS EVALUATION

Lot 44 Big Sky Estates No. 1  
4075 Bluebell Drive  
Liberty, Weber County, Utah

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FIGURE 4C

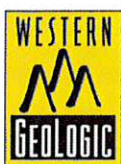


SCALE: 1 inch = 25 feet  
 No vertical exaggeration  
 Contacts based on subsurface data and are inferred in unexplored areas and at depth

**CROSS SECTION**

**GEOLOGIC HAZARDS EVALUATION**  
 Lot 44 Big Sky Estates No. 1  
 4075 Bluebell Drive  
 Liberty, Weber County, Utah

**FIGURE 5**



**WESTERN GEOLOGIC, LLC**  
2150 SOUTH 1300 EAST, SUITE 500  
SALT LAKE CITY, UTAH 84106 USA

Phone: 801.359.7222

Fax: 801.990.4601

Email: cnelson@westerngeologic.com

July 26, 2016

Carson Young  
Solitude Builders  
PO Box 529  
Eden, Utah 84310

**SUBJECT:** Supplemental Plan Review Clarification  
Lot 44 Big Sky Estates No. 1  
4075 Bluebell Drive  
Liberty, Weber County, Utah

Dear Mr. Young:

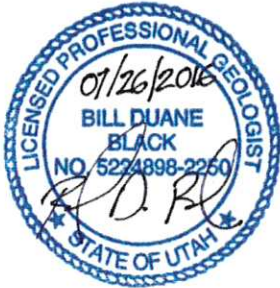
Western GeoLogic previously reviewed a revised site plan prepared for the subject site dated July 13, 2016. Based on our review, we prepared a supplemental plan review letter dated July 16, 2016 that noted that the new home location appeared to be only half (15 feet) the setback distance recommended (30 feet) in our June 4, 2016 geologic hazard evaluation report for the project. We indicated that a risk therefore remained for shearing to manifest in the home excavation and render it unusable. This risk is higher at a 15-foot setback rather than 30 feet. However, given that a variance may be needed to locate the home further north, the lower setback is acceptable to us if all other parties are willing to accept the risk for the excavation to be unusable should evidence for shearing be found. A future excavation inspection must be conducted by us that confirm there is no shearing in the area of the home. However, as we discussed, evaluation of any impacts on slope stability that may be caused by the lower setback is outside of our professional scope. The potential for such impacts should be assessed by the project geotechnical engineer that performed the slope stability analysis (GSH Geotechnical).

It is also our understanding that the septic system location has been changed from the area of the shear to east of the home as it originally was. We cannot confirm since a newer site plan was not provided, but it is our belief that this change will likely improve overall slope stability from that of the previous revised site plan; however, the project geotechnical engineer should be informed of this change.

It has been a pleasure working with you on this project. Should you have any questions, please call.


Sincerely,  
Western GeoLogic, LLC

Reviewed by:



Bill. D. Black, P.G.  
Senior Engineering Geologist



  
Craig V. Nelson, P.G.  
Principal Engineering Geologist