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APPLICANT ADDRESS	3517	E 7TH AVE			TAMPA	PHONE	813 892-8103	FL	33605
OWNER	-	HENDRICKSON			TAMFA	PHONE		<u></u>	33003
ADDRESS	265	SW THURMAN 7	redd		LAKE CI		-	FL	32024
CONTRACTO		RL KIRCHENDORF			LAKE CI	PHONE	813 241-9152		32024
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LAND USE &	ZONING	RSF-2				МАХ	K. HEIGHT		
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			CRC05	1408	(20001	25		
Culvert Permit	No.	Culvert Waiver	Contractor's	License Numb	er		Applicant/Owner	/Contract	tor
EXISTING		X09-209		BK			VR .		N
Driveway Conr	nection	Septic Tank Number	er	LU & Zoning	checked by	у Арј	proved for Issuance	ce N	New Resident
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MISC. FEES \$	0.00	ZONING	G CERT. FE	E\$ 50.00	FIRE FE	E\$0.00	WASTI	E FEE \$	
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INSPECTORS (OFFICE	Tale	Eclas	lu	CLERKS	S OFFICE	C	1	

PERMIT

NOTICE: IN ADDITION TO THE REQUIREMENTS OF THIS PERMIT, THERE MAY BE ADDITIONAL RESTRICTIONS APPLICABLE TO THIS PROPERTY THAT MAY BE FOUND IN THE PUBLIC RECORDS OF THIS COUNTY. AND THERE MAY BE ADDITIONAL PERMITS REQUIRED FROM OTHER GOVERNMENTAL ENTITIES SUCH AS WATER MANAGEMENT DISTRICTS, STATE AGENCIES, OR FEDERAL AGENCIES.

"WARNING TO OWNER: YOUR FAILURE TO RECORD A NOTICE OF COMMENCEMENT MAY RESULT IN YOUR PAYING TWICE FOR IMPROVEMENTS TO YOUR PROPERTY. IF YOU INTEND TO OBTAIN FINANCING, CONSULT WITH YOUR LENDER OR AN ATTORNEY BEFORE RECORDING YOUR NOTICE OF COMMENCEMENT."

EVERY PERMIT ISSUED SHALL BECOME INVALID UNLESS THE WORK AUTHORIZED BY SUCH PERMIT IS COMMENCED WITHIN 180 DAYS AFTER ITS ISSUANCE, OR IF THE WORK AUTHORIZED BY SUCH PERMIT IS SUSPENDED OR ABANDONED FOR A PERIOD OF 180 DAYS AFTER THE TIME THE WORK IS COMMENCED. A VALID PERMIT RECIEVES AN APPROVED INSPECTION EVERY 180 DAYS. WORK SHALL BE CONSIDERED NOT SUSPENDED, ABANDONED OR INVALID WHEN THE PERMIT HAS RECIEVED AN APPROVED INSPECTION WITHIN 180 DAYS OT THE PREVIOUS INSPECTION. Columbia County building Permit Application

For Office Use Only Applica	ition # 0907-15 Date Received	7-10-09 By 4 Permit # 27947
Zoning Official 61	Date 4-07.09 Flood Zone	Land Use RES In Devzoning RSF-2
FEMA Map # AVIA_ Eleva	tionMA MFEVA RiverV	Plans Examiner Date 7 (3/04
Comments Dwater Signat	use on Application	
NOC EH Deed or PA	Site Plan State Road of Parent P	arcel #
Dev Permit #	In Floodway / Letter of Auth. fro	om Contractor AF W Comp. letter
IMPACT FEES: EMS	FireCorr	Road/Code
School	= TOTAL	



Property ID Number 25-48-10-63153-613 14 X Septic Permit No. X09-209
Subdivision Name Piccadilly Park Lot Le Block B Unit Phase
Construction of Sinkhole Repair Growting Cost of Construction est 182,000.
Mobile Home Permit - Wew (or Used (Circle One) Year Length Width
Name of the Authorized Person Signing the Permit Christie Reeves
Phone \$13-241-9152 Fax \$13-241-8343 (christic @ 813-
Address 3517 E 7TH AVE Tampa, Fl 33605 892-8/03)
Owners Name Robert's Kathy Hendrickson Phone
911 Address 265 SW Thurman Terr. Lake City fe 32024
Relationship to Property Owner Is this Home Replacing an Existing Home
Contractors Name (ar 1 C. Kirchendorfer Phone 813-241-9152
Company Name Keystone Supports Fax 813-241-8343
Address 3517 E 7TH Aux Tampa F1 33405
Fee Simple Owner Name & Address 1
Bonding Co. Name & Address
Architect/Engineer Name & Address SDIL 6 (aba)
Mortgage Lenders Name & Address
Driving Directions to the Property 475, R 242, R Thurman Terr, at the right corner of sHannon stand Thurman Terr.
Lot Size 1675 Total Acreage 1675 Building across lot numbers 100
Actual Distance of Structure from Property Lines – Front/Road Left Side Right Side Rear
Number of Stories Heated Floor Area Total Floor Area Roof Pitch
Circle the correct power company - FL Power & Light - Clay Elec Suwannee Valley Elec.
Progress Energy - Slash Pine Electric
Do you currently have an: Existing Drive or Private Drive or need a Culvert Permit or Culvert Waiver (Currently using) (Blue Road Sign) (Putting in a Culvert) (No Culvert but do not need a Culvert)

Both Pages Must be Submitted to obtain a Building Permit.

Spoke \$0 Page 1 of 2



Columbia County Building Permits Application

Application # 0907-15

<u>TIME LIMITATIONS OF APPLICATIONS</u>: An application for a permit for any proposed work shall be deemed to have been abandoned 180 days after the date of filing, unless such application has been pursued in good faith or a permit has been issued; except that the building official is authorized to grant one or more extensions of time for additional periods not exceeding 90 days each. The extension shall be requested in writing and justifiable cause demonstrated.

TIME LIMITATIONS OF PERMITS: Every permit issued shall become invalid unless the work authorized by such permit is commenced within 180 days after its issuance, or if the work authorized by such permit is suspended or abandoned for a period of 180 days after the time work is commenced. A valid permit receives an approved inspection every 180 days. Work shall be considered not suspended, abandoned or invalid when the permit has received an approved inspection within 180 days of the previous approved inspection.

FLORIDA'S CONSTRUCTION LIEN LAW: Protect Yourself and Your Investment: According to Florida Law, those who work on your property or provide materials, and are not paid-in-full, have a right to enforce their claim for payment against your property. This claim is known as a construction lien. If your contractor fails to pay subcontractors or material suppliers or neglects to make other legally required payments, the people who are owed money may look to your property for payment, even if you have paid your contractor in full. This means if a lien is filed against your property, it could be sold against your will to pay for labor, materials or other services which your contractor may have failed to pay.

NOTICE OF RESPONSIBILITY TO BUILDING PERMITEE: YOU ARE HEREBY NOTIFIED: as the recipient of a building permit from Columbia County, Florida, you will be held responsible to the County for any damage to sidewalks and/or road curbs and gutters, concrete features and structures, together with damage to drainage facilities, removal of sod, major changes to lot grades that result in ponding of water, or other damage to roadway and other public infrastructure facilities caused by you or your contractor, subcontractors, agents or representatives in the construction and/or improvement of the building and lot for which this permit is issued. No certificate of occupancy will be issued until all corrective work to these public infrastructures and facilities has been corrected.

WARNING TO OWNER: YOUR FAILURE TO RECORD A NOTICE OF COMMENCMENT MAY RESULT IN YOU PAYING TWICE FOR IMPROVEMENTS TO YOUR PROPERTY. A NOTICE OF COMMENCEMENT MUST BE RECORDED AND POSTED ON THE JOB SITE BEFORE THE FIRST INSPECTION. IF YOU INTEND TO OBTAIN FINANCING, CONSULT WITH YOUR LENDER OR ATTORNEY BEFORE RECORDING YOUR NOTICE OF COMMENCEMENT.

State of Florida Notary Signature (For the Contractor)

CANDACE M. BOSLEY
MY COMMISSION # DD564461
EXPIRES: June 15, 2010
1-8003-NOTARY
FI. Notary Discount Assoc. Co.

Page 2 of 2

Columbia County Property Appraiser DB Last Updated: 4/27/2009

2009 Preliminary Values

Tax Record

Property Card

Interactive GIS Map

Search Result: 1 of 1

Parcel: 25-4S-16-03153-013 HX

Owner & Property Info

Owner's Name	HENDRICKSON ROBERT I &							
Site Address	THURMAN							
Mailing Address	KATHY S P O BOX 3806 LAKE CITY, FL 320563806							
Use Desc. (code)	SINGLE FAM (000100)							
Neighborhood	025416.04	Tax District	2					
UD Codes	МКТА06	Market Area	06					
Total Land Area	0.675 ACRES							
Description	COMM INTERS E LINE OF NE1/4 OF NW1/4 & N R/W CR-242, RUN W ALONG R/W 564.32 FT TO E R/W OF JAMES ST, RUN N 747.5 FT FOR POB, CONT N 172.5 FT, E 170 FT, S 172.5 FT, W 170 F POB. (AKA LOT 6 BLOCK B PICCADILLY PARK S/D UNREC) ORB 691-363, 777-391,							

GIS Aerial



Property & Assessment Values

Mkt Land Value	cnt: (1)	\$18,450.00
Ag Land Value	cnt: (0)	\$0.00
Building Value	cnt: (1)	\$80,127.00
XFOB Value	cnt: (5)	\$13,263.00
Total Appraised Value		\$111,840.00

Just Value	\$111,840.0					
Class Value	\$0.00					
Assessed Value	\$83,756.00					
Exemptions	(code: HX) \$50,000.					
Total Taxable Value	County: \$33,756.00 City: \$33,756.00 Other: \$33,756.00 School: \$58,756.00					

Sales History

Sale Date	Book/Page	Inst. Type	Sale VImp	Sale Qual	Sale RCode	Sale Price
7/1/1993	777/391	WD	I	Q		\$68,100.00
7/14/1989	691/363	WD	I	Q		\$80,500.00
9/1/1986	602/312	WD	I	U	01	\$76,500.00

Building Characteristics

Bldg Item	Bldg Desc	Year Blt	Ext. Walls	Heated S.F.	Actual S.F.	Bldg Value		
1	SINGLE FAM (000100)	1973	Common BRK (19)	1703	2353	\$80,127.00		
Note: All S.F. calculations are based on exterior building dimensions.								

Extra Features & Out Buildings

Code	Desc	Year Blt	Value	Units	Dims	Condition (% Good)
0166	CONC,PAVMT	1973	\$1,000.00	0000001.000	0 x 0 x 0	(000.00)
0280	POOL R/CON	1977	\$7,373.00	0000512.000	32 x 16 x 0	(00.00)
0070	CARPORT UF	1993	\$1,080.00	0000360.000	18 x 20 x 0	(000.00)

STATE CERTIFIED CONTRACTOR LICENSE NO. CRC051408

Columbia County

3517 E. 7th AVENUE TAMPA. FL 33605 (813) 241-9152 PH (813) 241-8343 FX

RE: PERMITTING

PLEASE ALLOW Steven Harrison, FDL# H625-780-58-171-0, PICK UP PERMITS UNDER MY LICENSE. MY STATE LICENSE NUMBER IS CRC051408.

IF YOU HAVE ANY QUESTIONS REGARDING THIS MATTER, PLEASE CONTACT CARL C. KIRCHENDORFER AT (813) 241-9152.

SINCERELY

CARL C. KIRCHENDORFER

SWORN TO AND SUBSCRIBED BEFORE ME THIS

DAY OF

2009 BY COOL KUROVENCO ON, WHO IS PERSONALLY KNOWN TO ME OR HAS PRODUCED

FLORIDA DRIVER LICENSE AS IDENTIFICATION AND WHO DID NOT TAKE AN OATH.

NOTAR

HOLLACE J. MICHAEL
MY COMMISSION # DD 885106
EXPIRES: June 6, 2013
Bonded Thru Notary Public Underwriters

MY COMMISSION EXPIRES:

STATE CERTIFIED CONTRACTOR LICENSE NO. CRC051408

3517 E. 7th AVENUE TAMPA, FL 33605 (813) 241-9152 PH (813) 241-8343 FX

RE: PERMITTING

PLEASE ALLOW CHRISTIE-ANN REEVES FDL# R120-100-82-593-0, PICK UP PERMITS UNDER MY LICENSE. MY STATE LICENSE NUMBER IS CRC051408.

IF YOU HAVE ANY QUESTIONS REGARDING THIS MATTER, PLEASE CONTACT CARL C. KIRCHENDORFER AT (813) 241-9152.

SINCERELY

SWORN TO AND SUBSCRIBED BEFORE ME THIS 14th DAY OF July,
2009 BY Carl C Kirchendorfer, WHO IS PERSONALLY KNOWN TO ME OR HAS PRODUCED FLORIDA DRIVER LICENSE AS IDENTIFICATION AND WHO DID NOT TAKE AN OATH.

CANDACE M. BOSLEY
MY COMMISSION # DD564461
EXPIRES: June 15, 2010
FI. Notery Discount Assoc. Co.

NOTARY PUBLIC

MY COMMISSION EXPIRES:



Permit No			Tax Folio No. 25-4S-16-03153-013 HX
This Instrumen	t Prepared By: Karla	Christmann, NEC Keystone, Inc.	Address: 3517 East 7th Avenue, Tampa, FL 33605
			real property, and in accordance with Section 713.13 of the Florida Statutes, the
[[[[[[[[[[[[[[[[[[[[NOTICE OF COMMENCEMENT.	
1) Descriptio	n of Property		
ŧ	a) Legal Description:	LOT 6, BLOCK B PICCADILLY PARK S/D UNRI	EC, ORB 691-363, 777-391
		55 SW THURMAN TERRACE, LAKE CITY, F	LORIDA
2) General De	escription of Impro	ovements	
6	a) Ground Subsidence	e Stabilization	
3) Owner Info	ormation		
	a) Name & Address:	ROBERT & KATHY HENDRICKSON, P.O.	BOX 3806, LAKE CITY FL 32056-3806
	7. # 이 것 같습니다. 이 보고 있는 것 같습니다. 그 같습니다. 그 것 같습니다. 그 같습	f fee simple titleholde(if other than owner):	
	c) Interest in Property	: Property Owner	
4) Contractor		Ond C Kimbandarfan NEO Kaustana Ina	2547 E 7th Ave. Tomps El 22605
	a) Name & Address: b) Telephone No.:	Carl C. Kirchendorfer, NEC Keystone, Inc. (813) 248-8779	3517 E. 7th Ave., Tampa, FL 33605 Fax No. 813-241-8343
	27 LT	(010) 240-0110	10.00211000
5) Surety Info	a) Name & Address:		
) Amount of Bond:		
	c) Telephone No.:		Inst:200912011718 Date:7/15/2009 Time:9:16 AM DC,P.DeWitt Cason,Columbia County Page 1 of 1 B:1177 P:291
6) Lender			S Z Doi: Dovini Gason, Columbia Godiny Lago 1 of 1 B. 1771 .251
	a) Name & Address:		
t) Telephone No.:		
7) Identity of	person within the	State of Florida designated by owner	upon whom notices or other documents may be served:
	a) Name & Address:		
t) Telephone No.:		Fax No.
8) In addition	to himself, owner	designates the following person to r	eceive a copy of the Lienor's Notice as provided in Section
713.13(1)(k	o), Florida Statutes	:	
50	Name & Address:		Fax No.
	o) Telephone No.:		
9) Expiration	date of Notice of	Commencement (The expiration date is one year	from date of recording unless otherwise specified.)
WAR TO S	WAIFD. A	is and by the super AFTED the surjection of	f the Notice of Commencement are considered improper payments under Cha
WARNING TO C	ion 713.13 Florida Sta	tutes, and can result in your paying twice for i	mprovements to your property. A Notice of Commencement must be recorded an
posted on the jol	osite BEFORE the first	inspection. If you intend to obtain financing, o	consult your lender or an attorney before commencing work or recording your
Notice of Comme	encement.	2 2	
			1/ 1/ 1
		10	x Mathy Rendriction
	Harth Co	solina	Signature of Owner's Authorized Officer/Director/Partner/Manager
State of Flori	Caberrus		x Kathy Hendrickson
County of _	Capacing	-	Print Name
		, - h	2 V
The foregoing in:	strument was acknowle	edged before me on this 18 day o	June, 2009, by Kathy Hendrickson
as Own	or	for Kathy Hendr	icksen .
as Own	(Type of Authority, e.g. officer, trus		of whom instrument was executed) Personally Known
	\		OR
Notary Signature	2000) - muler	Produced Identification
		The Common of the state of the	as — Consideration Constitution
Print Name	13-11- D 1	Carlo Carlo	
		AND	
		Florida Statutes. Under penalties of perjury,	I declare that I have read the foregoing and that the facts stated in it are true to the
best of my know	leuge and beller.	32 48 210 (3)	x Rothy Hendrickson

Signature of Natural Person Signing Above in Line #10



Engineering & Consulting, Inc.

STATE FARM
FLORIDA INSURANCE COMPANY

November 4, 2008

Received

Code

Ms. Lori Robinson - 904-828-1688 - State Farm Florida Insurance Company P.O. Box 44036

Jacksonville, Florida 32231

Subject:

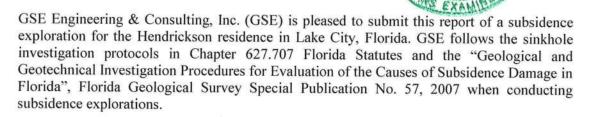
Summary Report of a Subsidence Exploration

Claim No. 59-D215-335 Hendrickson Residence 265 SW Thurman Terrace

Lake City, Columbia County, Florida

GSE Project No. 10314

Dear Ms. Robinson:



GSE certifies that this exploration was of sufficient scope to determine the cause(s) of damage within a reasonable professional probability, and that the individuals signing this report are qualified to determine the existence of sinkhole activity in accordance with §627.707 Florida Statutes.

GSE appreciates the opportunity to have assisted you on this project. If you have any questions or comments concerning this report, please contact us.

Sincerely,

GSF Engineering & Consulting, Inc.

Joakim (Jay) B. Nordqvist, P.E.

Principal Engineer

Florida Registration Number 42681

Kenneth L. Hill, P.E.

Principal Engineer

Florida Registration Number 40146

,

Z:General Projects\10314 Hendrickson\10314.doc

Distribution:

Addressee (5)

File (1)

GSE Engineering & Consulting, Inc. 4949 SW 41st Boulevard, Unit 70 Gainesville, Florida 32608 352-377-3233 Phone 352-377-0335 Fax www.gseengineering.com GSE Project No. 10314

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GSE Project No. 10314

- 1. Project Site Location Map
- 2. Site Plan Showing Locations and Representative Photographs of Damage
- 3. Site Plan Showing Approximate Locations of Field Tests
- 4. Floor Slab Elevation Plan
- 5. Site Plan Showing Approximate Locations of Grout Injection Points
- 6. Site Plan Showing Approximate Locations of Underpinning Piles

APPENDIX

GeoView Report No. 5724 dated October 1, 2008

EXECUTIVE SUMMARY

GSE Engineering & Consulting, Inc. (GSE) was retained by State Farm Florida Insurance Company to conduct a subsidence exploration at the Hendrickson residence located at 265 SW Thurman Terrace in Lake City, Columbia County, Florida.

The purpose of this subsidence exploration was to explore the subsurface conditions at the site and determine the existence of sinkhole activity and sinkhole loss as defined by §627.706 Florida Statutes. This exploration has been performed in accordance with the requirements of §627.707 Florida Statutes.

It is GSE's professional opinion that the overall pattern of decreasing soil strength with depth and drilling fluid circulation losses associated with weight-of-hammer (WOH) strength materials in the unconsolidated portion of the boring profile encountered by SPT boring B-3 is indicative of sinkhole activity as defined by §627.706 Florida Statutes.

The damage at the residence is attributed to material shrinkage/thermal expansion and differential foundation movement. Some of the damage occurs near corners, windows, and doors that are generally more susceptible to post construction material shrinkage cracking. However, due to the overall stair-step damage pattern to the brick walls and other noted damage patterns, the observed damage should be considered as possibly having been affected by the foundation movement. Contributing factors to the differential settlement that cannot be ruled out within a reasonable professional probability include post construction settlement, affects of highly expansive clay-rich soils, and sinkhole activity.

GSE recommends that initially subsurface soils be improved to minimize further subsidence damage. Soil improvement should be accomplished through grout injection to compact and improve the density of sandy soils beneath the home and swimming pool. Grout injection is also intended to seal the top of the limestone surface to reduce the potential for future raveling. Upon completion of the grouting program, GSE recommends the foundation along the perimeter of the home be stabilized using underpinning piles.

The remainder of this report summarizes the services conducted as part of this subsidence exploration and presents our evaluation, conclusions, and recommendations.

1.0 INTRODUCTION

1.1 General

GSE Engineering & Consulting, Inc. (GSE) was retained by State Farm Florida Insurance Company to conduct a subsidence exploration at the Hendrickson residence located at 265 SW Thurman Terrace in Lake City, Columbia County, Florida.

According to the Columbia County Property Appraiser's web site¹, the legal description of the property is:

COMM INTERS E LINE OF NE1/4 OF NW1/4 & N R/W CR-242, RUN W ALONG R/W 564.32 FT TO E R/W OF JAMES ST, RUN N 747.5 FT FOR POB, CONT N 172.5 FT, E 170 FT, S 172.5 FT, W 170 FT POB. (AKA LOT 6 BLOCK B PICCADILLY PARK S/D UNREC) ORB 691-363, 777-391,

The current property owner is listed by the Columbia County Property Appraiser's web site as:

HENDRICKSON ROBERT I & KATHY S

1.2 Project Description

The Hendrickson residence is a single-story, structural brick construction supported by a stemwall foundation. According to the Columbia County Property Appraiser, the home was built in 1973 and purchased by the Hendrickson family in 1993¹. Construction documents (plans) for the home were not readily available from the Columbia County building department.

Mrs. Hendrickson was present during our on-site reconnaissance. Mrs. Hendrickson informed us she first noticed holes developing in her yard approximately one year ago. After this initial damage was noticed, she started noticing cracks in the sidewalk/driveway and other damage within the home. Mrs. Hendrickson informed us that she is aware of sinkhole activity in her neighborhood and is concerned the holes in her yard are related to sinkhole activity.

1.3 Purpose

The purpose of this subsidence exploration was to explore the subsurface conditions at the site, and determine the existence of sinkhole activity and sinkhole loss as defined by §627.706 Florida Statutes. This exploration has been performed in accordance with the requirements of §627.707 Florida Statutes.

¹Columbia County, Florida Property Appraiser's web site.

2.0 SITE RECONNAISSANCE

Mr. Joakim B. Nordqvist, P.E. visited the site on September 19, 2008 to observe site conditions, document damage to the home, and interview the homeowner. The homeowner, Mrs. Kathy Hendrickson was present during this site visit.

The home is single-story, structural brick construction built in 1973¹. The home sits on the northwest corner of SW Thurman Terrace and SW Shannon Road in Lake City and faces northwest. The residence is sited on a lot that gently to moderately slopes down away from the home. For the purposes of discussion, the northeast side of the home will be referred to as the north side of the home throughout this report.

The flooring within the home consists of carpet, tile, and vinyl flooring. The interior walls and ceilings consist of drywall. Mrs. Hendrickson informed us that the ceiling was refinished about 3 years ago in the kitchen, hallway, and living room. The interior and exterior of the home was last painted approximately 3 and 8 years ago, respectfully. The roof of the home is gable end construction and no gutters were installed along the roofline at the time of our exploration.

During our on-site reconnaissance, the homeowner informed us that the screened porch on the rear or east side of the home was added approximately 10 years ago. A concrete driveway and walkway are present on the south and west side of the home, respectfully. A vinyl-lined, concrete, in-ground pool and deck exist on the east side of the residence. Mrs. Hendrickson informed us that a leak was associated with the pool at an approximate rate of 2 to 3 inches per week. The backyard and pool area are enclosed by a chain-link fence.

The home is serviced by a well and septic tank. The well is located on the south side of the property, and the septic tank and drain-field are believed to be located on the east side of the home.

Landscaping is present around most of the perimeter of the home. The yard generally consists of grass lawn with large scattered pine trees. A large palm tree exists just east of the pool on the eastern side of the residence. The homeowner informed us that approximately 20 trees were removed from the property about 15 to 20 years ago.

The homeowner informed us that 5 to 7 holes developed over the past year. Five holes/depressions observed were located on all sides of the home and ranged from 2 to 3 feet bls. These were less than 18 inches in diameter. Two of the holes were hand augered during our investigation.

Cracking damage was noted on both the interior and exterior of the home. Figure 2 illustrates the overall layout and observed representative damage to the interior and exterior of the home.

Interior damage consisted of cracks in the interior walls above doors and windows, cracks in the tile flooring in the bathrooms, separations within the framing of the windows, separations

265 SW Thurman Terrace Lake City, Columbia County, Florida GSE Project No. 10314

between walls and adjoining sinks, bathtubs, and cabinets, and separations between the ceiling and wall joints. These cracks and separations are generally hairline to less than 1/16-inch wide. Along with the cracking damage within the interior of home, some of the doors and windows appeared out-of-square and were difficult to open.

Moisture staining and damage was noted in the interior of the home. The damage was observed on the ceiling of the northeastern bedroom of the home. No obvious sources of moisture (such as a leaking pipe or other moisture source) were noted in these areas.

Cracks and delamination of the plaster finish was observed on the ceiling of the garage. The widths of the cracks in the ceiling are approximately hairline to less than 1/16-inch.

Cracking damage to the exterior of the residence generally consists of cracks in the exterior walls through the bricks and mortar ranging from hairline to less than 1/16-inch wide. Some of these cracks have a stair-step type pattern.

Damage on the exterior of the home also consisted of cracks in the concrete pool deck, driveway, and walkway. The widths of the cracks ranged from approximately 1/16-inch to less than 1/8inch.

3.0 HISTORICAL DATA REVIEW

This section presents a review of readily available published information related to topography, hydrological data, soil survey information and regional geology.

3.1 Review of Published Topographic Data

The Columbia USGS Topographic Map indicates the ground surface elevation in the area of the home range from 90 to 95 feet² NGVD. The home is located on a gently to moderately sloping hillside, with the regional topography generally sloping down from north to south. Closed depressions were identified on the topographic map approximately within half a mile of the home. Closed depressions are not necessarily an indicator of sinkholes, and could represent other landforms.

3.2 Review of Published Hydrological Data

The Floridan Aquifer in the vicinity of the site has an elevation on the order of 30 to 40 feet³. This elevation is well below land surface, indicating a downward hydraulic gradient occurs at the site.

3.3 Review of Published Soil Information

The Columbia County Soil Survey⁴ maps two soil types in the vicinity of the site, consisting of Blanton fine sand and Bonneau fine sand. The following soil descriptions are from the County soil survey.

Blanton fine sand, 0 to 5 percent slopes - This is a moderately well drained, nearly level to gently sloping soil on broad ridges and undulating side slopes. The areas of this soil range from about 20 to 1,000 acres and are irregular in shape.

Typically, the surface layer is gray fine sand about 7 inches thick. The subsurface layer is very pale brown fine sand in the upper 30 inches and light gray fine sand in the lower 15 inches. The subsoil extends to a depth of 80 inches. In the upper 10 inches, it is light yellowish brown fine sandy loam with brownish yellow mottles; in the next 5 inches, it is very pale brown with strong brown and pale brown mottles; and in the lower part, it is light brownish gray fine sandy loam with strong brown mottles.

Included with this soil in mapping are small areas of Albany, Alpin, Chipley, Lakeland, Ocilla, Troup, and Bonneau soils. These soils make up less than 15 percent of the map unit.

² DeLorme Topo USA® 6.0.

³ Potentiometric Surface of the Upper Floridan Aquifer in the St. Johns River Water Management District and Vicinity, Florida, September 2005, U.S. Geological Survey.

⁴ United States Department of Agriculture, Natural Resources Conservation Service, Web Soil Survey.

This Blanton soil has a water table at a depth of 5 to 6 feet most of the year. In wet seasons, a perched water table is above the subsoil for less than a month. The available water capacity is medium in the surface layer and low in the subsurface layer and subsoil. Permeability is rapid in the surface and subsurface layers and moderate in the subsoil. Natural fertility and the organic matter content are low.

Bonneau fine sand, 2 to 5 percent slopes - This is a moderately well drained, gently sloping soil on uplands and on knolls in the uplands. The areas of this soil range from 3 to 200 acres and are circular.

Typically, the surface layer is grayish brown fine sand about 7 inches thick. The subsurface layer is fine sand about 20 inches thick. In the upper 8 inches, it is yellowish brown, and below that, it is brownish yellow with very pale brown splotches. The subsoil extends to a depth of 80 inches. In the upper 9 inches, it is yellowish brown fine sandy loam; in the next 22 inches it is very pale brown, yellowish red, and grayish brown sandy clay loam; in the next 16 inches, it is very pale brown, yellowish red, and grayish brown sandy clay loam with pockets of fine sandy loam; and in the lower part it is gray and pink sandy clay loam.

Included with this soil in mapping are small areas of Lucy, Ocilla, Blanton, Goldsboro, and Ichetucknee soils. These soils make up les than 20 percent of the map unit.

This Bonneau soil has a water table at a depth of 48 to 72 inches for 1 to 2 months during rainy periods in most years. Otherwise, the water table is below a depth of 72 inches. The available water capacity is low in the surface and subsurface layers and upper part of the subsoil and medium in the lower part of the subsoil. Permeability is rapid in the surface and subsurface layers and moderate in the subsoil. Natural fertility is moderate. The organic matter content is very low.

3.4 Review of Published Regional Geology

The Hendrickson residence is located in the central portion of Columbia County. This area of Columbia County maps as the Undifferentiated Sediments⁵ geological region. The following description is from the Geological Survey.

Undifferentiated Quaternary Sediments – Much of Florida's surface is covered by a varying thickness of undifferentiated sediments consisting of siliciclastics, organics and freshwater carbonates. Where these sediments exceed 20 feet (6.1 meters) thick, they were mapped as discrete units. In an effort to subdivide the undifferentiated sediments, those sediments occurring in flood plains were mapped as alluvial and flood plain deposits (Qal). Sediments showing surficial expression of beach ridges and dunes were mapped separately (Qbd) as were the sediments composing Trail Ridge (Qtr). Terrace sands were not mapped (refer to Healy [1975] for a discussion of the terraces in Florida). The subdivisions of the Undifferentiated Quaternary

⁵ Open-File Report 80, Thomas M. Scott, P.G. No. 99, Text to Accompany the Geological Map of Florida, Florida Geological Survey, 2001.

Sediments (Qu) are not lithostratigraphic units but are utilized in order to facilitate a better understanding of the State's geology.

The siliciclastics are light gray, tan, brown to black, unconsolidated to poorly consolidated, clean to clayey, silty, unfossiliferous, variably organic-bearing sands to blue green to olive green, poorly to moderately consolidated, sandy, silty clays. Gravel is occasionally present in the panhandle. Organics occur as plant debris, roots, disseminated organic matrix and beds of peat. Freshwater carbonates, often referred to as marls in the literature, are scattered over much of the State. In southern Florida, freshwater carbonates are nearly ubiquitous in the Everglades. These sediments are buff colored to tan, unconsolidated to poorly consolidated, fossiliferous carbonate muds. Sand, silt and clay may be present in limited quantities. These carbonates often contain organics. The dominant fossils in the freshwater carbonates are mollusks.

4.0 FIELD AND LABORATORY TESTS

4.1 General Description

The procedures used for field sampling and testing are in general accordance with industry standards of care and established geotechnical engineering and geological investigation practices for this geographic region. Our field exploration consisted of performing geophysical services consisting of ground penetrating radar (GPR) and electrical resistivity (ER), hand auger borings with static cone penetrometer soundings, test pits, Standard Penetration Test (SPT) borings, laboratory tests on samples recovered from the site and a relative floor elevation survey. The following sections describe our field testing program in more detail.

4.2 Ground Penetrating Radar and Electrical Resistivity Imaging Surveys

Ground Penetrating Radar (GPR) and Electrical Resistivity Imaging (ERI) surveys were performed at the site by GeoView, Inc. (GeoView) as a subconsultant to GSE.

A GPR survey was conducted both inside and outside of the residence. The GPR survey outside of the residence was conducted along a series of perpendicular transects spaced 10 ft apart. The GPR survey was performed in the inside areas of the home that were accessible. The GPR data was collected with a Mala radar system.

The ERI survey was conducted using the Advanced Geosciences, Inc. Sting R8 automatic electrode resistivity system. A total of four ERI transects were performed using up to 27 electrodes on each line with an "a spacing" of 5 ft. A dipole-dipole combined with an inverse Schlumberger electrode configuration was used with a maximum "n value" of six. The ERI data was analyzed using EarthImager 2D, a computer inversion program, which provides two-dimensional vertical cross-sectional resistivity model (pseudo-section) of the subsurface.

A more detailed description of the GPR and ERI methods is included in the GeoView report attached in the Appendix (GeoView Project No. 5724).

4.3 Auger Borings

The auger borings were performed in accordance with ASTM Specification D-1452. The borings were performed with hand auger equipment that was rotated into the ground in a manner that reduces soil disturbance. After penetrating to the required depth, the auger was retracted and the soils collected in the auger bucket were field classified and placed in sealed containers. Representative samples of each stratum were retained from the auger boring. The boring locations were selected to provide a general representation of the near surface soil conditions at the site.

Static cone penetrometer soundings were performed at the hand auger locations to depths of four feet below land surface (bls). The penetrometer probes provide an indicator of soil strength, and can be generally correlated to the N-value of the SPT test in sandy, clayey and silty soils.

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Results from the hand auger borings and static cone penetrometer soundings are provided in Section 8.1. The auger boring locations are indicated on Figure 3.

4.4 Standard Penetration Test Borings

The boring locations were selected considering the findings of the geophysical survey, relative floor elevation survey and damage to the home. The soil borings were performed with a drill rig employing mud rotary drilling techniques and Standard Penetration Testing (SPT) in accordance with ASTM Specifications D-1586. The SPTs were performed continuously to ten feet and at five-foot intervals thereafter. Soil samples were obtained at the depths where the SPTs were performed. The soil samples were classified in the field, placed in sealed containers, and returned to our laboratory for further evaluation.

After drilling to the sampling depth and flushing the borehole, the standard two-inch O.D. split-barrel sampler was seated by driving it six inches into the undisturbed soil. Then the sampler was driven an additional 12 inches by blows of a 140-pound hammer falling 30 inches. The number of blows required to produce the 12 inches of penetration were recorded as the penetration resistance ("N" value). These values and the complete SPT boring logs are provided in Section 8.2.

Upon completion of the sampling, the boreholes were abandoned in accordance with Water Management District guidelines.

The SPT boring locations are indicated on Figure 3.

4.5 Test Pits

Two test pits were manually excavated at the residence in order to observe the foundation type, measure its dimensions and confirm the embedment depth. The location of the test pits are indicated on Figure 3.

4.6 Relative Floor Elevation Survey

A relative floor elevation survey of the interior floor of the residence was performed using a Zip Level Pro[®]. Data for the floor elevation survey was collected at random points in the rooms that were readily accessible. GSE does not move furniture to obtain the floor elevation data. The data is accurate to approximately 0.1 inch. The data is used in a computer model that plots contours of the relative elevation of the floor slab. The floor elevation survey map is not prepared by a licensed surveyor, and is not to be considered a survey as regulated by §472 Florida Statutes. The results of the relative floor elevation survey are provided on Figure 4.

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Soil Laboratory Tests

The soil samples recovered from the soil borings were returned to our laboratory, and examined to confirm the field descriptions. Representative samples were then selected for laboratory testing. The laboratory tests consisted of the percent passing the No. 200 sieve determinations with natural moisture contents, and Atterberg Limits tests. These tests were performed in order to aid in classifying the soils and to further evaluate their engineering properties. The laboratory tests are provided in Section 8.4.

5.0 FINDINGS

This section summarizes the findings of the field and laboratory services.

5.1 Geophysical Testing (GPR & ERI)

A complete discussion of the GPR and ERI methods and findings are presented in the GeoView report attached in the Appendix. The following discussion was taken from the GeoView report.

Results of the GPR survey indicated the presence of two well-defined, relatively continuous sets of GPR reflectors at depth ranges of 1 to 3 ft bls and 15 to 22 ft bls. The upper GPR reflector set correlates to the lithological contact between the clayey sand and underlying clay stratum identified at 1.5 ft bls by the hand auger boring. The lower GPR reflector set is below the depth of the hand auger boring, and accordingly cannot be correlated to any lithological contact. However, the reflector set is most likely associated with some change in lithological conditions at that depth range.

One GPR anomaly area was identified north of the residence. The anomaly is semi-elliptical in shape with a total area of approximately 540 square ft. The apparent vertical relief of the upper portion of the anomaly area is 4 to 5 ft as characterized by the observed downwarping of the lower GPR reflector set. The apparent center of the feature is characterized as the area of maximum downwarping of the previously referenced GPR reflectors. It is noted that no disruption to the sediments overlying the downwarped GPR reflector was observed. This suggests that the GPR anomaly is likely associated with relic depositional or erosion activity, rather than possible karst activity.

In addition, the GPR data identified a linear feature within the GPR anomaly area at a depth range of 2 to 3 ft (Figure 3). This linear feature is most likely associated with buried debris (i.e. buried tree/root). No near-surface soil disturbances were observed directly below any of the small surface depressions located throughout the survey area.

ERI transects 1, 2 and 4 are of acceptable quality. ERI Transect 3 is of poor quality. The poor attribution to the quality of the ERI data is based upon the large number of data points that needed to be removed as part of the inversion process (greater than 30 percent) and the relatively high RMS and L2-norm of the ERI data. Accordingly, modeling results from ERI Transect 3 may not be representative of actual subsurface geological conditions.

Analysis of the ERI Transects indicate the presence of high to moderate resistivity near-surface soil materials across the majority of the project site to the maximum depth of investigation of the ERI transects which ranged from approximately 13 to 29 ft bls. However, Transects 3 and 4 did indicate an approximately 4 to 8 ft thick low resistivity horizon at a depth range of approximately 3 to 7 ft bls. The high to moderate resistivity materials likely correspond to the clayey sand identified in the hand auger borings and the low resistivity layer likely corresponds to an increase in the clay content of the soil materials.

Two ERI anomalies were identified at the project site, one of which corresponds to the general location of the GPR anomaly (Figure 3). This corresponding ERI anomaly was characterized by the localized occurrence of relatively less resistive soil materials at depth. These relatively less resistive sediments occurred at an estimated depth range of 7 to 27 ft bls. The southern ERI anomaly was characterized by a localized area of increased resistivity with depth.

It is noted that no geological structures suggesting a possible downward raveling of sediments was observed within these areas on the GPR data. In addition, the southern ERI anomaly is suspect due to the poor quality of the data used in the inversion process to create the model. Accordingly, these ERI anomalies are likely associated with naturally-occurring lateral variations in resistivity or modeling errors, rather than sinkhole activity.

There was a poor correlation between the GPR identified layers and the ERI modeling results. The GPR appears to have identified the contact between the near surface clayey sand and clay layer observed at 1.5 ft bls in the hand auger boring, along with a deeper unknown horizon at a depth range from 15 to 22 ft bls. The ERI method identified high to moderate resistivity soils across the majority of the project site with the exception of 4 to 8 ft of low resistivity materials observed on ERI Transects 3 and 4 at a depth range of 3 to 7 ft bls. This low resistivity layer most likely corresponds to a response from the clay stratum identified in the hand auger boring. The ERI method was not able to consistently resolve the lithological contact between the surficial clayey sand and underlying clay stratum as identified by the GPR survey.

An ERI anomaly was identified in the area of the GPR Anomaly, but no GPR anomaly was identified within the southern ERI anomaly. Accordingly, the area with two corresponding geophysical anomalies has the greatest probability for being associated with karst activity, rather than being a result of the modeling process of suspect ERI data. However, the lack of any indications of downwarping or other observed soil disturbances in the GPR data overlying these anomaly areas suggests that these anomalies are more likely relic depositional features, rather than possible karst activity.

5.2 Hand Auger Boring Results

The locations of the hand auger borings are provided on Figure 3. The complete logs for the borings are provided in Section 8.1. Descriptions for the soils encountered are based on visual observation of the recovered soil samples and the laboratory testing performed. Stratification boundaries between the soil types should be considered approximate, as the actual transition between soil types may be gradual.

The five hand auger borings conducted indicate the near surface soil conditions across the site are relatively similar. The borings typically encountered 1 to 2.5 feet of silty sand (SM) overlying clayey to very clayey sand and clay (SC, CL/CH) to the explored depths of 10 feet bls.

Two of the five auger borings were conducted in the holes or depressions observed in the grass lawn. These borings encountered silty sand with decayed wood and roots. Our findings indicate that these depressions are related to historical locations of trees that were removed, where the stumps have decayed over time.

The water table was not encountered in the hand auger borings within the explored depths at the time of our exploration.

The static cone penetrometer soundings performed at the auger boring locations found soil penetration resistance values of 6 to 57 kg/cm². The test results indicate very loose to medium dense soil conditions.

5.3 Standard Penetration Test Boring Results

The three SPT borings encountered near surface soil conditions similar to the auger boring findings, consisting of a 2 foot thick layer of silty sand (SM) overlying medium dense to dense clayey to very clayey sand (SC) with interbedded layers of stiff to hard sandy clay and clay (CL/CH) on top of limestone with the exception of boring B-3. Boring B-3 encountered similar conditions, but with weight-of-hammer (WOH) strength materials above the limestone within boring profile. The limestone formation was encountered at depths ranging from 50 to 58 feet bls. The boring termination depths ranged from 50 to 65 feet bls.

Boring B-1 was drilled at the center of the GPR anomaly and ERI anomaly on the north side of the home. The boring was terminated due to drilling refusal on hard chert at an approximate depth of 51.5 feet bls.

Boring B-2 was drilled on the eastern portion of the ERI anomaly on the north side of the home. Drilling fluid losses were encountered at approximate depths of 48.5 feet bls. The boring was terminated due to drilling refusal on hard chert at an approximate depth of 50 feet bls.

Boring B-3 was drilled at the ERI anomaly on the south side of the home. This area also corresponded to the lowest elevations within the home where abrupt changes in the floor slab elevation survey were encountered. A drilling fluid loss was encountered within the unconsolidated portion of the boring profile at an approximate depth of 53 feet bls. Two WOH events occurred within the unconsolidated portion of the boring profile from 53.5 to 54.5 feet bls and from 58.5 to 58.75 feet bls. Limestone was encountered at an approximate depth of 58 feet bls and continued to the explored depth of 65 feet bls.

Ground water was not encountered within a depth of 10 feet bls at the SPT boring locations. Due to the mud rotary method of advancing the boreholes, the groundwater depth was not determined in the SPT borings below 10 feet.

The loss of drilling fluid circulation that occurred in boring B-2 was near the surface of the limestone formation and within the epikarst where circulation losses commonly occur. The losses of drilling fluid circulation associated with WOH strength materials in boring B-3 within

the unconsolidated portion of the boring profile and the overall decreasing soil strength with depth is indicative of sinkhole activity.

5.4 Test Pit Results

Two test pits were excavated at the site to determine the foundation type and embedment depth. Figure 3 indicates the test pit locations.

TP-1 indicates the foundation of the home consists of a stem wall placed on a continuous shallow foundation. The top of the foundation was encountered 8.5 inches bls. The foundation extended out from the stem wall 3 inches with a thickness of 7.5 inches. The test pit indicates the foundation consists of a 7.5 inch thick continuous foundation embedded about 16 inches, with an overall width of 14 inches.

TP-2 was performed at the rear porch and the foundation was determined to be a monolithic thickened edge foundation. The top of the slab was approximately one inch below the ground surface and the foundation thickness was approximately 5.5 inches, indicating an embedment depth of 6.5 inches.

5.5 Relative Floor Elevation Survey Results

The relative floor elevation survey indicates approximately 1.5 inches of elevation change occurs across the floor of the main living area of the home. The lowest elevation was encountered near the southeast corner of the residence near the kitchen and utility room. This area corresponds to damage found on the exterior of the home. The highest elevations were encountered on the western central portion of the home near the front door. Considering the variation of height of the carpet found within the home, we conclude the rest of the home appears relatively level with no abrupt changes in floor elevations. The magnitude of the floor elevation changes and noted damage indicate that differential movement has occurred within the main living area of the home.

The floor slab survey of the rear screened enclosed porch on the east side of the home indicates a gentle downward slope going downward from the east to the west. Approximately 0.9 inches of elevation change occurs across the concrete slab. Porch and patio slabs are commonly sloped down away from the home to allow drainage away from the residence. Although there are not compelling damage and floor elevation trends, the elevation contours are inconclusive as to whether or not differential movement has occurred.

The floor slab survey of the garage indicates a gentle slope going downward from the north to the south side of the garage towards the garage door opening. Approximately 2.0 inches of elevation change occurs across the garage slab. Garage slabs are also commonly sloped down toward the garage door openings to allow drainage out of the garage. The elevation contours are inconclusive as to whether or not differential movement has occurred, although some of the noted damage in the area suggests that some differential movement has occurred.

The relative floor elevation survey results are provided on Figure 4.

5.6 Laboratory Soil Analysis

Selected soil samples recovered from the soil borings were analyzed in order to aid in classifying the soils and to further evaluate their engineering properties. The laboratory tests consisted of five percent passing the No. 200 sieve determinations with natural moisture contents and two Atterberg Limits tests. Locations of the soil borings are shown on Figure 3. Selected soil samples for laboratory testing were collected from depths ranging from 2 to 10 feet bls. The complete laboratory report is provided in Section 8.4.

The laboratory tests indicate the tested soils consist of very clayey sand, sandy clay and clay. The tested very clayey sand (SC) has 50 percent soil fines passing the No. 200 sieve. The tested sandy clay and clay (CH) has 54 to 97 percent soil fines passing the No. 200 sieve.

The Atterberg Limits tests indicate the tested clay-rich soils have Liquid Limit (LL) values of 66 and 100, Plastic Limit (PL) values of 24 and 38, and Plasticity Index (PI) values of 42 and 62, respectfully. This corresponds to a material with high (LL < 50, PI < 25) potential for expansive behavior⁶.

The natural moisture content tests indicate the sandy clay and clay have very low moisture contents, with values less than the PL.

⁶ U.S. Department of the Army USA, 1983, Foundations in Expansive Soils, TM 5-818-7, p. 4-1.

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6.0 EVALUATION AND CONCLUSIONS

GSE Engineering & Consulting, Inc. has performed a comprehensive exploration of the subsurface conditions at the Hendrickson residence to evaluate the presence of sinkhole activity and likely cause(s) of damage to the home. It is GSE's professional opinion that the overall pattern of decreasing soil strength with depth and drilling fluid circulation losses associated with WOH strength materials in the unconsolidated portion of the boring profile encountered by SPT boring B-3 is indicative of sinkhole activity as defined by §627.706 Florida Statutes.

The damage at the residence is attributed to material shrinkage/thermal expansion and differential foundation movement. Some of the damage occurs near corners, windows, and doors that are generally more susceptible to post construction material shrinkage cracking. However, due to the overall stair-step damage pattern to the brick walls and other noted damage patterns, the observed damage should be considered as possibly having been affected by the foundation movement.

Contributing factors to the differential settlement that cannot be ruled out within a reasonable professional probability include post construction settlement, affects of highly expansive clayrich soils and sinkhole activity.

Some of the noted differential settlement is consistent with foundation settlement that is within an expected range for the type and age of construction, considering identified site and the subsurface conditions encountered at the residence. Various factors influence actual manifestation of post construction differential settlement including lack of adequate compaction, disturbance of the foundation supporting soils during construction, surface water diversion, foundation embedment, and erosion.

The observed cracking in the concrete slabs is consistent with concrete drying shrinkage. Some of the noted damage has been aggravated by differential movement. Concrete slabs are susceptible to long-term post construction settlement resulting from surface runoff erosion around the perimeter and through shrinkage cracks due to their typically shallow embedment depth and sandy nature of supporting soils.

Effects of expansive clay-rich soils identified at the site are also a likely contributing factor to differential foundation movement. The depth variation and variability in the expansive characteristics of the clay-rich soils and availability of water can cause differential movement of the foundation consistent with that identified at this residence.

Sinkhole activity is related to raveling of overlying soils into the limestone formation, which can result in subsidence or collapse of the near surface soils supporting foundations. This loss of support of the near surface soils can cause differential movement of the foundation such as that observed at this residence.

Decayed wood was encountered in the hand augur borings conducted within the holes or depression around the perimeter of the home. The borings and observations at the residence

November 4, 2008

indicate the small holes/depressions are attributed to the decomposition of tree stumps. The decomposing stumps are likely a result of the removal of about 20 trees from the property approximately 15 to 20 years ago.

7.0 RECOMMENDATIONS

Prior to implementing the proposed subsurface remediation plan, the swimming pool should be repaired to address the leak. GSE recommends that initially subsurface soils be improved to minimize further subsidence damage. Soil improvement should be accomplished through grout injection to compact and improve the density of sandy soils beneath the home and swimming pool. Grout injection is also intended to seal the top of the limestone surface to reduce the potential for future raveling.

The grouting program should incorporate up to 42 injection points spaced approximately 10 feet on center around the perimeter of the structure and pool. The grout points should be vertical and inclined as shown in Figure 5. The actual locations and number of grout points should be confirmed in the field and adjusted as necessary to accommodate site specific conditions.

The depth of grouting, based on the field boring logs is likely to vary from approximately 55 to 65 feet. An average grout pipe depth of 60 feet can be considered for budgeting purposes. Typical compaction grout mix with a slump between 4 and 6 inches should be used, pumped at slow enough rates such that the grout will densify and not hydro-fracture the soil.

The total quantity of grout required can vary based on site conditions, but is likely to be between 200 and 250 cubic yards (cy).

Continuous monitoring of the structure elevation should be undertaken during the grouting process to identify and prevent unnecessary upward movement of the structure.

Upon completion of the grouting program, GSE recommends the foundation along the perimeter of the home be stabilized using underpinning piles. These piles are installed into the subsurface that bear on competent materials, and a steel bracket attaches the piles to the foundation. A hydraulic ram is typically used to jack the foundation against the piles, which in some cases can lift the foundation back to near the original elevation and also transfer the foundation load to the piles. The piles are then permanently attached to the bracket, and the rams are removed.

Underpinning should be installed to an approximate 6 feet on center spacing along the exterior walls of the home. GSE estimates 38 underpinning piles will be necessary to support the perimeter of the structure. Figure 6 illustrates the approximate locations of the recommended underpinning piles. The actual locations should be confirmed in the field and adjusted as necessary. Piles that fall under windows or lightly loaded areas of the structure should consider spreader beams to limit collateral damage during pile installation.

GSE anticipates the depth of the underpinning piles will range from about 50 to 60 feet in depth. An average depth of 55 feet should be assumed for cost evaluation purposes. Due to the anticipated variability in the depth to limestone, deeper and shallower piles could occur and should be anticipated. The underpinning piles and bracket assembly should have an ultimate capacity of at least 30 kips. These piles should be driven, hydraulically advanced or drilled to bear on competent material at depth. In some areas, pre-drilling of the piles may be necessary to

advance the desired depth. Alternate pile installation methods must be submitted to the geotechnical engineer for approval.

The optimum level to which the structure can be lifted as a result of the underpinning process is a function of the structural configuration as well as the amount of long-term and irreversible stresses that have accumulated. In many cases, it may not be practical to attempt to completely level the structure, as excessive collateral damage may result. The structure should be carefully monitored during the lifting process. The contractor is responsible for the means and methods of construction.

GSE recommends all grouting and underpinning operations be performed under the observation of the geotechnical engineer. The contractor should submit the proposed grouting and pin pile systems and proposed installation methods to the geotechnical engineer for approval.

Cosmetic repairs to the home should be postponed for at least 60 days after the underpinning repairs are completed to allow re-distribution of stresses through the structure resulting from the underpinning program.

8.0 FIELD DATA

8.1 Auger Boring Logs



GSE Engineering & Consulting, Inc. 4949 SW 41st Blvd., Unit 70 Gainesville, Florida 32608 Telephone: 352-377-3233

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-		AU 1	16	(SM) Dark gray silty SAND	1.0			AU 1	40	(SM) Brown silty SAND
			17	(SC) Brown to orange claye				AU 2	57	(SC) Orange to red and gray very clayey SAND
2.5		AU 2	6			2.5			45	
ale vertex		AU 3	36	(CH) Gray, red and orange	4.0	<u> </u>				(CH) Gray and red CLAY with sand
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.0.0		X6		Bottom of borehole a		, 10.0	118			Bottom of borehole at 10.0 feet.



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	CLIE	ENT _	State Far	m Ins	urance Company	PRO	JECT	ΓNA	ME He	ndrick	ckson Residence Claim No. 59-D215-335			
75.							PROJECT LOCATION Lake City, Columbia County, Florida							
	DATE PERFORMED _9/30/2008 BORING NUMBER A-3 DRILLING CONTRACTOR _GSE Engineering GROUND WATER LEVELS: LOGGED BY _CC AT TIME OF DRILLING _NE _ CHECKED BY _DSK SESTIMATED SEASONAL HIGH _NA						DATE PERFORMED _9/30/2008 BORING NUMBER _A-4 DRILLING CONTRACTOR _GSE Engineering GROUND WATER LEVELS: LOGGED BY _CC AT TIME OF DRILLING _NE CHECKED BY _DSK ESTIMATED SEASONAL HIGH _NA NOTES							
	O DEPTH	GRAPHIC LOG	SAMPLE TYPE NUMBER	PPT (kerlens ²)	MATERIAL DESCRIPTION	O DEPTH	GRAPHIC	FOG	SAMPLE TYPE NUMBER	PPT (kg/cm²)	MATERIAL DESCRIPTION			
BORINGS/10314 BORINGS.GPJ			AU 1	22	(SM) Brown silty SAND	-	-				VOID			
RESIDENCE 59-D-215-335/10314 E	2.5		AU 3 AU 4	14	(CL/CH) Brown to orange sandy CLAY (CL/CH) Brown, orange, and red sandy CLAY		7		AU 1		(SM) Dark brown silty SAND with decayed wood			
ALV-ROJECT STIUS 14 MENURICASOIN	5.0		AU 5		(SC) Gray, orange, and red clayey SAND)					Bottom of borehole at 4.0 feet.			
NOO 03.23 - NOCHVEN NOCHMEN	7.5		AU 6		(CH) Gray and red CLAY									
	10.0		AU 7		(SC) Gray and red clayey SAND 10.0 Bottom of borehole at 10.0 feet.									



GSE Engineering & Consulting, Inc. 4949 SW 41st Blvd., Unit 70 Gainesville, Florida 32608 Telephone: 352-377-3233

	Engin	Engineering & Consulting, Inc. Telephone: 352-377-3233											
					rance Company		ndrickson Residence Claim No. 59-D215-335						
	PRO		NUMBER			PROJECT LOCATION	Lake City, Columbia County, Florida						
		DRILI GROI	LING CON UND WAT T TIME O STIMATE	ITRAC ER LI F DRI	9/25/2008 BORING NUMBER A-5 CTOR GSE Engineering EVELS: LOGGED BY CC LLING NE CHECKED BY DSK ASONAL HIGH NA	4							
	O DEPTH		SAMPLE TYPE NUMBER	PPT (kg/cm²)	v v								
13-333110314 BORINGS110314 BORINGS.GPJ	 2.5				VOID								
4 HENDRICKSON NESIDENCE 39-D-2	5.0		AU 1		3. (SP-SM) Brown and tan SAND with silt								
ייטריי אביי ויטרואריי אריי ויטריי ויטריי	7.5		AU 2		(SP-SC) Brown SAND with clay, roots, and nodules of red clayey sand								
					Bottom of borehole at 8.0 feet.								

8.2 Standard Penetration Test Boring Logs

GSE

SPT BORINGS - GINT STD US.GDT - 10/31/08 09:21 - NSERVER1/GENERAL/PROJECTS/10314 HENDRICKSON RESIDENCE 59-D-215-335/10314 BORINGS/10314 BORINGS.GPJ

GSE Engineering & Consulting, Inc. 4949 SW 41st Blvd., Unit 70 Gainesville, Florida 32608

BORING NUMBER B-1

Engineering &	Consulting, Inc. Telephone: 352-377-3233										
CLIENT	State Farm Insurance Company		PR	ROJE	T NAME _H	endric	kson F	Reside	nce C	laim No	o. 59-D215-335
PROJECT	NUMBER 10314		PR	ROJEC	CT LOCATION	La	ke City	, Colu	ımbia (County	, Florida
	ARTED 9/25/08 COMPLETED 9/25/08		GF	ROUN	D ELEVATION				HOL	LE SIZE	
DRILLING	CONTRACTOR GSE Engineering		GF	ROUN	D WATER LEV	ELS:					
DRILLING	METHOD Mud Rotary			▼ A	T TIME OF DR	ILLING	3 <u>N</u>	IA			
LOGGED	BY CC CHECKED BY DSK										
NOTES _											
DEPTH (ft)		CONTACT DEPTH (ft)	SAMPI E TYPE	NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %	▲ SPT N VALUE ▲
0	(SM) Brown silty SAND with roots	+									20 40 60 80
- 1		2	М	AU 1							
	(CL/CH) Brown, red, and tan sandy CLAY	1-		AU							
		4	И	2					55	24	
5	(SC) Medium dense gray, brown, and orange clayey SAND		V	SPT	3-6-11-18						
		6	À	3	(17)						1
	(CL/CH) Very stiff gray, orange, and tan sandy CLAY		V	SPT	9-16-13-16				EA	10	\setminus
		8		4	(29)				54	18	1
- 1//	(SC) Dense to medium dense gray, reddish orange, and tan very clayey SAND		V	SPT	16-16-15-18						
10	Stange, and tan itsly daye, or the			5	(31)						1
				SPT	10-10-13					18	
15				6	(23)						
- ///											
///	(SC) Medium dense gray to pale green and orange	17									
1/2	very clayey SAND										
1//			Y	SPT 7	6-7-11					l l	
20				-	(18)					-	
		22									
	(SC) Medium dense orange and tan clayey SAND	22									
25			X	SPT 8	9-11-9 (20)						A
1//		27									
1//	(SC) Medium dense light gray to white and orange										
	clayey SAND			007	0.40.44						
30			X	SPT 9	8-10-11 (21)						A
	3										
1//											
-1//			V	SPT	7-9-9						
00 1/1	A	1 1	A	10	/10)	- 1	- 1	- 1	- 1		A : : : :



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BORING NUMBER B-1

CLIENT State Farm Insurance Company PROJECT NAME Hendrickson Residence Claim No. 59-D215-335 PROJECT NUMBER 10314 PROJECT LOCATION Lake City, Columbia County, Florida PLASTIC LIMIT, % LIQUID LIMIT, % PERCENT PASS NO. 200 SIEVE SAMPLE TYPE NUMBER PLASTICITY INDEX MOISTURE CONTENT, % CONTACT DEPTH (ft) GRAPHIC LOG DEPTH (ft) ▲ SPT N VALUE ▲ MATERIAL DESCRIPTION 20 40 60 80 (SC) Medium dense light gray to white and orange clayey SAND (continued) SPT 11 4-5-7 (12) (CL/CH) Stiff gray to pale green and orange CLAY with sand SPT BORINGS - GINT STD US.GDT - 10/31/08 09/21 - NSERVER1/GENERAL/PROJECTS/10/314 HENDRICKSON RESIDENCE 59-D-215-333/10/314 BORINGS/10/314 BORINGS GPJ SPT 12 3-4-5 (9) 45 SPT 13 35-20-14 (34)Terminated boring at 51.5' due to refusal on hard SPT 14 9-5-6 (11)Bottom of borehole at 51.0 feet.

1	19	الانعد			
1		10	17	7	1
1	y,		41	4	4
_			1	-	200

GSE Engineering & Consulting, Inc. 4949 SW 41st Blvd., Unit 70 Gainesville, Florida 32608 Telephone, 352,377,3233

BORING NUMBER B-2

Sept 10-15-27-22 Sept 20 Sept 20	Enginee	ering & Cou	relephone: 352-377-3233										
DATE STARTED 9/25/08 COMPLETED 9/25/08 GROUND ELEVATION HOLE SIZE DRILLING CONTRACTOR GSE Engineering GROUND WATER LEVELS: DRILLING METHOD Mud Rotary LOGGED BY CC CHECKED BY DSK NOTES HUBBRIAN OF DRILLING NA WATERIAL DESCRIPTION MATERIAL DESCRIPTION (SM) Brown silty SAND with roots (SC) Orange to brown very clavery SAND with roots GROUND ELEVATION HOLE SIZE GROUND WATER LEVELS: AT TIME OF DRILLING NA SESTIMATED SEASONAL HIGH NA SPT N VALUE AU 1 AU AU	CLIEN	NT Sta	ate Farm Insurance Company		P	ROJE	CT NAME H	endric	kson l	Reside	nce C	aim N	o. 59-D215-335
DATE STARTED 9/25/08 COMPLETED 9/25/08 GROUND ELEVATION HOLE SIZE DRILLING CONTRACTOR GSE Engineering DRILLING METHOD Mud Rotary LOGGED BY CC CHECKED BY DSK NOTES MATERIAL DESCRIPTION MATERIAL DESCRIPTION (SM) Brown silty SAND with roots GROUND WATER LEVELS: AT TIME OF DRILLING NA SETIMATED SEASONAL HIGH NA SPT N VALUE AU 1 AU AU	PROJ	ECT NU	JMBER10314		Р	ROJE	CT LOCATION	La	ke Cit	y, Colu	ımbia (County	, Florida
DRILLING CONTRACTOR GSE Engineering DRILLING METHOD Mud Rotary LOGGED BY CC CHECKED BY DSK NOTES MATERIAL DESCRIPTION MATERIAL DESCRIPTION MATERIAL DESCRIPTION (SM) Brown silty SAND with roots GROUND WATER LEVELS: AT TIME OF DRILLING NA ESTIMATED SEASONAL HIGH NA SPT N VALUE AU 1 AU 1 (SC) Orange to brown very claves SAND with roots	DATE	START											
DRILLING METHOD Mud Rotary LOGGED BY CC CHECKED BY DSK NOTES MATERIAL DESCRIPTION MATERIAL DESCRIPTION (SC) Orange to brown very clavely SAND with roots (SC) Orange to brown very clavely SAND with roots AU (SC) Orange to brown very clavely SAND with roots AU (SC) Orange to brown very clavely SAND with roots	DRILL	ING CO	ONTRACTOR GSE Engineering										
LOGGED BY CC CHECKED BY DSK ESTIMATED SEASONAL HIGH NA NOTES MATERIAL DESCRIPTION MATERIAL DESCRIPTION MOISTURE NO. 200 SIEVE NO. 200 SIEV						V A	T TIME OF DR	BILLING	G N	JA			
NOTES COUNTY COU													
O DEPTH O COUNTS O C							011111111111111111111111111111111111111	3 10011		-	1473		
MATERIAL DESCRIPTION O O O O O O O O O O O O				1	_					_		_	
(SM) Brown silty SAND with roots AU 1 (SC) Orange to brown very clavey SAND with roots		GRAPHIC LOG	MATERIAL DESCRIPTION	CONTACT DEPTH (#)	(1)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %	▲ SPT N VALUE ▲
(SC) Orange to brown very clavey SAND with roots			(SM) Brown silty SAND with roots		T								20 40 60 80
(SC) Orange to brown very clavey SAND with roots	-			2									
(SC) Medium dense gray, red, and orange clayey SAND (SC) Medium dense gray, red, and orange clayey SAND (SC) Medium dense gray, and orange CLAY with sand (SC) Dense to medium dense brown to tan clayey SAND (CL/CH) Very stiff light gray and orange sandy (SC) Medium dense light gray to white and orange clayey SAND (SC) Medium dense light gray to white and orange clayey SAND (SC) Medium dense light gray to white and orange clayey SAND (SC) Medium dense light gray to white and orange clayey SAND	- 1	1//	(SC) Orange to brown very clayey SAND with roots	- 2	1	·							
SC) Medium dense gray, red, and orange clayey SAND SPT 3-6-10-16 (16)				١,	П								
SAND (CH) Hard dark gray, gray, and orange CLAY with sand (SC) Dense to medium dense brown to tan clayey SAND (SC) Dense to medium dense brown to tan clayey SAND (CL/CH) Very stiff light gray and orange sandy CLAY (SC) Medium dense light gray to white and orange clayey SAND (SC) Medium dense light gray to white and orange clayey SAND (SC) Medium dense light gray to white and orange clayey SAND (SC) Medium dense light gray to white and orange clayey SAND			(SC) Medium dense gray, red, and orange clayey	4	-		001010						
(CL/CH) Very stiff light gray and orange sandy (CL/CH) Very stiff light gray and orange sandy (CL/CH) Very stiff light gray and orange sandy (SC) Medium dense light gray to white and orange (SC) Medium dense light gray to white and orange (SC) Medium dense light gray to white and orange 22 (SC) Medium dense light gray to white and orange (SC) Medium dense light gray to white and orange (SC) Medium dense light gray to white and orange	3		SAND		X								4
Sept 18-21-22-20 66 24 42 67 23	- 1		(CH) Hard dark gray, gray, and orange CLAY with	- 6									
SPT 10-15-27-22 SAND SPT 10-15-27-22 SPT 10-13-13 SPT 10-1	- 1		sand		X			66	24	42	67	23	*
SAND SPT 10-15-27-22 (42) SPT 9-16-16 (32) (CL/CH) Very stiff light gray and orange sandy CLAY SPT 6-6-10 (16) SPT 6-6-10 (16) SPT 6-6-10 (16) SPT 6-6-10 (16)			(SC) Dense to medium dense brown to tan clavey	8			28.8						
(CL/CH) Very stiff light gray and orange sandy CLAY SPT 9-16-16 (32) SPT 6-6-10 (16) SPT (10-13-13 8 10-13-13 8 (26)	+		SAND		X								
CL/CH) Very stiff light gray and orange sandy (CL/CH) Very stiff light gray and orange sandy (CLAY SPT 6-6-10 (16) SPT 6-6-10 (16) SPT 6-6-10 (16) SPT 8 10-13-13 (26)	10						(/						
(CL/CH) Very stiff light gray and orange sandy CLAY SPT 6-6-10 (16) (SC) Medium dense light gray to white and orange clayey SAND SPT 10-13-13 8 (26)	 15				X		33772-53						
CL/CH) Very stiff light gray and orange sandy CLAY SPT 6-6-10 (16) SPT 6-6-10 (16) SPT 6-6-10 (26) SPT 8-7 (26)													
(CL/CH) Very stiff light gray and orange sandy CLAY SPT 6-6-10 (16) SPT 7 10-13-13 (26)	_			17									
SPT 6-6-10 (16) SPT 6-6-10 (16) SPT 7 10-13-13 (26)	. [(CL/CH) Very stiff light gray and orange sandy CLAY										/
20 (SC) Medium dense light gray to white and orange clayey SAND SPT (16) SPT (16) SPT (10-13-13 (26)	. [ерт	6.6.10				9		
(SC) Medium dense light gray to white and orange clayey SAND SPT 10-13-13 (26)	20				Ă								★
(SC) Medium dense light gray to white and orange clayey SAND SPT 10-13-13 (26)													
(SC) Medium dense light gray to white and orange clayey SAND SPT 10-13-13 (26)	1			22									
SPT 10-13-13 (26)											- 1		
25 SPI 10-13-13			dayby ONIVD			OPT	40 40 40				- 1		
	25				X	8					- 1		A
					Г						- 1		
	7												
	7												
	7						120120000000000000000000000000000000000	ı					
30 SPT 9-12-12 9 (24)	30				X	SPT 9					- 1		*
												t	
	t												
	t												
	t												
35 SPT 8-8-9 10 (17)	25				Y	SPT 10	8-8-9						



GSE Engineering & Consulting, Inc. 4949 SW 41st Blvd., Unit 70 Gainesville, Florida 32608 Telephone: 352-377-3233

BORING NUMBER B-2

CLIENT State Farm Insurance Company PROJECT NAME Hendrickson Residence Claim No. 59-D215-335 PROJECT NUMBER 10314 PROJECT LOCATION Lake City, Columbia County, Florida PLASTIC LIMIT, % LIQUID LIMIT, % PERCENT PASS NO. 200 SIEVE SAMPLE TYPE NUMBER PLASTICITY INDEX MOISTURE CONTENT, % CONTACT DEPTH (ft) GRAPHIC DEPTH (ft) ▲ SPT N VALUE ▲ MATERIAL DESCRIPTION 60 (SC) Medium dense light gray to white and orange clayey SAND (continued) SPT 11 7-7-7 (14)SPT BORINGS - GINT STD US, GDT - 10/31/08 09/21 - NSERVER1/GENERAL/PROJECTS/10/314 HENDRICKSON RESIDENCE 59-D-215-338/10/314 BORINGS/10/314 BORINGS/GPJ SPT 12 5-5-8 (CL/CH) Stiff brown and orange CLAY with sand (13)47 (CL/CH) Stiff brown, orange, and tan CLAY Loss of circulation at 48.5' SPT 13 4-4-6 Terminated boring at 50' due to refusal on hard chert (10)50 50 Bottom of borehole at 50.0 feet.

GSE

GSE Engineering & Consulting, Inc. 4949 SW 41st Blvd., Unit 70 Gainesville, Florida 32608

BORING NUMBER B-3

Engineering &	Consulting, Inc. Telephone: 352-377-3233									
CLIENT _	State Farm Insurance Company		PROJEC	T NAME _H	lendric	kson f	Reside	nce Cl	aim N	o. 59-D215-335
PROJECT	NUMBER 10314		PROJEC	T LOCATION	La	ke City	y, Colu	mbia (County	, Florida
DATE STA	RTED 9/25/08 COMPLETED 9/25/08									i
1	CONTRACTOR GSE Engineering			D WATER LEV	master -					
	METHOD Mud Rotary						ΙΔ			
	Y CC CHECKED BY DSK									
				STIMATED SE	ASON	AL HI	3H _	IVA		
NOIES _										
O DEPTH (ft) (ft) GRAPHIC	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %	▲ SPT N VALUE ▲ 20 40 60 80
	(SM) Brown silty SAND with nodules of orange sandy clay	2	AU 1							20 40 60 80
	(SC) Orange, red, and tan very clayey SAND	4	AU 2					50	22	
5	(SC) Medium dense gray, red, and orange very clayey SAND	6	SPT 3	5-9-9-13 (18)						-
	(CH) Hard to very stiff gray and red CLAY		SPT 4	14-17-22-25 (39))
10			SPT 5	5-11-17-20 (28)	100	38	62	97	33	4
	(SC) Medium dense gray and reddish orange very	12								
	clayey SAND		SPT	10-12-12						
15			6	(24)						1
20			SPT 7	9-9-9 (18)						A
	(00)	22								
	(SC) Medium dense gray and orange very clayey SAND		SPT	6-4-8						
25			8	(12)						<u> </u>
	(SC) Medium dense light gray to white and orange clayey SAND	27								\\
30			SPT 9	12-11-11 (22)						A
		20								
35	(SC) Medium dense orange clayey SAND	33	SPT 10	10-10-11 (21)						



GSE Engineering & Consulting, Inc. 4949 SW 41st Blvd., Unit 70 Gainesville, Florida 32608 Telephone: 352-377-3233

BORING NUMBER B-3

CLIENT State Farm Insurance Company PROJECT NAME Hendrickson Residence Claim No. 59-D215-335 PROJECT NUMBER 10314 Lake City, Columbia County, Florida PROJECT LOCATION PLASTIC LIMIT, % PERCENT PASS NO. 200 SIEVE LIQUID LIMIT, % SAMPLE TYPE NUMBER PLASTICITY INDEX MOISTURE CONTENT, % CONTACT DEPTH (ft) BLOW COUNTS (N VALUE) GRAPHIC LOG DEPTH (ft) ▲ SPT N VALUE ▲ MATERIAL DESCRIPTION 20 40 60 80 (SC) Medium dense orange clayey SAND (continued) SPT 11 9-9-11 (20)42 (SC) Medium dense tan and gray clayey SAND SPT BORINGS - GINT STD US.GDT - 10/31/08 09/21 - NSERVER1/GENERAL/PROJECTS/10/314 HENDRICKSON RESIDENCE 59-D-215-335/10/314 BORINGS/10/314 BORINGS/GPJ SPT 12 5-7-9 (16)47 (CL/CH) Firm orange and brown CLAY SPT 13 5-2-3 (5)50 52 (CL/CH) Very soft brown and orange sandy CLAY Loss of circulation at 53' Weight of hammer from 53.5' to 54.5' SPT 14 0-0-1 (1) 55 58 Soft to very hard tan to white LIMESTONE Weight of hammer from 58.5' to 58.75' 11-4-7 (11)SPT 16 50-49-50 (99)65 65 Bottom of borehole at 65.0 feet.

Summary Report of a Subsidence Exploration Claim No. 59-D215-335 Hendrickson Residence 265 SW Thurman Terrace Lake City, Columbia County, Florida GSE Project No. 10314

8.3 Key to Soil Classifications

KEY TO SOIL CLASSIFICATION CHART

	MAJOR DIVISIO	ONE	SYM	BOLS	TYPICAL	
	MAJOR DIVISIO	JNS	GRAPH	LETTER	DESCRIPTIONS	
	GRAVEL AND GRAVELLY	CLEAN GRAVELS		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES	
COARSE GRAINED	SOILS	(LITTLE OR NO FINES)		GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES	
SOILS	MORE THAN 50% OF COARSE FRACTION	GRAVELS WITH FINES		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES	
	RETAINED ON NO. 4 SIEVE	(APPRECIABLE AMOUNT OF FINES)		GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES	
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	SAND AND SANDY	CLEAN SANDS		sw	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	
	SOILS	(LITTLE OR NO FINES)		SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES	
	MORE THAN 50% OF COARSE FRACTION	SANDS WITH FINES		SM	SILTY SANDS, SAND - SILT MIXTURES	
	PASSING ON NO. 4 SIEVE	(APPRECIABLE AMOUNT OF FINES)		sc	CLAYEY SANDS, SAND - CLAY MIXTURES	
				ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY	
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS	
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE				МН	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS	
	SILTS AND LIQUI CLAYS	LIQUID LIMIT GREATER THAN 50		СН	INORGANIC CLAYS OF HIGH PLASTICITY	
				ОН	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS	
	HIGHLY ORGANIC SO	ILS	7 77 77 77 77 7 72 77 77 77 77	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS	

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

CORRELATION OF PENETRATION RESISTANCE WITH RELATIVE DENSITY AND CONSISTENCY

	NO. OF BLOW, N	RELATIVE DENSITY	N	O. OF BLOWS, N	CONSISTENCY
	0 - 4	Very Loose		0 - 2	Very Soft
	5 - 10	Loose		3 - 4	Soft
SANDS:	11 - 30	Medium dense	SILTS	5 - 8	Firm
	31 - 50	Dense	&	9 - 15	Stiff
	OVER 50	Very Dense	CLAYS:	16 - 30 31 - 50	Very Stiff Hard
				OVER 50	Very Hard

PARTICLE SIZE IDENTIFICATION

BOULDERS:

Greater than 300 mm

COBBLES:

Coarse -

75 mm to 300 mm

GRAVEL:

19.0 mm to 75 mm

Fine -

SANDS:

SILTS & CLAYS:

Coarse -

4.75 mm to 19.0 mm

Medium -

2.00 mm to 4.75 mm

Fine -

0.425 mm to 2.00 mm

0.075 mm to 0.425 mm Less than 0.075 mm

SAMPLE LEGEND



Location of SPT sample



Location of Auger sample

Claim No. 59-D215-335 Hendrickson Residence 265 SW Thurman Terrace Lake City, Columbia County, Florida GSE Project No. 10314

8.4 Laboratory Test Results



SUMMARY REPORT OF LABORATORY TEST RESULTS

Project Number: 103

Project Name:

Hendrickson Residence 59-D215-335

			Natural				Percent		
			Moisture				Passing	Organic	
Boring			Content	Liquid	Plastic	Plasticity	No. 200	Content	Unified Soil
_	Number Depth (ft)	Soil Description	(%)	Limit	Limit	Index		(%)	Classification
	2-4	Brown, red, and tan sandy CLAY	24				55		CL/CH
	8 - 9	Gray, orange, and tan sandy CLAY	18				54		СЦСН
B-2	8-9	Dark gray, gray, and orange CLAY with sand	23	99	24	42	29		8
	2-4	Orange, red, and tan very clayey SAND	22				50		SC
	8 - 10	Gray and red CLAY	33	100	38	62	97		CH.

Summary Report of a Subsidence Exploration Claim No. 59-D215-335 Hendrickson Residence 265 SW Thurman Terrace Lake City, Columbia County, Florida GSE Project No. 10314

9.0 LIMITATIONS

9.1 Warranty

GSE Engineering & Consulting, Inc. has prepared this report for our client for his exclusive use, in accordance with generally accepted soil and foundation engineering and geological investigation practices, and makes no other warranty either expressed or implied as to the professional opinions provided in the report.

9.2 Standard Penetration Test and Auger Borings

The determination of soil type and conditions was performed from the ground surface to the maximum depth of the borings. Any changes in subsurface conditions that occur between or below the borings would not have been detected or reflected in this report.

Soil classifications that were made in the field are based upon identifiable textural changes, color changes, changes in composition or changes in resistance to penetration in the intervals from which the samples were collected. Abrupt changes in soil type, as reflected in boring logs and/or cross sections may not actually occur, but instead, be transitional.

Depth to the water table is based upon observations made during the performance of the borings. This depth is an estimate and does not reflect the annual variations that would be expected in this area due to fluctuations in rainfall and rates of evapotranspiration.

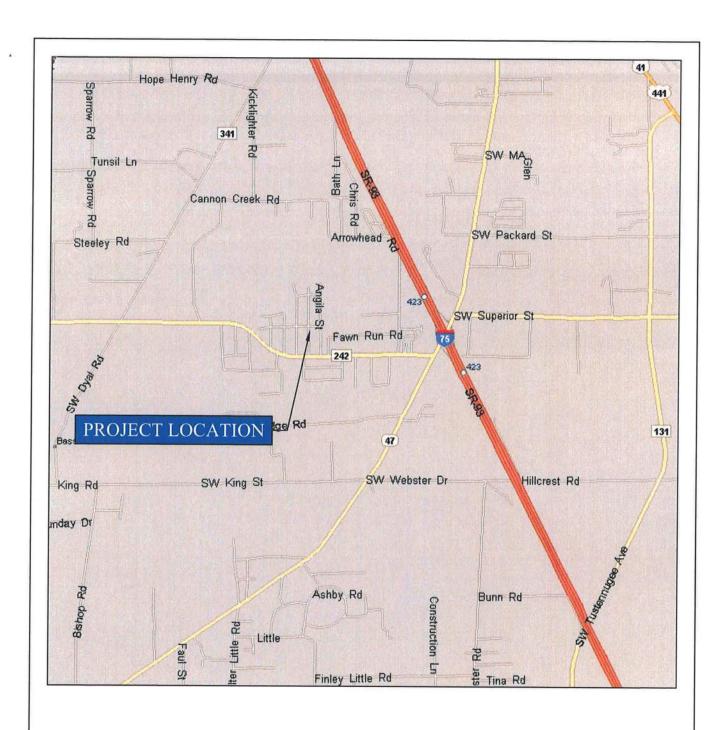
9.3 Site Figures

The measurements used for the preparation of the figures in this report were made using measuring devices and/or by estimating distances from existing structures and site features. The illustrated test locations should be considered approximate. Figures in this report were not prepared by a licensed land surveyor and should not be interpreted as such.

GSE Project No. 10314

November 4, 2008

FIGURES





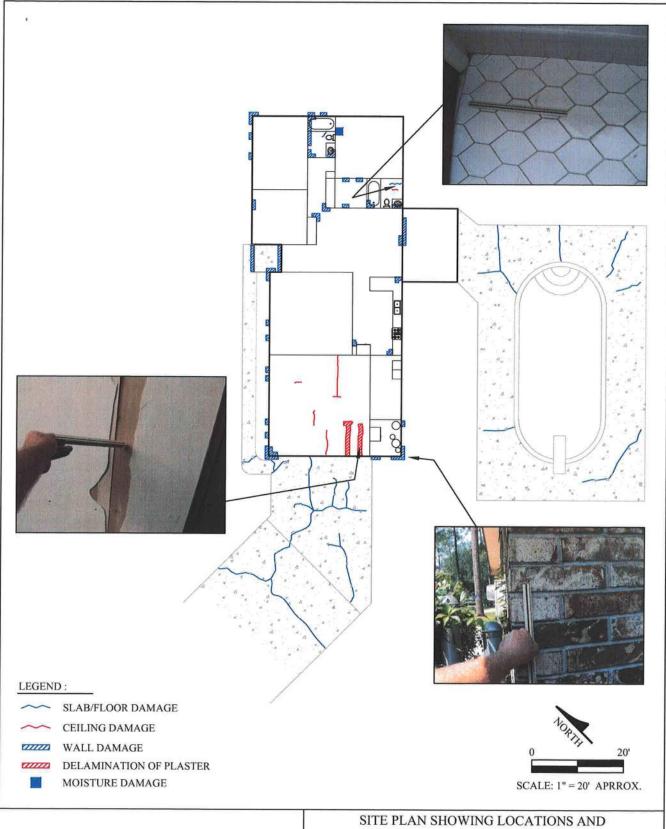
CLAIM No. 59-D215-335 HENDRICKSON RESIDENCE LAKE CITY, COLUMBIA COUNTY, FLORIDA GSE PROJECT No. 10314

PROJECT SITE LOCATION MAP

DESIGNED BY: JBN CHECKED BY: JBN DRAWN BY: KMD



FIGURE



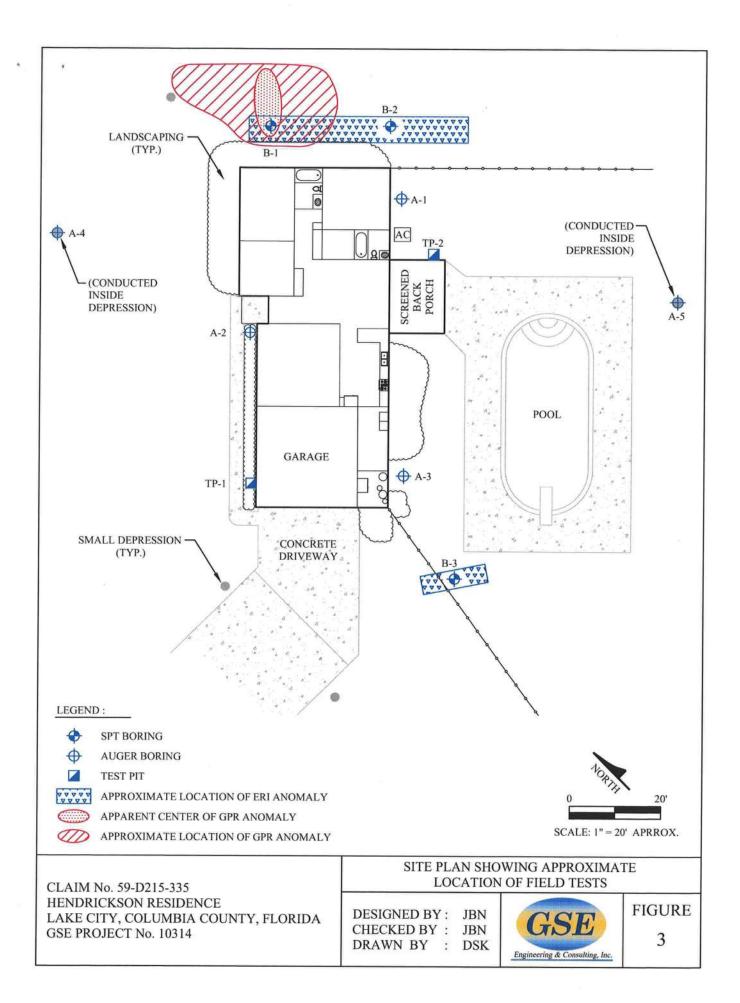
CLAIM No. 59-D215-335 HENDRICKSON RESIDENCE LAKE CITY, COLUMBIA COUNTY, FLORIDA GSE PROJECT No. 10314

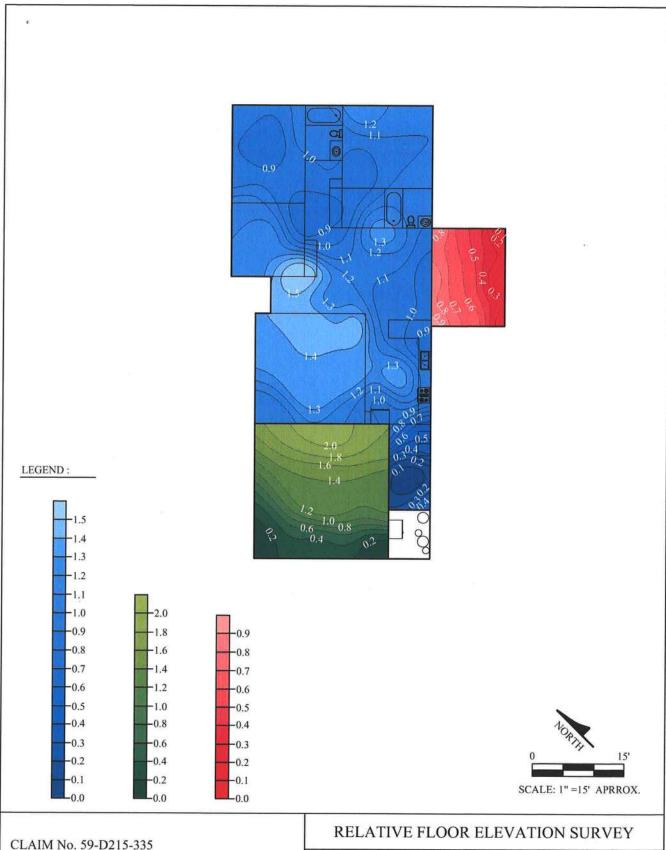
REPRESENTATIVE PHOTOGRAPHS OF DAMAGE

DESIGNED BY: JBN CHECKED BY: JBN DRAWN BY : DSK



FIGURE



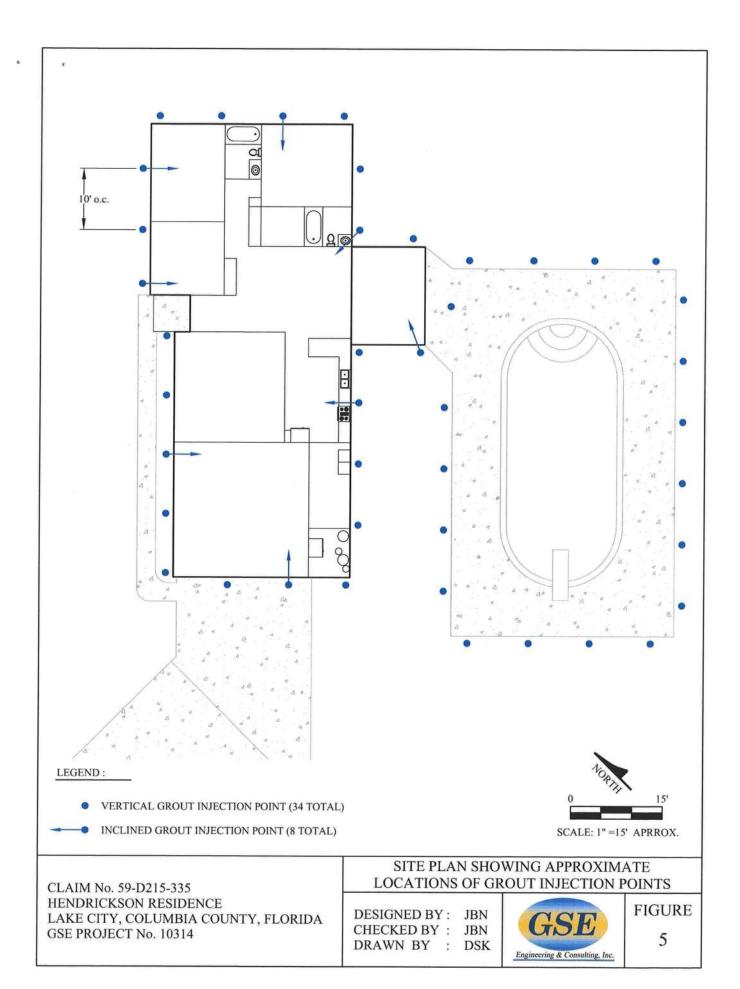


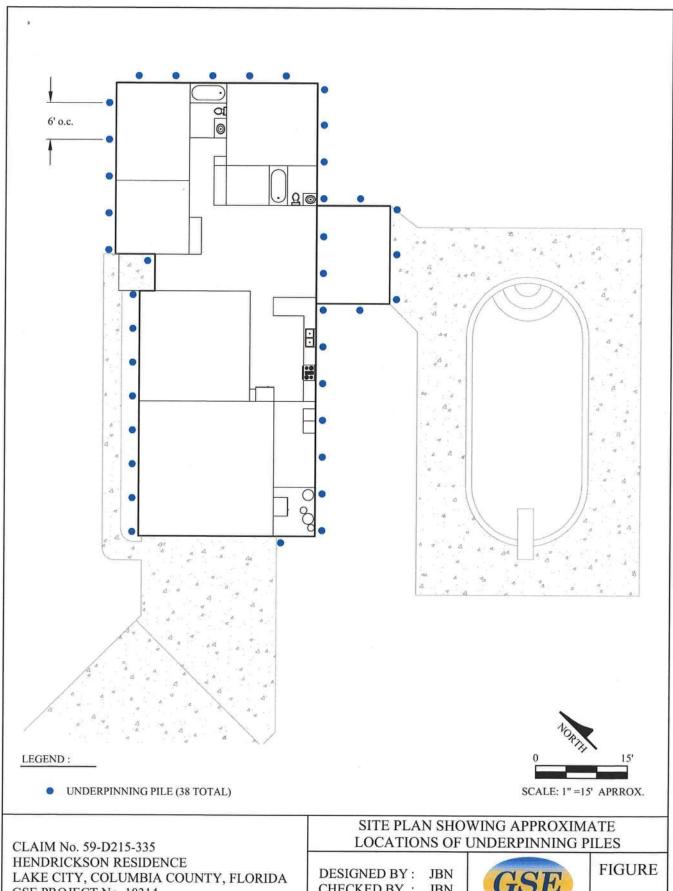
CLAIM No. 59-D215-335 HENDRICKSON RESIDENCE LAKE CITY, COLUMBIA COUNTY, FLORIDA GSE PROJECT No. 10314

DESIGNED BY: JBN CHECKED BY: JBN DRAWN BY: KMD



FIGURE





GSE PROJECT No. 10314

CHECKED BY: JBN DRAWN BY : DSK



APPENDIX

FINAL REPORT GEOPHYSICAL INVESTIGATION HENDRICKSON RESIDENCE LAKE CITY, FL

Prepared for GSE Engineering & Consulting, Inc. Gainesville, FL

Prepared by GeoView, Inc. St. Petersburg, FL



October 1, 2008

Mr. Ken Hill, P.E. GSE Engineering & Consulting, Inc. 4949 SW 41st Boulevard, Unit 70 Gainesville, FL 32608

Subject: Transmittal of Final Report for Geophysical Investigation

Hendrickson Residence - Lake City, FL

GeoView Project Number 5724

Dear Mr. Hill,

GeoView, Inc. (GeoView) is pleased to submit the final report that summarizes and presents the results of geophysical investigation conducted at the Hendrickson Residence. Ground penetrating radar and electrical resistivity were used to evaluate near-surface geological conditions. GeoView appreciates the opportunity to have assisted you on this project. If you have any questions or comments about the report, please contact us.

GEOVIEW, INC.

Michael J. Wightman, P.G.

President

Florida Professional Geologist

Number 1423

Steve Scruggs, P.G.

Geophysicist

Florida Professional Geologist

Tel.: (727) 209-2334

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Number 2470

A Geophysical Services Company

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1.0 Introduction

A geophysical investigation was conducted at the Hendrickson Residence located at 265 SW Thurman Terrace in Lake City, Florida. The investigation was conducted on September 19th, 2008. At the time of this investigation there were several small depressions located throughout the survey area.

The purpose of the geophysical investigation was to help characterize nearsurface geological conditions in the area of the residence and to identify subsurface features that may be associated with sinkhole activity. The location of the geophysical survey area is provided on Figure 1. A discussion of the field methods used to generate the report figures is provided in Appendix A2.1.

2.0 Description of Geophysical Investigation

2.1 Ground Penetrating Radar Survey

A GPR survey was conducted both inside and outside of the residence. The GPR survey outside of the residence was conducted along a series of perpendicular transects spaced 10 ft apart. The GPR survey was performed in the inside areas of the home that were accessible (Figure 1). The GPR data was collected with a Mala radar system. The GPR settings used for the survey are presented in Table 1.

Table 1
GPR Equipment Settings Used for Exterior and Interior GPR Surveys

Location	Antenna Frequency	Time Range (nano-seconds)	Estimated Depth of GPR Signal Penetration
Exterior	250 MHz ^{1/}	199	27 to 30 ft bls
Interior	500 MHz	100	13 to 15 ft bls

1/ MHz means mega-Hertz and is the mid-range operating frequency of the GPR antenna.

A description of the GPR technique and the methods employed for geological characterization studies is provided in Appendix A2.2.

2.2 Electrical Resistivity Imaging Survey

The ERI survey was conducted using the Advanced Geosciences, Inc. Sting R8 automatic electrode resistivity system. A total of four ERI transects were performed using up to 27 electrodes on each line with an "a spacing" of 5 ft. A dipole-dipole combined with an inverse Schlumberger electrode configuration was used with a maximum "n value" of six. The ERI data was analyzed using EarthImager 2D, a computer inversion program, which provides two-dimensional vertical cross-sectional resistivity model (pseudo-section) of the subsurface. A

description of the ERI method and the methods employed for geotechnical characterization studies is provided in Appendix A2.2. A discussion of the modeling process used to create the ERI results is provided in Appendix A2.2.1.

2.3 Hand Auger Boring

A hand auger boring was performed at the project site (Figure 1). The purpose of the hand auger boring was to obtain information regarding near-surface soil conditions. This information was used to assist in the interpretation of the GPR data. A discussion of the methods used for the hand auger boring is provided in Appendix 2. The location of the boring (HA-1) is provided on Figure 1 and the results are presented in Table 2.

Table 2 Hand Auger Results

Hand Auger Designation	Depth Interval	Soils Description	
HA-1	0 to 1.5 ft bls	Clayey Sand	
	1.5 to 3 ft bls	Clay	

3.0 Identification of Possible Sinkhole Features Using GPR and ERI Methods

3.1 Identification of Possible Sinkhole Features Using GPR

The features observed on GPR data that are most commonly associated with sinkhole activity are:

- A downwarping of GPR reflector sets, that are associated with suspected lithological contacts, toward a common center. Such features typically have with a bowl or funnel shaped configuration and can be associated with a deflection of overlying sediment horizons caused by the migration of sediments into voids in the underlying limestone. If the GPR reflector sets are sharply downwarping and intersect, they can create "bow-tie" shaped GPR reflection feature, which often designates the apparent center of the GPR anomaly.
- A localized significant increase in the depth of the penetration and/or amplitude of the GPR signal response. The increase in GPR signal penetration depth or amplitude is often associated with either a localized increase in sand content at depth or decrease in soil density.
- An apparent discontinuity in GPR reflector sets, that are associated with suspected lithological contacts. The apparent discontinuities

and/or disruption of the GPR reflector sets may be associated with the downward migration sediments.

The greater the severity of these features or a combination of these features the greater the likelihood that the identified feature is a sinkhole. It is not possible based on the GPR data alone to determine if an identified feature is a sinkhole or, more importantly, whether that feature is an active sinkhole.

3.2 Identification of Possible Sinkhole Features Using ERI

Karst features are typically characterized by one of the following conditions on the ERI profile:

- The occurrence of highly resistivity material that extends to depth in a columnar fashion toward the top of the limestone. Such a feature may indicate the presence of a sand-filled depression or raveling zone.
- The localized presence of low-resistivity material extending below the interpreted depth to the top of limestone. Such a feature may indicate the presence of a clay-filled void or fracture with the limestone or the presence of highly weathered limestone rock.
- Any significant localized increase in the depth to limestone. Such a feature may indicate the presence of an in-filled depression (paleosink).

When comparing the results of the ERI method, the following considerations should be given. The ERI method, for example, describes the transition from clay to limestone as a transition, rather than a discrete depth. This transition is due to several factors including; a) The vertical density of the resistivity data decreasing with depth and b) The possibility that the upper portion of the limestone is weathered which would create a physical transition zone in terms of resistivity between the clay and competent (non-weathered) limestone and 3) The limitations in the modeling process.

4.0 Survey Results

4.1 Discussion of GPR Survey Results

Results of the GPR survey indicated the presence of two well-defined, relatively continuous sets of GPR reflectors at depth ranges of 1 to 3 ft bls and 15 to 22 ft bls. The upper GPR reflector set correlates to the lithological contact between the clayey sand and underlying clay stratum identified at 1.5 ft bls by the hand auger boring. The lower GPR reflector set is below the depth of the hand

auger boring, and accordingly cannot be correlated to any lithological contact. However, the reflector set is most likely associated with some change in lithological conditions at that depth range.

Description of GPR Anomaly

One GPR anomaly area was identified north of the residence. The anomaly is semi-elliptical in shape with a total area of approximately 540 square ft. The apparent vertical relief of the upper portion of the anomaly area is 4 to 5 ft as characterized by the observed downwarping of the lower GPR reflector set. The apparent center of the feature is characterized as the area of maximum downwarping of the previously referenced GPR reflectors. It is noted that no disruption to the sediments overlying the downwarped GPR reflector was observed. This suggests that the GPR anomaly is likely associated with relic depositional or erosion activity, rather than possible karst activity.

In addition, the GPR data identified a linear feature within the GPR anomaly area at a depth range of 2 to 3 ft (Figure 1). This linear feature is most likely associated with buried debris (i.e. buried tree/root). No near-surface soil disturbances were observed directly below any of the small surface depressions located throughout the survey area. An example of the GPR data collected across the anomaly area is provided in Appendix 1. A discussion of the limitations of the GPR technique in geological characterization studies is provided in Appendix 2.

4.2 Discussion of ERI Survey Results

Results from ERI surveys are presented in Appendix 1. ERI transects 1, 2 and 4 are of acceptable quality. ERI Transect 3 is of poor quality. The poor attribution to the quality of the ERI data is based upon the large number of data points that needed to be removed as part of the inversion process (greater than 30 percent) and the relatively high RMS and L2-norm of the ERI data. Accordingly, modeling results from ERI Transect 3 may not be representative of actual subsurface geological conditions. A discussion of the criteria used to determine the quality of an ERI inversion model is provided in Appendix A2.3.1.

Analysis of the ERI Transects indicate the presence of high to moderate resistivity near-surface soil materials (represented in green to red on the ERI transects) across the majority of the project site to the maximum depth of investigation of the ERI transects which ranged from approximately 13 to 29 ft bls. However, Transects 3 and 4 did indicate an approximately 4 to 8 ft thick low resistivity horizon (represented in blue) at a depth range of approximately 3 to 7 ft bls. The high to moderate resistivity materials likely correspond to the clayey sand

identified in the hand auger borings and the low resistivity layer likely corresponds to an increase in the clay content of the soil materials.

Discussion of ERI Anomalies

Two ERI anomalies were identified at the project site, one of which corresponds to the general location of the GPR anomaly (Figure 1). This corresponding ERI anomaly was characterized by the localized occurrence of relatively less resistive soil materials at depth. These relatively less resistive sediments occurred at an estimated depth range of 7 to 27 ft bls. The southern ERI anomaly was characterized by a localized area of increased resistivity with depth.

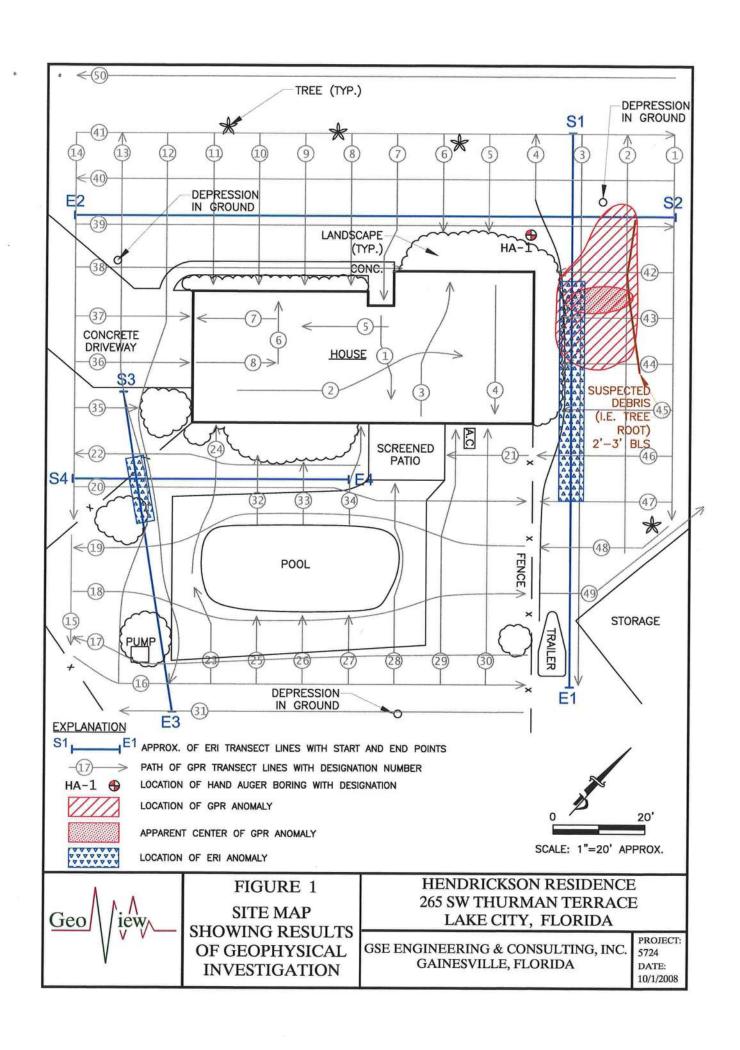
It is noted that no geological structures suggesting a possible downward raveling of sediments was observed within these areas on the GPR data. In addition, the southern ERI anomaly is suspect due to the poor quality of the data used in the inversion process to create the model. Accordingly, these ERI anomalies are likely associated with naturally-occurring lateral variations in resistivity or modeling errors, rather than sinkhole activity.

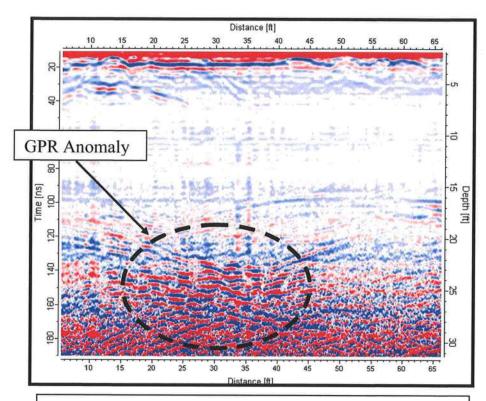
4.3 Correlation of GPR and ERI Survey Results

There was a poor correlation between the GPR identified layers and the ERI modeling results. The GPR appears to have identified the contact between the near surface clayey sand and clay layer observed at 1.5 ft bls in the hand auger boring, along with a deeper unknown horizon at a depth range from 15 to 22 ft bls. The ERI method identified high to moderate resistivity soils across the majority of the project site with the exception of 4 to 8 ft of low resistivity materials observed on ERI Transects 3 and 4 at a depth range of 3 to 7 ft bls. This low resistivity layer most likely corresponds to a response from the clay stratum identified in the hand auger boring. The ERI method was not able to consistently resolve the lithological contact between the surficial clayey sand and underlying clay stratum as identified by the GPR survey.

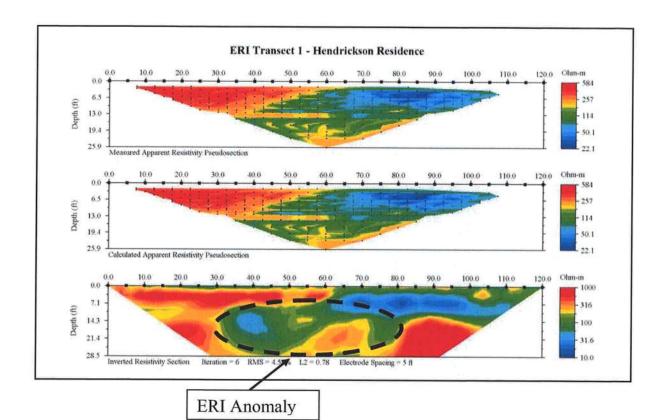
An ERI anomaly was identified in the area of the GPR Anomaly, but no GPR anomaly was identified within the southern ERI anomaly. Accordingly, the area with two corresponding geophysical anomalies has the greatest probability for being associated with karst activity, rather than being a result of the modeling process of suspect ERI data. However, the lack of any indications of downwarping or other observed soil disturbances in the GPR data overlying these anomaly areas suggests that these anomalies are more likely relic depositional features, rather than possible karst activity.

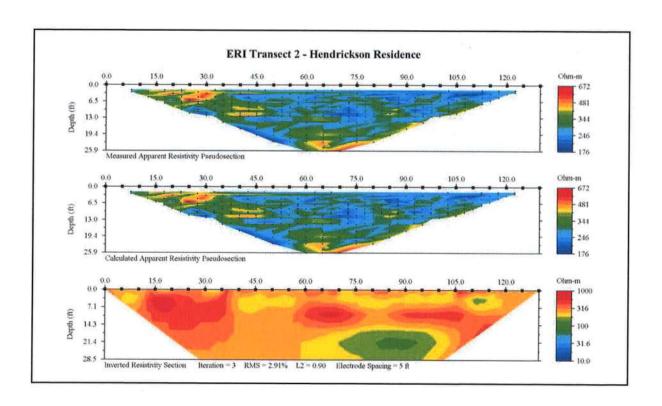
APPENDIX 1 FIGURE AND EXAMPLE OF GPR ANOMALY AND ERI TRANSECTS

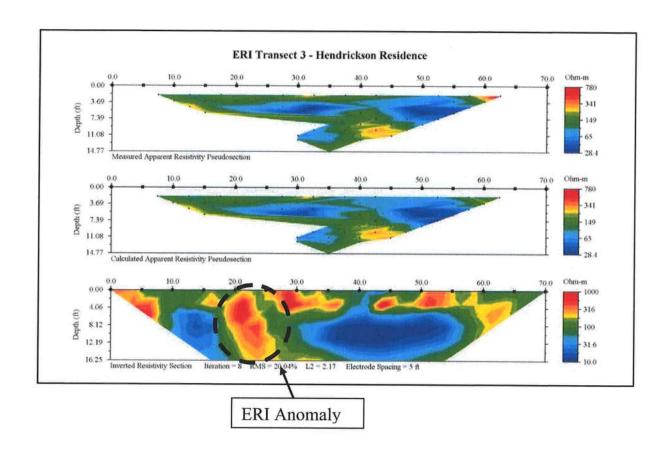


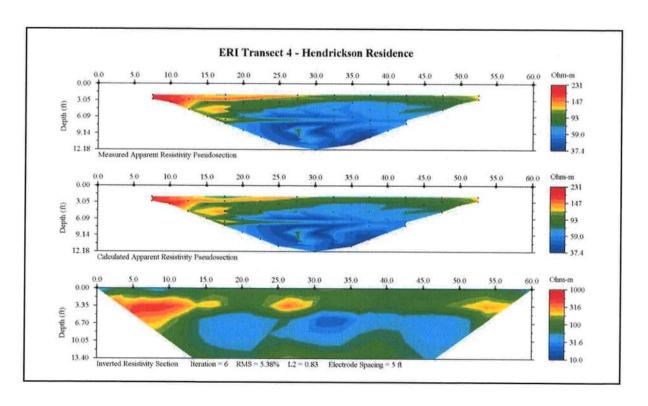


GPR Transect 3 Showing Example of GPR Anomaly









APPENDIX 2 DESCRIPTION OF GEOPHYSICAL METHODS, SURVEY METHODOLOGIES AND LIMITATIONS

A2.1 On Site Measurements

The measurements that were collected and used to create the site map were made using a fiberglass measuring tape. Right angles were estimated using the exterior walls of the residence. The degree of accuracy of such an approach is typically \pm 5% for lengths and \pm 2.5 degrees for angles.

A2.2 Ground Penetrating Radar

Ground Penetrating Radar (GPR) consists of a set of integrated electronic components that transmits high frequency (200 to 1500 megahertz [MHz]) electromagnetic waves into the ground and records the energy reflected back to the ground surface. The GPR system consists of an antenna, which serves as both a transmitter and receiver, and a profiling recorder that both processes the incoming signal and provides a graphic display of the data. The GPR data can be reviewed as both printed hard copy output or recorded on the profiling recorder's hard drive for later review. GeoView uses a Mala GPR system. Geological characterization studies are typically conducted using a 250 MHz antenna.

A GPR survey provides a graphic cross-sectional view of subsurface conditions. This cross-sectional view is created from the reflections of repetitive short-duration electromagnetic (EM) waves that are generated as the antenna is pulled across the ground surface. The reflections occur at the subsurface contacts between materials with differing electrical properties. The electrical property contrast that causes the reflections is the dielectric permittivity that is directly related to conductivity of a material. The GPR method is commonly used to identify such targets as underground utilities, underground storage tanks or drums, buried debris, voids or geological features.

The greater the electrical contrast between the surrounding earth materials and target of interest, the greater the amplitude of the reflected return signal. Unless the buried object is metal, only part of the signal energy will be reflected back to the antenna with the remaining portion of the signal continuing to propagate downward to be reflected by deeper features. If there is little or no electrical contrast between the target interest and surrounding earth materials it will be very difficult if not impossible to identify the object using GPR.

The depth of penetration of the GPR signal is very site specific and is controlled by two primary factors: subsurface soil conditions and selected antenna

frequency. The GPR signal is attenuated (absorbed) as is passes through earth materials. As the energy of the GPR signal is diminished due to attenuation, the energy of the reflected waves is reduced, eventually to the level that the reflections can no longer be detected. As the conductivity of the earth materials increases, the attenuation of the GPR signal increases thereby reducing the signal penetration depth. In Florida, the typical soil conditions that severely limit GPR signal penetration are near-surface clays and/or organic materials.

The depth of penetration of the GPR signal is also reduced as the antenna frequency is increased. However, as antenna frequency is increased the resolution of the GPR data is improved. Therefore, when designing a GPR survey a tradeoff is made between the required depth of penetration and desired resolution of the data. As a rule, the highest frequency antenna that will still provide the desired maximum depth of penetration should be used. For areas outside of the home, a low-frequency (250 MHz) antenna is used. This allows for maximum signal penetration and thereby maximum depth from which information will be obtained. For GPR surveys conducted inside of a home a 500 MHz antenna is often used. The 500 MHz antenna sometimes provides higher quality data on concrete surfaces.

A GPR survey is conducted along survey lines (transects) that are measured paths along which the GPR antenna is moved. Electronic marks are placed in the data by the operator at designated points along the GPR transects. These marks allow for a correlation between the GPR data and the position of the GPR antenna on the ground.

For geological characterization surveys, the GPR survey is conducted along a set of perpendicularly orientated transects. The survey is conducted in two directions because subsurface features such as sinkholes are often asymmetric. Spacing between the transects typically ranges from 10 to 50 feet. Closely spaced grids are used when the objective of the GPR survey is to identify all sinkhole features within a project site. Coarser grids are used when the objective is to provide a general overview of site conditions. After completion of a survey using a given grid spacing, additional more-closely spaced GPR transects are often performed to better characterize sinkhole features identified by the initial survey. This information can be used to provide recommended locations for geotechnical borings.

Depth estimates to the top of lithological contacts or sinkhole features are determined by dividing the time of travel of the GPR signal from the ground surface to the top of the feature by the velocity of the GPR signal. The velocity of the GPR signal is usually obtained from published tables of velocities for the type

and condition (saturated vs. unsaturated) of soils underlying the site. The accuracy of GPR-derived depths typically ranges from 20 to 40 percent of the total depth.

Interpretation and Limitations of GPR data

The analysis and collection of GPR data is both a technical and interpretative skill. The technical aspects of the work are learned from both training and experience. Having the opportunity to compare GPR data collected in numerous settings to the results from geotechnical studies performed at the same locations develops interpretative skills for geological characterization studies.

The ability of GPR to collect interpretable information at a project site is limited by the attenuation (absorption) of the GPR signal by underlying soils. Once the GPR signal has been attenuated at a particular depth, information regarding deeper geological conditions will not be obtained. GPR data can only resolve subsurface features that have a sufficient electrical contrast between the feature in question and surrounding earth materials. If an insufficient contrast is present, the subsurface feature will not be identified.

GeoView can make no warranties or representations of geological conditions that may be present beyond the depth of investigation or resolving capability of the GPR equipment or in areas that were not accessible to the geophysical investigation.

A2.3 Electrical Resistivity

Electrical resistivity surveying is a geophysical method in which an electrical current is injected into the earth; the subsequent response (potential) is measured at the ground surface to determine the resistance of the underlying earth materials. The resistivity survey is conducted by applying electrical current into the earth from two implanted electrodes (current electrodes C_1 and C_2) and measuring the associated potential between a second set of implanted electrodes (potential electrodes P_1 and P_2). Field readings are in volts. Field readings are then converted to resistivity values using Ohm's Law and a geometric correction factor for the spacing and configuration of the electrodes. The calculated resistivity values are known as "apparent" resistivity values. The values are referred to as "apparent" because the calculations for the values assume that the volume of earth material being measured is electrically homogeneous. Such field conditions are rarely present.

Resistivity of earth materials is controlled by several properties including composition, water content, pore fluid resistivity and effective permeability. For this study the properties that had the primary control on measured resistivity values

are composition and effective permeability. The general geological setting of this project area is clay overlain by limestone.

For this study a dipole-dipole combined with an inverse Schlumberger resistivity array configuration was used. The dipole-dipole array is different that most other resistivity arrays in that the electrode and current electrodes are kept together using a constant spacing value referred to as an "a spacing". The current and potential electrode sets are moved away from each other using multiples of the "a spacing" value. The number of multiples is referred to as the "n value". For example, an array with an "a spacing" of 5 feet and a "n value" of 6 would have the current and potential electrode sets spaced 30 ft apart with a separation between the two electrodes in the set of 5 ft. By sampling at varying "n values", greater depth measurements can be achieved. Inverse Schlumberger data is collected with the current set of electrodes being kept with a fixed separation (L spacing) and the potential electrodes a minimum distance of 5L from the inner current electrodes. Dipole-dipole resistivity data is usually presented in a two-dimensional pseudosection format. Inverse Schlumberger data is usually presented as a vertical profile of resistivity distribution below the center point between the two current electrodes. The dipole-dipole and inverse Schlumberger data is combined and presented as either a contour of the individual data points (using the calculated apparent resistivity values) or as a geological model using least squares analysis. Such least squares analysis was used for this study using the computer software program (EarthImager 2D) developed for the equipment manufacturer. Apparent resistivity values are calculated using the following formula for a dipole-dipole configuration: $\gamma_a = \pi (b^3/a^2 - b) \nabla V/I$:

Where:

apparent resistivity $\gamma_a =$

3.14 $\pi =$

"a spacing" a=

"a spacing" x "n value" b=

 ∇V = voltage between the two potential electrodes

I=current (in amps)

For a Schlumberger configuration the apparent resistivity is calculated using: $\gamma_a = \pi([s^2 - a^2]/4)\nabla V/aI$:

Where:

 $\gamma_a =$ apparent resistivity

3.14 $\pi =$

a= spacing between the inner set of electrodes"

s= distance between the outer electrode and nearest inner electrode

 ∇V = voltage between the two potential electrodes

I= current (in amps)

A2.3.1 Inversion Modeling of ERI Data

The objective for inversion modeling of resistivity data is to create a description of the actual distribution of earth material resistivity based on the subsurface geology that closely matches the resistivity values that are measured by the instrumentation. This modeling is done through the use of EarthImagerTM, a proprietary computer program developed by the equipment manufacturer. When evaluating the validity of the inversion model several factors need to be considered. The RMS, or root mean square error, expresses the quality of fit between the actual and modeled resistivity values for the given set of points in the model. The lower the RMS error the higher the quality of fit between the actual and modeled data sets. In general, inversion models with an RMS error of less than 5 to 10 percent are acceptable. The size of the RMS error is dependent upon the number of bad data points within a data set and the magnitude of how bad the data points are. As part of the modeling process bad data points are typically removed, which decreases the RMS error and improves (with limitations) the quality of the model. The quality of fit between the actual and modeled resistivity values is also expressed as the L-2 norm. When the modeled and actual data sets have converged, the L-2 norm reduces to unity (1.0 or smaller).

However, as the number of data points is reduced, the validity of the inversion model is diminished. Accordingly, when interpreting a particular area of an inversion model the number of data points used to create that portion of the model must be taken into consideration. If very few points are within a particular area of the model, then the modeled solution in that area should be considered suspect and possibly rejected.

The entire ERI transect should be considered suspect if a model has a high RMS error and a large number of removed data points. It is likely that sources of interference have affected the field readings and rendered the modeled solution invalid. Such sources of interference can include buried metallic underground utilities, reinforced concrete slabs, septic leach fields or electrical grounding systems. Accordingly, all efforts need to be made in the field to locate, to the degree possible, the ERI transect lines away from such features. The locations of such features also need to be mapped in the field so their potential effects can be considered when interpreting the modeled results.

A2.4 Hand Auger Boring

A hand auger boring was performed outside of the residence. The boring was performed in general accordance with ASTM standards D1452-90 (1995) titled "Standard Practice for Soil Investigation and Sampling by Auger Borings". The purpose of the hand auger boring was to obtain information regarding near-surface soil conditions to assist in the interpretation of the GPR data. The boring was performed by manually advancing the auger bucket into the ground in approximate increments of 6 inches. Soils were retrieved and placed on plastic sheet for identification. Classifications of soils were made in the field based upon observed textural, color and compositional characteristics. Hand auger borings are typically advanced to the depth of the first competent clay layer, the water table or to a maximum depth of 9 feet. Unless requested, soil samples are not saved.



000027947

SDII Global Corporation www.sdii-global.com

4509 George Road Tampa, FL 33634 tel 813-496-9634 fax 813-496-9664 December 4, 2009

Ms. Lori Robinson State Farm Florida Insurance Company P.O. Box 9604 Winter Haven, Florida 33883-9604

Subject: Completion Report of Underpinning Remediation

Hendrickson Residence

265 SW Thurman Terrace in Lake City, Florida

Claim No. 59-D215-335

Remediation Contractor: NEC Keystone, Inc. Remediation Contractor Permit No. 000027947

SDII Project No. 3020180B

Dear Ms. Robinson:

SDII Global Corporation (SDII) is pleased to present this report summarizing the underpinning remediation performed at the Hendrickson residence located at 265 SW Thurman Terrace in Lake City, Florida. Figure 1 illustrates the project location.

BACKGROUND INFORMATION

SDII was retained to monitor and confirm that foundation repairs were made in substantial compliance with the recommendations made within SDII's *Remedial Recommendation* letter for the Hendrickson residence dated July 9, 2009.

The purpose of the underpinning program was to stabilize the foundation of the structure. SDII monitored the contractor's operations during the underpinning to verify compliance with the intent of SDII's recommendations.

SUMMARY OF MONITORING SERVICES

The following summarizes the activities SDII observed and documented at the site:

 Between November 9 and November 20, 2009, NEC Keystone, Inc. installed 34 steel pipe piles along the exterior of the residence comprised of 1,045 linear feet of steel piling that was advanced into the subsurface. Completion Report of Underpinning Remediation Hendrickson Residence – Lake City, Florida Claim No. 59-D215-335 SDII Project No. 3020180B

- The piles consisted of 3-inch diameter steel pipe and were hydraulically or manually advanced to bear on competent material. The hydraulic seating pressures for the perimeter piles ranged from 550 to 2,000 psi at the bearing depth and final seating pressures ranged from 250 to 500 psi. The tip depth of the perimeter piles ranged from 11 to 38 feet.
- The contractor used the installed underpinning piles and hydraulic rams to support the foundation and close any existing cracks on the exterior of the home. The perimeter of the residence was lifted 1/16 inch.

Based on our observations, the underpinning pile installations were documented as substantially complying with SDII's recommendations. Table 1 in the Appendix summarizes the pin pile installation. Figure 2 illustrates the location and numbering of the pin pile locations.

It is SDII's understanding that cosmetic repairs will be done following the underpinning operations. Accordingly, any existing damage and/or collateral damage associated with the underpinning operations should be repaired at that time by a qualified restoration contractor.

CLOSING

SDII appreciates the opportunity to have assisted you on this project. If you should have any questions concerning the contents of this report, or if we may be of further assistance, please contact us.

Sincerely,

SDII GLOBAL CORPORATION

Steven H. Meiggs, PE, PG, PSSC Senior Geological Engineer Florida License Number 64832

Florida License Number PG2352

APPENDIX: Table 1 – Pin Pile Installation Summary

Figure 1 – Project Site Location Map

Figure 2 – Site Plan Showing As-Installed Pin Pile Locations

Selected Site Assessment Photographs

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File - 1

Completion Report of Underpinning Remediation Hendrickson Residence – Lake City, Florida Claim No. 59-D215-335 SDII Project No. 3020180B

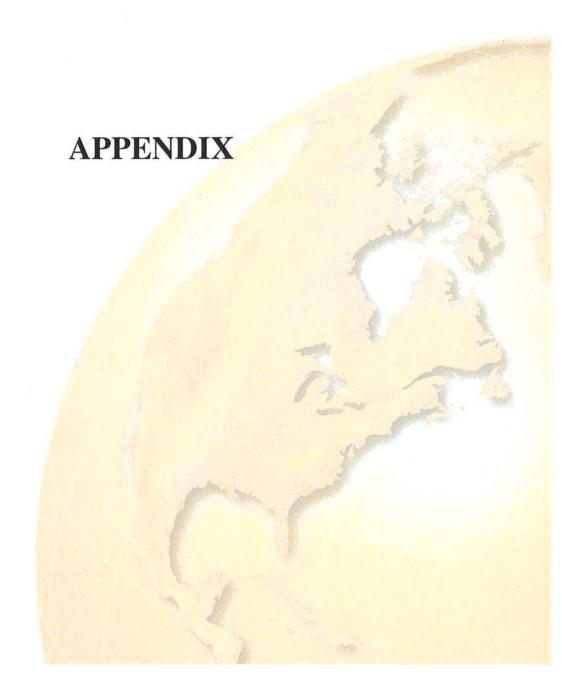
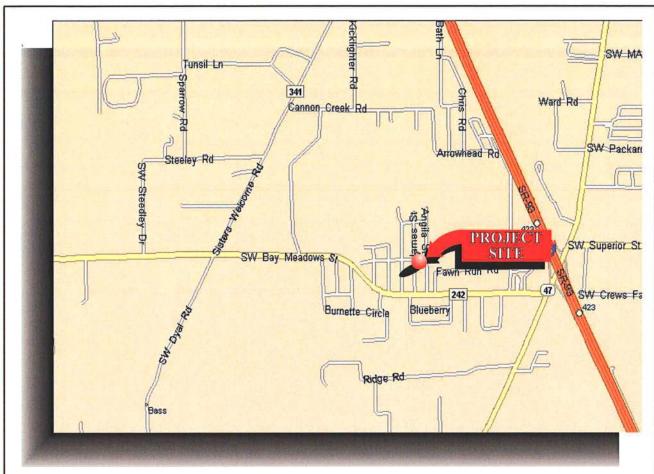


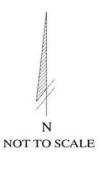
Table 1. Pin Pile Installation Summary

		Exterior Piles		
D21 - M -	Installation Depth	Installation Seating	Final Lift Pressure	Final Lift
Pile No	(Feet)	Pressure (PSI)	(PSI)	(Inches)
1	31.0	1,800	500	1/16
2	32.0	2,000	500	1/16
3	32.0	1,750	500	1/16
4	32.0	1,750	500	1/16
5	31.0	1,950	500	1/16
6	30.0	1,850	500	1/16
7	32.0	1,900	500	1/16
8	31.0	1,700	500	1/16
9	33.0	1,750	500	1/16
10		ELIMINATI	ED	
11		ELIMINATI	ED	
12		ELIMINATI	ED	
13		ELIMINATI	ED	
14		ELIMINATI	ED	
15	31.0	1,800	500	1/16
16	31.0	1,850	500	1/16
17	32.0	2,000	500	1/16
18	32.0	2,000	500	1/16
19	34.0	1,800	500	1/16
20	38.0	1,900	500	1/16
21	36.0	1,850	500	1/16
22	34.0	1,800	500	1/16
23	30.0	1,500	500	1/16
24	29.0	1,250	500	1/16
25	11.0	550	250	1/16
26	29.0	1,500	500	1/16
27	31.0	1,700	500	1/16
28	30.0	1,700	500	1/16
29	31.0	1,750	500	1/16
30	31.0	1,750	500	1/16
31	30.0	1,850	500	1/16
32	30.0	1,200	500	1/16
33	30.0	1,600	500	1/16
34	30.0	1,500	500	1/16
35	30.0	1,750	500	1/16
36	31.0	1,700	500	1/16
37	31.0	2,000	500	1/16

Completion Report of Underpinning Remediation Hendrickson Residence – Lake City, Florida Claim No. 59-D215-335 SDII Project No. 3020180B

Exterior Piles				
Pile No	Installation Depth (Feet)	Installation Seating Pressure (PSI)	Final Lift Pressure (PSI)	Final Lift (Inches)
38	30.0	2,000	500	1/16
39	29.0	1,550	500	1/16
TOTAL	1,045.0	N/A	N/A	N/A







STATE FARM FLORIDA INSURANCE COMPANY WINTER HAVEN, FLORIDA



PROJECT SITE LOCATION MAP

HENDRICKSON RESIDENCE LAKE CITY, FLORIDA

DESIGNED BY: TF PROJECT NO.: 3020180B FIGURE

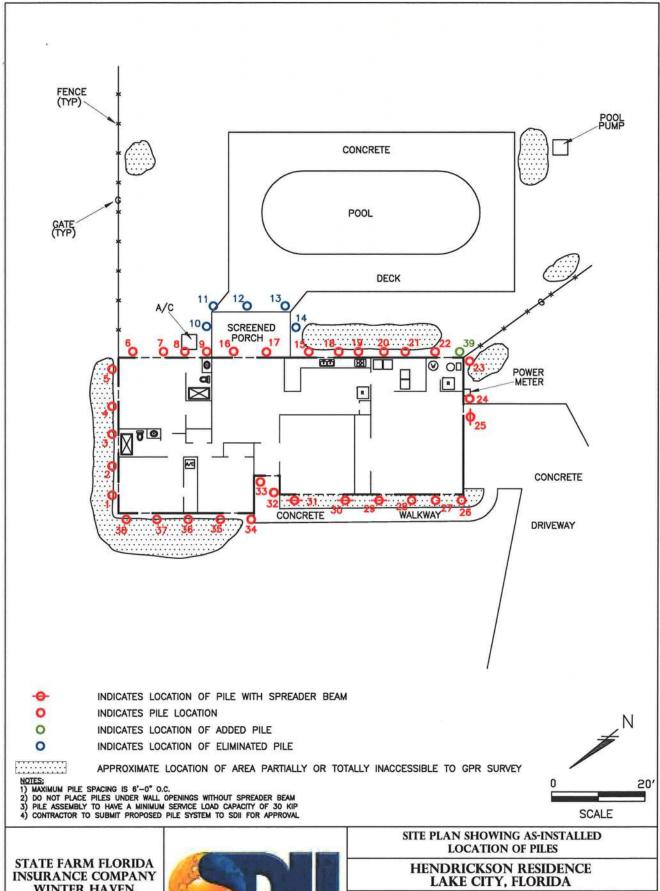
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DRAWN BY: SAS

DRAWING NO.: 0180B-1

DATE: 11/23/09

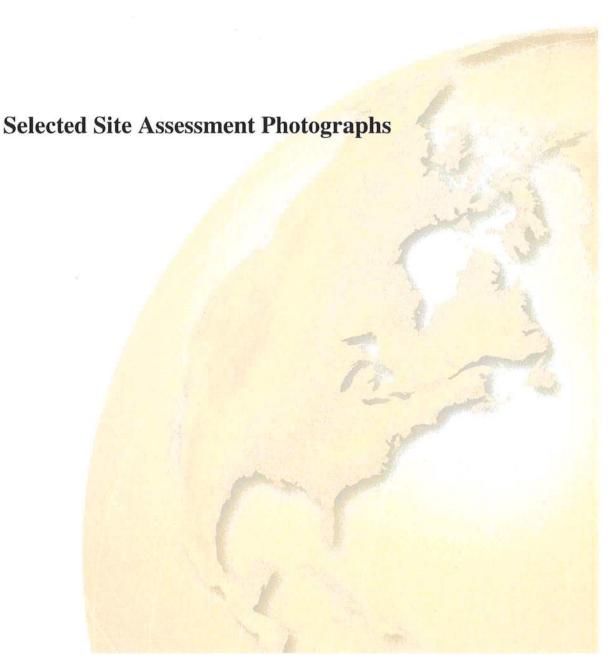
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WINTER HAVEN, **FLORIDA**



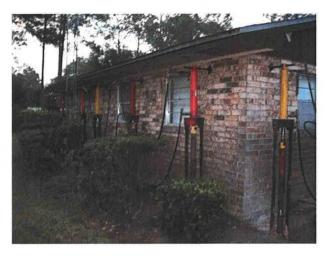
	DESIGNED BY:		PROJECT NO.:		FIGURE
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	CREATED BY:	SAS	DATE:	11/23/09	2























GROUND MODIFICATION & GEOTECHNICAL CONSTRUCTION SERVICES

3517 E. 7th Ave. Tampa, FL 33605

Phone: (813) 248-8779

Fax: (813) 241-8343

RE: Permitting

Please allow the following individuals Dolores Dean FDL# D500-171-63-633-0 and Corey North FDL# N630-101-74-322-7 to process and sign for any and all permits relating to Keystone Supports, Inc. under my license. My state license number is CRC051408.

If you have any questions regarding this matter please contact Carl C. Kirchendorfer at (813) 248-8779.

Sincerely,

Carl C. Kirchendorfer

Sworn to and subscribed before me this 11th day of Ebruary 2010 by

Carl Kirchendorfer, who is personally known to me or has produced a Florida

Driver's License as identification and who did not take an oath.

Notary Public

My Commission Expires

GRETCHEN EMIG
MY COMMISSION # EE 006616
EXPIRES: July 6, 2014
Bonded Thru Notary Public Underwriters

GROUND MODIFICATION & GEOTECHNICAL CONSTRUCTION SERVICES

3517 E. 7th Ave. Tampa, FL 33605

Phone: (813) 248-8779

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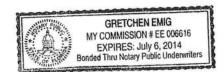
Carl hirchendorler, who is personally known to me or has produced a Florida

Driver's License as identification and who did not take an oath.

Notary Public

7/10/2014

My Commission Expires





SDII Global Corporation www.sdii-global.com

4509 George Road Tampa, FL 33634 tel 813-496-9634 fax 813-496-9664 July 9, 2009

Ms. Lori Robinson State Farm Florida Insurance Company P.O. Box 44036 Jacksonville, FL 32231

Subject: Remedial Recommendation

Hendrickson Residence Claim Number 59-D215-335 SDII Project No. 3020180



Dear Ms. Robinson:

At your request, SDII Global Corporation (SDII) has reviewed the Summary Report of a Subsidence Exploration for the Hendrickson residence (see Figure 1 for project site location) submitted by GSE Engineering & Consultation, Inc. (GSE) dated November 4, 2008. Specifically, SDII has been requested to evaluate the foundation remediation recommendations contained within the report. Based on the results of the field-testing and evaluation, GSE concluded that sinkhole conditions were present at the site and have contributed to the damage to the residence. GSE also noted that differential foundation movement due to the highly expansive clay soils identified beneath the home has also contributed to the damage.

Based on the review of the GSE report and the observations made during SDII's July 8, 2009 site inspection, it is our recommendation that the subsurface soils be stabilized to minimize further subsidence damage. Stabilization should be accomplished through grout injection to compact and densify the sandy soils beneath the residence. Grout injection is also intended to seal the top of the limestone surface to minimize future raveling.

The grout stabilization should incorporate 42 injection points spaced approximately 10 feet on center around the perimeter of the structure and the pool area. The grout points should be vertical and inclined as shown on Figure 2. Based on the Standard Penetration Test boring information contained within the GSE report, the depth of grouting is likely to vary from approximately 55 to 65 feet. Typical compaction grout mix with a slump between 4 and 6 inches should be used, pumped at slow enough rates such that the grout will densify and not merely hydro-fracture the soil. The elevation of the structure should be monitored continuously during the grouting process to minimize unnecessary upward movement.

The total quantity of grout required can vary based on site conditions, but is likely to be between 200 and 250 cubic yards (cy). Following the grout injection it is our recommendation that the foundation of the residence be stabilized through the installation of underpinning piles around the perimeter of the structure. The intent of the underpinning is to resupport the foundation/slab on piles bearing on competent material at depth. The installation of the underpinning piles will lift and support the structure and span the clay soils that exist at the site. The underpinning pile assembly, including mounting bracket, is to have a minimum load capacity of 30 kips. The contractor is to submit the proposed pin pile system to SDII for approval.

It is important to note that the optimum level to which the structure can be lifted as a result of the underpinning process is a function of the structural configuration as well as the amount of long-term and irreversible stresses that have accumulated. It may not be practical to attempt to completely relevel the structure, as excessive collateral damage may result. It is our recommendation that the structure be carefully monitored during the lifting process. It should be noted that the contractor is responsible for the means and methods of construction.

The underpinning piles should be installed around the perimeter of the house. These piles should be driven, hydraulically advanced or drilled to bear on competent material at depth. Alternate pile installation methods must be submitted to SDII for approval. The depth of underpinning is estimated to be approximately 55 to 65 feet. Pile spacing should be approximately 6 feet on center. SDII estimates that a total of 38 underpinning piles will be required to support the foundation of the residence. Approximate pile locations are shown on Figure 3. These locations will require adjustment by the Contractor based on site conditions.

A. Install grout pipes: 42 @ 60 feet (avg)

B. Grouting: 250 cy

C. Install pin piles: 38 piles

D. Monitoring and Certification

Continuous monitoring by SDII personnel during remediation is suggested to verify compliance with these recommendations and to make necessary adjustments to the remediation program due to unforeseen site conditions. This will also allow the engineer who created the remedial design to certify that the remediation met design specifications.

Hendrickson Residence Claim #59-D215-335 SDII Project No. 3020180

SDII appreciates the opportunity to have assisted State Farm Florida Insurance Company on this project. Should you have any questions concerning this or any other matter, please do not hesitate to contact us.

Sincerely,

SDII Global Corporation

Thomas H. Fisher, P. E.

2/9/09

Senior Principal Engineer (Civil/Structural)

State of Florida Registration 58027

FBPE Certificate of Authorization 8778

Attachments: Figure 1 – Project Site Location Map

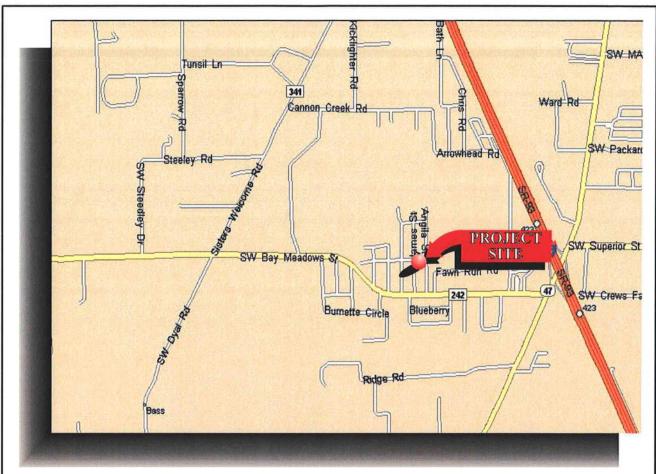
Figure 2 – Site Plan Showing Approximate Location of Grout Points

Figure 3 - Site Plan Showing Approximate Location of Piles

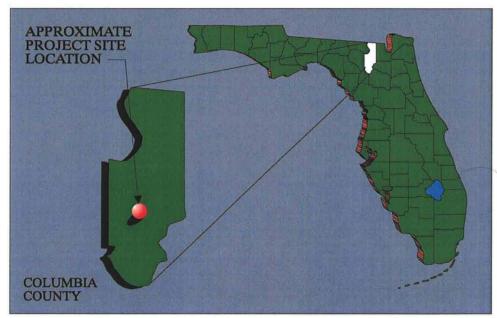
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STATE FARM FLORIDA INSURANCE COMPANY WINTER HAVEN, FLORIDA



PROJECT SITE LOCATION MAP

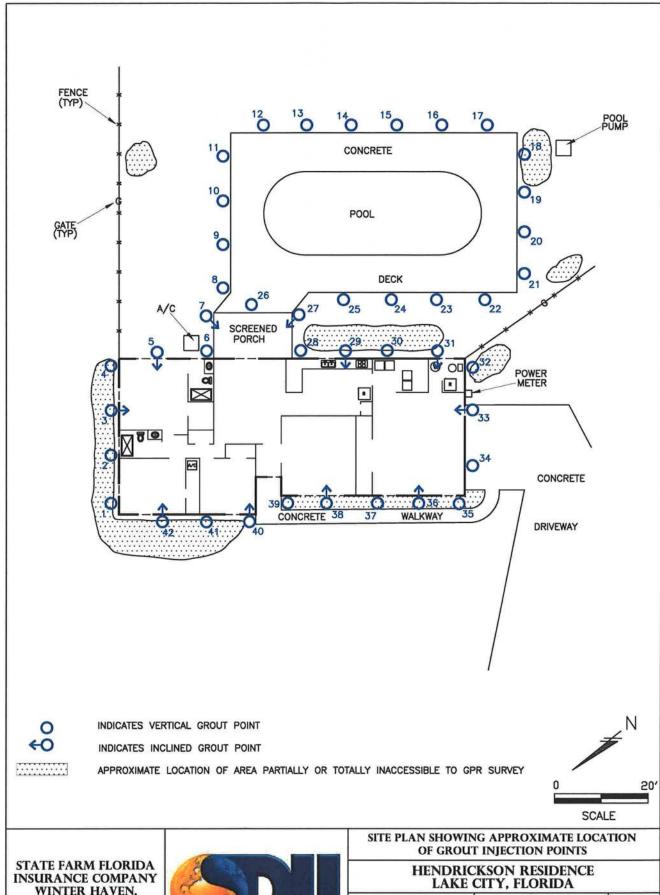
HENDRICKSON RESIDENCE LAKE CITY, FLORIDA

DESIGNED BY: TF

CHECKED BY: SU

DRAWN BY: SAS PROJECT NO.: 3020180 FIGURE DRAWING NO.: 0180-1

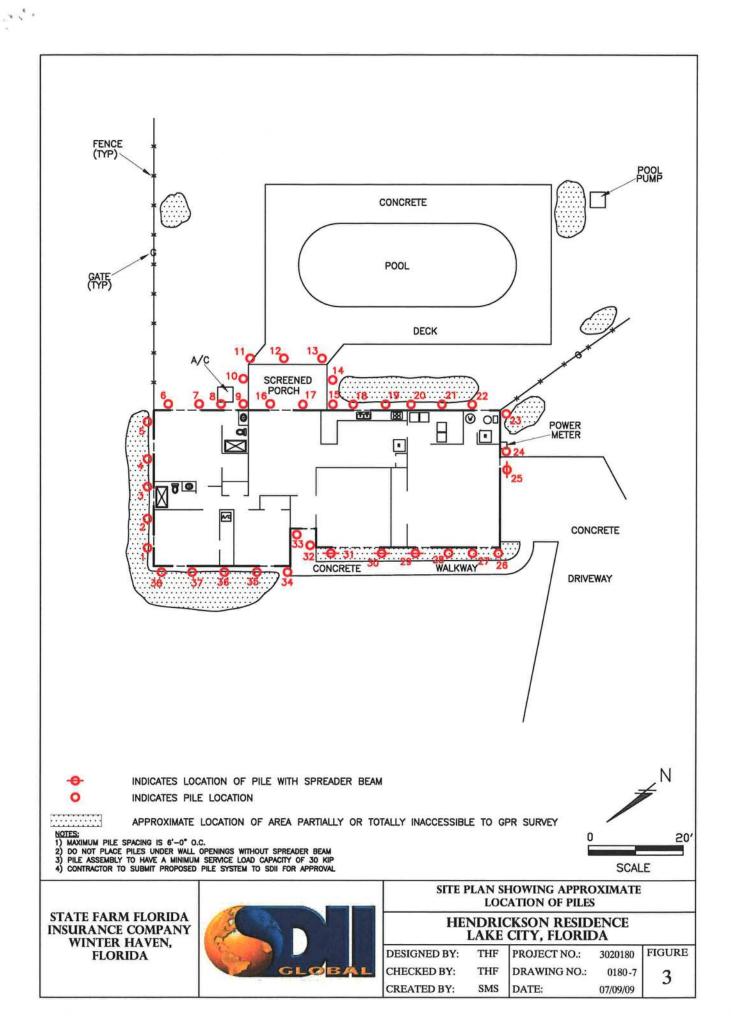
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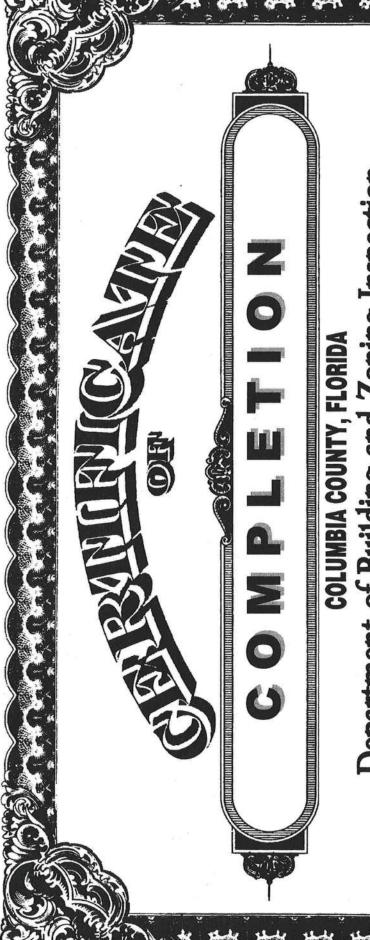


WINTER HAVEN, **FLORIDA**



и.		LAKE CITT, FLORIDA			
l	DESIGNED BY:	THF	PROJECT NO.:	3020180	FIGURE
J	CHECKED BY:	THF	DRAWING NO.:	0180-6	2
	CREATED BY:	SMS	DATE:	07/09/09	





Department of Building and Zoning Inspection

This Certificate of Occupancy is issued to the below named permit holder for the building and premises at the below named location, and certifies that the work has been completed in accordance with the Columbia County Building Code.

Parcel Number 25-4S-16-03153-013

Building permit No. 000027947

CARL KIRCHENDORFER Permit Holder Owner of Building ROBERT HENDRICKSON

Location: 265 SW THURMAN TERR, LAKE CITY, FL 32024

Date: 03/01/2011

Building Inspector

POST IN A CONSPICUOUS PLACE (Business Places Only)