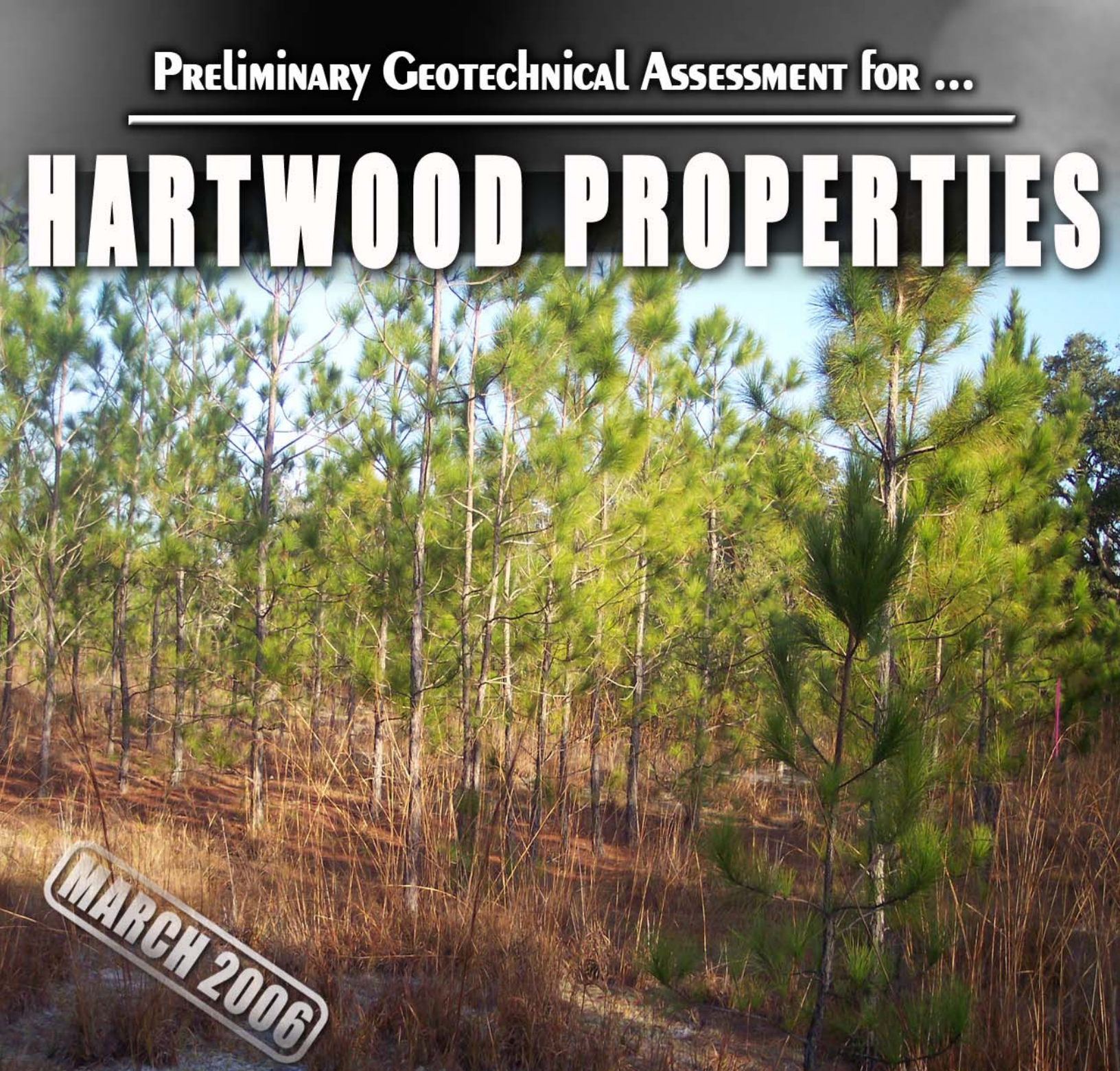
Preliminary Geotechnical Assessment for ...

HARTWOOD PROPERTIES



MARCH 2006

120± Acres, Hartwood Marsh Road, Off US Highway 27, Clermont, Lake County, Florida
Sections 9 & 16, Township 23 South, Range 26 East

Prepared for

Lake Webster, LLC.
401 Ferguson Drive
Orlando, Florida 32805

Prepared by

DEVO Engineering
CONSULTING GEOTECHNICAL ENGINEERS

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Date: March 5, 2006	*Devo's Project No.* 05-585.09
To: **LAKE WEBSTER, LLC.,** 401 Ferguson Drive Orlando, Florida 32805 phone: 407-629-1037 attention: **JEFFRY B. FUQUA, PH.D.**	*cc:* **DONALD W. MCINTOSH ASSOCIATES, INC.** 2200 Park Avenue North Winter Park, FL 32789 phone: 407-644-4068 fax: 407-644-8318 attention: **JOHN H. FLORIO, P.E.**
Re: ***Preliminary Geotechnical Assessment for ...*** **HARTWOOD PROPERTIES** ***120± Acres, Hartwood Marsh Road, Off US Highway 27, Clermont, Lake County, Florida*** ***[Sections 9 & 16, Township 23 South, Range 26 East]***	

Dear Mr. Fuqua:

We understand that Lake Webster, LLC., is considering the purchase of the land identified within Lake County, Florida commonly known as *"Hartwood Properties"* and that, in order to assist in its decision whether to purchase the land, Lake Webster, LLC., has requested our professional assistance with respect to the feasibility of using the land for a residential development.

We acknowledge that:

1. We are professional geotechnical engineers licensed by the State of Florida.

2. We have professional errors and omissions insurance coverage with limits of at least one million dollars.

3. We have inspected the land described above which Lake Webster, LLC., proposes to purchase, and we have conducted and/or reviewed such tests as we deem appropriate to form a professional opinion that the land can be used for the intended purpose.

Our site specific geothechnical investigation for this preliminary assessment included drilling of twenty-three (23) hand auger borings of depths up to 13 ft, installation of piezometers, and measurements to the ground water table. The borings disclosed mostly free draining fine sands with a shallow water table in the lower (western) portion of site and a deep water table in the upland areas to the east and south.

Based upon our investigation, review, and tests, it is our professional opinion that there are no soil conditions which

(a) would materially increase the cost of developing the property for the proposed use, or

(b) would require special design of foundation footings, underground utility systems, surface or subsurface drainage systems, paving, cut and fill procedure, dewatering, soil removal and disposal, or any other development and construction activities, in order to render the land suitable for the proposed use.

We trust that this report contains sufficient geotechnical data to guide the preliminary planning and feasibility analysis of the project. Please feel free to call us if there are any questions.

Sincerely,

Vijay Boodhoo Project Geotechnical Engineer	Devo Seereeram Devo Seereeram, Ph.D., P.E. Florida Registration No. 48303 Date: March 5, 2006

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1.0 SITE LOCATION AND DESCRIPTION

1.1 SITE LOCATION

The 120± acre project is located along the southern side of Hartwood Marsh Road just east of US Highway 27 in Clermont, Lake County, about 3 miles south of West Colonial Drive (SR 50). The site is partially within a valley that extends westwards to Lake Louisa, some 4,000 ft away. Figure 1.1 (attached) shows the site on a scanned image of the USGS 7.5 minute quadrangle map for Lake Louisa, Florida. As noted on the figure, the site lies within Sections 9 and 16 of Township 23 South, Range 26 East.

1.2 EXISTING CONDITIONS

The site boundaries are shown on a February 2005 aerial image in Figure 1.2. Note on this figure that the site is undeveloped and, is mostly covered with vegetation. The eastern, central and extreme southern portions of the site are sloping uplands covered with mostly, planted pines. The western portion of the site is essentially wetlands. There are several vehicular trails within the site, many of which, can be easily seen on the site aerial image in Figure 1.2.

1.3 TOPOGRAPHY

General topographic information was obtained from the USGS Lake Louisa, Florida 7.5 minute series quadrangle map, Figure 1.1, which has 5 ft ground surface contours for the site. As noted on the figure, the wetlands in the western portion of the site are at about +95 ft NGVD. The land rises steeply to the east and south and, towards to north somewhat, to +125 to +135 ft NGVD. The closest major water body is Lake Louisa to the west with a published elevation of +98 ft. There are few small unnamed water bodies on the other side of the ridge to the south. These appear to have water elevations in the order of +98 ft.

1.4 PROPOSED DEVELOPMENT

A preliminary development was not yet available at the time of writing of this report, however, a residential development is envisaged. The development will include numerous residential structures as well as internal roadways, stormwater ponds, drainage structures and associated utilities.

2.0 OBJECTIVES

The objectives of this investigation are listed below:

- ✎ Preliminary geotechnical report to assess site suitability for single-family residential construction.
- ✎ Construction of associated project infrastructure, including parking areas, internal roads, and underground sewers.
- ✎ Prepare preliminary predevelopment seasonal water table estimates to provide guidance on grading of the site.

3.0 NRCS SOIL MAP UNITS

The Natural Resources Conservation Service (NRCS), an agency of the US Department of Agriculture, has mapped and published descriptions of the shallow soils (i.e., within 80 inches of land surface) in Lake County (Fl). In undeveloped areas (without the addition of impervious areas, the establishment of drainage systems, and/or site grading), the NRCS soil mapping is usually fairly reliable and, it is good engineering practice to compare the published NRCS characterization data to the site-specific geotechnical data.

Figure 1.3 (attached) shows the approximate limits of the site on the Lake County NRCS Soils Map. As noted in the figure, there are six (6) soils map units present within the site and these are grouped according to their drainage characteristics as follows:

EXCESSIVELY DRAINED SOILS

- Astatula sand, dark surface, 0 to 5% slopes (AtB).
- Astatula sand, dark surface, 5 to 12% slopes (AtD).

MODERATELY WELL DRAINED SOIL

- Tavares sand (Ta).

POORLY DRAINED SOILS

- Myakka sand (Mk).

VERY POORLY DRAINED SOILS

- Placid sand (Pe).
- Placid and Myakka sands (PmA).

The gently sloping, Astatula sand, dark surface, 0 to 5% slopes (AtB) and the moderately sloping, Astatula sand, dark surface, 5 to 12% (slopes) (AtD), are mapped in the major portion of the uplands in the eastern and southern portions of the site. These excessively drained Astatula soils have a seasonal high water table is at a depth of more than 120 inches below ground surface.

Tavares sand (Ta), a nearly level to gently sloping, moderately well drained soil, is mapped in a band in the upland area just fringing the eastern and southern sides of the wetlands. Tavares sand has a seasonal high water table that is about 40 inches below the ground surface.

Myakka sand (Mk), a nearly level, poorly drained soil, is mapped in small isolated areas in the lower part of the uplands adjacent to the wetlands. Myakka sand has a seasonal high water at a depth of about 10 inches below the ground surface.

Placid sand (Pe) and, Placid and Myakka sands (PmA), both very poorly drained soils, are mapped within the wetlands in the western portion of the site. Both these soils have a seasonal high water table that is at or just above the ground surface.

Key NRCS characterization data for these six (6) soil map units are presented in Tables 1 through 5.

Table 1. Key NRCS Characterization Data for Astatula sands (AtB & AtD)

This is an excessively drained sandy soil which occurs on undulating ridge areas. Normal seasonal high groundwater levels are greater than 10 feet below the ground surface.		
Hydrologic Soil Group		A
Typical Soil Profile		
Depth	Soil Color & Texture	Permeability
0 - 7 in	dark gray sand	> 40 ft/day
7 - 24 in	brown sand	
24 - 86 in	yellowish brown sand	

Table 2. Key NRCS Characterization Data for Tavares sand (Ta)

This is a nearly level to gently sloping, moderately well drained soil. The water table is at a depth of 40 to 60 inches for more than 6 months of the year. During periods of drought, it is below 60 inches.		
Hydrologic Soil Group		A
Typical Soil Profile		
Depth	Soil Color & Texture	Permeability
0 - 7 in	very dark grayish-brown sand	> 40 ft/day
7 - 25 in	very pale brown sand	
25 - 34 in	light yellowish-brown sand	
34 - 61 in	very pale brown sand	
61 - 99 in	white sand	

Table 3. Key NRCS Characterization Data for Myakka sand (Mk)

This is a nearly level, poorly drained soil that has a layer stained by organic material at a depth of less than 30 inches. The water table is normally at a depth of 10 to 40 inches, but the depth is less than 10 inches in wet seasons, and more than 40 inches during extended dry periods.		
Hydrologic Soil Group		B/D
Typical Soil Profile		
Depth	Soil Color & Texture	Permeability
0 - 6 in	black sand	12 to 40 ft/day
6 - 20 in	white sand	
20 - 24 in	black sand	1.2 to 4 ft/day
24 - 36 in	dark reddish brown sand	
36 - 56 in	dark brown sand	
56 - 85 in	dark grayish brown sand	1.2 to 40 ft/day

Table 4. Key NRCS Characterization Data for Placid sand (Pe)

This is a nearly level, very poorly drained soil. The water table is at the surface most of the year. During extended dry periods it is within a depth of 15 inches. Shallow water covers many areas for 4 to 6 months in wet seasons.		
Hydrologic Soil Group		A/D
Typical Soil Profile		
Depth	Soil Color & Texture	Permeability
0 - 12 in	black sand	12.6 to 40 ft/day
12 - 18 in	very dark gray sand	
18 - 38 in	grayish-brown sand	
38 - 80 in	light brownish-gray sand	

Table 5. Key NRCS Data for Placid and Myakka sands, 0 to 2% slopes (PmA)

These are nearly level, very poorly drained and poorly drained soils in low, marshy depressions. The water table in these soils is nearer the surface for longer periods than in Myakka sand, and the soil is covered with water for 4 to 6 months in most years.		
Hydrologic Soil Group		
Typical Soil Profile		
Depth	Soil Color & Texture	Permeability
Placid sand		
0 - 12 in	Black sand	12.6 to 40 ft/day
12 - 18 in	Very dark gray sand	
18 - 38 in	Grayish brown sand	
38 - 80 in	Light brownish gray sand	
Myakka sand		
0 - 6 in	Black sand	12.6 to 40 ft/day
6 - 20 in	White sand	
20 - 24 in	Black sand	1.26 to 4 ft/day
24 - 32 in	Dark reddish brown sand	
32 - 36 in	Dark reddish brown sand	
36 - 56 in	Dark brown sand	
56 - 85 in	Dark grayish brown sand	1.26 to 40 ft/day

4.0 GEOTECHNICAL FIELD & LABORATORY PROGRAMS

In order to obtain the necessary data for this preliminary assessment the following field and laboratory programs were performed:

- ❒ Drilling of eight (8) hand auger borings to depths of 8 to 13 ft in the lower areas of site. These borings are labeled H-L-1 through H-L-8, Figure 1.4.
- ❒ Drilling of fifteen (15) hand auger borings to depths of 10 to 13 ft in the higher areas of the site. These borings are labeled, H-H-1 through H-H-15, in Figure 1.4.
- ❒ Installation of piezometers and measurements to the ground water table at each borehole location.
- ❒ Visual & tactile examination and classification of soil samples.

Note the boring locations were approximated the field by our site personnel using aerial maps and existing land features.

5.0 SHALLOW SOIL AND WATER TABLE CONDITIONS

5.1 GENERAL

Boring locations are shown in Figure 1.4.

Graphic soil profiles for the hand auger borings drilled in the lower areas of the site, H-L-1 through H-L-8, are presented in Figures 2.1 through 2.2 (attached) while, profiles for the fifteen (15) hand auger borings drilled in the higher areas of the site, H-H-1 to H-H-15, are presented in Figures 3.1 to 3.3.

5.2 SURFICIAL ORGANICS

None of the twenty-three (23) borings drilled on the site disclosed any surficial or buried organics.

5.3 SOIL STRATIGRAPHY

Borings in Lower Areas of the Site [Figures 2.1 to 2.2, Borings H-L-1 to H-L-8]

The eight (8) hand auger borings drilled in the lower portions of the site disclosed layers of free-draining fine sands from the ground surface through to the termination of the borings which, ranged from 8 to 13ft depth.

Borings in Higher Areas of the Site [Figures 3.1 to 3.3, Borings H-H-1 to H-H-15]

The fifteen (15) hand auger borings drilled in the higher portions of the site, generally disclosed layers of free-draining fine sands from the ground surface through to the termination of the borings at 13 ft depth. However, slightly clayey fine sands were disclosed in H-H-1, H-H-6 and H-H-11 from about 10 ft depth through to the termination of these borings at 13 ft depth.

5.4 SOIL HYDRAULIC CONDUCTIVITY

No soil hydraulic conductivity tests were performed in this preliminary investigation, however, based on the type of material present (clean fine sands) soil hydraulic conductivity values are expected to be on the high side (> 40 ft/day) in the eastern uplands area which, are mapped with Astatula soils and, 12 to 40 ft/day in the lower upland areas. This will be verified by field sampling and laboratory testing during the design level investigation.

5.5 WATER TABLE MEASUREMENTS & SHWT

Water table depth measurements are plotted adjacent to the soil profiles in Figures 2.1, 2.2, and 3.1 through 3.3 and, these are presented digitally in Table 6. Note that the water table was not encountered in any of 13 ft deep borings in the higher eastern portion of the site which, has mostly deep permeable fine sands.

The water table altitude normally fluctuates seasonally primarily due to short-term and long-term differences in rainfall and evapotranspiration. Since the evapotranspiration does not vary much from year to year, variation in the rainfall amounts are the primary cause of the fluctuation. Initial checks disclosed that ground water table does not appear to be influenced by the potentiometric surface of the Upper Floridan Aquifer (see Figures 1.5 and 1.6 which are regional maps of the area).

Preliminary seasonal high water table estimates are provided at each boring location in Table 6. These seasonal high water table estimates were made by reviewing the antecedent rainfall, the NRCS soil map units, the soil profiles and, available site topography.

A more detailed assessment of the water table will be performed as part of the design-level study.

Table 6. Water Table Values in On-Site Piezometers

Boring No.	Boring depth (ft)	Measured depth to water table (ft)	Depth to estimated seasonal high water table (ft)
BORINGS IN LOWER AREAS			
H-L-1	8.0	1.8	0.5
H-L-2	13.0	NE	>10.0
H-L-3	10.5	10.1	7.5
H-L-4	10.0	6.9	4.5
H-L-5	10.0	9.2	6.8
H-L-6	9.0	8.9	6.0
H-L-7	10.0	NE	>8.0
H-L-8	9.5	6.9	4.5
BORINGS IN HIGHER AREAS			
H-H-1	13.0	NE	>11.0
H-H-2	13.0	NE	>11.0
H-H-3	13.0	NE	>11.0
H-H-4	13.0	NE	>11.0
H-H-5	13.0	NE	>11.0
H-H-6	13.0	NE	>11.0
H-H-7	13.0	NE	>11.0
H-H-8	13.0	NE	>11.0
H-H-9	13.0	NE	>11.0
H-H-10	13.0	NE	>11.0
H-H-11	13.0	NE	>11.0
H-H-12	13.0	NE	>11.0
H-H-13	9.5	8.3	5.8
H-H-14	10.0	NE	>8.0
H-H-15	10.0	NE	>8.0

Water table measured January 18 and 28, 2006.
NE - Denotes water table not encountered within depth of exploration on date of exploration.

6.0 EVALUATIONS AND RECOMMENDATIONS

6.1 GENERAL

Based on our preliminary investigation and experience in this area, it is our opinion that the subsurface soil and ground water conditions pose no significant geotechnical constraints to

❶ the development of typical single-family residential structures on conventional shallow foundations, and

❷ the construction of the associated infrastructure (pavement, storm sewer, etc.) on this property.

There ground water table is relatively close to the land surface in the poorly drained soils which, fringe the wetlands (see values in Table 6). The poorly drained soils are identified on the soils map in Figure 1.3 (Myakka sand).

Based on the geotechnical data collected to date, the following are our preliminary recommendations for the various elements of the development outside the wetland area:

❶ The ***building foundations*** can be conventional shallow footings with an allowable bearing pressure of 2,500 lb/ft^2. The base elevation of any building slabs should be at least 3 feet above the seasonal high water table estimates in Table 6. Note that further definition of these water table estimates will be required as part of the design-level study.

❷ The top of the ***pavement grade*** at the road centerline should be at least 2.5 ft above the wet season water table. If this separation distance cannot be achieved, road underdrains shall be used to lower the water table and protect the road base from groundwater-related distress.

❸ In the higher uplands to the east and south, the main construction-related problem with the areas of sloping sands is downhill erosion of sands during heavy rainfall events and, dust control during the dry season. Great care should be taken to ensure erosion control measures (silt fences, etc.) are installed and maintained while bare soil is exposed. Dust palliatives are also recommended.

- ❹ With the shallow water table in the lower areas fo the site, construction dewatering may be required to facilitate dry excavation of ponds and structure pits/trenches. Construction dewatering rates can be expected to be high because of the permeable sands. Closely spaced horizontal sock drains shall be considered where feasible and then deep wells if the groundwater withdrawal rates are too high for sock drains.

6.2 Stormwater Management Ponds - Borrow Suitability

The locations of the stormwater ponds have not been laid out at the time of writing of this report, however, based on experience, there ought to be deep layers of suitable fine sands and slightly silty fine sands on this site and, these soils should provide a good source of on-site borrow material for general and structural backfill. This however, must be confirmed by drilling of deep borings and laboratory testing when the pond locations are finalized.

6.3 Stormwater Management Ponds - Recommended Types

Dry bottom ponds are recommended in the higher (eastern) portions of the site where there are thick layers of permeable sands with a deep water table. However, wet detention or wet retention ponds are recommended for the lower portions of the site (where land surface elevations are less than 5 ft higher than the wetlands).

St. Johns River Water Management District requires that the control elevation of wet detention ponds be set at or above the normal on-site ground water table elevation. This elevation may be determined by calculating the average of the seasonal high and seasonal low water table elevations. Ground water baseflow must be considered when the control elevation is set below the normal water table elevation or the project utilizes road underdrains.

FIGURES

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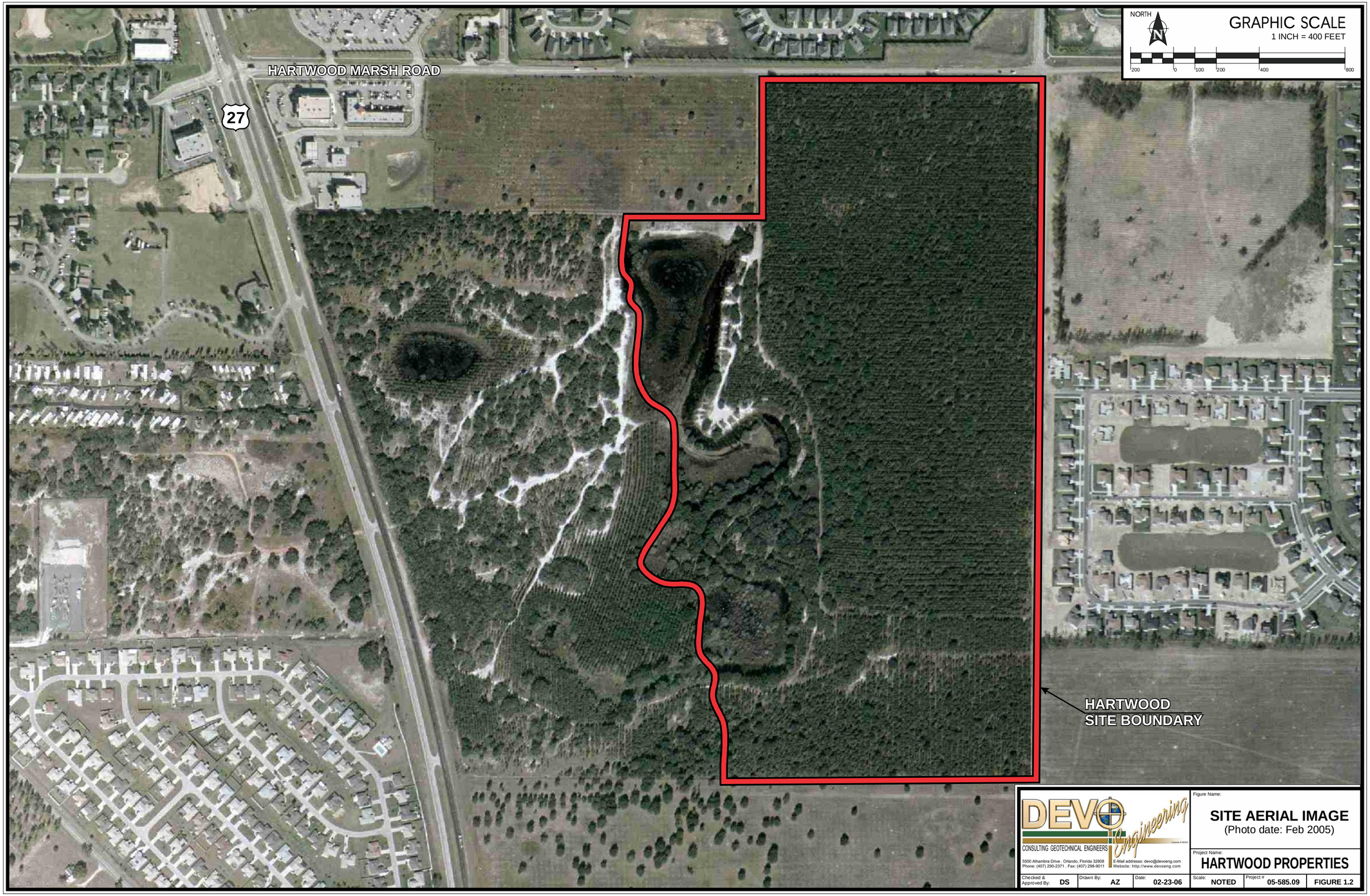
Figure Name:
SITE VICINITY MAP
Source: Lake Louisa, FL. Photorevised 1980, Sections 9 & 16, Township 23 S, Range 26 E

Project Name:
HARTWOOD PROPERTIES

Checked & Approved By:	Drawn By:	Date:	Scale:	Project #	
DS	AZ	02-23-06	NOTED	05-585.09	FIGURE 1.1



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Checked & Approved By:	Drawn By:	Date:
DS	AZ	02-23-06

Figure Name:

SITE AERIAL IMAGE
(Photo date: Feb 2005)

Project Name:

HARTWOOD PROPERTIES

Scale:	Project #	
NOTED	05-585.09	FIGURE 1.2

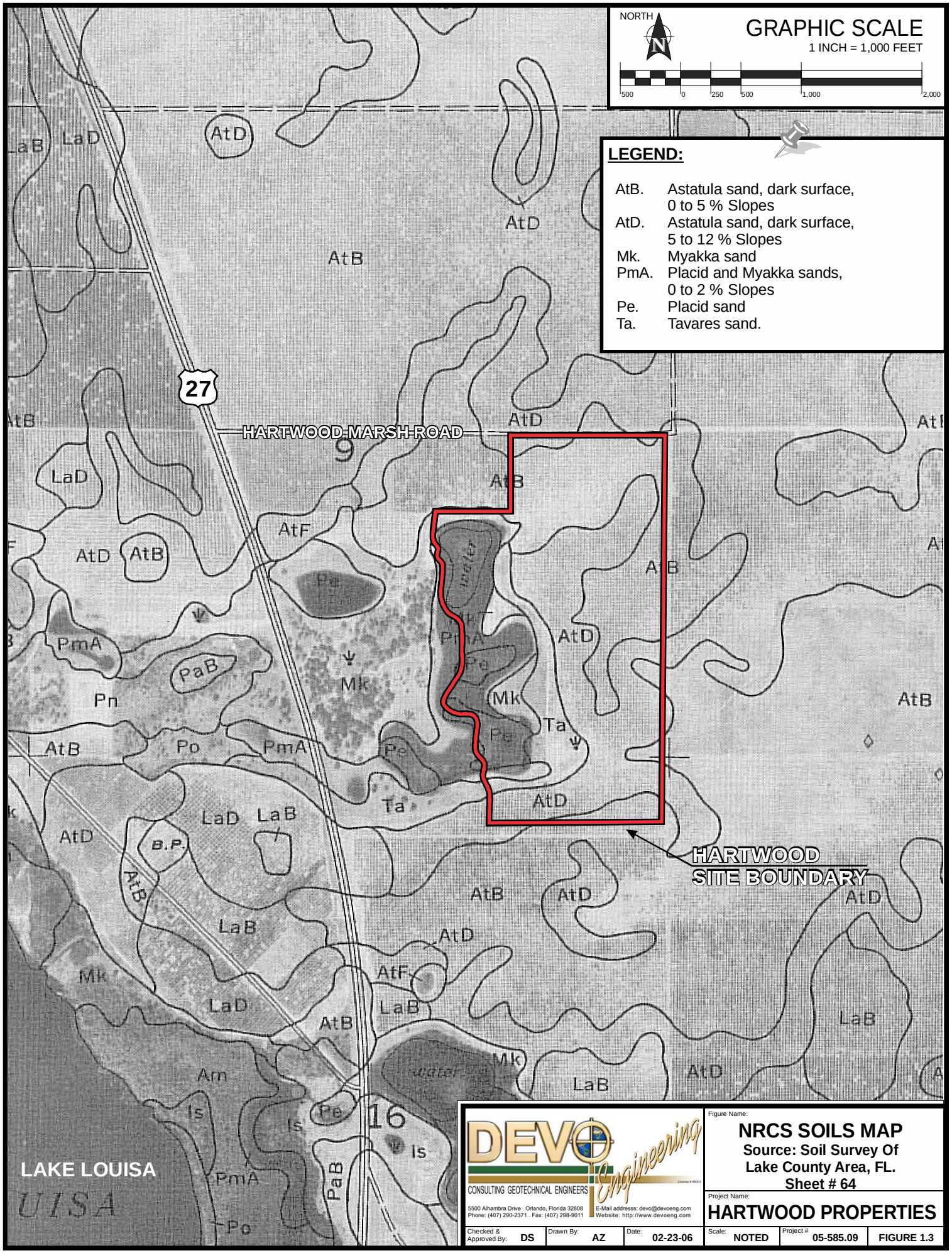

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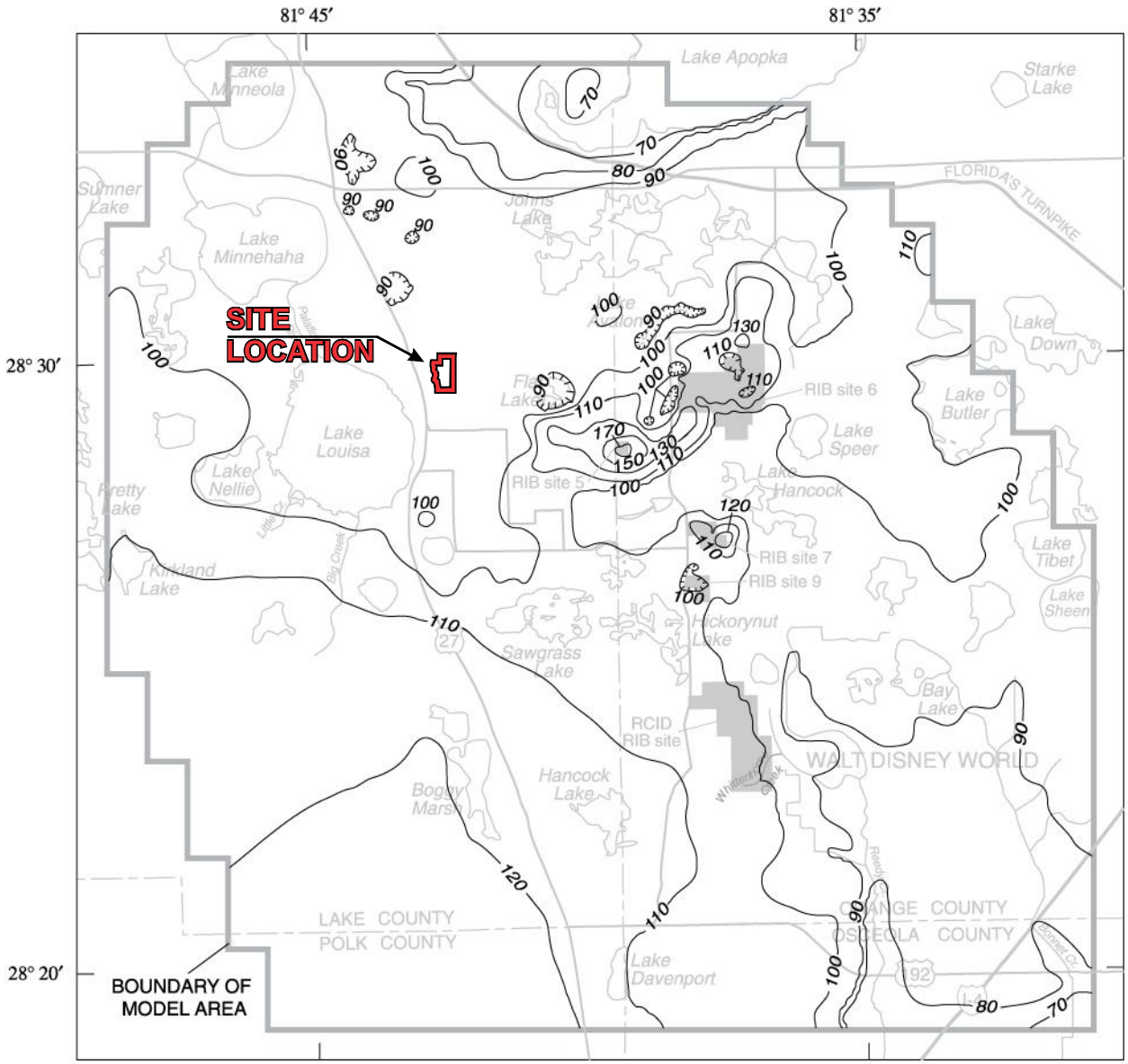
Figure Name:
NRCS SOILS MAP
Source: Soil Survey Of Lake County Area, FL. Sheet # 64

Project Name:
HARTWOOD PROPERTIES

Checked & Approved By:	Drawn By:	Date:	Scale:	Project #	
DS	AZ	02-23-06	NOTED	05-585.09	FIGURE 1.3



EXPLANATION

— 120 — WATER TABLE CONTOUR -- Shows average altitude of water table in 1995. Hachures indicate depression. Contour interval 10 and 20 feet

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Figure Name: **Regional Water Table Contours for 1995**

Project Name: **HARTWOOD PROPERTIES**

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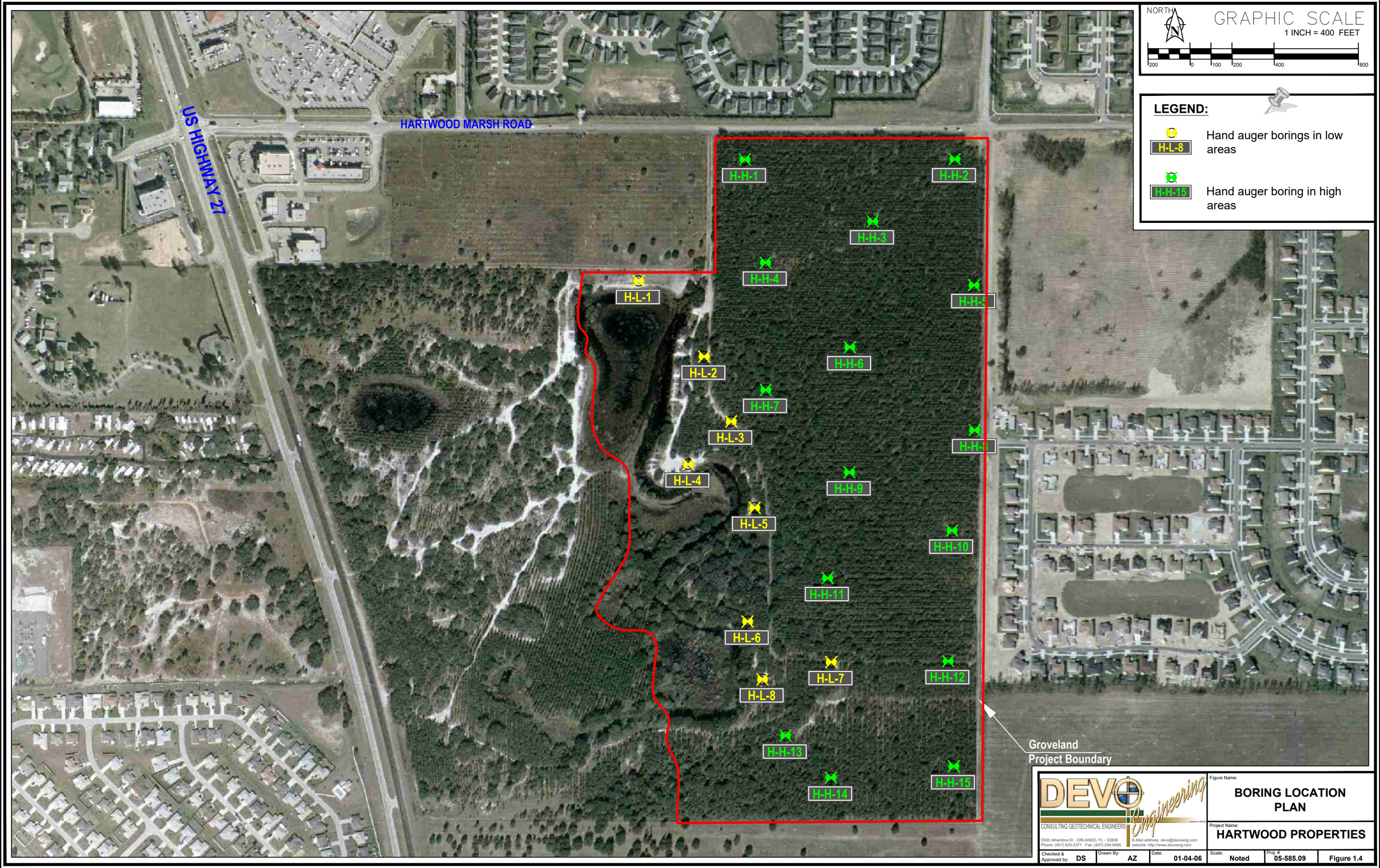
DS	AZ	01-25-06	NOTED	05-585.09	FIGURE 1.5



NORTH

GRAPHIC SCALE
1 INCH = 400 FEET

200 0 100 200 400 800

LEGEND:

H-L-8 — Hand auger borings in low areas

H-H-15 — Hand auger boring in high areas

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Figure Name: **BORING LOCATION PLAN**

Project Name: **HARTWOOD PROPERTIES**

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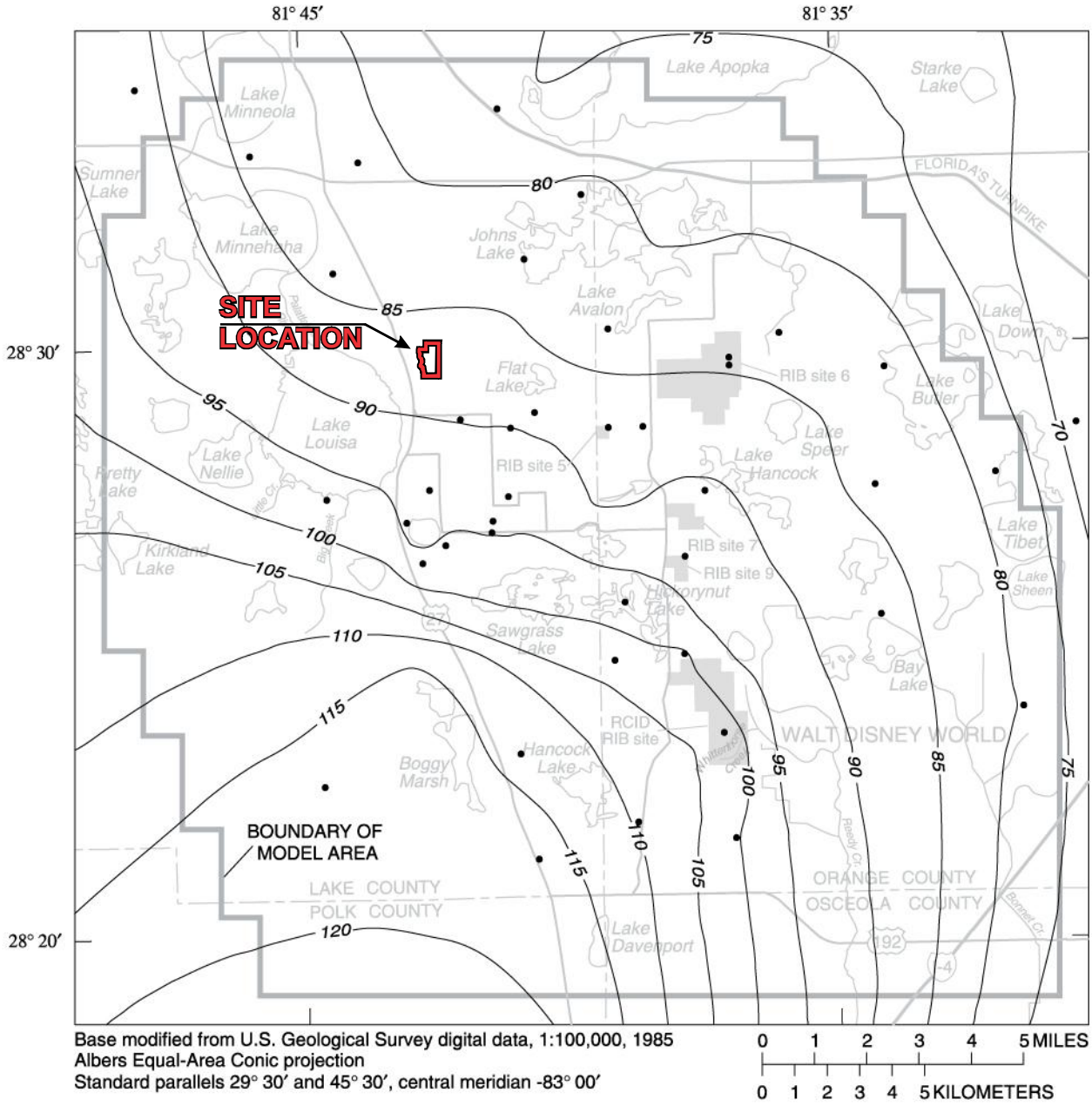
DS	AZ	01-04-06	Noted	05-585.09	Figure 1.4



Base modified from U.S. Geological Survey digital data, 1:100,000, 1985
Albers Equal-Area Conic projection
Standard parallels 29° 30′ and 45° 30′, central meridian -83° 00′

0 1 2 3 4 5 MILES
0 1 2 3 4 5 KILOMETERS

EXPLANATION

—120— POTENTIOMETRIC CONTOUR -- Shows the average altitude at which water level would have stood in tightly cased wells tapping the Upper Floridan aquifer in 1995. Contour interval 5 feet

• OBSERVATION WELL

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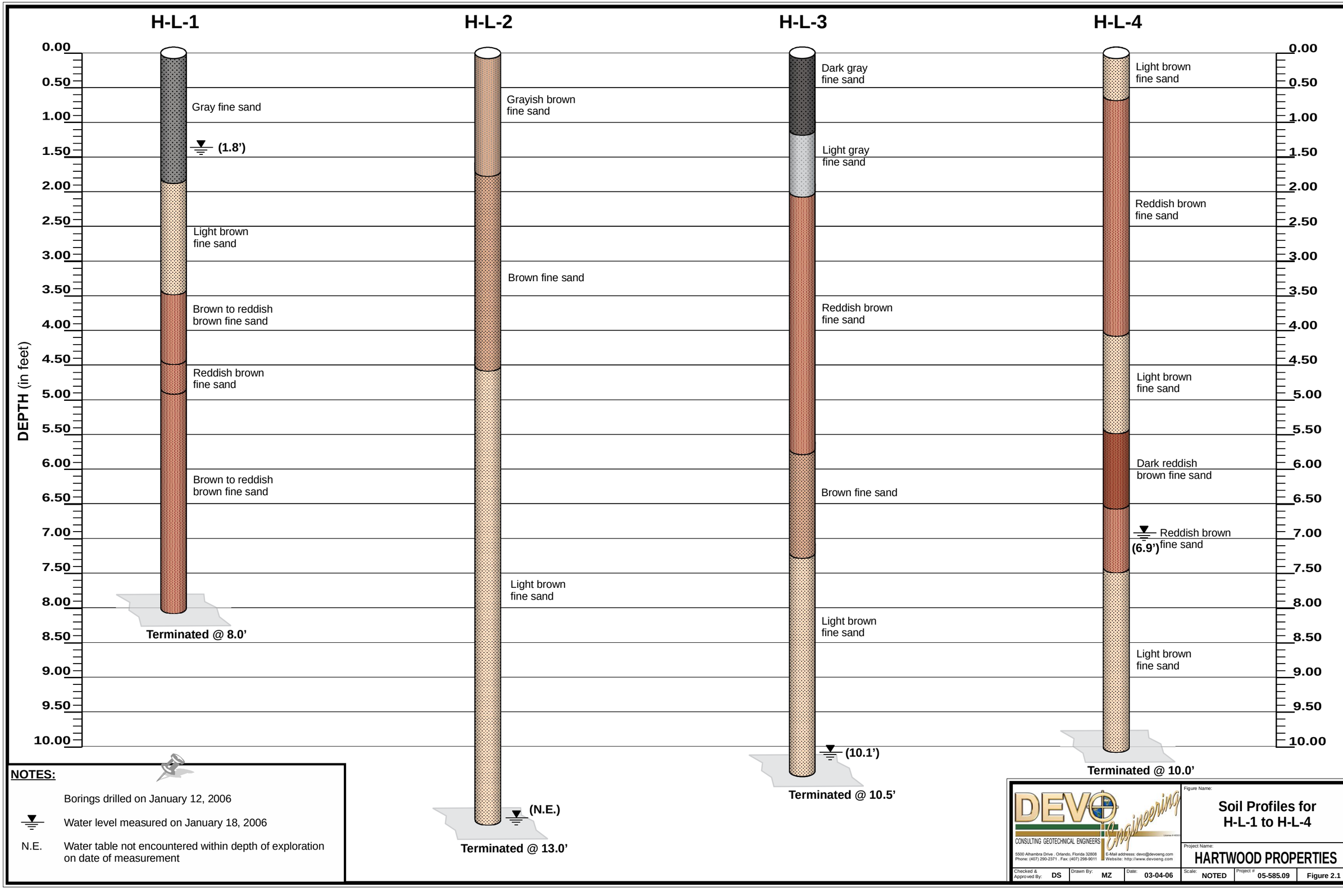
Figure Name: **Potentiometric Surface of Upper Floridan Aquifer for 1995**

Project Name: **HARTWOOD PROPERTIES**

Checked & Approved By:	Drawn By:	Date:	Scale:	Project #	
DS	AZ	01-25-06	NOTED	05-585.09	FIGURE 1.6



NOTES:

Borings drilled on January 12, 2006

Water level measured on January 18, 2006

N.E. Water table not encountered within depth of exploration on date of measurement

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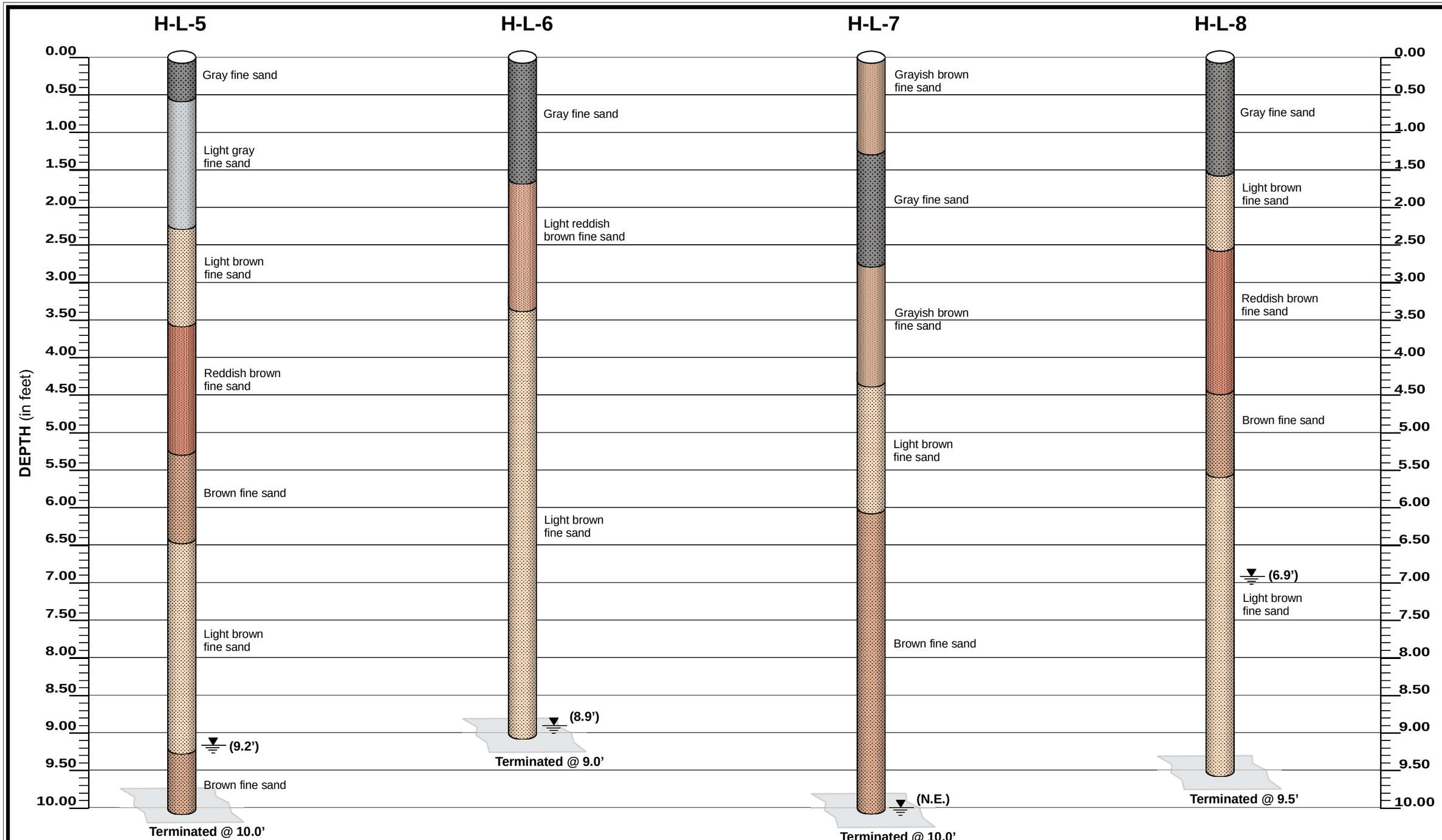
Figure Name: **Soil Profiles for H-L-1 to H-L-4**

Project Name: **HARTWOOD PROPERTIES**

Checked & Approved By:	Drawn By:	Date:	Scale:	Project #	
DS	MZ	03-04-06	NOTED	05-585.09	Figure 2.1



NOTES:

Borings drilled on January 12, 2006

Water level measured on January 18, 2006

N.E. Water table not encountered within depth of exploration on date of measurement

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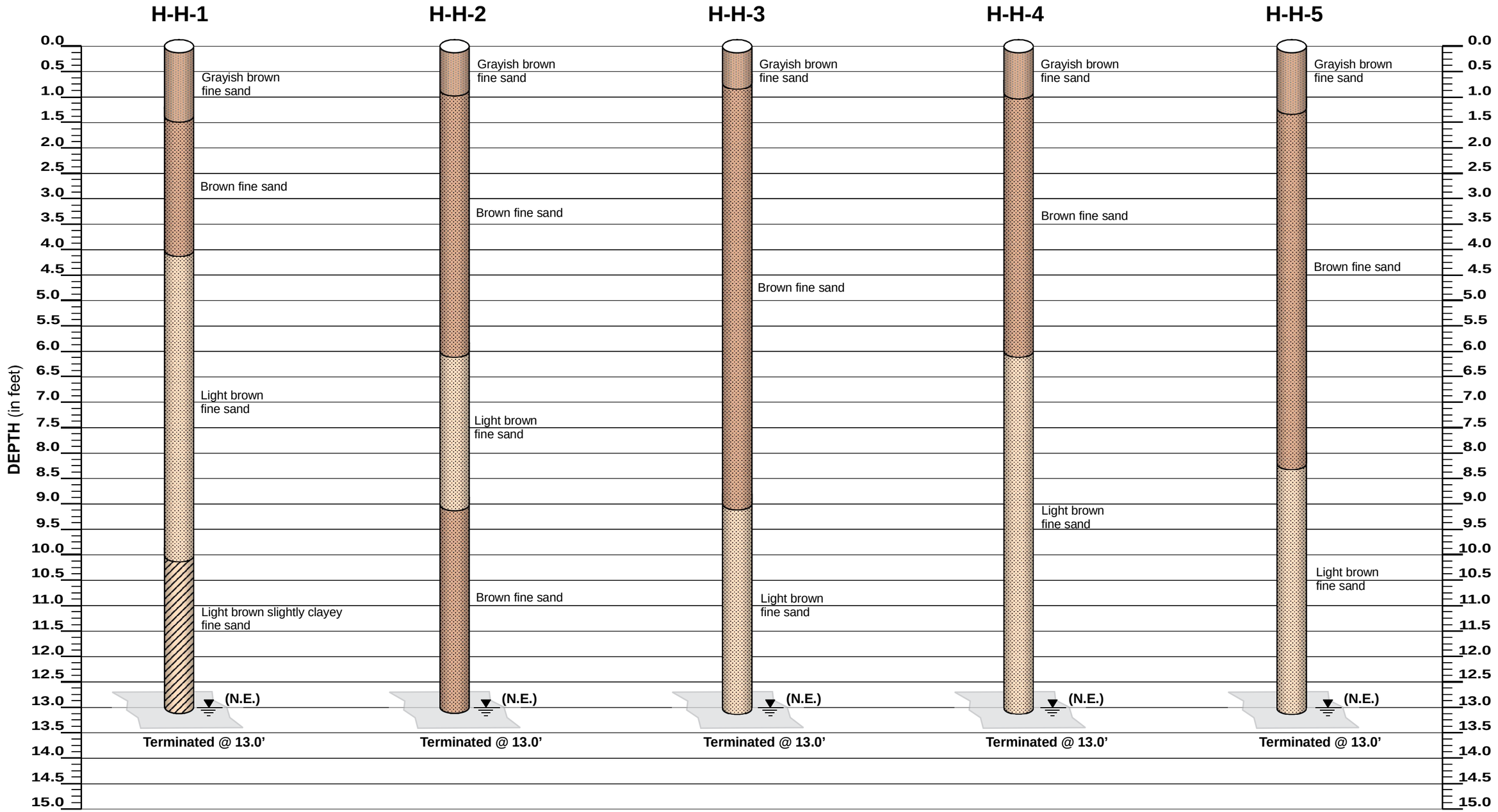
Figure Name: **Soil Profiles for H-L-5 to H-L-8**

Project Name: **HARTWOOD PROPERTIES**

Checked & Approved By:	Drawn By:	Date:	Scale:	Project #	
DS	MZ	05-04-06	NOTED	05-585.09	Figure 2.2



NOTES:

Borings drilled on January 17, 2006

Water level measured on January 17, 2006

N.E. Water table not encountered within depth of exploration on date of measurement

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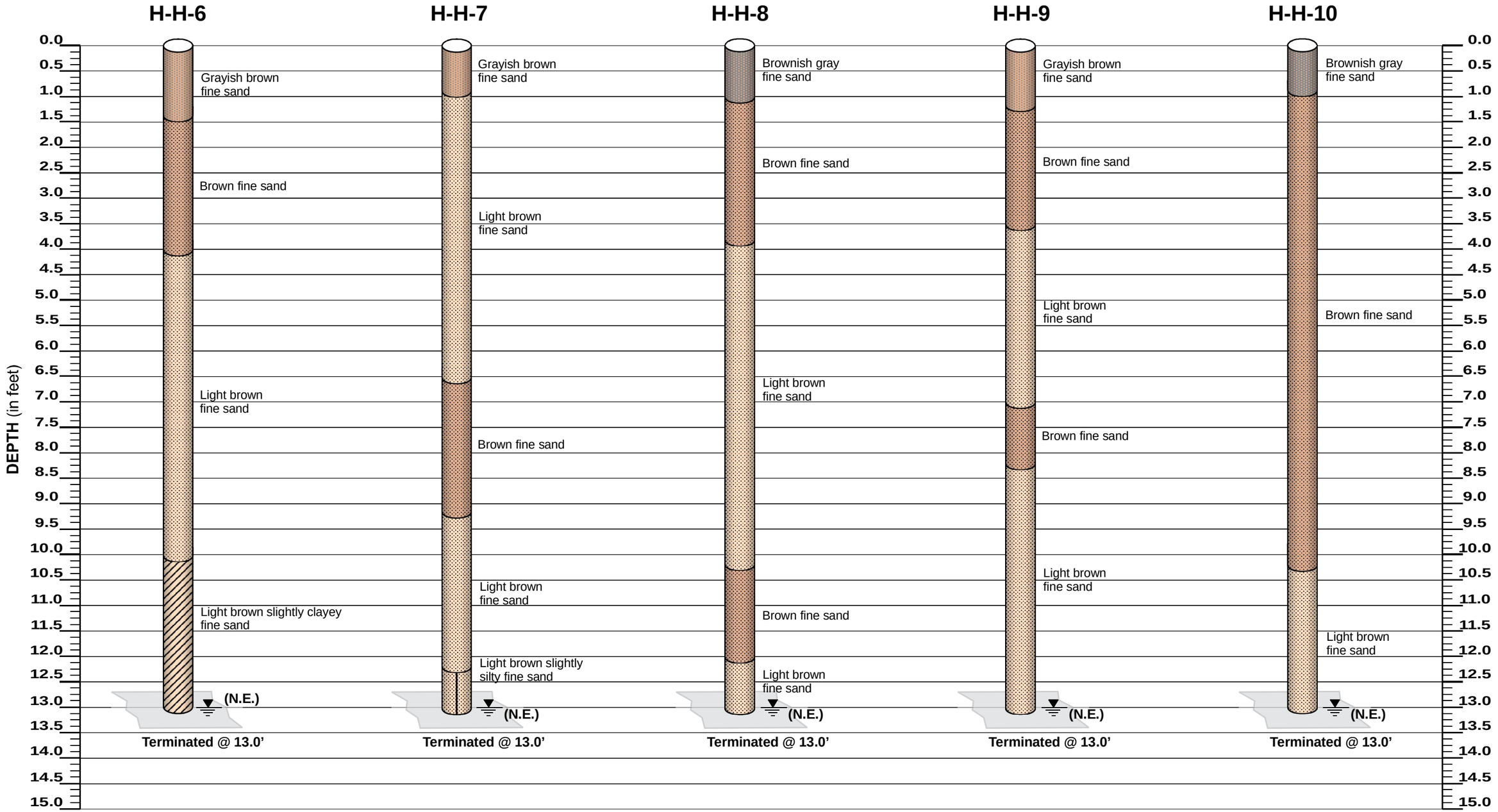
Figure Name: **Soil Profiles for H-H-1 to H-H-5**

Project Name: **HARTWOOD PROPERTIES**

Checked & Approved By:	Drawn By:	Date:	Scale:	Project #	
DS	MZ	03-04-06	NOTED	05-585.09	Figure 3.1



NOTES:

Borings drilled on January 17, 2006

Water level measured on January 17, 2006

N.E. Water table not encountered within depth of exploration on date of measurement

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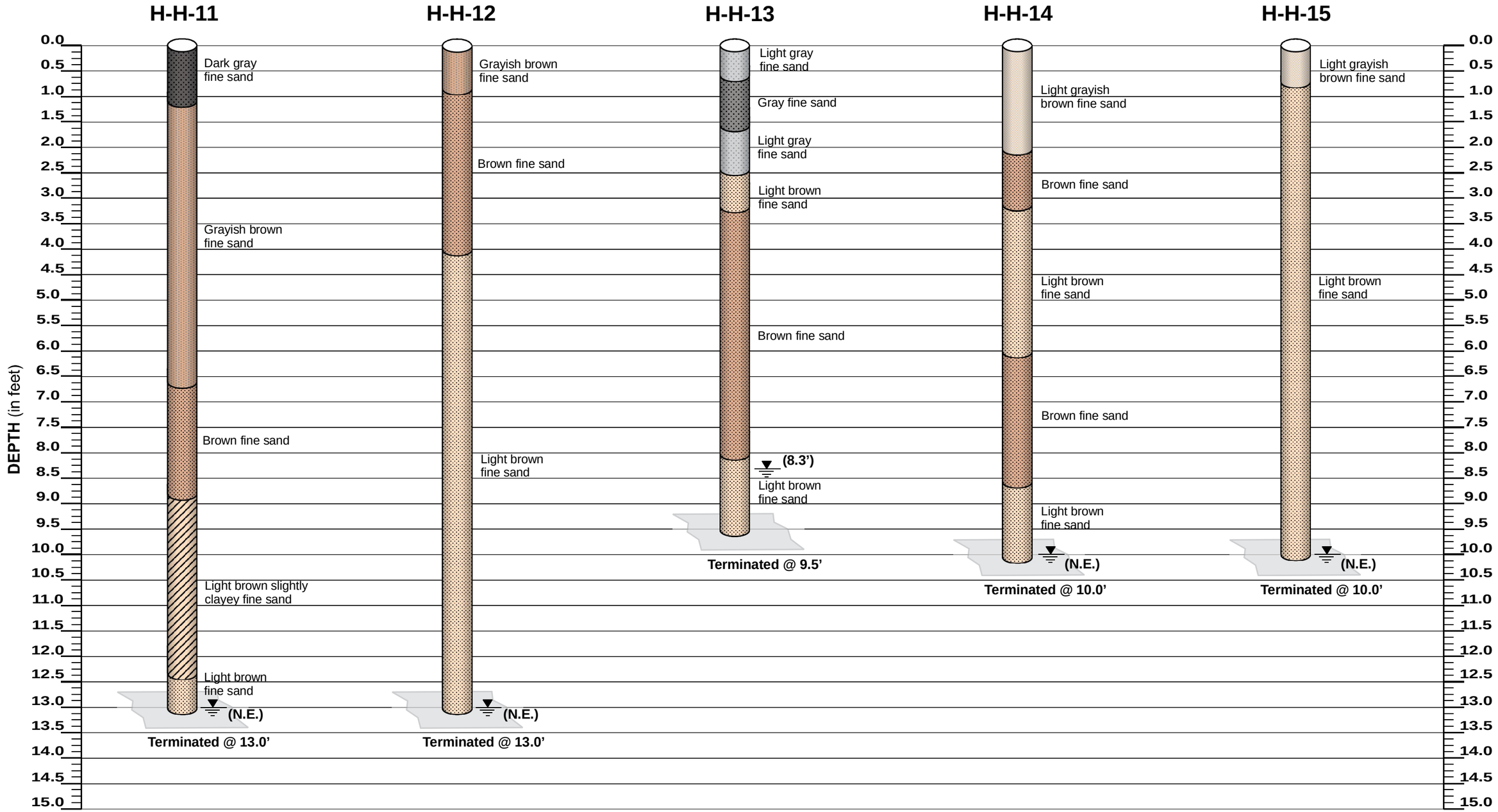
Figure Name: **Soil Profiles for H-H-6 to H-H-10**

Project Name: **HARTWOOD PROPERTIES**

Checked & Approved By:	Drawn By:	Date:	Scale:	Project #	
DS	MZ	03-04-06	NOTED	05-585.09	Figure 3.2



NOTES:

Borings drilled on January 28, 2006

Water level measured on January 28, 2006

N.E. Water table not encountered within depth of exploration on date of measurement

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Figure Name: **Soil Profiles for H-H-11 to H-H-15**

Project Name: **HARTWOOD PROPERTIES**

Checked & Approved By:	Drawn By:	Date:	Scale:	Project #	
DS	MZ	03-04-06	NOTED	05-585.09	Figure 3.3