



**GROUND WATER
ELEVATION**



STORMWATER 2005

DEVO ENGINEERING

PART 1a

Estimating the
Seasonal **H**igh **W**ater **T**able
A Mix of Art & Science

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by Devo Seereeram, Ph.D., P.E.

This paper was originally written in 1993 & generated a lot of interest. The approach described in this paper is now being used by SWFWMD in their training workshops and is now recognized as acceptable by the NRCS.

Seasonal High Water Table

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Perhaps the most important soil feature affecting site engineering in Florida is the water table and particularly its range of fluctuation from season to season.

The prediction of the seasonal high water table is a subtle combination of many sciences, including soil science, shallow aquifer groundwater mechanics, geohydrology, hydrometeorology, geotechnical engineering, and bryology which remain a mystery to the uninitiated, non-soil engineer.

What is the SHWT?

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- A seasonal high water table (SHWT) is the shallowest depth to free water that stands in an unlined borehole or where the soil moisture tension is zero for a significant period (more than a few weeks) (Watts and Hurt, 1991).
- According to Rule 40C-42, Florida Administrative Code, the seasonal high groundwater table (SHWT) elevation means the highest level of the saturated zone in the soil in a year with normal rainfall.

What is the SHWT? (Continued)

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- Groundwater professionals are routinely called upon by site grading and drainage engineers and other professionals to predict these groundwater elevations, typically to within an accuracy of ± 6 inches
- Errors in these estimates can result in detrimental environmental, economic, and functional impacts, such as the hydrologic failure of created wetlands, septic tank drainfields, stormwater management ponds, effluent reuse land application systems, road base distress due to saturated conditions, etc

What is the Starting Point?

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- The starting point is the measurement of the stabilized groundwater level in a newly opened borehole, or piezometer at a selected location and time.
- A stabilized reading, in this sense, means that the water level in the newly created borehole or well has equalized with the water table level in the aquifer.
- A minimum of 24 hours is usually allowed before taking a reading, although sandy soils require less time than silty or clayey soils to achieve equilibrium levels.
- Although the published sources of information (such as the NRCS publications) generally provide reliable preliminary guidance on the depth to the water table at a site, there is no substitute for a site-specific investigation for design level studies.

What is the Starting Point? (Continued)

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- The date of the water table measurement is very important and must be recorded since the groundwater table fluctuates throughout the year in response to seasonal rainfall.
- In addition, the soil profile in the test hole or boring should be described, noting soil texture (i.e., sand, silty sand, "hardpan", clayey sand, etc.), color (including mottling and staining, more formally known as redoximorphic features), and, if available, Standard Penetration Test boring "N" values variations which may manifest memory of the seasonal fluctuation.

How do we adjust from the starting point?

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- Antecedent rainfall (short-term as well as long-term)
- Soil map unit descriptions published by the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS)
- Examination of the soil profile, including color variations (redoximorphic features), SPT "N" values, depth to "hardpan" or other impermeable horizons (such as clayey fine sands and clays), etc.
- Consistency of water levels with adjacent surface water bodies and knowledge of typical hydraulic gradients (water table slopes).
- Vegetative indicators

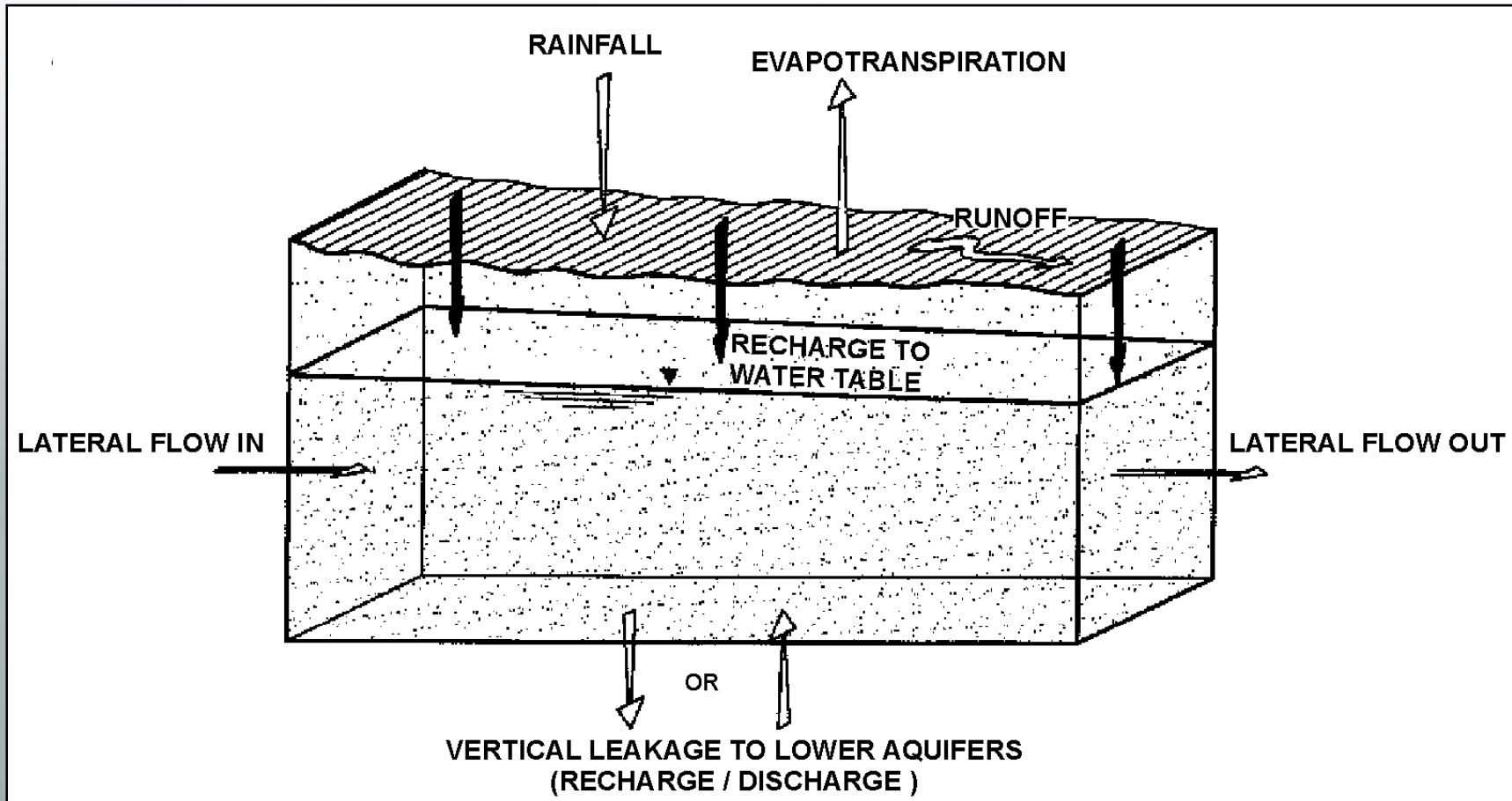
How do we adjust from the starting point? (Continued)

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- Effects of existing and future development
- Hydrogeologic setting including potentiometric surface of Floridan aquifer and degree of connection between the water table aquifer and the Floridan aquifer.
- Mathematical Correlation With Soil Morphological Features

ANTECEDENT RAINFALL

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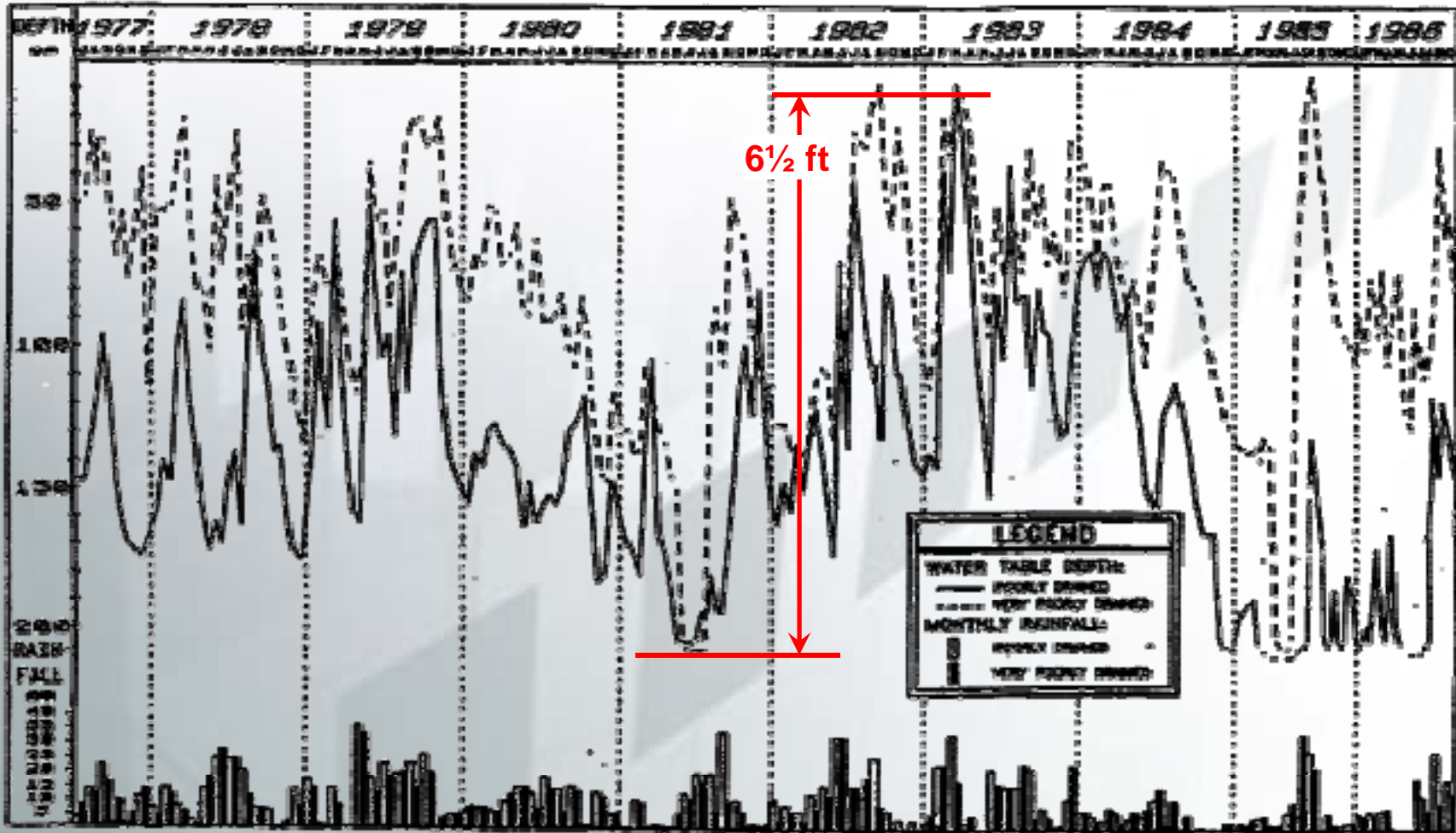


Can run continuous simulation

A Key Point To Note

It is first important to appreciate that, under natural conditions, the rate of lateral groundwater movement in the uppermost water table aquifer in Central Florida is no more than 300 to 400 feet per year and usually much less. Therefore, a water particle entering the water table aquifer at one end of a site may take several years before it exits the downgradient boundary of the site or discharges into a surface water body within the site. The reaction of the water table within a wet season, spanning typically about 4 months (June through September), is therefore not controlled significantly by lateral groundwater inflows and outflows to the prism or by conditions which exist greater than a lateral distance of 300 to 400 feet.

Water Table Fluctuations Example - Pine Flatwood in Polk County -

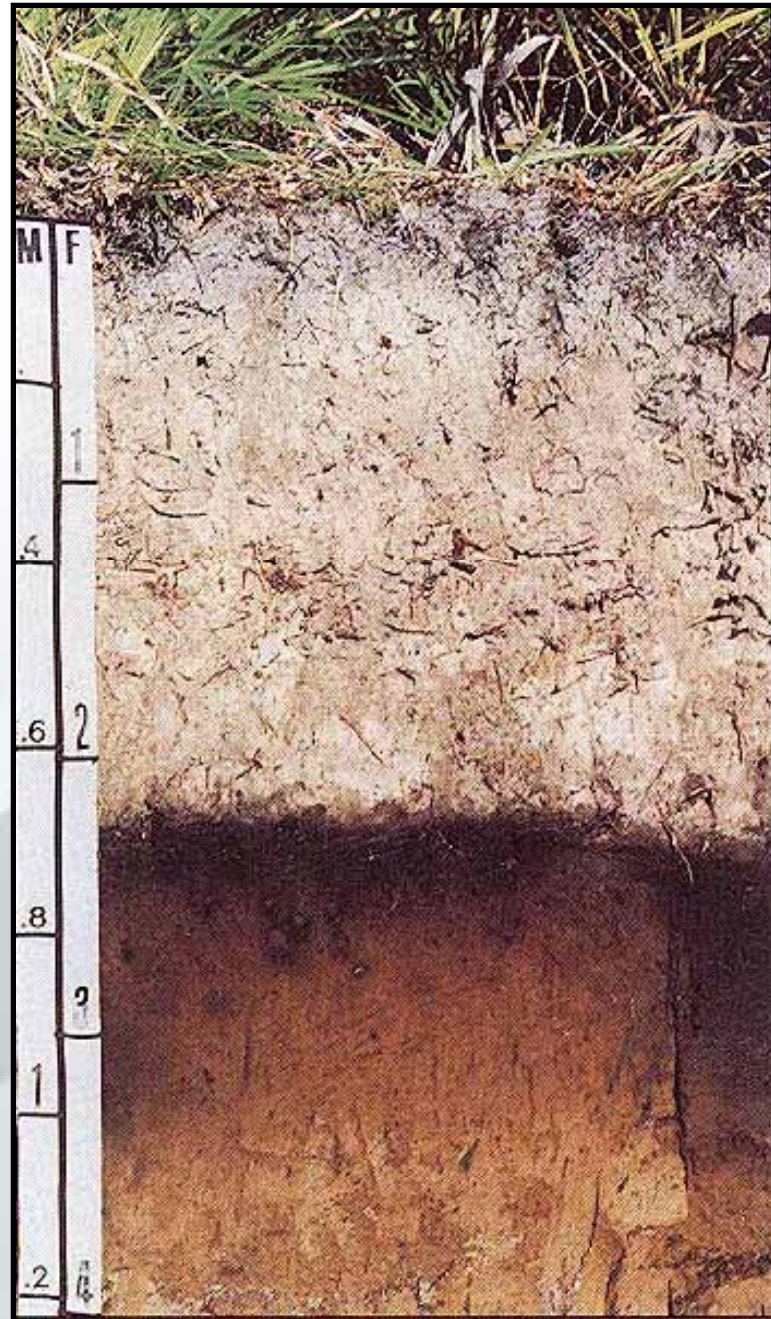


Long-Term Fluctuation of the Water Table (After HYDE and Ford, 1989)

REDOXIMORPHIC FEATURES

- NRCS procedure is based solely on morphology; i.e., identifying mottles and low chroma colors in a soil horizon which form by processes related to saturation and reduction of iron. These processes may be actively occurring during the year or have occurred in the horizon at some time in the past.
- Soil mottling patterns can also be relicts of past moisture regimes.
- NRCS maps are on a scale of 1:20000 and are not a substitute for on-site investigations. Experience indicates that the NRCS estimates of SHWT are reliable in areas where recent development or long-term hydrogeologic changes have not influenced the shallow groundwater flow regime.
- NRCS data should always be reviewed as part of the water table evaluation.

**Myakka Fine Sand -
The State Soil**



SHWT determination in E horizon of Spodosols (Soils with hardpan)

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Chroma 1
no organic matter accumulation around root

SHWT
area where chroma 1 & 2 are mixed

Chroma 2
organic matter accumulation around root

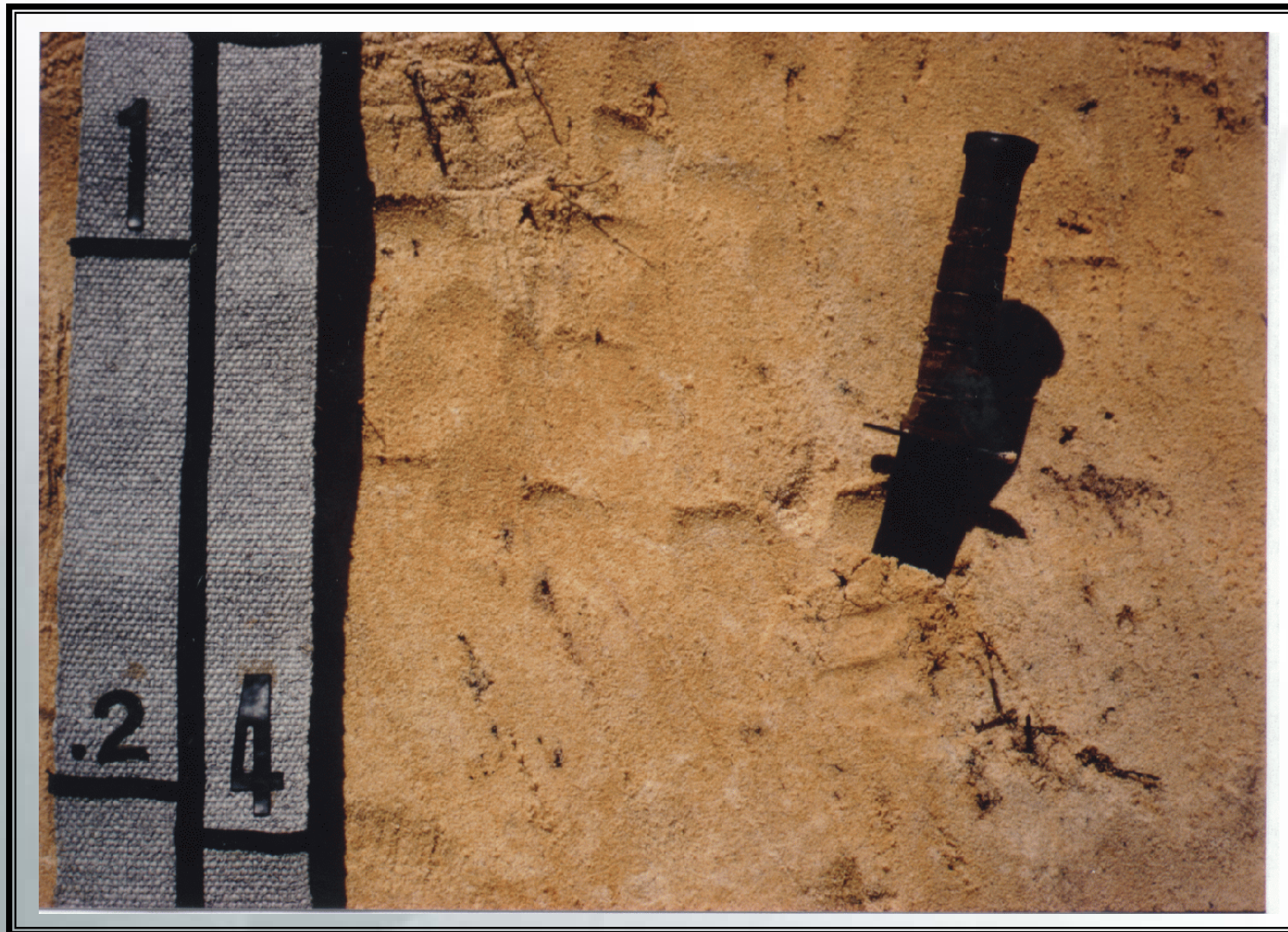
Sandy Soil, no mottles

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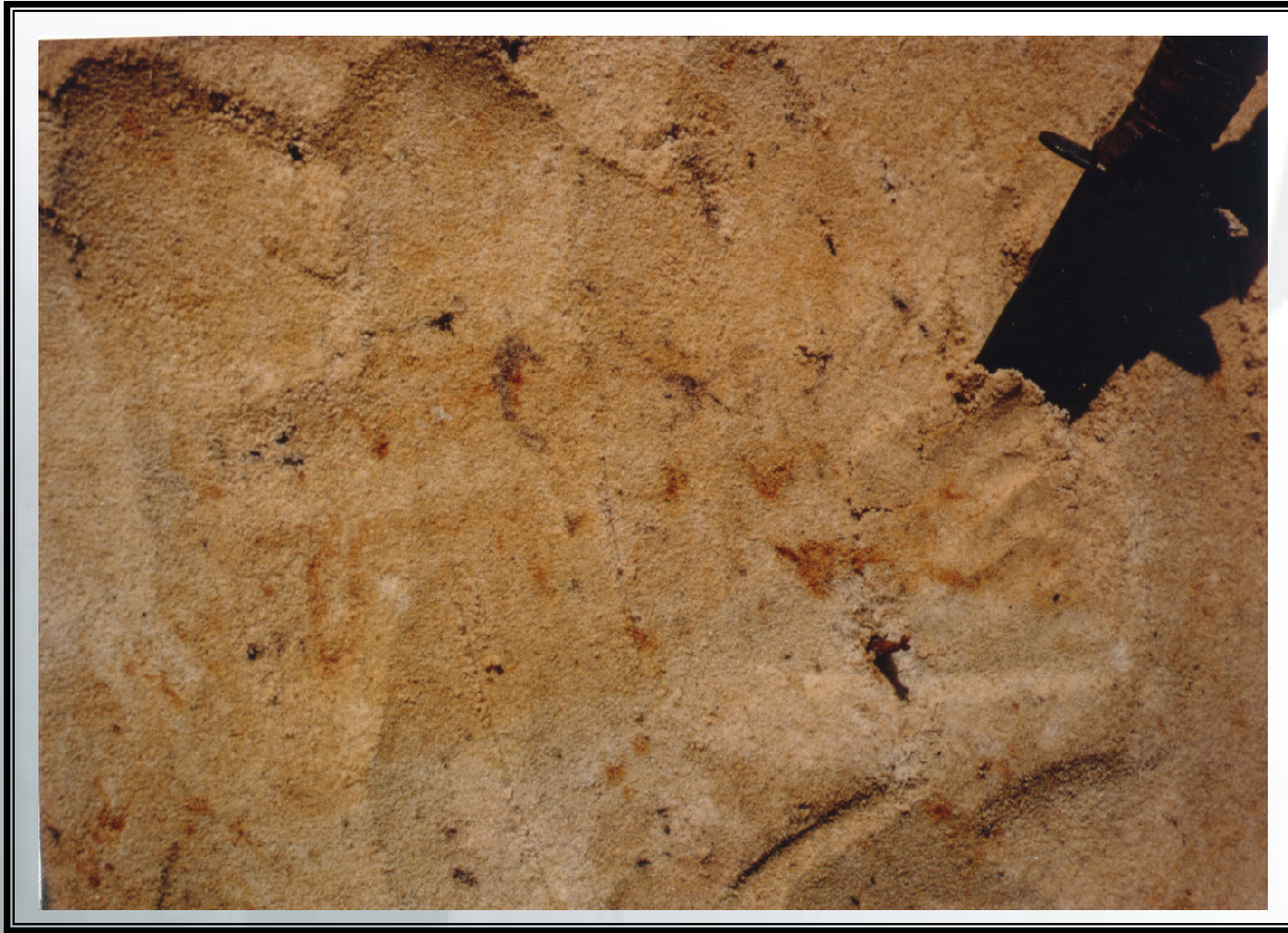
Sandy Soil - few mottles, not indicative of SHWT

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**Sandy Soil – common bright iron colored mottles,
indicative of SHWT**

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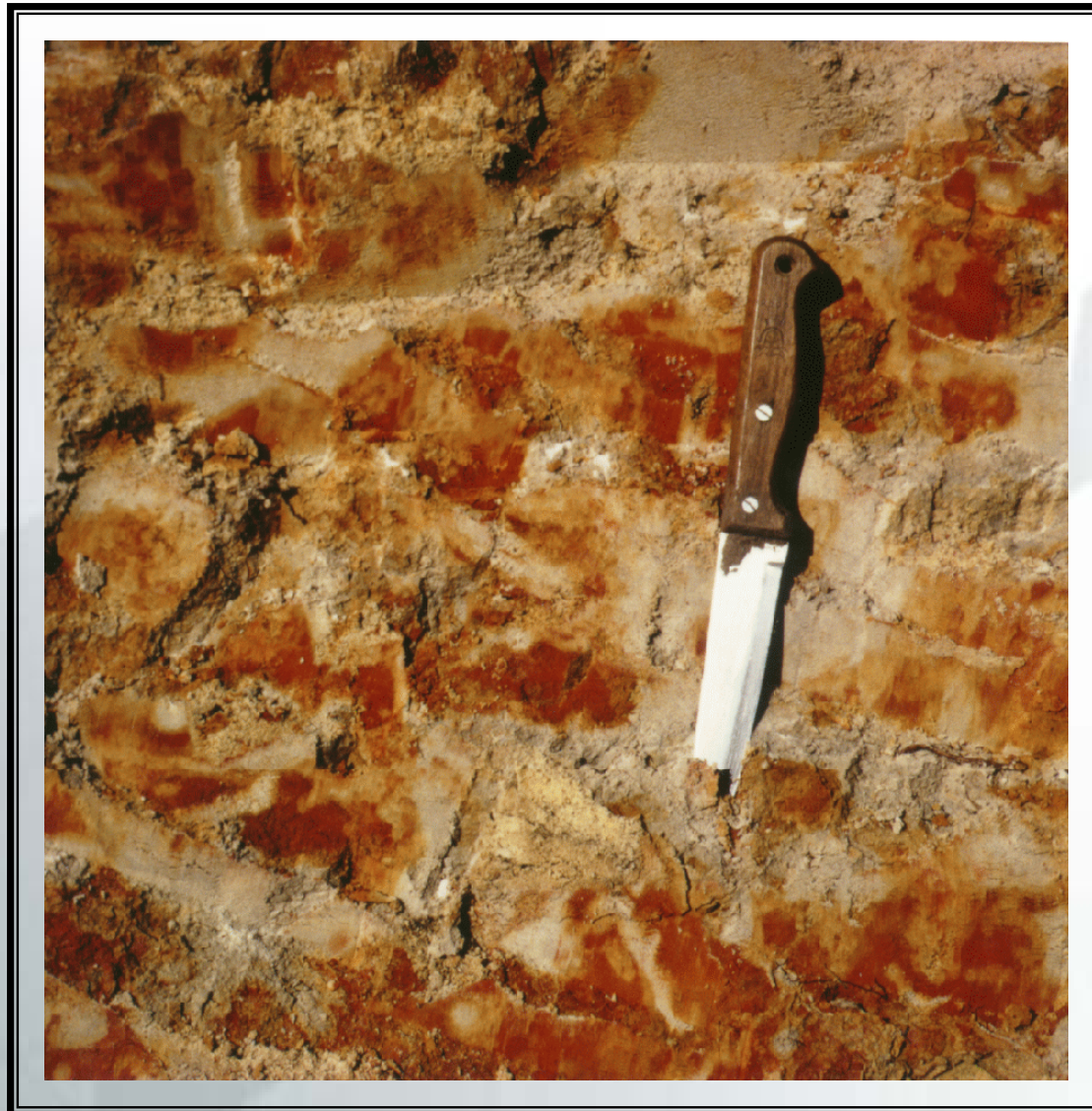
**Sandy Soil - many bright iron colored mottles,
indicative of SHWT**

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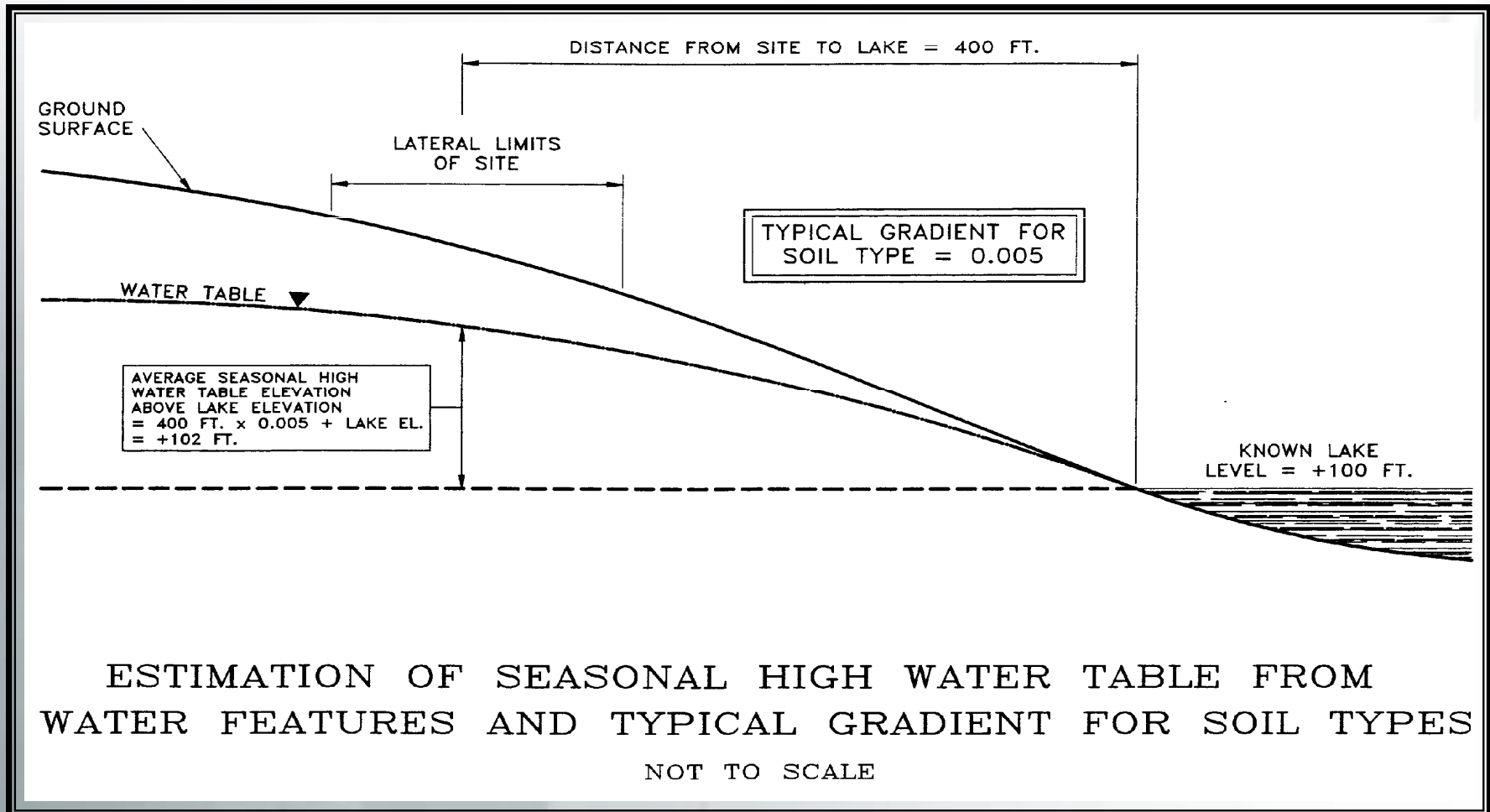
Loamy soil - gray at ped surfaces, indicative of SHWT

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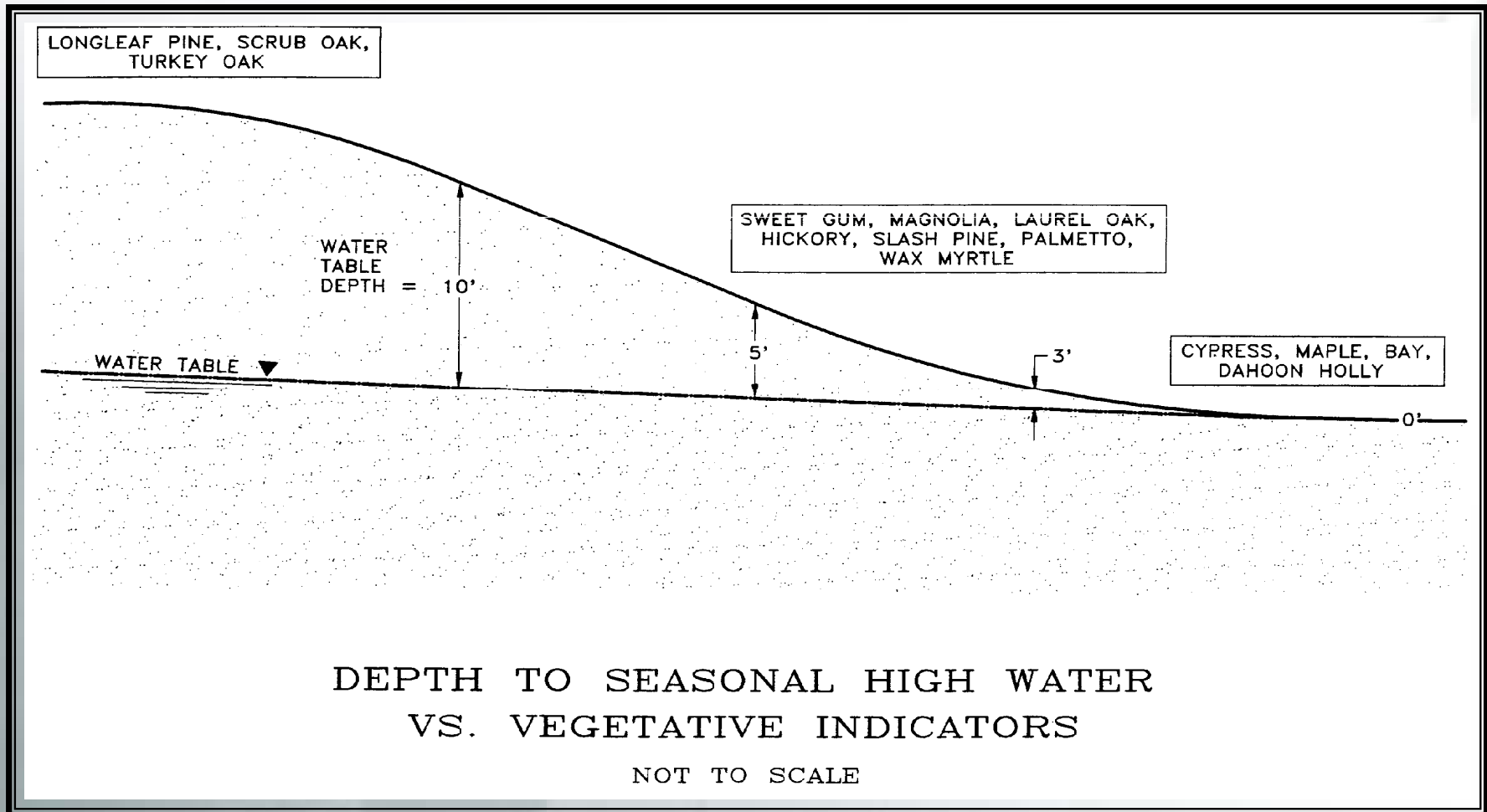
CORRELATION TO TYPICAL GRADIENTS

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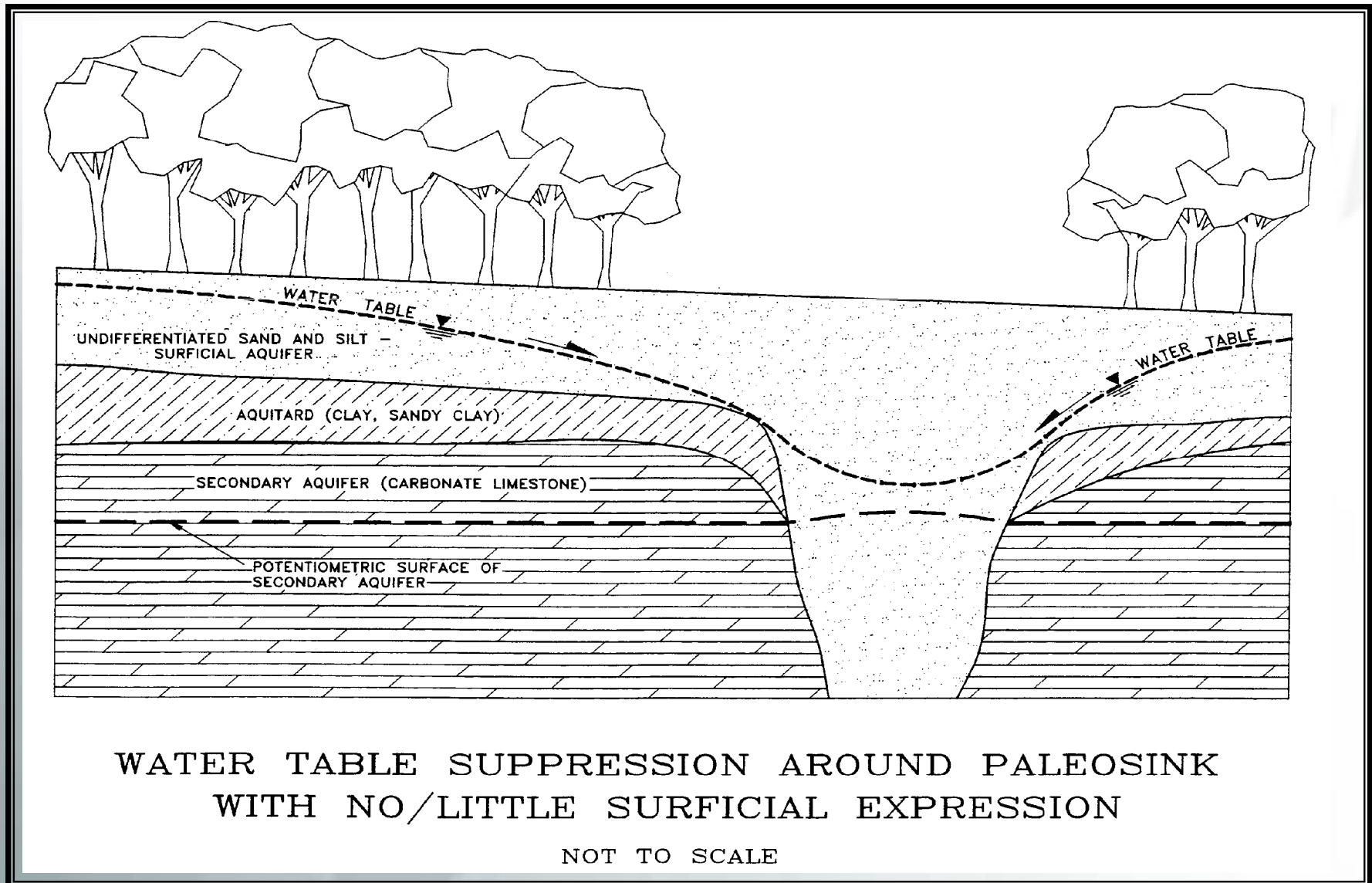
VEGETATIVE INDICATORS

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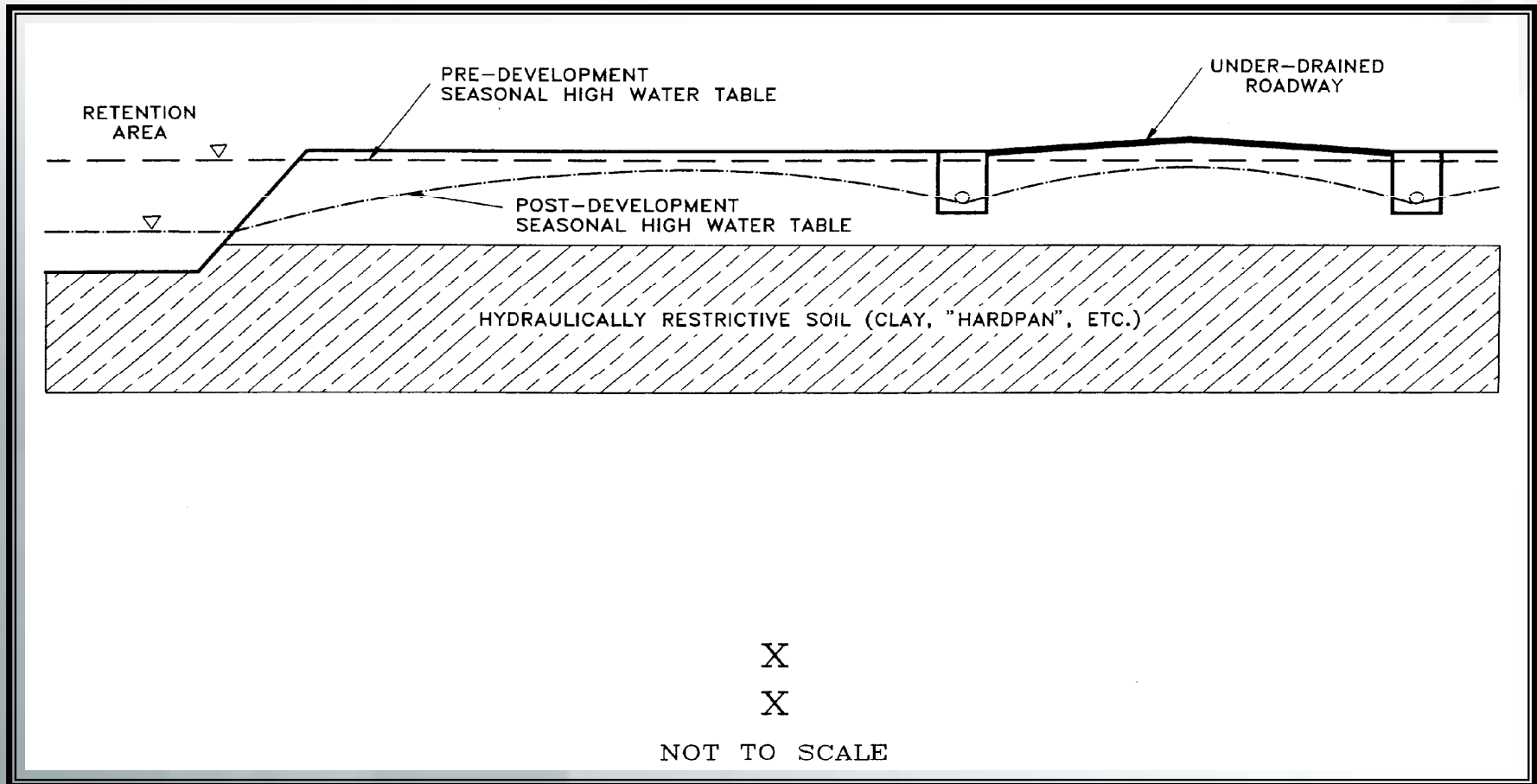
BURIED PALEOSINKS - ORANGE GROVE AERIALS

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IMPACTS OF DEVELOPMENT

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RECOMMENDED ADDITIONAL READING

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The following resource provides additional information on soil redoximorphic features:

**NRCS / SWFWMD
Seasonal High Ground Water Table
(SHGWT)
Workshop**



February / March, 2005

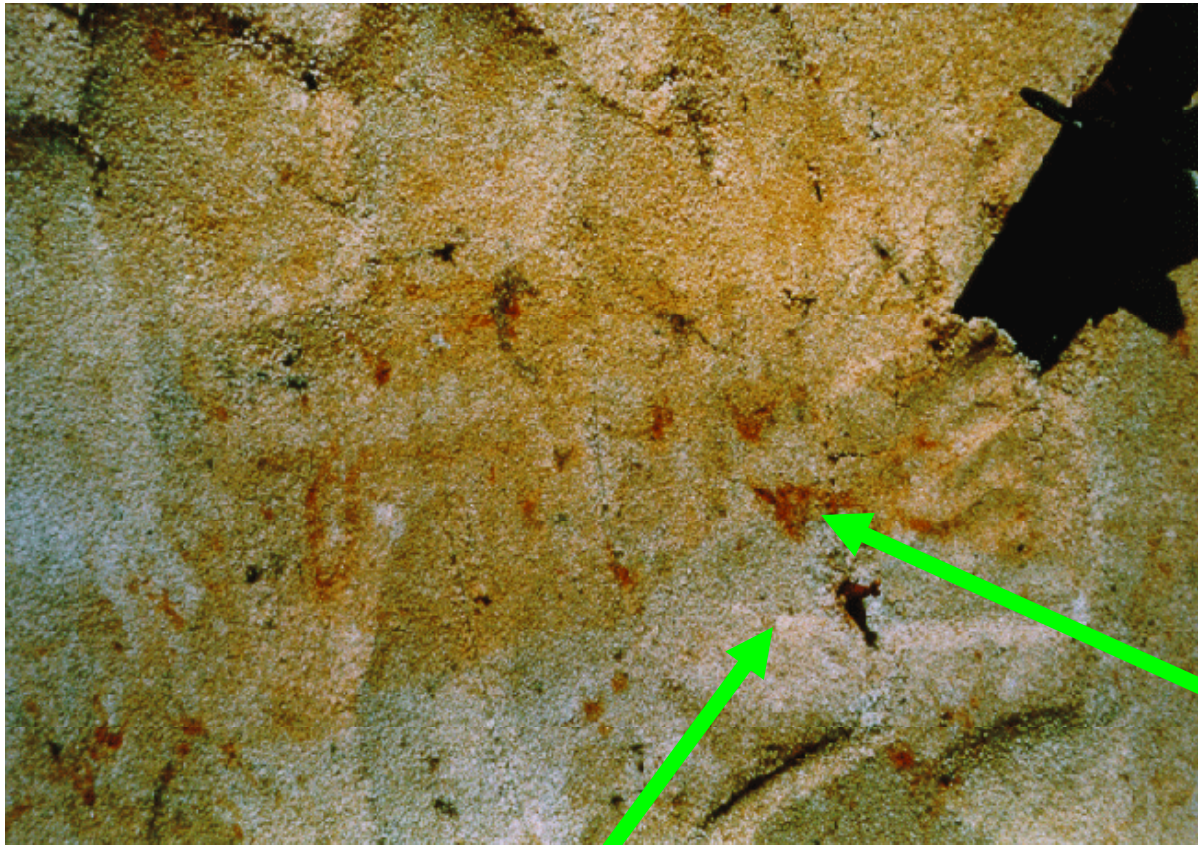
Definition of Mottles

Mottling, (Soil)

Irregular spots of different colors that vary in number and size. **Mottling generally indicates poor aeration and impeded drainage.** Descriptive terms are as follows: abundance (few, common, and many), size (fine, medium, and coarse), and contrast (faint, distinct, and prominent). The size measurements are of the diameter along the greatest dimension. Fine indicates less than 5 millimeters (about 0.2 inch); medium, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and coarse, more than 15 millimeters (about 0.6 inch).

Color soil profile showing many mottles

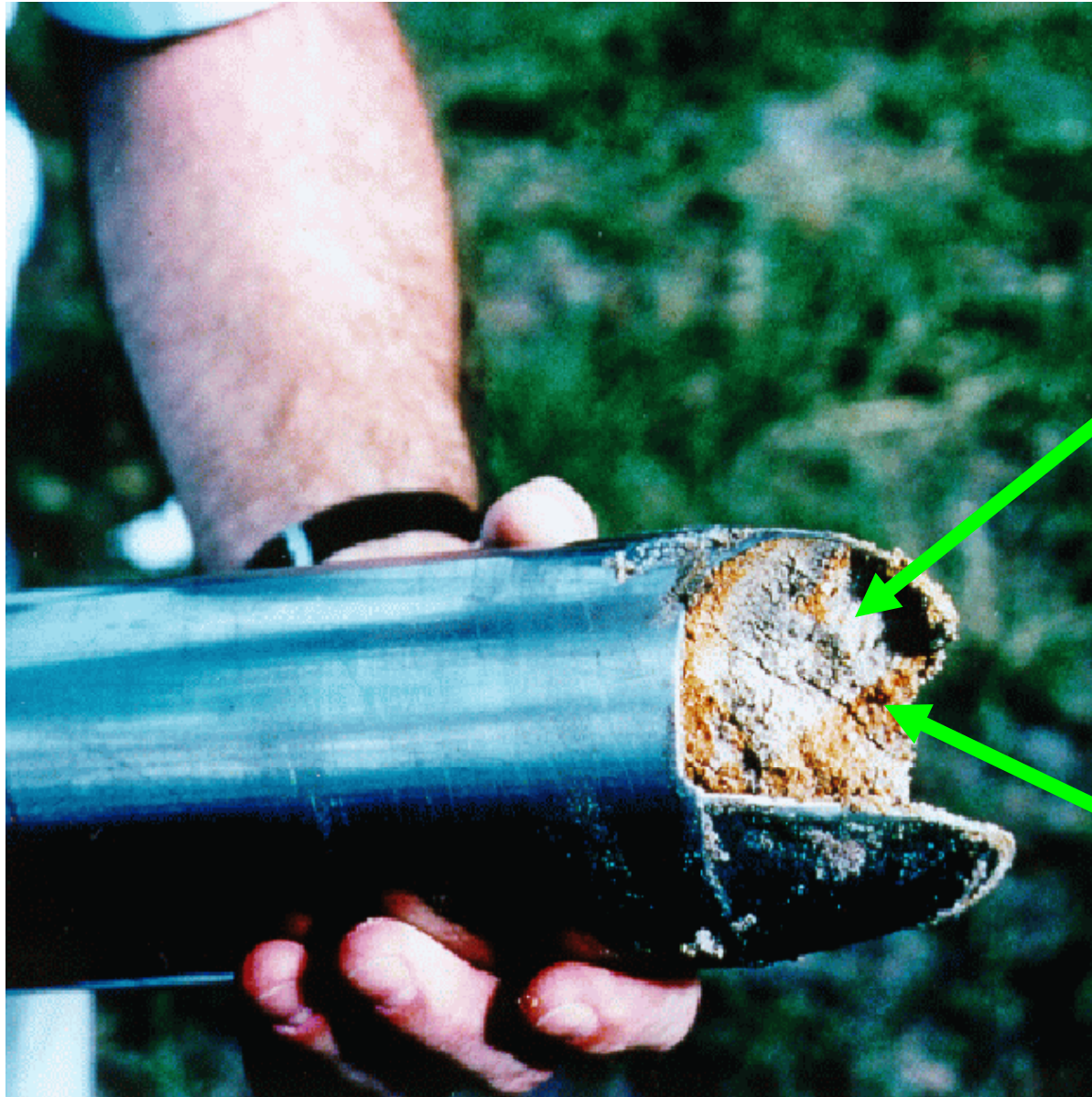
an indicator of the SHGWT



“Grey” soil colors, an indicator of wetness.

Soil mottles, an indicator of anaerobic (water saturated) conditions.

Color photograph of hand auger soil sample showing many soil mottles.



“Grey” soil colors, an indicator of wetness.

Soil mottles, an indicator of anaerobic (water saturated) conditions.

Color photograph of hand auger soil sample showing many soil mottles.

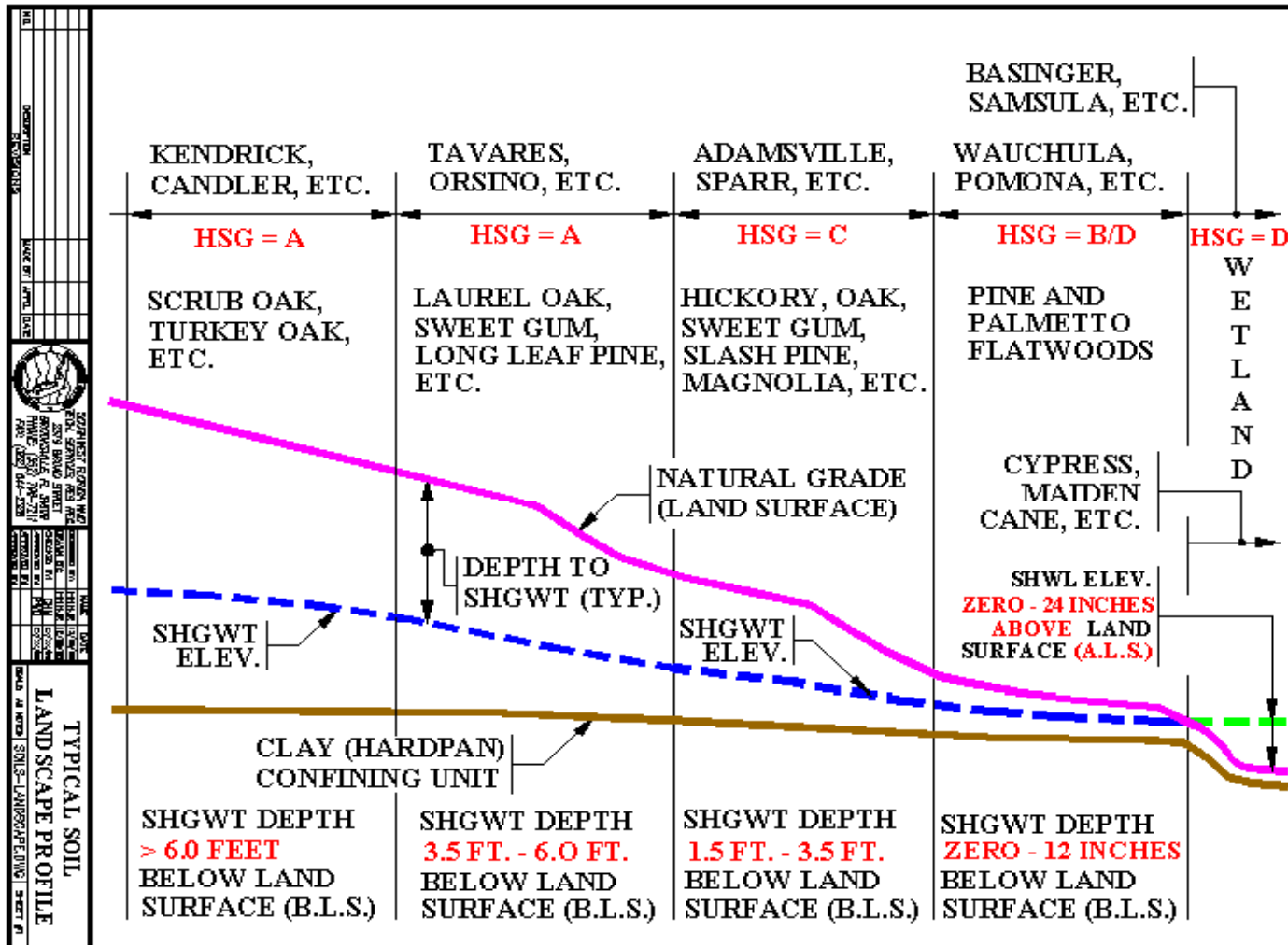


“Grey” soil colors, an indicator of wetness.

Soil mottles, an indicator of anaerobic (water saturated) conditions.

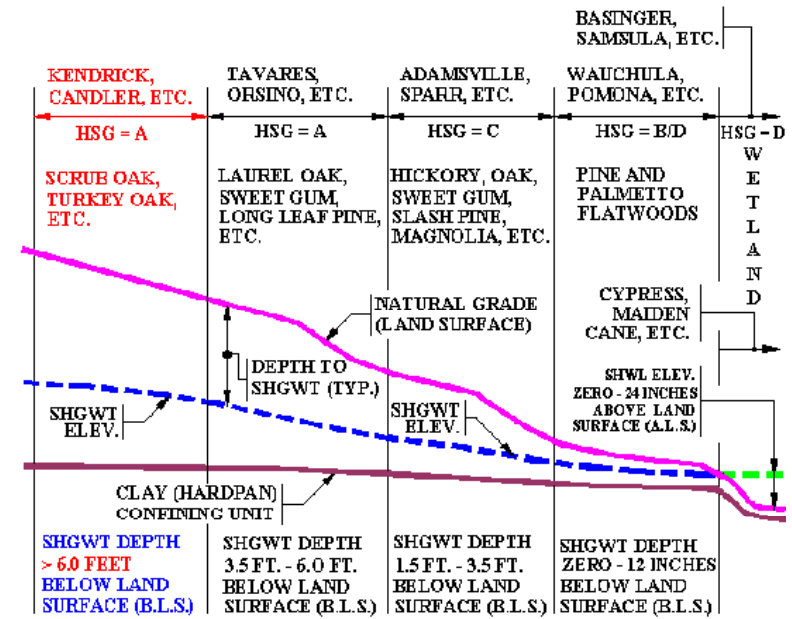
Natural vegetation (overstory & understory)

Remember your position on the landscape when performing your auger borings



Lake soil, HSG = A

SHGWT depth > 6.0 feet B.L.S.



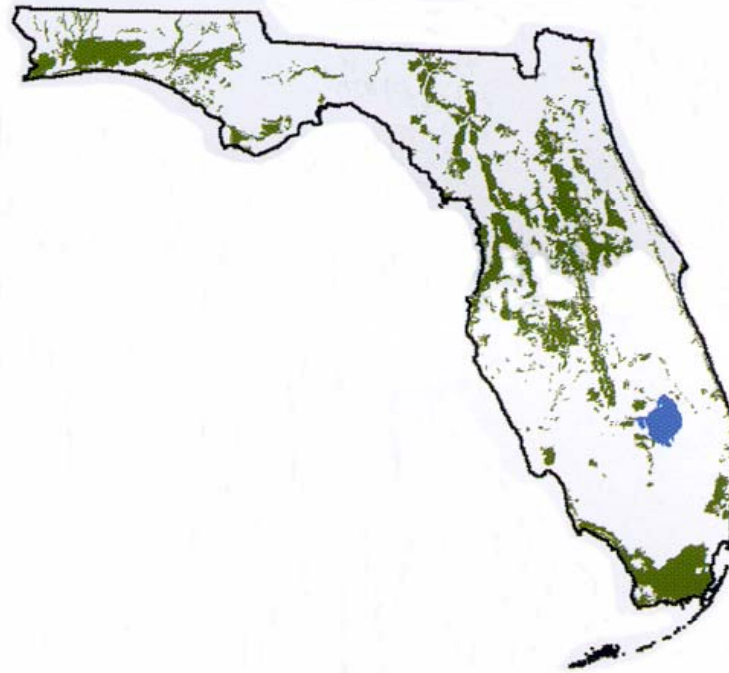
Notice the upland vegetation, consisting of **scrub and turkey oaks**, and a sparse ground cover, all of which indicate excessively drained (“dry”) conditions.

“Top of the hill” in regard to landscape position.

Generalized location map of Entisols

Excessively drained soils (i.e. sandy scrub) in **Central** Florida

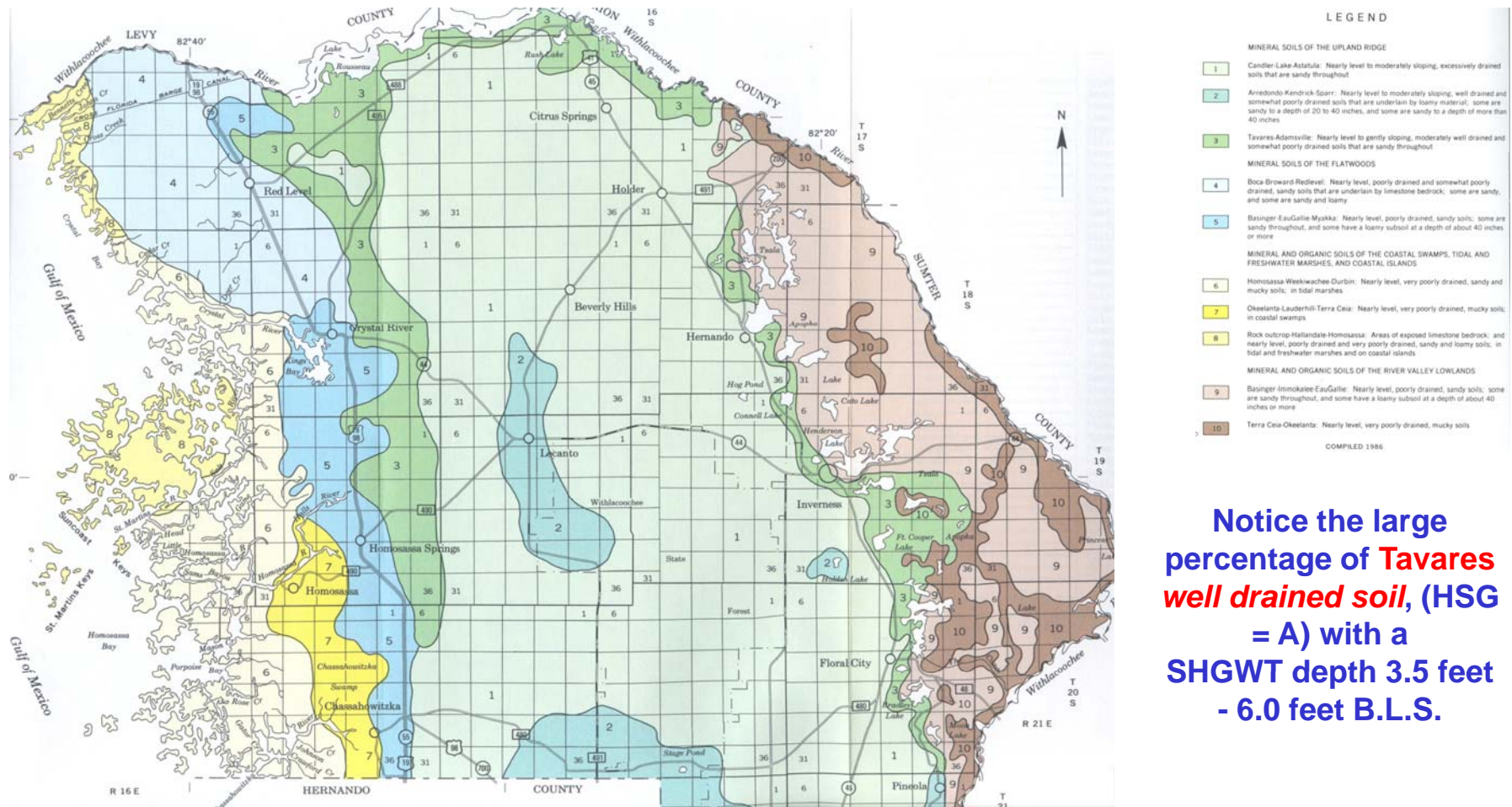
Not for site specific use. Refer to the [County Soil Surveys](#) for more detailed information.



ENTISOLS are generally young, sandy soils that show little or no development of pedogenic horizons except for ochric epipedons and albic horizons. Entisols are excessively to poorly drained. Some of the soils include the Astatula (see photo), Candler, Lakeland, Paola, Kershaw, Ortega, Chipley, and St. Lucie soils. Entisols cover approximately 7.5 million acres.

General Soils Map of Citrus County

For information purposes only, NOT for detailed site - specific investigations



Notice the large percentage of **Tavares well drained soil, (HSG = A)** with a **SHGWT depth 3.5 feet - 6.0 feet B.L.S.**

Note that the majority of Citrus County contains upland ridge **Candler and Kendrick excessively drained soils (HSG = A)** with a **SHGWT > 6' B.L.S.** **Karst topography is also present in many parts of this county (i.e. potential sinkholes).**

Candler soil, HSG = A
SHGWT depth > 6.0 feet B.L.S.

Color landscape photograph in S.E. 1/4 of S06, T28S, R20E (Hillsborough County), within Trout Creek Park (District property).



Kendrick soil, HSG = A

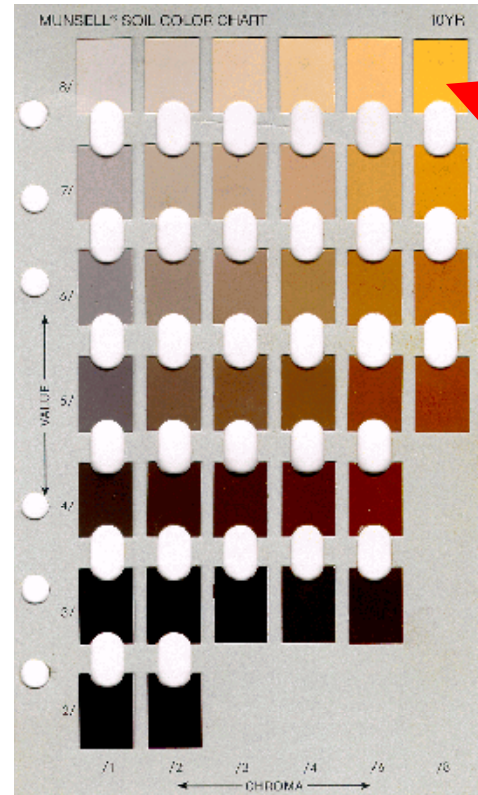
SHGWT depth > 6.0 feet B.L.S.

Color profile of soil



Notice the deep roots.

Notice the bright uniform colors, depth to the root zone, and a lack of soil mottles or hardpan.



Excessively drained, HSG = A soils typically fall in this area of the 10YR page.

10YR page. Upper right corner indicates excessively drained soils (HSG = A), lower left corner indicates wetlands (HSG = D).

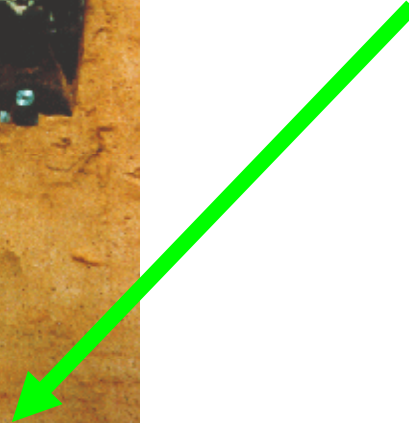
Candler soil, HSG = A
SHGWT depth > 6.0 feet B.L.S.

Color profile of soil



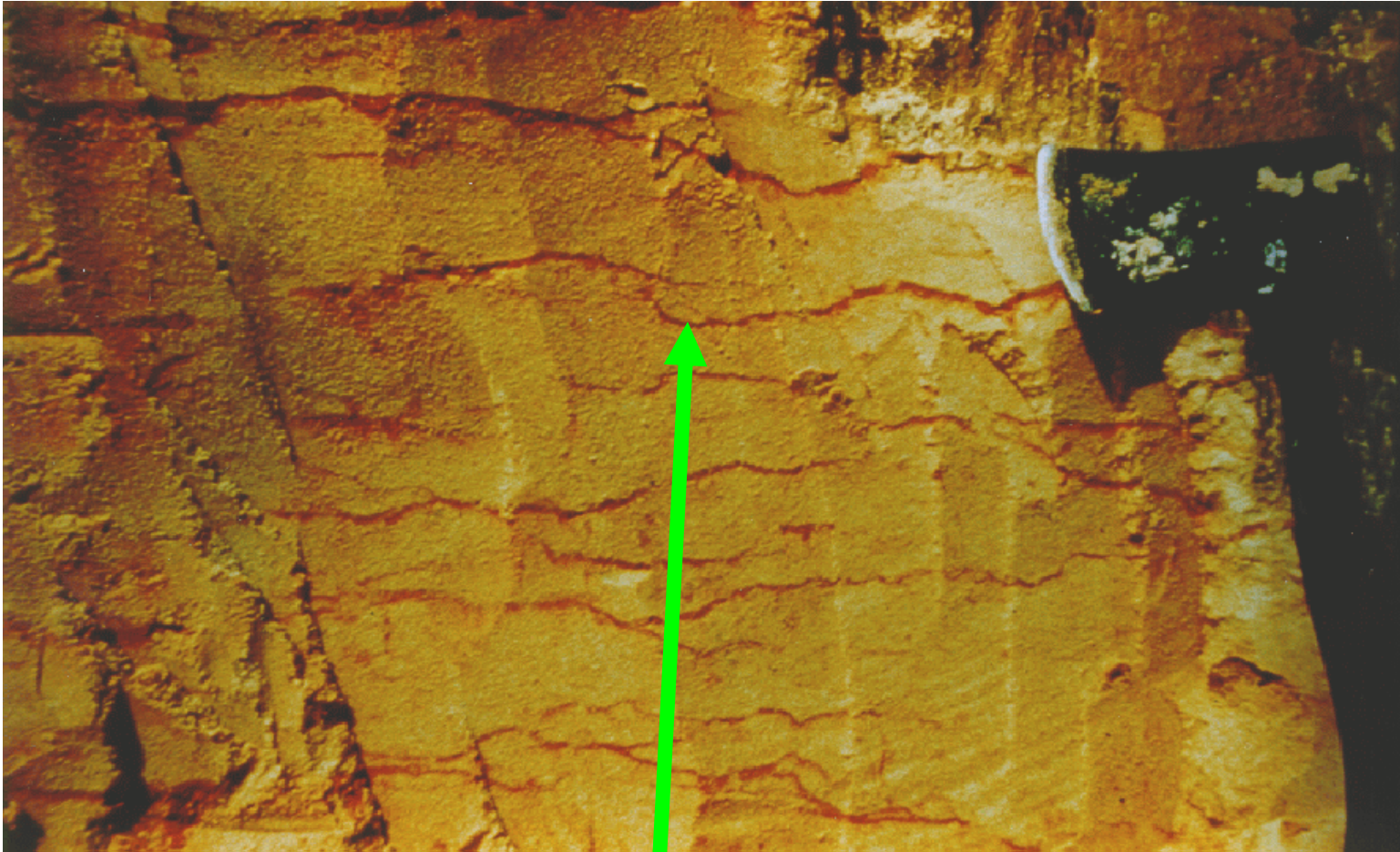
Lamella

(thin clay ribbons that are fractured, and do NOT impede the flow of ground water)



Candler soil, HSG = A
SHGWT depth > 6.0 feet B.L.S.

Color profile of soil

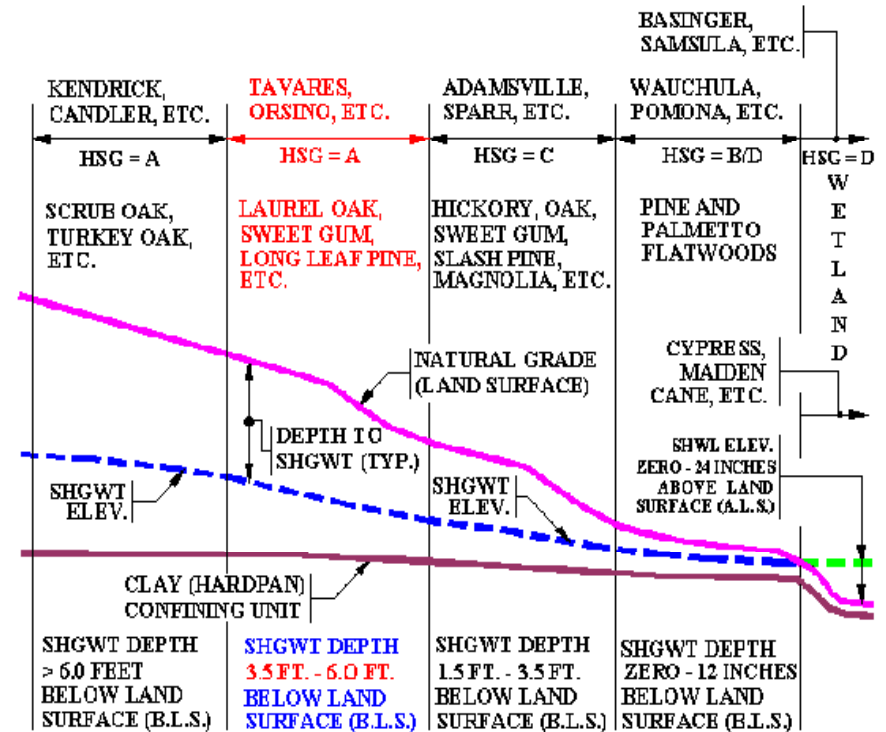


Lamella

(thin clay ribbons that are fractured, and do NOT impede the flow of ground water)

Tavares soil, HSG = A

SHGWT depth 3.5 feet - 6.0 feet B.L.S.



Notice the **change in upland vegetation**, and a **thicker ground cover**. Tavares is a well drained soil, with a higher SHGWT elevation.

Moving down gradient in regard to landscape position.

Sand Scrub on Duette soil

HSG = A

SHGWT depth 3.5 feet - 6.0 feet B.L.S.

Color landscape photograph in S.E. 1/4 of S31, T34S, R20E, Lake Manatee State Recreation Area (Manatee County)



Tavares soil, HSG = A

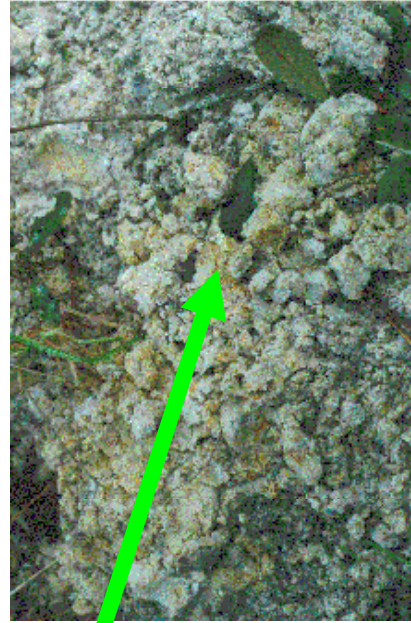
SHGWT depth 3.5 feet - 6.0 feet B.L.S.

Color profile of soil
(Highlands County)



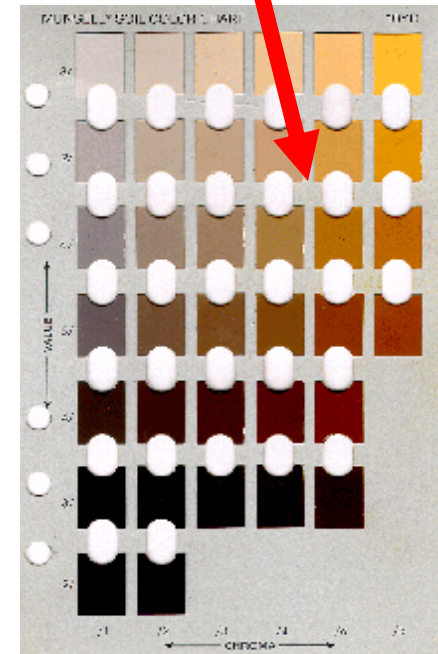
Notice the shallower root depths.

Notice the change in colors at this depth.



Soil mottles, an indicator of anaerobic (water saturated) conditions.

Well drained, HSG = A soils of this type typically fall in this area of the 10YR page.

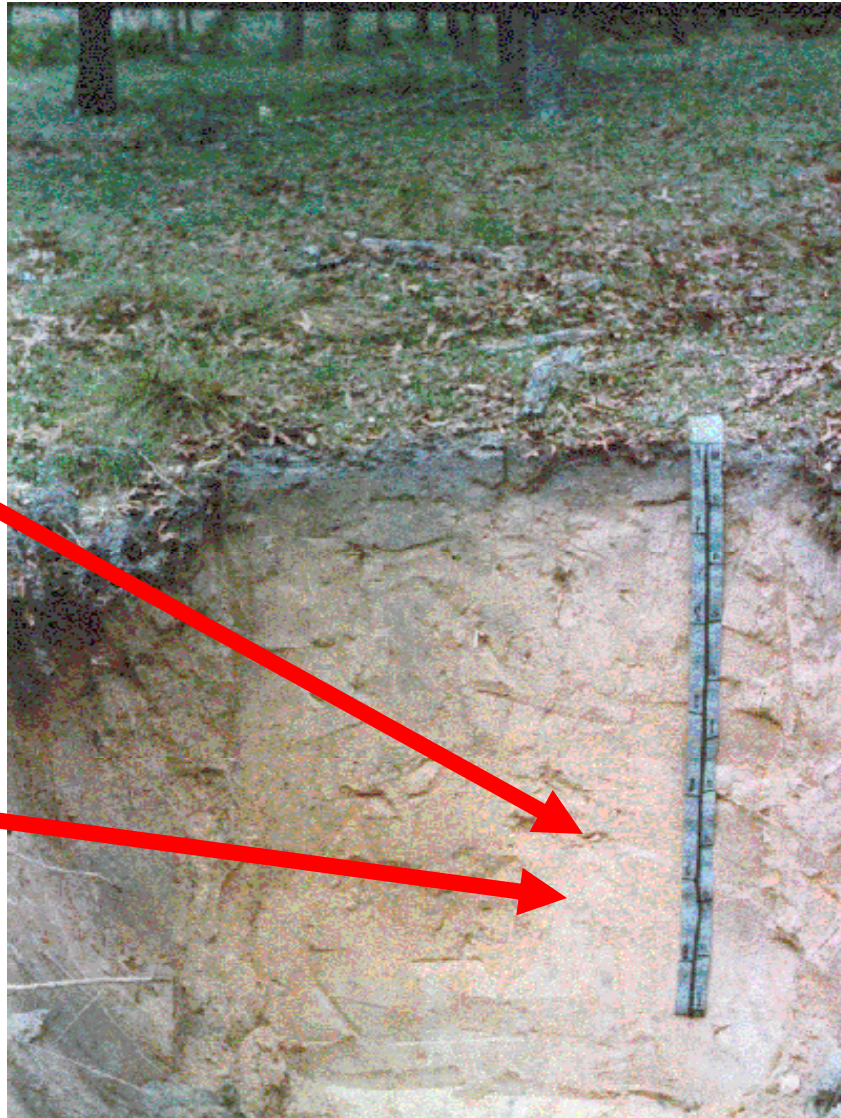


10YR page. Upper right corner indicates excessively drained soils (HSG = A), lower left corner indicates wetlands (HSG = D).

Tavares soil, HSG = A

SHGWT depth 3.5 feet - 6.0 feet B.L.S.

Color profile of soil (Pasco County)



Notice the shallower root depths.

Notice the change in colors at this depth.

Generalized location map of Alfisols

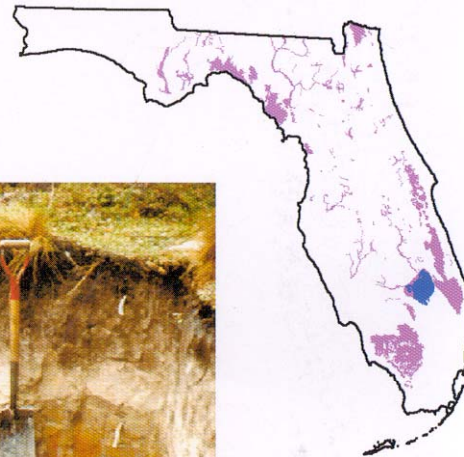
Extent of Alfisols Soils in Florida – 4.6 Million Acres

Not for site specific use. Refer to the County Soil Surveys for more detailed information.

ALFISOLS are soils that have an ochric epipedon (surface layer), an argillic horizon (subsoil with a higher clay content than the layers above), and a moderate to high level of bases. Alfisols range from well drained soils on ridges, and knolls to very poorly-drained soils on flats, depressions, and floodplains. Limestone sometimes occurs below the argillic horizon. Some of the more extensive Alfisols in Florida include the Boca, Felda (see photo), Malabar, Meggett, Pineda, and Riviera soils. Alfisols cover approximately 4.6 million acres.



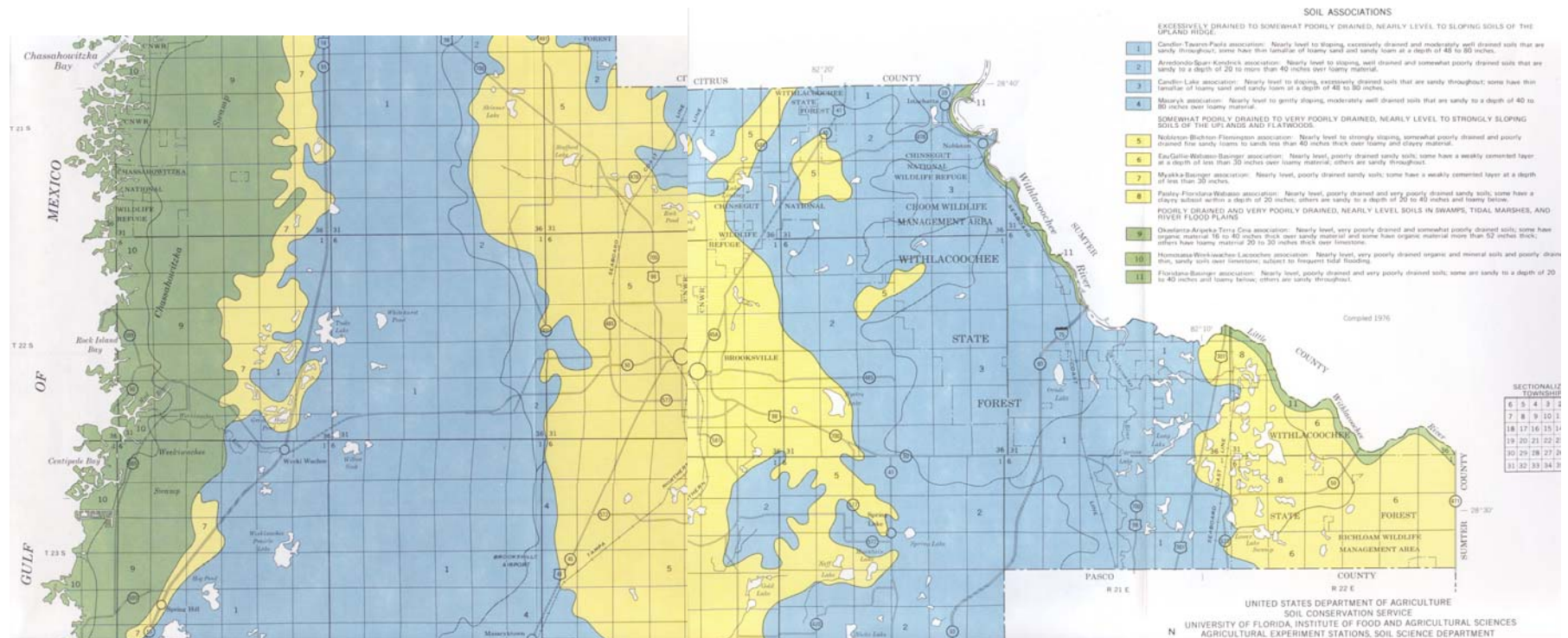
Alfisols



Alfisols are typically classified as moderately drained, HSG = C, with a SHGWT between 1.5' to 3.5' B.L.S.

General Soils Map of Hernando County

For information purposes only, NOT for detailed site - specific investigations



Note that a large portion of Hernando County contains **Nobleton / moderately to somewhat poorly drained soil** (HSG = C) with a **SHGWT > 1.5' – 3.5' B.L.S.**

Upland Hardwood Hammock on Micanopy soil

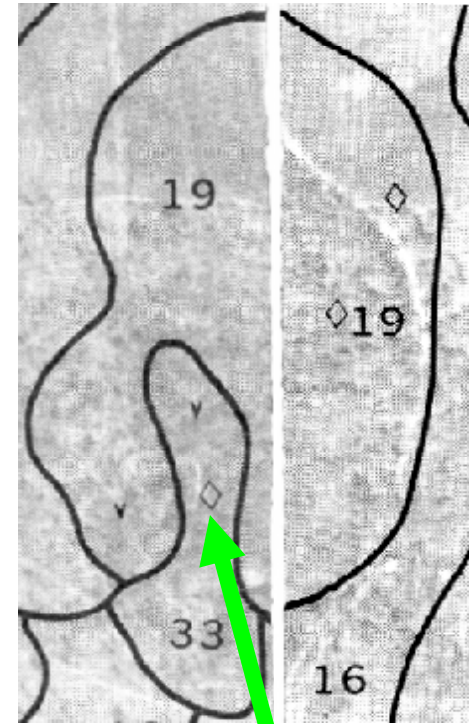
HSG = C

SHGWT depth 1.5 feet - 2.5 feet B.L.S.

Color landscape photograph in S.E. 1/4 of S017 T20S, R19E, (Withlacoochee State Forest, Citrus County)



**Relic sinkhole area
in background.**



**Notice diamond symbol
which indicates karst
topography**

Sparr soil, HSG = C

SHGWT depth 1.5 feet - 3.5 feet B.L.S.

Color profile of soil
(Hardee County)



Notice the shallower root depths.

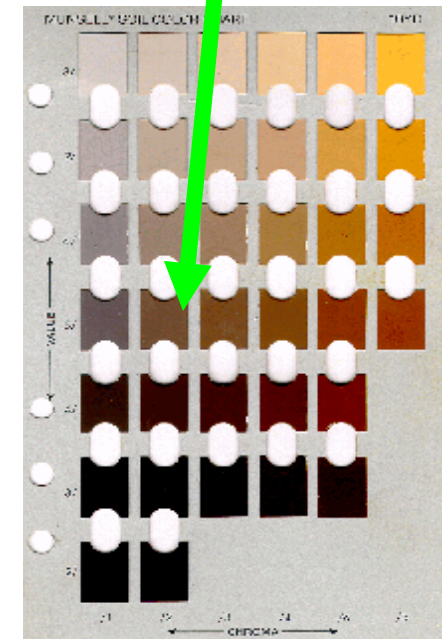


Soil mottles, an indicator of anaerobic (water saturated) conditions.

Notice the change in colors at this depth.

Notice the well defined hardpan.

Moderately drained, HSG = C soils typically fall in this area of the 10YR page.



10YR page. Upper right corner indicates excessively drained soils (HSG = A), lower left corner indicates wetlands (HSG = D).

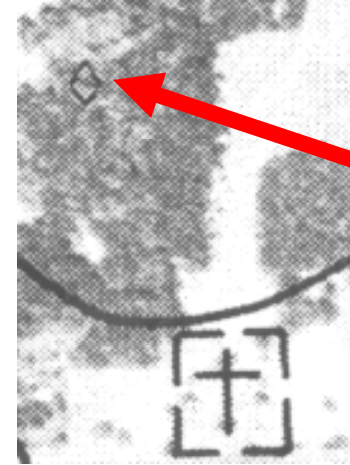
Sparr soil, HSG = C

SHGWT depth 1.5 feet - 3.5 feet B.L.S.

Color photograph of soil in S.E. 1/4 of S04, T19S, R18E, Private property, Citrus County



Notice the presence of many soil mottles at a depth of 36± inches B.L.S..



Per the special (diamond) symbol on the NRCS soils map, this is a potential karst (sinkhole) area.



Naturally occurring Cedar trees are also an indicator of karst topography.

Sparr soil, HSG = C
SHGWT depth 1.5 feet - 3.5 feet B.L.S.

Color profile of soil (Citrus County)



Notice the shallower root depths.

Notice the change in colors at this depth.

Notice the well defined hardpan.

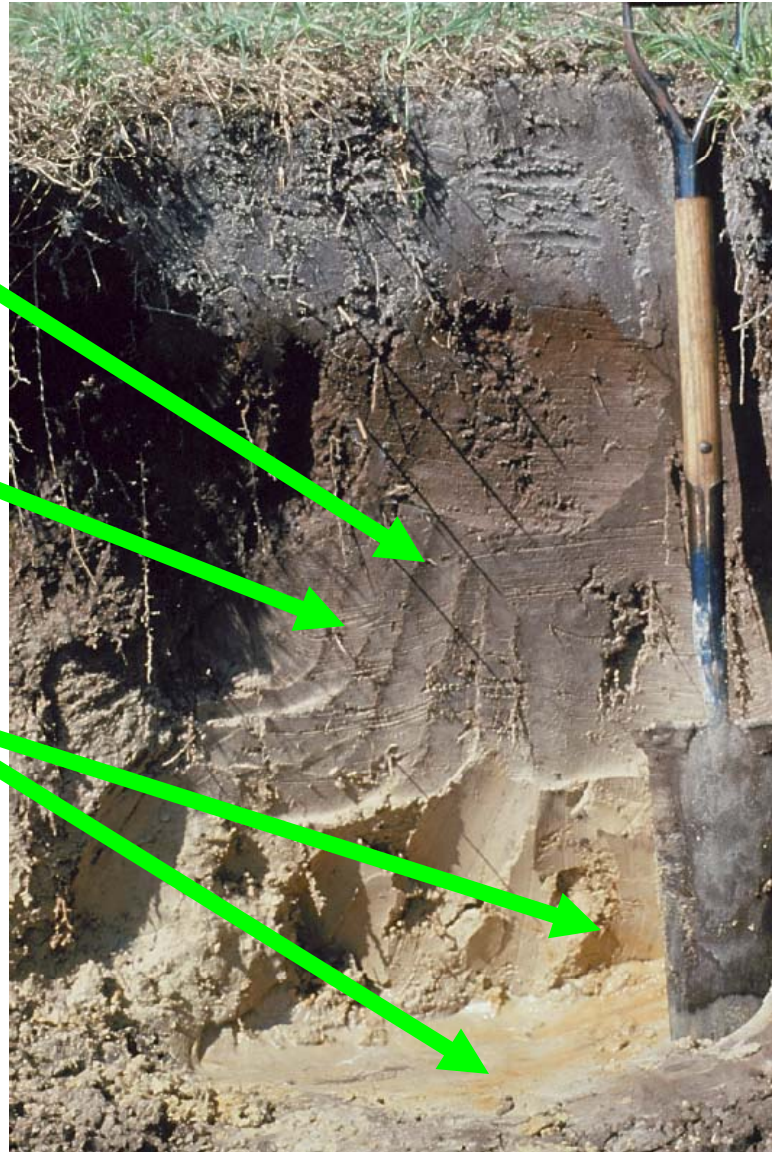
Narcoossee soil, HSG = C
SHGWT depth 2.0 feet - 3.5 feet B.L.S.

Color profile of soil (Pasco County)

Notice the shallower
root depths.

Notice the
change in colors
at this depth.

Notice the well
defined hardpan.

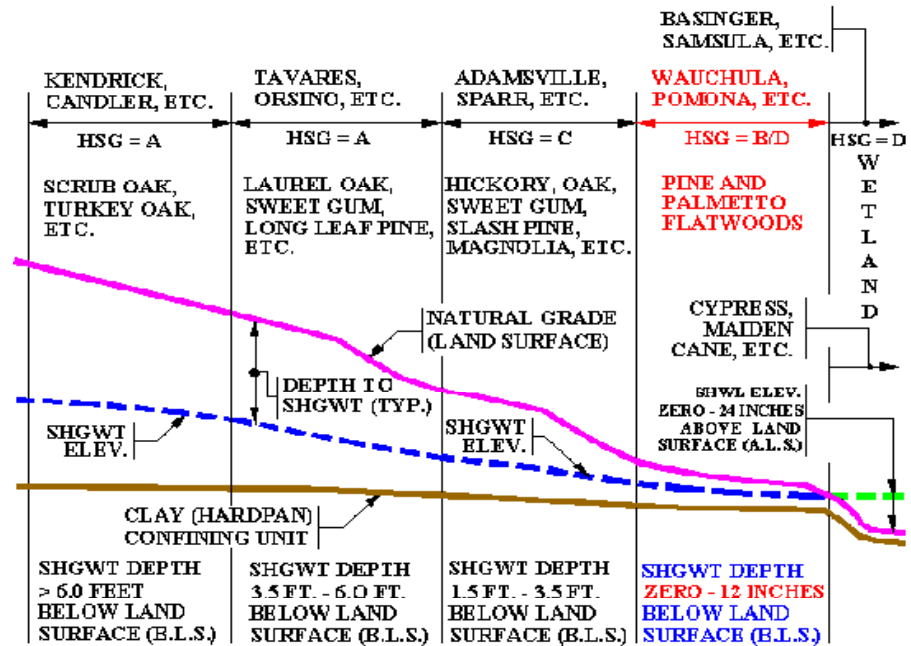


Pomona soil, HSG = B/D

SHGWT depth 0 inches - 12 inches B.L.S.



Typical pine flatwoods soil. Pomona is a poorly drained soil, with a SHGWT elevation at (or near) the surface.

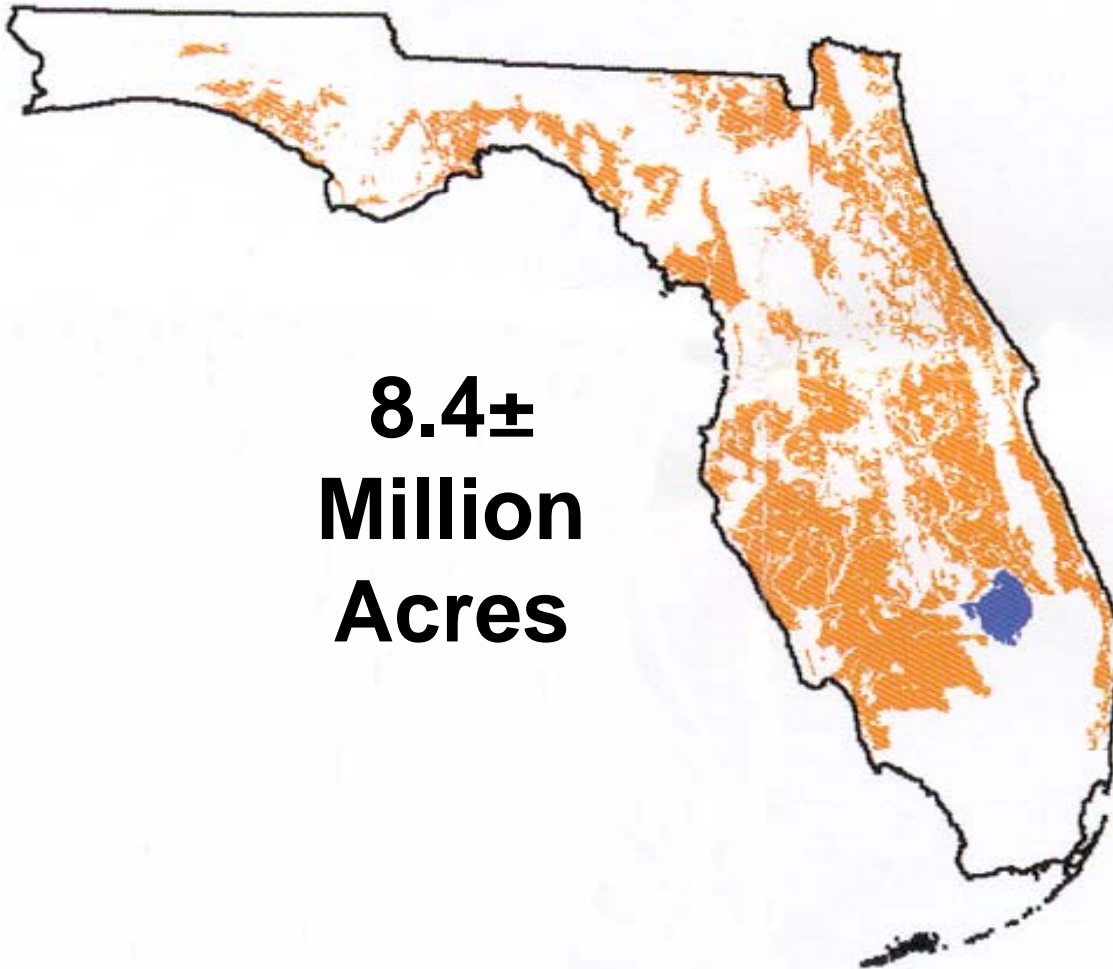


Moving farther down gradient in regard to landscape position.

Refer to the reference material handouts for a copy of the SWFWMD Training Memorandum entitled "USDA- NRCS Hydrologic Soil Groups and Development Effects". For the vast majority of cases, a B/D soil should be considered as a HSG = D.

Generalized location map of Spodosols (i.e. Pine Flatwoods)

Not for site specific use. Refer to the County Soil Surveys for more detailed information.



**8.4±
Million
Acres**

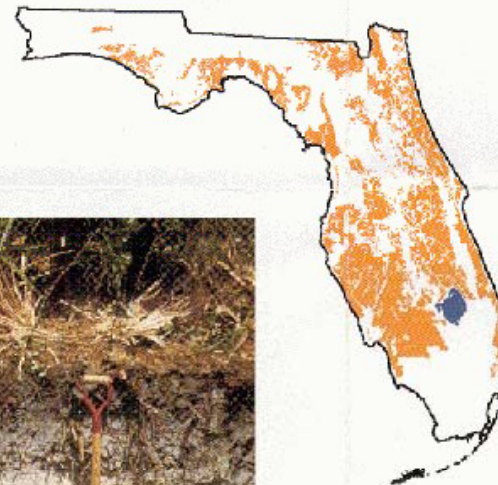
**Most of the “good”
land in central and
south Florida has
already been
developed. What is
left is wetlands,
flood plains and Pine
Flatwoods soils
(with a SHGWT
depth of 0” – 12”
B.L.S.).**

Definition of Spodosols

Extent of Pine Flatwoods Soils in Florida – 8.4 Million Acres

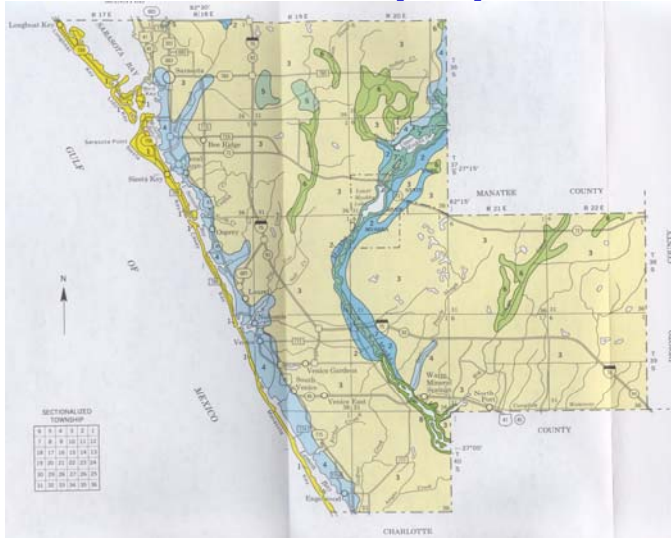
SPODOSOLS are soils that have an accumulation of organic matter and aluminum in a layer (spodic horizon) in the subsoil. Properties include translocated organic matter and aluminum, or organic matter, aluminum, and iron, as amorphous materials forming a spodic horizon. They developed in sandy, acid parent materials. The majority of the Spodosols in Florida are poorly or very poorly-drained, and are widespread in the flatwoods of Florida. Spodosols include the Myakka, Leon, Immokalee, Pomona, and Smyrna soils. The Myakka soil has been designated as the Florida State Soil (see photo). Spodosols cover approximately 8.4 million acres.

Spodosols

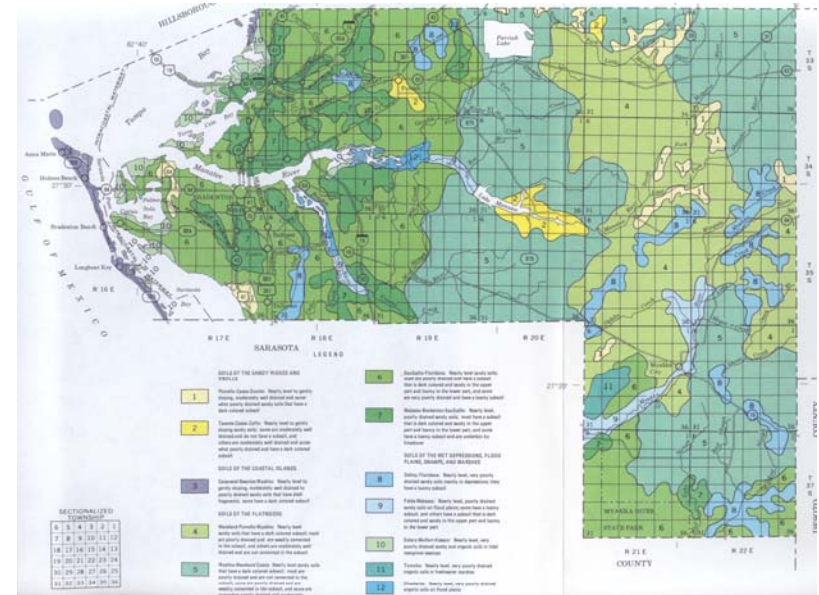


General Soils Map of Sarasota, Manatee and DeSoto Counties

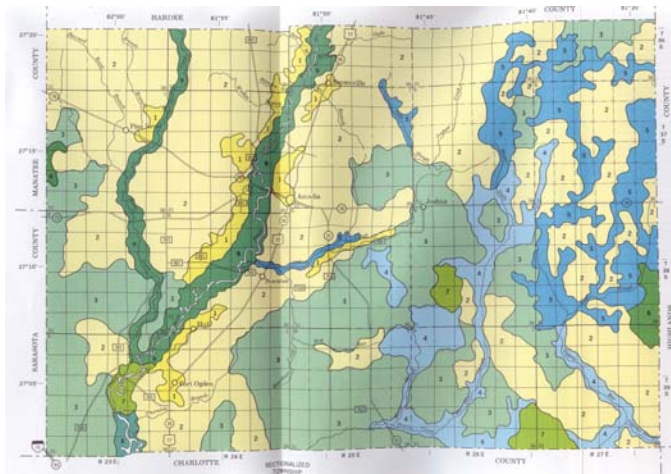
For information purposes only, NOT for detailed site - specific investigations



- SOILS ON THE COASTAL PLAINS:**
- 1 CANAVELLA BEACHED MEDIUM: Beaches and nearby lower to gently sloping, moderately well drained, somewhat poorly drained, and very poorly drained soils that have small fragments and thin to very poorly drained zones from a surface layer of sand.
- SOILS ON HAMMOCKS:**
- 2 MIRAZZO CASUALTY FIELDS: Nearly level, poorly drained, and very poorly drained soils that have a sandy, and sandy subsoil or a heavy subsoil.
- SOILS ON FLATWOODS:**
- 3 KAYVILLE MYNKA HICKORY PINES: Nearly level, poorly drained and very poorly drained soils that have a sandy surface layer and a heavy subsoil, are sandy throughout, or have a sandy surface layer and a heavy subsoil.
 - 4 POMELLO SPINNA SUGALLO: Nearly level, moderately well drained and poorly drained, sandy, and clay or more clayey soils in the upper part of the subsoil and soil part.
- SOILS IN INTERDUMPS:**
- 5 FLORISSA: Nearly level, very poorly drained, sandy soils that have a heavy subsoil.
 - 6 FELDHALLOWAY DELUAY: Nearly level, very poorly drained, sandy soils that have a heavy subsoil.
- SOILS ON FLOOD PLAINS:**
- 7 DELRAY FIELDS (FORMER): Nearly level, very poorly drained and poorly drained, sandy soils that do not erode from a heavy subsoil but in some areas are sandy throughout.
 - 8 KESLON WILKYTT: Nearly level, very poorly drained, sandy and organic soils in interdune swamps.
- Compiled 1991



- LEGEND**
- SOILS ON THE SANDY PINNACLES:**
- 1 ZULO FERRASS: Nearly level to gently sloping, somewhat poorly drained and moderately well drained soils that are sandy throughout, some have a heavy subsoil and/or a depth of more than 40 inches.
- SOILS ON THE FLATWOODS:**
- 2 SPINNA SPINNA SPINNA: Nearly level, poorly drained soils that are sandy throughout and that have a subsoil of more than 40 inches and/or a depth of more than 40 inches.
 - 3 FERRASS CASUALTY OF MANAHO: Nearly level, poorly drained, sandy soils that have a dark colored subsoil or a subsoil colored within a depth of 15 inches that is uncolored to heavy mottled.
- SOILS ON THE SUBSIDES:**
- 4 VALASSA PINNACLE BALASSA: Nearly level, poorly drained, sandy soils that have a heavy subsoil and a depth of more than 40 inches.
 - 5 VALASSA PINNACLE BALASSA: Nearly level, poorly drained soils that are sandy throughout and have a depth of more than 40 inches and/or a depth of more than 40 inches.
- SOILS OF THE BEST EXPRESSIONS, SANDY, THAL, SANDY, AND FLOOD PLAINS:**
- 6 FLORISSA CASUALTY FIELDS: Nearly level, very poorly drained, sandy soils that have a heavy subsoil and a depth of 20 inches.
 - 7 SARTON SPINNA CASUALTY: Nearly level, very poorly drained soils that are sandy throughout and have a depth of more than 40 inches and/or a depth of more than 40 inches.
 - 8 SPINNA SPINNA CASUALTY: Nearly level, very poorly drained soils that are sandy throughout and have a depth of more than 40 inches and/or a depth of more than 40 inches.
 - 9 SANDY SPINNA CASUALTY: Nearly level, very poorly drained soils that are sandy throughout and have a depth of more than 40 inches and/or a depth of more than 40 inches.
- Compiled 1991



Note that the majority of these Counties consist of Pine Flatwoods Soils (poorly drained), with a SHGWT from 0" – 12" B.L.S.

Special Definition of Soils With Variable HSG Classifications (i.e. A/D, B/D, etc.)

Some soils are listed in the NRCS Soil Surveys as being in more than one HSG. **Such soils** (indicated as A/D or B/D) **are in HSG D in their natural (pre-developed) condition** because of high water table conditions that create drainage impedance. If these soils can be effectively drained (and properly maintained) they may be reclassified in a different HSG. For instance, an Ona soil is classified as HSG B/D. This indicates that effectively drained (and maintained) Ona soil can be reclassified as high as HSG B, but it can not be HSG A.

South Florida Flatwoods on Pomona soil

HSG = B/D

SHGWT depth 0 inches - 12 inches B.L.S.

Color landscape photograph, Green Swamp along the Van Fleet Trail, Polk County

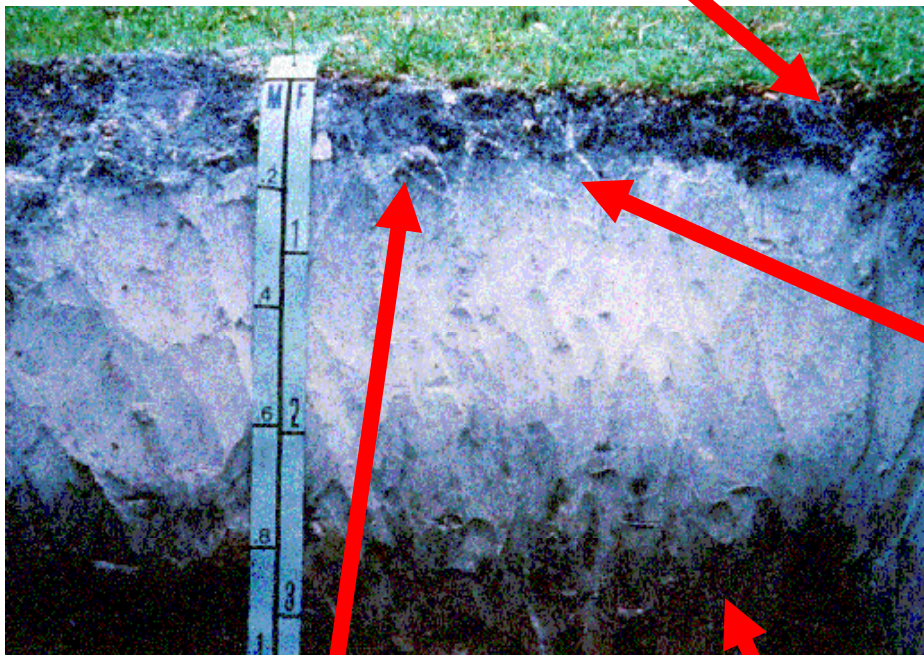


Bassinger soil, HSG = B/D

SHGWT depth 0 inches - 12 inches B.L.S.

Color profile of soil

Notice that all of the roots are concentrated at the surface.



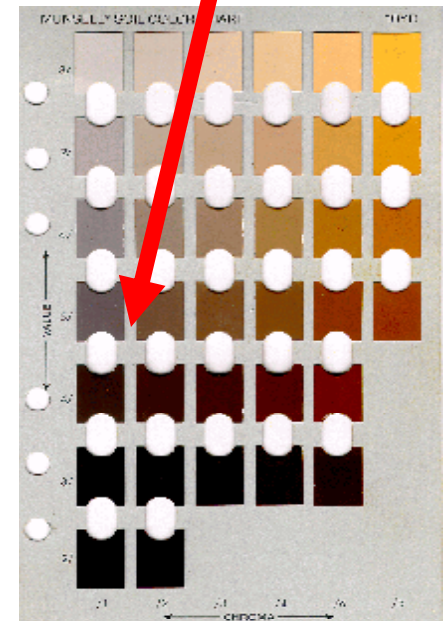
“Grey” colors indicate wetness.

Spodic horizon.

For the vast majority of cases, a B/D soil should be considered as a HSG = D.

Notice the color change at this depth.

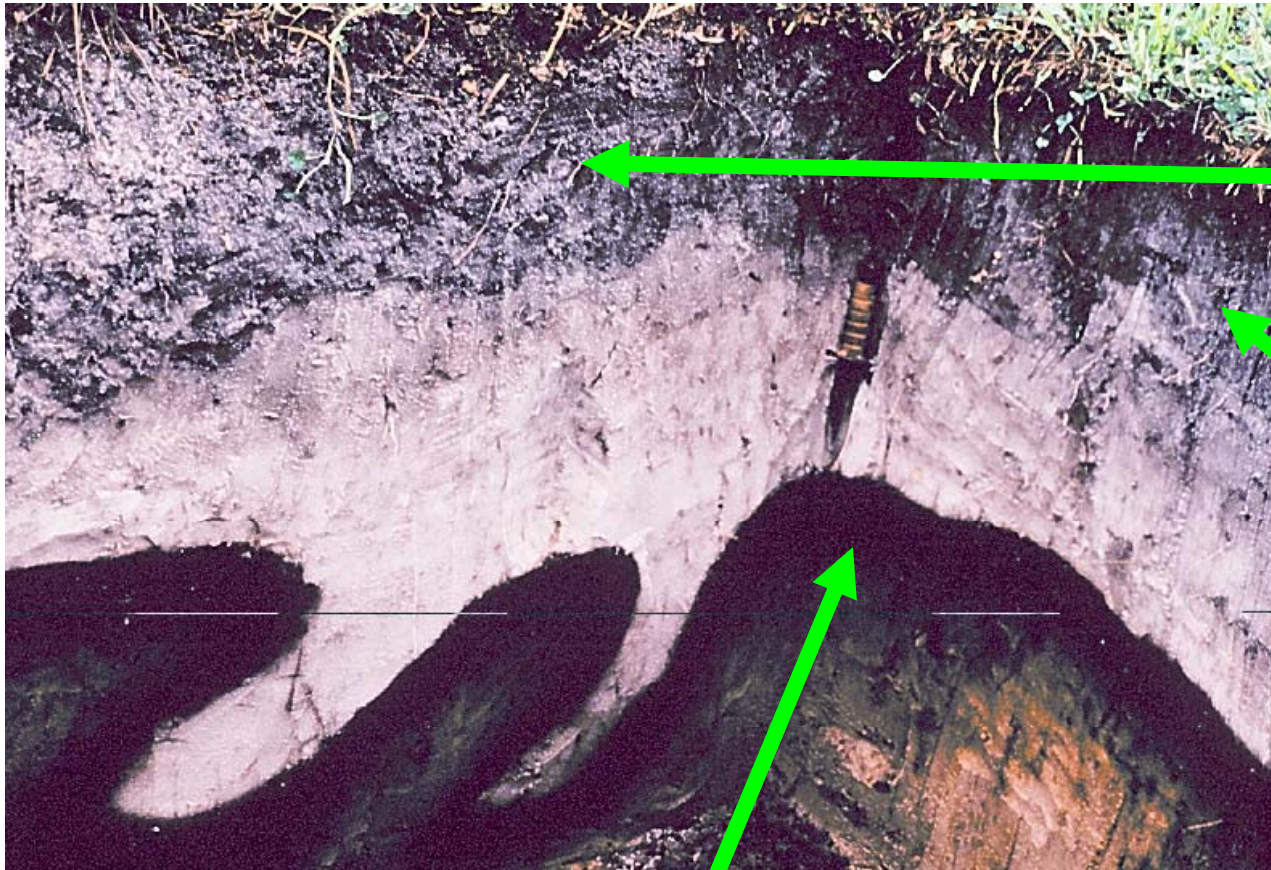
Poorly drained, HSG = B/D soils typically fall in this area of the 10YR page.



10YR page. Upper right corner indicates excessively drained soils (HSG = A), lower left corner indicates wetlands (HSG = D).

Symrna soil, HSG = B/D
SHGWT depth 0 inches - 12 inches B.L.S.

Color soil profile, Highlands County



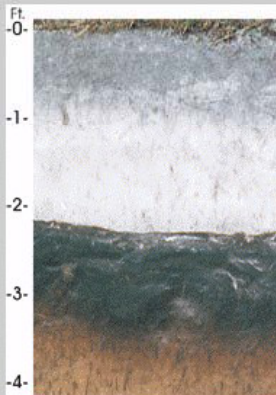
Notice that all of the roots are concentrated at the surface.

“Grey” colors indicate wetness.

Spodic horizon.

Myakka soil, HSG = B/D
SHGWT depth 0 inches - 12 inches B.L.S.

Myakka -- Florida State Soil



Myakka Soil Profile

[Myakka Series](#)

**Sandy, siliceous, hyperthermic
Aeric Alaquods**

Surface layer: gray fine sand
 Subsurface layer: light gray fine sand
 Subsoil: dark reddish brown fine sand with organic stains
 Substratum: brown and yellowish brown fine sand

The State of Florida has the largest total acreage of Aquods (wet, sandy soils with an organic-stained subsoil layer) on flatwood landforms in the nation. Myakka (pronounced My-yak-ah), an Indian word for Big Waters, is a native soil of Florida and does not occur in any other state. It occurs on more than 1» million acres in Florida. It is the most extensive soil in the state.

The Florida Association of Professional Soil Classifiers and the Florida Chapter of the Soil and Water Conservation Society worked together to commemorate the state's unique soil legacy. It is very fitting that they adopted Myakka, a typical flatwoods soil, as the state soil to acknowledge the heritage that has made agriculture the state's major industry.

On May 22, 1989, Governor Bob Martinez signed Senate bill number 524 into law, making Myakka Florida's Official State Soil.



Myakka - This soil is poorly suited to urban development. Wetness is a management concern. Septic tank absorption fields can be maintained above the seasonal high water table by mounding and backfilling with suitable fill material.



The new house pictured above has been elevated to overcome the severe wetness.

DRAINAGE AND PERMEABILITY: Myakka soils are poorly to very poorly drained. They have slow internal drainage and slow to ponded runoff. Permeability is rapid in the A and E horizons and moderate or moderately rapid in the Bh horizon. The water table is at depths of less than 18 inches for 1 to 4 months duration in most years and recedes to depths of more than 40 inches during very dry seasons. Depressional areas are covered with standing water for periods of 6 to 9 months or more in most years.

Flatwoods (colloquial): Broad, linear-relief landforms that have slightly convex relief along flats, depressions, and flood plains and have concave relief along rises and knolls.

Flood plain: A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Myakka soil, HSG = B/D
SHGWT depth 0 inches - 12 inches B.L.S.

Color soil profile, Polk County



Notice that all of
the roots are
concentrated at
the surface.

Spodic horizon.

**As noted on the previous
slide, Myakka is the
Florida State Soil.**

HSG “D” Soils



Felda, Soil #49, Charlotte County,
SHGWT depth **+2.0 feet A.L.S.** to
1.0 feet B.L.S.



Kaliga, Soil #47, Highlands County,
SHGWT depth 0.0 feet to 1.0 feet
B.L.S.

Color Landscapes of Wetlands



Maidencane Marsh



Mixed hardwood cypress swamp



Horse Creek flood plain



Pickeralweed / Sawgrass Marsh



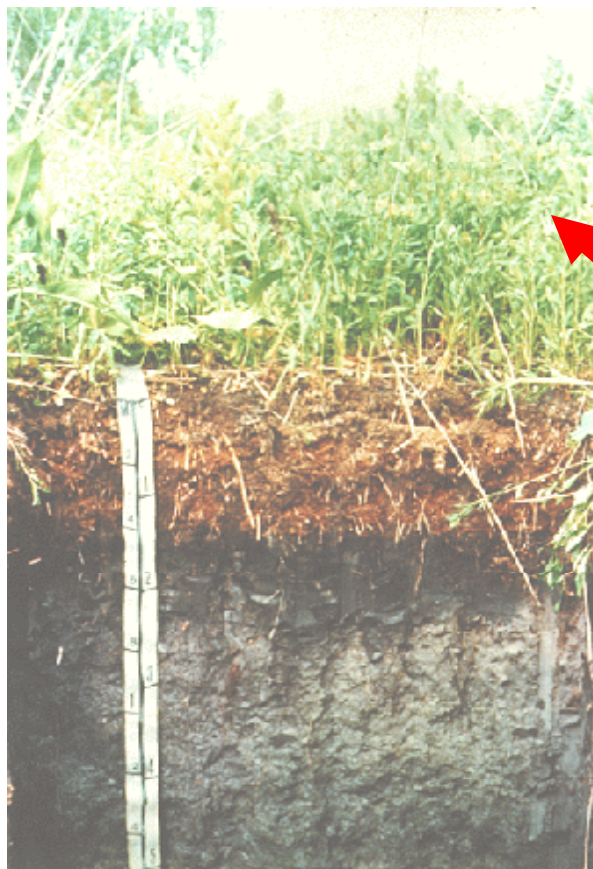
Lakeshore Cypress fringe



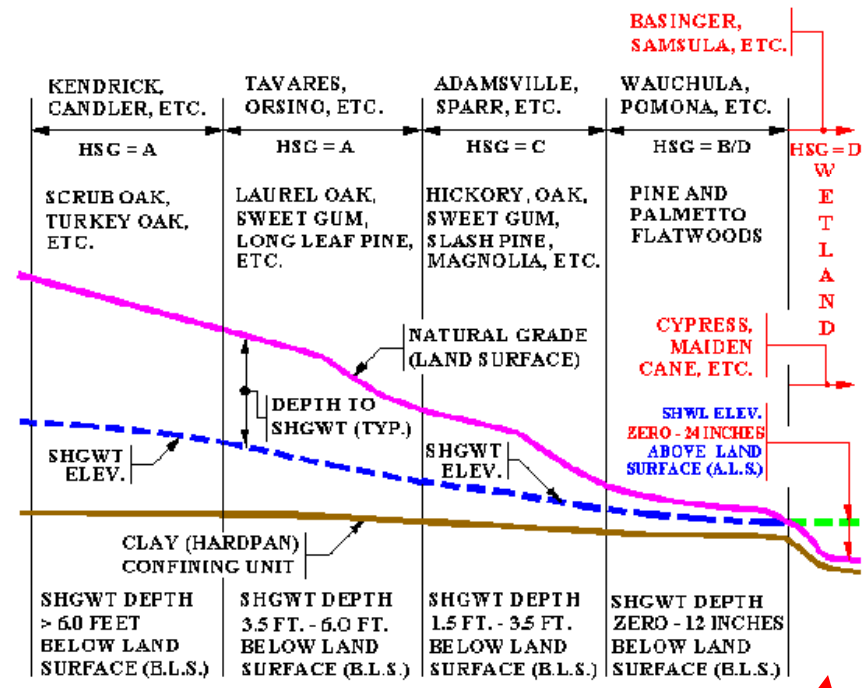
Bayhead

Terra Ceia, HSG = D

SHGWT depth 0 inches - 24 inches ABOVE land surface



Notice the wetlands vegetation.



“Bottom of the hill” in regard to landscape position.

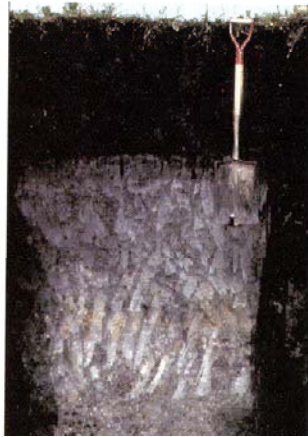
Terra Ceia is a hydric (wetland) soil, with a SHGWT elevation at (or above) the surface.

Generalized location map of Histolos & Mollisols

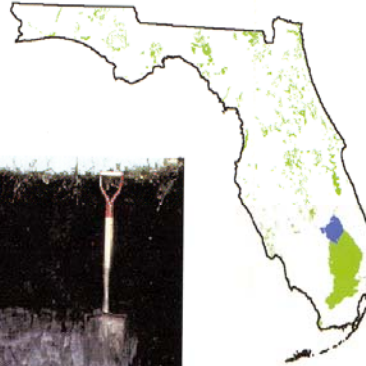
Extent of Histolos & Mollisols in Florida – 5.1 Million Acres

Not for site specific use. Refer to the County Soil Surveys for more detailed information.

HISTOSOLS are soils that have organic material that is 40 cm or more in thickness. The underlying materials are sandy to loamy mineral soils, or limestone bedrock. Properties are a very high content of organic carbon. Most Florida Histosols formed from partially decomposed plant remains that accumulated in water. Common very poorly-drained Histosols in Florida include the Lauderhill, Pamlico, Torry, Okeelanta, Terra Ceia, Pahokee, Gator (see photo) and Samsula soils. More common names for Histosols are peats or mucks. Histosols cover approximately 4.0 million acres.



Histosols



MOLLISOLS are soils that have a thick, very dark-colored surface layer with a high level of organic matter and bases. Many have argillic horizons. Properties associated with a mollic epipedon are a reasonable reserve of plant nutrients (Ca, Mg, K, and sometimes N), massive or weak structures, and very slow permeability. Mollisols in Florida are generally very poorly-drained soils in depressions and floodplains. The more extensive Mollisols include the Anclote, Buccaneer, Chobee (see photo), Delray Yulee, and Floridana soils. Mollisols cover approximately 1.1 million acres.



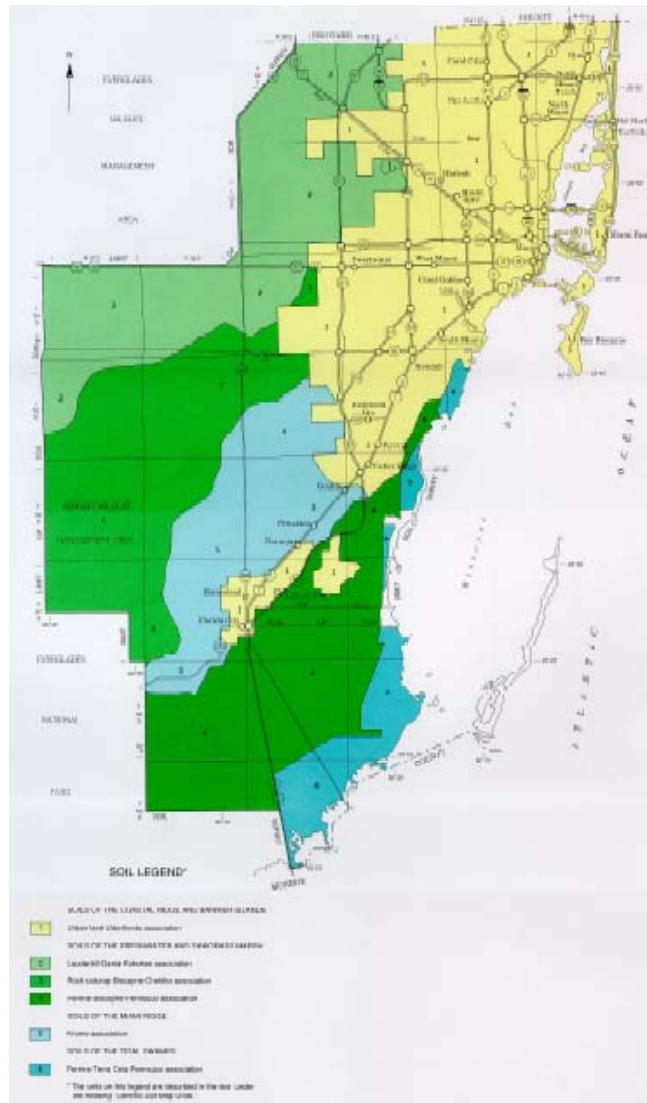
Mollisols



Alfisols are typically classified as very poorly drained soils, HSG = D, with a SHGWT between 0" to 24" A.L.S.

General Soils Map of Dade County

For information purposes only, NOT for detailed site - specific investigations



Note that over half of Dade County contains **wetland soils** (HSG = D) with a SHGWT 0" - 24" A.L.S.

Samsula Muck, HSG = D

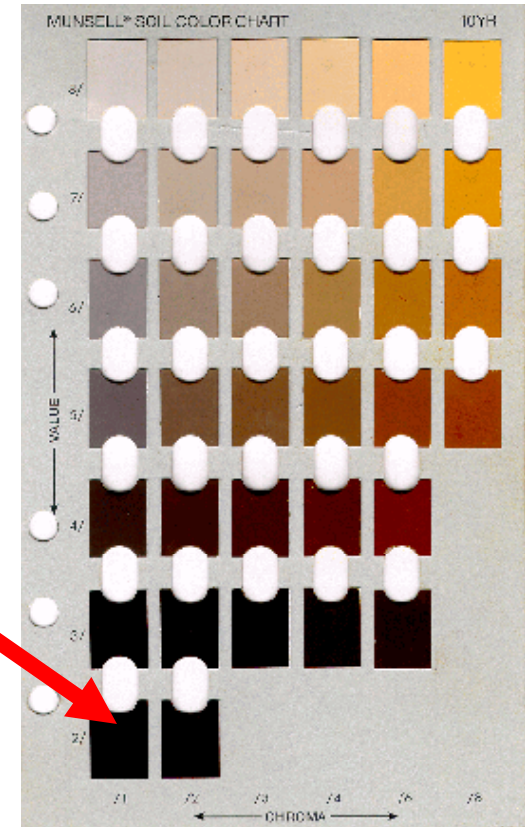
SHGWT depth 0 inches - 24 inches ABOVE land surface

Color profile of soil

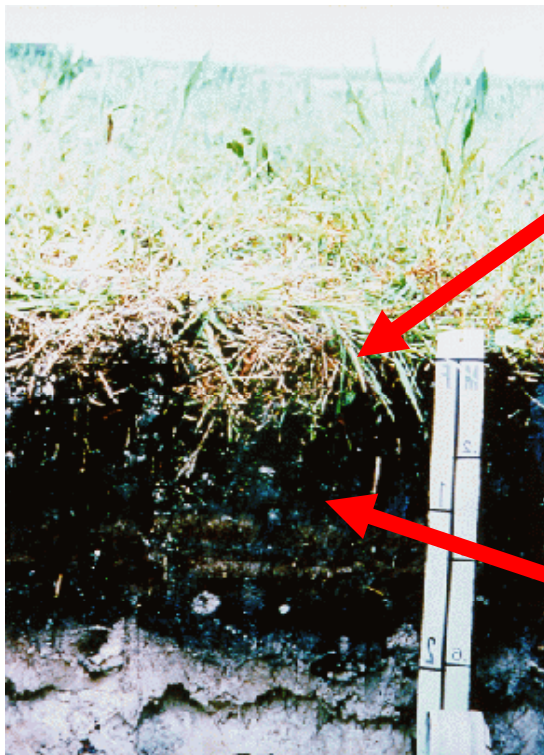
Notice that all of the roots are concentrated at the surface.

Hydic (wetland) soils (HSG = D) typically fall in this area of the 10YR page.

Muck



10YR page. Upper right corner indicates excessively drained soils (HSG = A), lower left corner indicates wetlands (HSG = D).



“Black” colors indicate hydric (wetland) soils.

**Wetland Inclusion (Felda - depressional, #86) within Pomona Sand (#7)
SHGWT depth 0 inches - 24 inches ABOVE land surface**

**“Black”
colors
indicate
hydric
(wetland)
soils.**



Polk County

Muck, HSG = D
SHGWT is 0" - 24" ABOVE land surface

Color landscape and soil profile in Palm Beach County



Subsidence of Kaliga Muck

(photo taken from page #41 of the Polk County Soil Survey)



Subsidence of Kaliga muck leaves tree roots exposed above the present ground surface.

Flood plain: A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Color landscape photograph showing muck subsidence in Palm Beach County



Additional Soil Profile Slides



Presented by Hank Higginbotham, P.E.
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Southwest Florida Water Management District
7601 Highway 301 North, Tampa, Florida 33637-6759
800-836-0797 (Florida only), 813-985-7481 (local) or SunCom 578-2001
e-Mail: hank.higginbotham@swfwmd.state.fl.us

Additional Soil Profile Slides

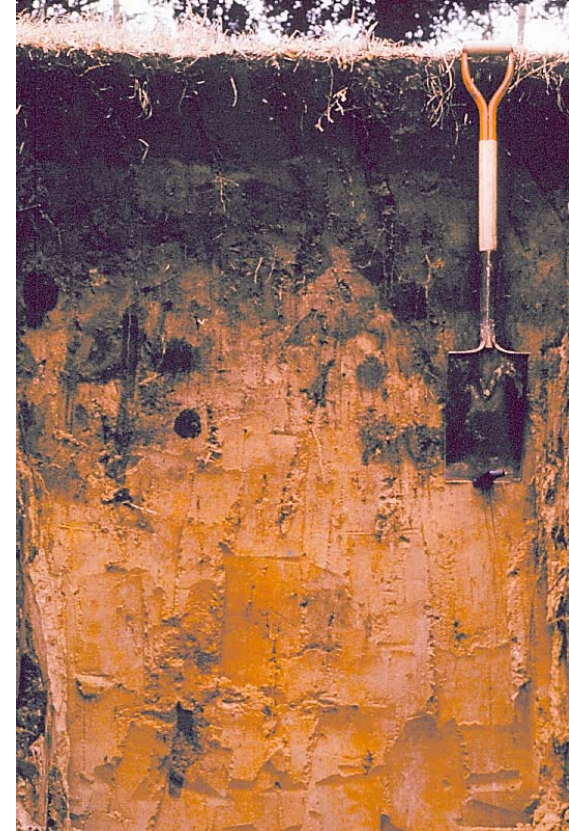
HSG "A" Soils



Arredondo, Soil #16 & #17, Citrus County, SHGWT depth > 6.0 feet B.L.S.



Astatula, Soil#76, Levy County, SHGWT depth > 6.0 feet B.L.S.



Florahome, Soil #20, Sumter County, SHGWT depth 4.0 feet to 6.0 feet B.L.S.

Additional Soil Profile Slides

HSG "A" Soils



**Kendrick, Soil #18 & #19, Citrus
County, SHGWT depth > 6.0 feet
B.L.S.**



**Kendrick, Soil #18 & #19, Citrus
County, SHGWT depth > 6.0 feet
B.L.S.**



**Lake, Soil #14 & #15, Citrus
County, SHGWT depth > 6.0 feet
B.L.S.**

Additional Soil Profile Slides

HSG “A” Soils



**Paola, Soil #1, Highlands County,
SHGWT depth > 6.0 feet B.L.S.**



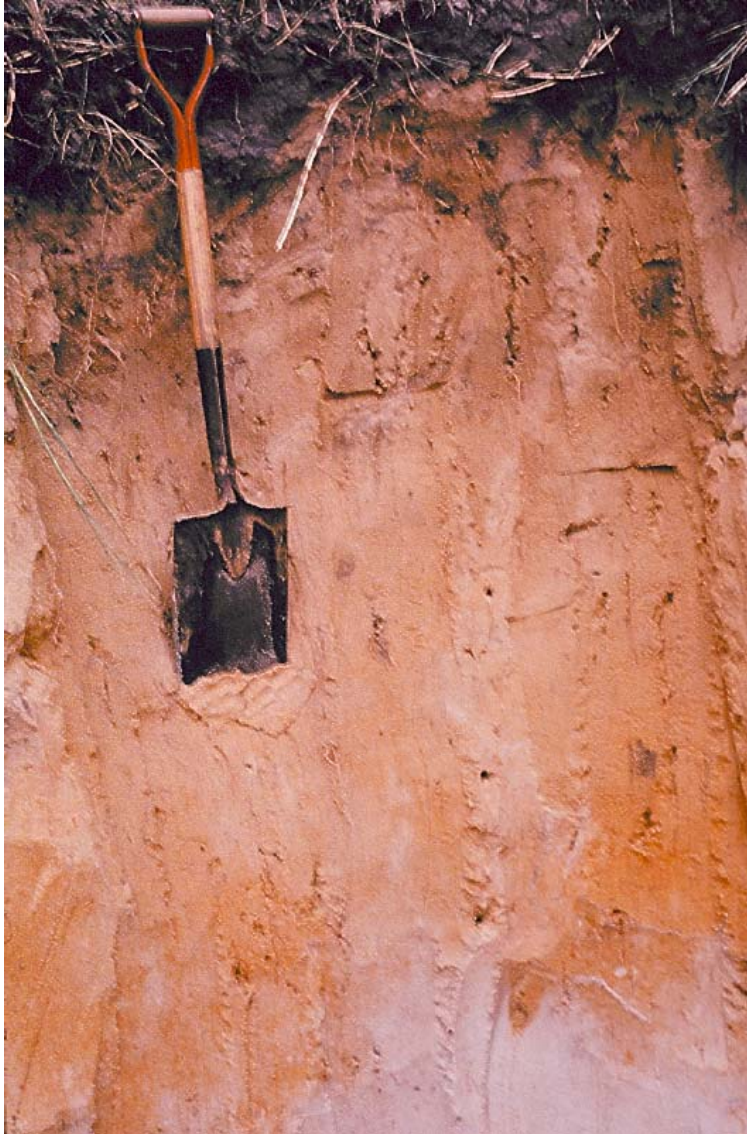
**Paola variant, Soil #8, Citrus
County, SHGWT depth > 6.0 feet
B.L.S.**



**St. Lucie, Soil #2, Highlands
County, SHGWT depth > 6.0 feet
B.L.S.**

Additional Soil Profile Slides

HSG “A” Soils



**Tavares, Soil #6,
Highlands County,
SHGWT depth 3.5
feet to 6.0 feet B.L.S.**

Additional Soil Profile Slides

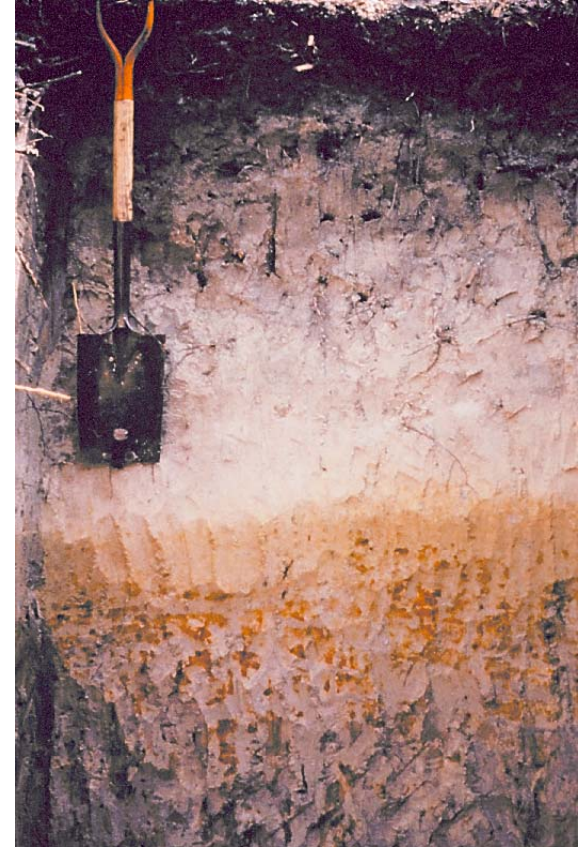
HSG “C” Soils



**Narcoossee, Soil #26, Pasco
County, SHGWT depth 2.0 feet to
3.5 feet B.L.S.**



**Sparr, Soil #7, Pasco County,
SHGWT depth 1.5 feet to 3.5 feet
B.L.S.**



**Sparr, Soil #10, Sumter County,
SHGWT depth 1.5 feet to 3.5 feet
B.L.S.**

Additional Soil Profile Slides

HSG “C” Soils



Sparr, Soil#23, Hardee County,
SHGWT depth 1.5 feet to 3.5 feet
B.L.S.



Sparr, Soil #31, Citrus County,
SHGWT depth 1.5 feet to 3.5 feet
B.L.S.

Special Definition of Soils With Variable HSG Classifications (i.e. A/D, B/D, etc.)

Some soils are listed in the NRCS Soil Surveys as being in more than one HSG. **Such soils** (indicated as A/D or B/D) **are in HSG D in their natural (pre-developed) condition** because of high water table conditions that create drainage impedance. If these soils can be effectively drained (and properly maintained) they may be reclassified in a different HSG. For instance, an Ona soil is classified as HSG B/D. This indicates that effectively drained (and maintained) Ona soil can be reclassified as high as HSG B, but it can not be HSG A.

Additional Soil Profile Slides

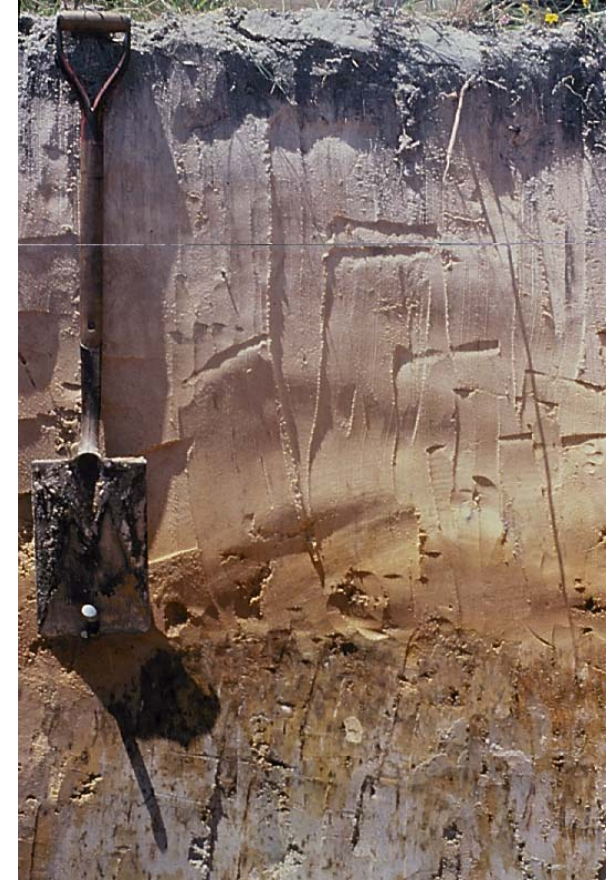
HSG “B/D” Soils



**Eau Gallie, Soil #36, Citrus County,
SHGWT depth 0.0 feet to 1.0 feet
B.L.S.**



**Felda variant, Soil 12, Hardee
County, SHGWT depth 0.0 feet to
1.0 feet B.L.S.**



**Malabar, Soil #63, Charlotte
County, SHGWT depth 0.0 feet to
1.0 feet B.L.S.**

Additional Soil Profile Slides

HSG “B/D” Soils



**Myakka, Soil #17, Polk County,
SHGWT depth 0.0 feet to 1.0 feet
B.L.S.**



**Pomona - Uttic Haplaquads, Soil
#2, Pasco County, SHGWT depth
0.0 feet to 1.0 feet B.L.S.**

Additional Soil Profile Slides

HSG “B/D” Soils



**Smyrna, Soil #39, Highlands
County, SHGWT depth 0.0 feet to
1.0 feet B.L.S.**



**Wauchula, Soil #40, Polk County,
SHGWT depth 0.0 feet to 1.0 feet
B.L.S.**

Additional Soil Profile Slides

HSG “D” Soils



Felda, Soil #49, Charlotte County,
SHGWT depth **+2.0 feet A.L.S.** to
1.0 feet B.L.S.



Kaliga, Soil #47, Highlands County,
SHGWT depth 0.0 feet to 1.0 feet
B.L.S.

This concludes our presentation – thanks for your attention

Good engineering protects the environment!



Final Questions?



**Additional
Soil Profile
Slides**