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Dawn Lehnert

Fort Myers | Gainesville | Tallahassee

October 22, 2009

The Honorable Ray Judah, Chairman
Lee County Board of Commissioners
P. O. Box 398
Fort Myers, FL 33902-0398

Subject: CPA 2008-06 – DR/GR Amendments

Dear Chairman Judah:

On behalf of my client, Troyer Brothers Florida, Inc. (Troyer), I am writing to request the inclusion of the Troyer property as part of the Future Limerock Mining Overlay (proposed Lee Plan Map 14). While Troyer still objects to the adoption of CPA 2008-06, based upon the objections presented at the September 24, 2009 hearing, we are nevertheless attempting to provide the County with an alternative to protect Troyer's rights to the existing resources located upon the Troyer property while recognizing the unique location and attributes of the Troyer property. It is noted that the Troyer property is accessed via SR 82, not Corkscrew Road, and therefore is similar to those parcels already proposed for limerock extraction on the proposed Lee Plan Map 14.

I have taken the liberty of preparing a modified map and have included it as an attachment to this letter. In addition, for the purpose of providing data and analysis in support of the addition of the Troyer property to the Future Limerock Mining Overlay, I have included the Section 3 and Appendix A of the report entitled "Hydrogeology of Troyer Brothers Florida, Inc. with a Mining Impact Analysis, Lee County, Florida" prepared by Missimer Groundwater Science, a Schlumberger Company dated September 2008 demonstrating that significant reserves of the material are extant on the Troyer site.

Thank you for your kind consideration in this matter. I will be in attendance at the hearing on October 28 to address any questions that the Board of Commissioners may have.

Sincerely,
Morris-Depew Associates, Inc.

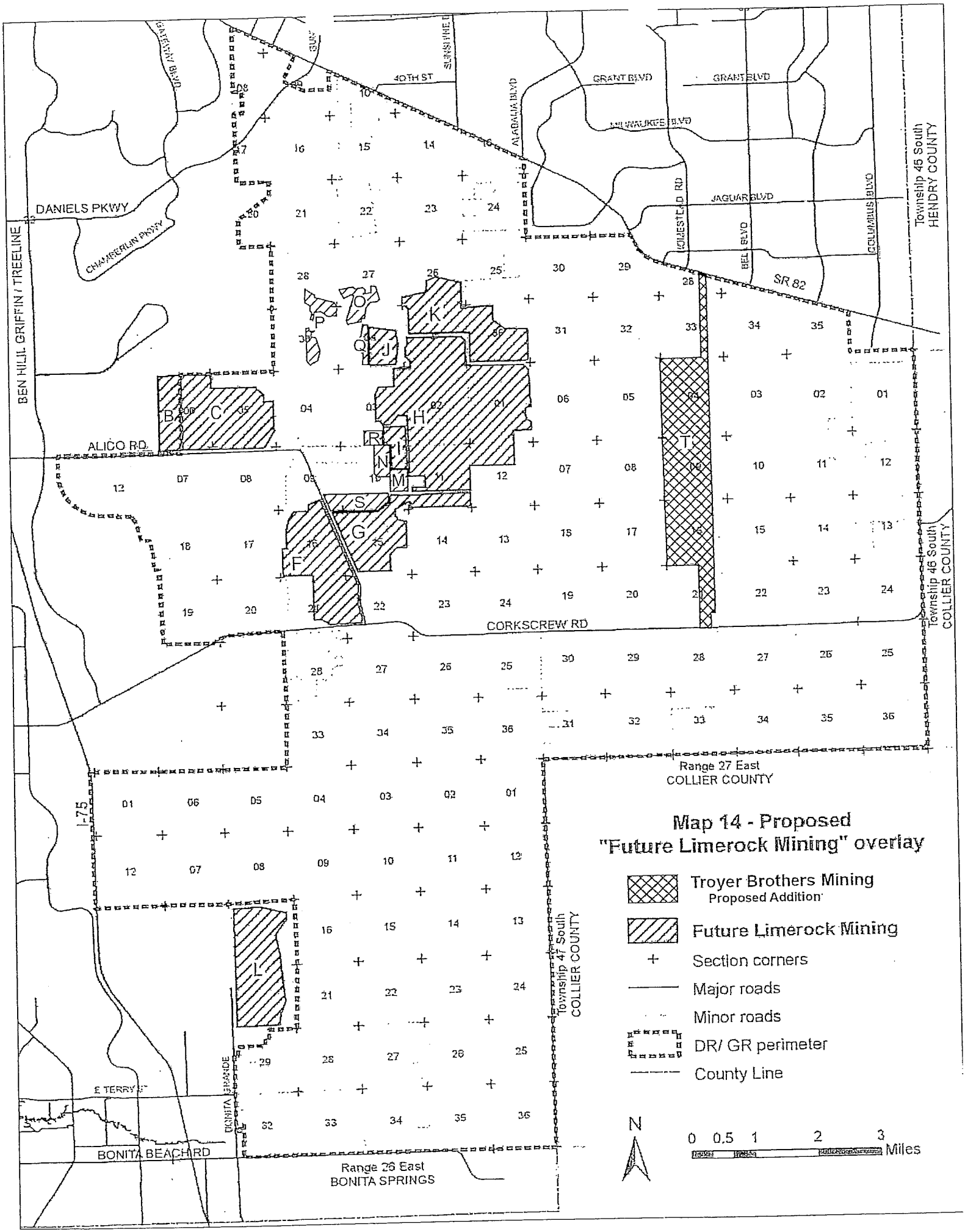
David W. Depew By:ATN

David W. Depew, PhD, AICP, LEED AP
President

Attachments: Modified Proposed Lee Plan Map 14
Section 3 & Appendix A, "Hydrogeology of Troyer Brothers Florida, Inc. with a Mining Impact Analysis, Lee County, Florida"

cc: Lee County Board of Commissioners
Ms. Mary Gibbs, Director, Lee County Department of Community Development
Mr. Paul O'Connor, Director, Lee County Division of Planning

DR GR 10-28-09
Transmittal


DANIELS PKWY
CHAMBERLIN PKWY
BEN HILL GRIFFIN / TREELINE
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ALABAMA BLVD
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MILWAUKEE BLVD
JAGUAR BLVD
HOMESTEAD RD
BELL BLVD
COLUMBUS BLVD
SR 82
Township 45 South
HENDRY COUNTY
ALICO RD.
CORKSCREW RD
Township 46 South
COLLIER COUNTY
Range 27 East
COLLIER COUNTY
I-75
Township 47 South
COLLIER COUNTY
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BONITA BEACH RD
Range 26 East
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Map 14 - Proposed
"Future Limerock Mining" overlay
Troyer Brothers Mining
Proposed Addition
Future Limerock Mining
Section corners
Major roads
Minor roads
DR/ GR perimeter
County Line
N
0 0.5 1 2 3
Miles

SECTION 3
GEOLOGY

3.1 Introduction

A detailed geologic assessment of the site was made using the sonic drilling technique. Sonic cores were collected through the entire geologic section from land surface to the base of economic benefit, which was defined as the occurrence of a regional lime mud/clay unit (Buckingham Member of the Tamiami Formation). Mining deeper than this unit is not feasible because the material has no economic benefit, and the formation is part of a regional confining unit separating the Surficial Aquifer System from the Intermediate Aquifer System. Breaching the unit would be a violation of rules of the South Florida Water Management District (SFWMD) (F.A.C. Chapter 40e).

In the part of the property evaluated for mining, there were 12 sonic cores collected. In addition, geologic, water quality, and water use data were collected from a total of 13 monitoring and 12 production wells on the site and 2 wells located off-site. Locations of the cores within the proposed mining area are shown in Figure 3-1, and the detailed locations and depths of the on-site wells and cores are given in Table 3-1. The sonic drilling technique was chosen because it allows a high quality core to be collected and a detailed geologic analysis to be made to assess lithologic changes at a resolution of one to two feet. The method also allows rapid collection of data, and the sizes of the cores are sufficient to measure the key aggregate rock properties including Los Angeles abrasion, specific gravity, absorption, and carbonate composition. A large number of samples were collected from all of the cores for physical examination in the laboratory and for measurement of rock properties. A total of 1,679 feet of core was collected and examined.

The locations of the monitoring and production wells completed in the water-table aquifer are shown in Figure 3-2, and those completed into the Sandstone Aquifer are given in Figure 3-3. Descriptions of the cores, geologic logs, geophysical logs, and water quality analyses are contained within the appendices.

Geologic descriptions of the cores were developed by careful examination using a binocular microscope and visual examination of the larger core pieces. The core descriptions contain an assessment of primary lithology, the color based on the Munsell Soil Color Chart, the hardness, the detailed carbonate classification based on the textural classification system of Dunham (1961), identification of index fossils, description of the pore types, and an assessment of sample hydraulic conductivity. The detail of the core descriptions is greater than can be developed from drill cuttings because the cores can be visually analyzed for sedimentary structures and other features that relate to rock properties and the potential for fluid flow. The presence of potential flow channels caused by sediment bioturbation can be recognized and noted.

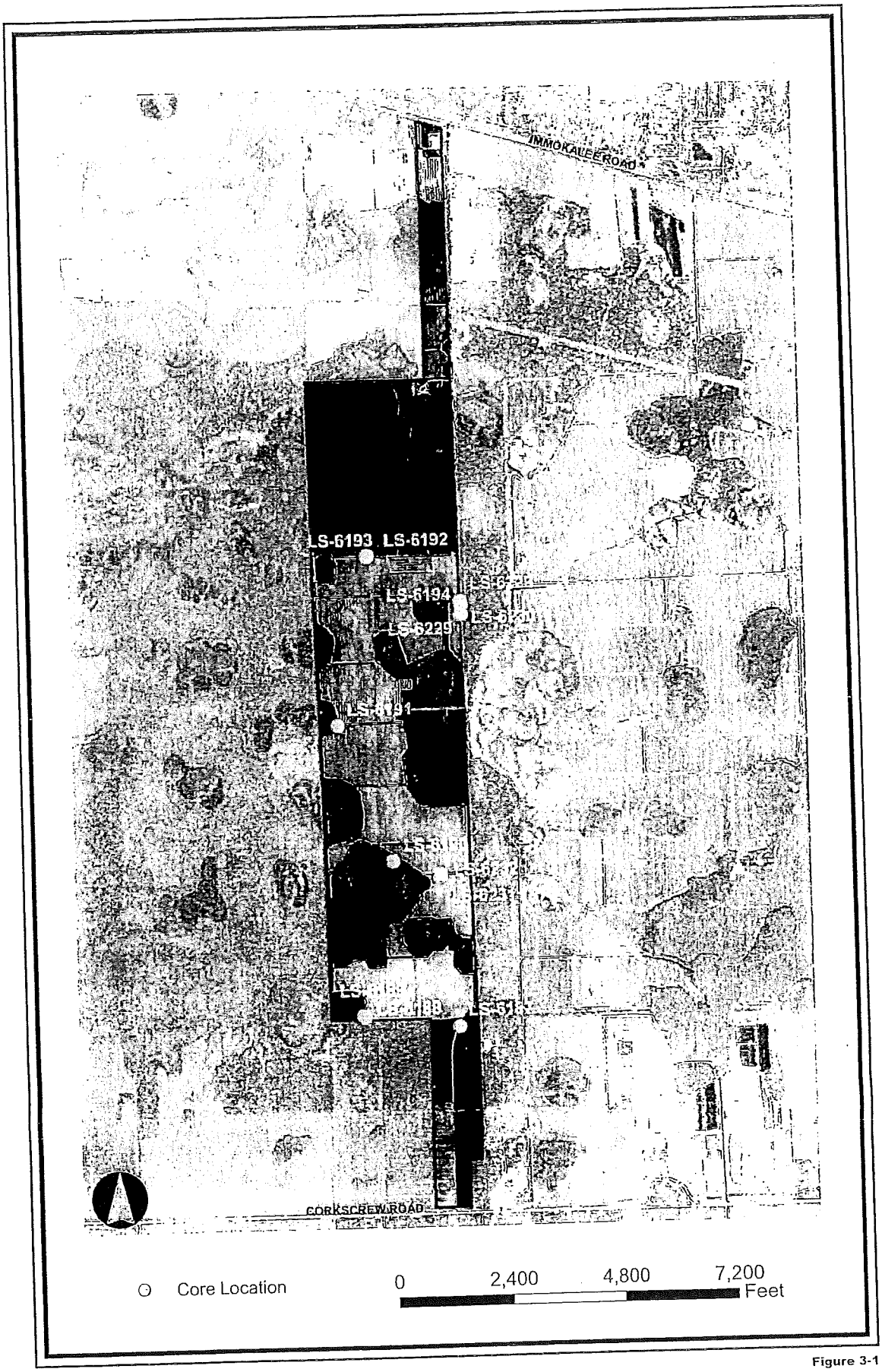

Figure 3-1
Hydrogeology of Troyer Brothers Florida, Inc.
Core Location Map

MGS Mission Groundwater Science

Table 3-1. List of On-Site Production Wells, Monitor Wells, and Cores

MGS Well No.	Site Well No.	GPS Coordinates	Total Depth (ft)	Casing Depth (ft)	Diameter (in)	Screened Interval (ft)	Use	Aquifer	Notes
LS-6187	TB-7	N 26 27.881, W 081 37.020	70	65	2	65-70	monitor	Water-table	core to 296
LS-6188	TB-6	N 26 27.925, W 081 37.490	291	281	2	281-291	monitor	Sandstone	core to 296
LS-6189	TB-8	N 26 27.933, W 081 37.492	45	40	2	40-45	monitor	Water-table	core to 46
LS-6190	TB-3	N 26 28.617, W 081 37.332	100	95	2	95-100	monitor	Water-table	core to 176
LS-6191	TB-2	N 26 29.225, W 081 37.592	126	121	2	121-126	monitor	Water-table	core to 146
LS-6192	TB-5	N 26 29.977, W 081 37.435	176	166	2	166-176	monitor	Sandstone	core to 176
LS-6193	TB-1	N 26 29.978, W 081 37.435	65	60	2	60-65	monitor	Water-table	core to 65
LS-6194	TB-4	N 26 29.917, W 081 36.969	50	45	2	45-50	monitor	Water-table	core to 136
LS-6195	WW-1	N 26 29.511, W 81 37.012	NA	NA	2	NA	monitor	Water-table	wetland well
LS-6196	WW-2	N 26 28.631, W 81 37.565	NA	NA	2	NA	monitor	Water-table	wetland well
LS-6197	WW-3	N 26 28.303, W 81 37.051	NA	NA	2	NA	monitor	Water-table	wetland well
LS-6198	WW-4	N 26 30.449, W 81 37.007	NA	NA	2	NA	monitor	Water-table	wetland well
LS-6229	MW-7D	N26 29.756, W081 36.972	200	190	2	190-200	monitor	Sandstone	apt monitor well
LS-6230	MW-7S	N26 29.771, W081 36.974	20	15	2	15-20	monitor	Water-table	apt monitor well
LS-6231	MW-6D	N26 28.550, W081 37.102	110	100	2	100-110	monitor	Water-table	apt monitor well
LS-6232	MW-6S	N26 28.554, W081 37.098	15	10	2	10-15	monitor	Water-table	apt monitor well
LS-6233	8	N 26 31.764, W 81 37.099	240	140	10	140-240	processing	Sandstone	construction per SFWMD permit
LS-6234	9	N 26 31.367, W 81 37.429	240	140	10	140-240	irrigation	Sandstone	construction per SFWMD permit
LS-6235	D1	N 26 31.074, W 81 37.434	41	20	5	20-41	irrigation	Water-Table	construction per SFWMD permit
LS-6236	D2	N 26 31.083, W 81 36.998	240	140	10	140-200	irrigation	Sandstone	construction per SFWMD permit
LS-6237	7	N 26 29.778, W 81 36.982	240	140	10	140-200	irrigation	Sandstone	construction per SFWMD permit
LS-6238	1	N 26 29.504, W 81 37.408	240	140	10	140-200	irrigation	Sandstone	construction per SFWMD permit
LS-6239	2	N26 29.302, W 81 37.605	240	182	10	182-240	irrigation	Sandstone	construction per SFWMD permit
LS-6240	3	N 26 29.236, W 81 37.413	225	100	10	100-225	irrigation	Water-Table	construction per SFWMD permit
LS-6241	4	N 26 28.965, W 81 37.402	240	77	10	77-240	irrigation	Water-Table	construction per SFWMD permit
LS-6242	5	N 26 78.854, W 81 37.161	223	86	10	86-223	irrigation	Water-Table	construction per SFWMD permit
LS-6243	6	N 26 28.563, W 81 37.089	260	80	10	80-260	irrigation	Water-Table	construction per SFWMD permit
LS-6244	10	N 26 28.186, W 81 37.243	240	140	10	140-240	irrigation	Water-Table	construction per SFWMD permit
LS-6245	11	N 26 27.913, W 81 37.240	240	140	10	140-240	irrigation	Water-Table	construction per SFWMD permit

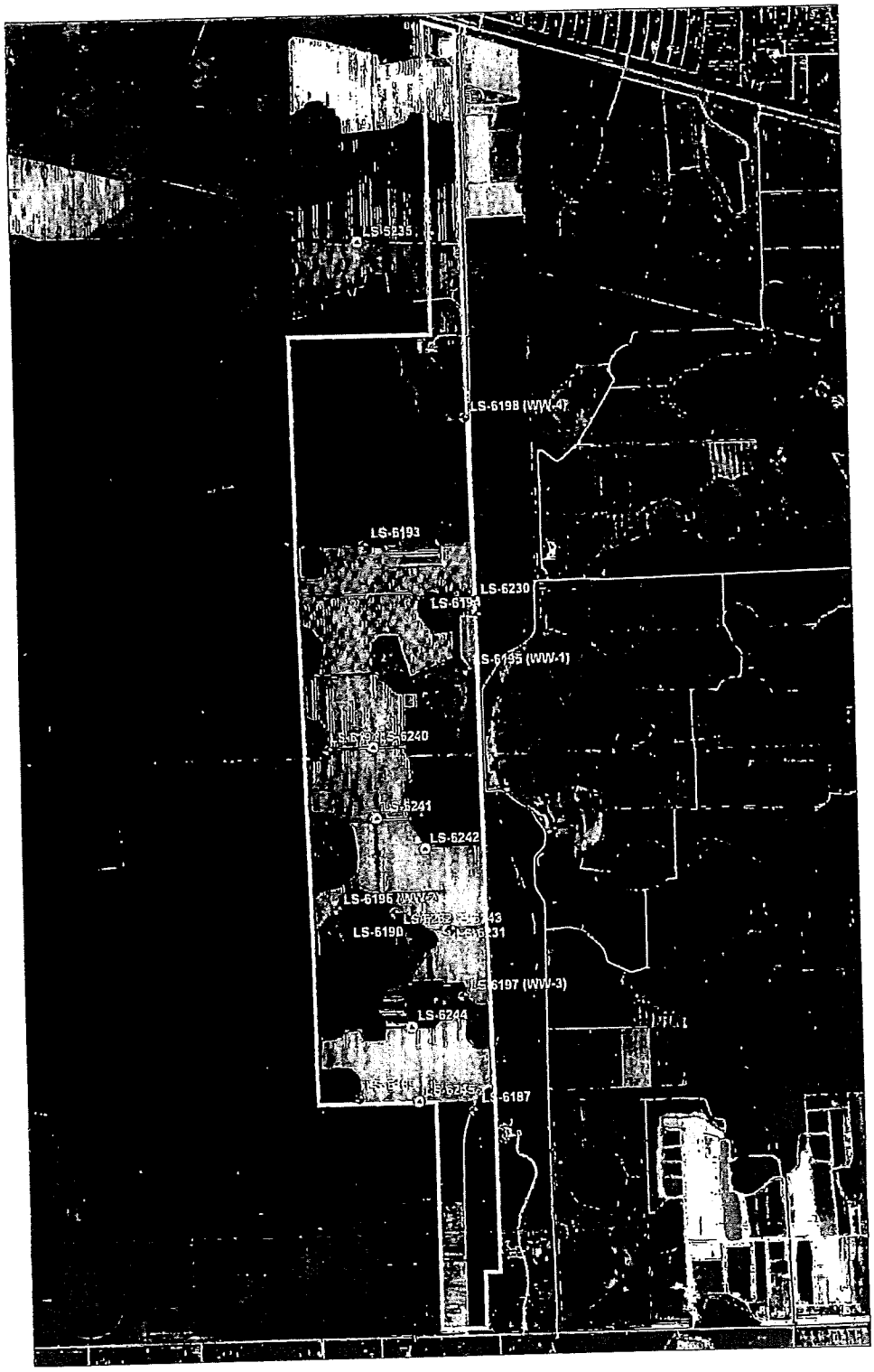

Figure 3-2

Hydrogeology of Troyer Brothers Florida, Inc.

Location of Water-Table Aquifer (WTA) Production and Monitoring Wells

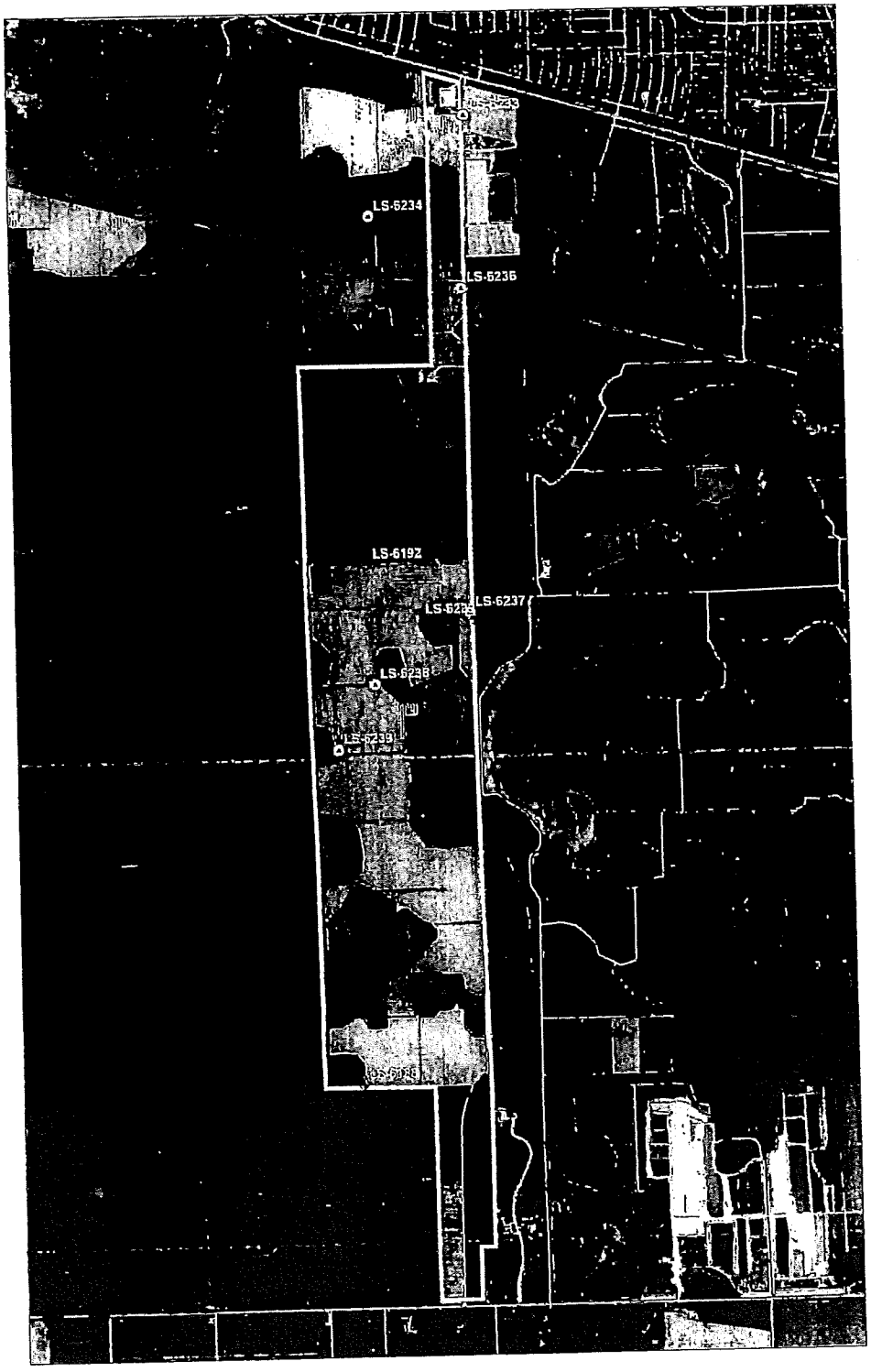

Figure 3-3
Hydrogeology of Troyer Brothers Florida, Inc.
Location of Sandstone Aquifer (SSA) Production and Monitoring Wells

A generalized stratigraphic column for the shallow geologic section is presented in Figure 3-4. This column was adapted from Missimer (2002) and contains the latest stratigraphic terminology as well as the age designation of the rock stratigraphic units as contained in Missimer (2001c). The stratigraphic terminology for the Hawthorn Group was taken from Scott (1988) with member names added based on common usage (Missimer & Associates, Inc., 1978). A second stratigraphic column shows the general geology of the site into the Ocala Formation (Figure 3-5).

3.2 Pamlico Sand/Fort Thompson Formation

The entire site is covered by a veneer of medium- to fine-grained quartz sand. There is debate in the geologic literature concerning the terminology applied to this unit because it may be related to deposition that occurred during the last major sea level incursion, which is commonly termed the Pamlico Terrace. However, the uppermost recognized major stratigraphic unit in southwest Florida is the Fort Thompson Formation, which is the latest Pleistocene unit deposited about 120,000 years ago (top of unit). This formation corresponds to the Pamlico Terrace; so the sand veneer is likely part of the Fort Thompson Formation and is not the result of another marine depositional episode. The sand was deposited as sea level receded at the end of the Pamlico Terrace event. Also, the Pamlico Terrace only reached an altitude of 25 feet above sea level based on the literature (Puri and Vernon, 1964), but the sands reach an altitude of up to 31 feet above sea level and overlie some crustal limestone deposits that may be Fort Thompson in age. Therefore, the literature definitions in this area of Florida may be incorrect.

Typically, the sand unit contains a number of different lithologies from organic-stained sand at the top to very clean fine sands or clayey sands in the middle to fine sands with some minor shell at the base. A map showing the thickness of the sand veneer is given in Figure 3-6. In several cores, the sand contains laminations indicative of primary deposition in the marine environment. The sand is in direct hydraulic connection with the underlying Fort Thompson, Caloosahatchee, or Tamiami Formation sediments.

3.3 Fort Thompson Formation

The Fort Thompson Formation was originally defined within the Caloosahatchee River area based on the occurrence of various types of molluscan fauna (Dall, 1890-1903, DuBar, 1958). There are distinctive differences in formation lithology between the original stratigraphic section described along the Caloosahatchee River and areas both to the north and south of the river (Missimer, 2001a; Missimer and Tobias, 2004). In areas outside of the Caloosahatchee River basin, the formation commonly consists of medium- to fine-grained quartz sand and shell containing a high percentage of the mollusk Chione cancellata. The unit also forms a "crust" of very hard, shelly limestone, commonly referred to as "caprock."

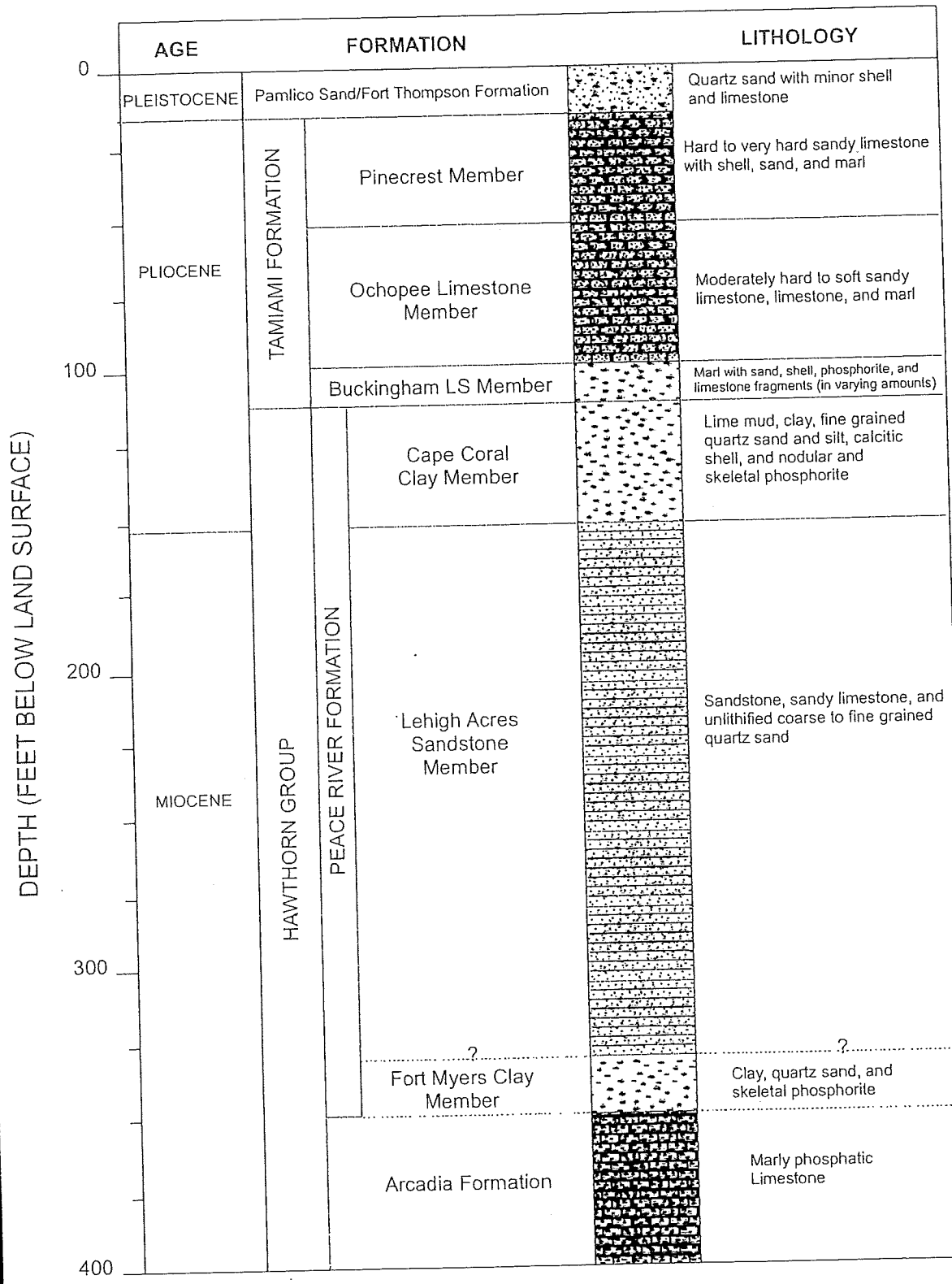

Figure 3-4
Hydrogeology of Troyer Brothers Florida, Inc.
Generalized Site Stratigraphic Column

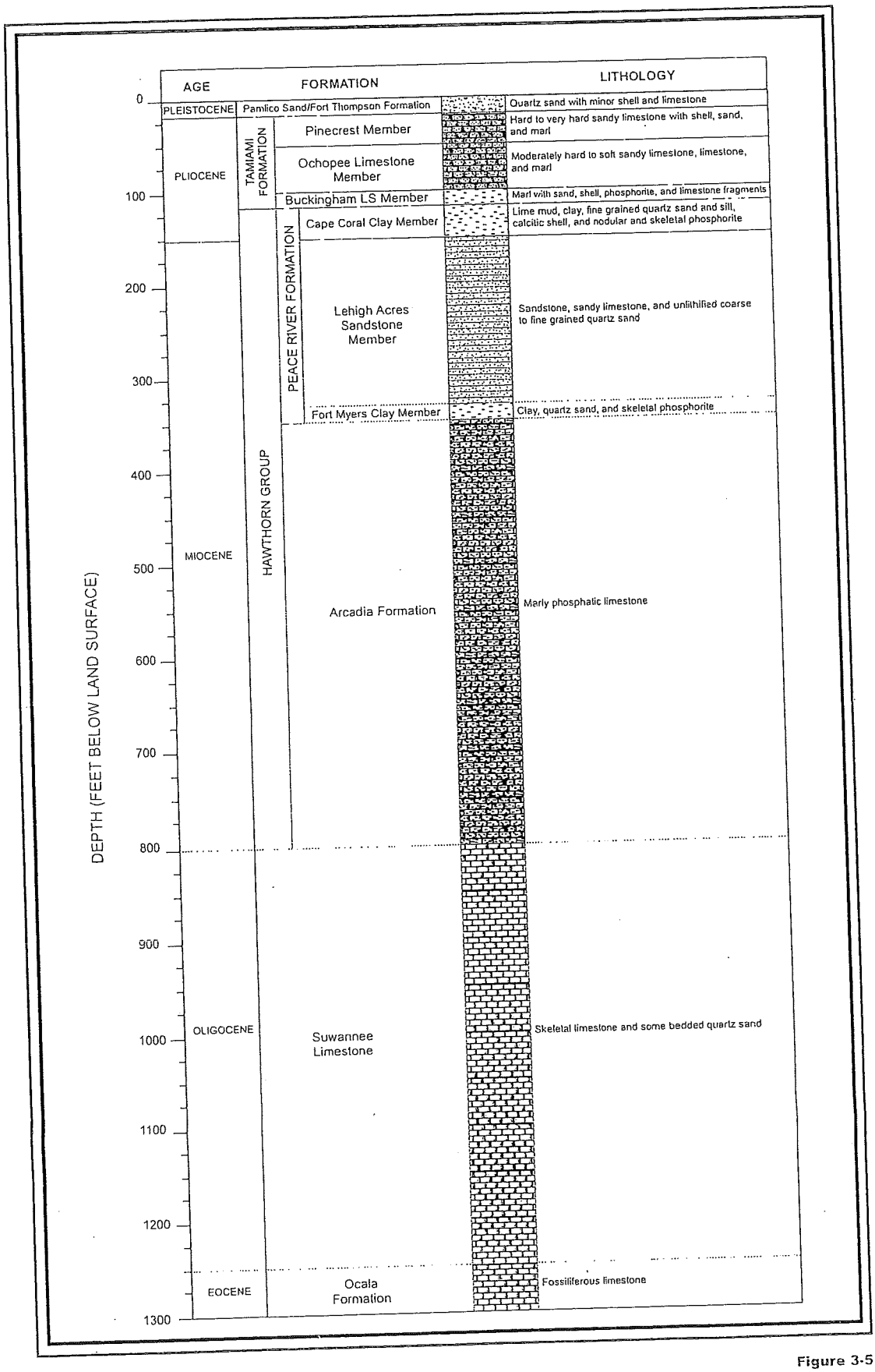

Figure 3-5

Hydrogeology of Troyer Brothers Florida, Inc.

Generalized Site Stratigraphic Column into the Ocala Fm

MGS Missimer Groundwater Science
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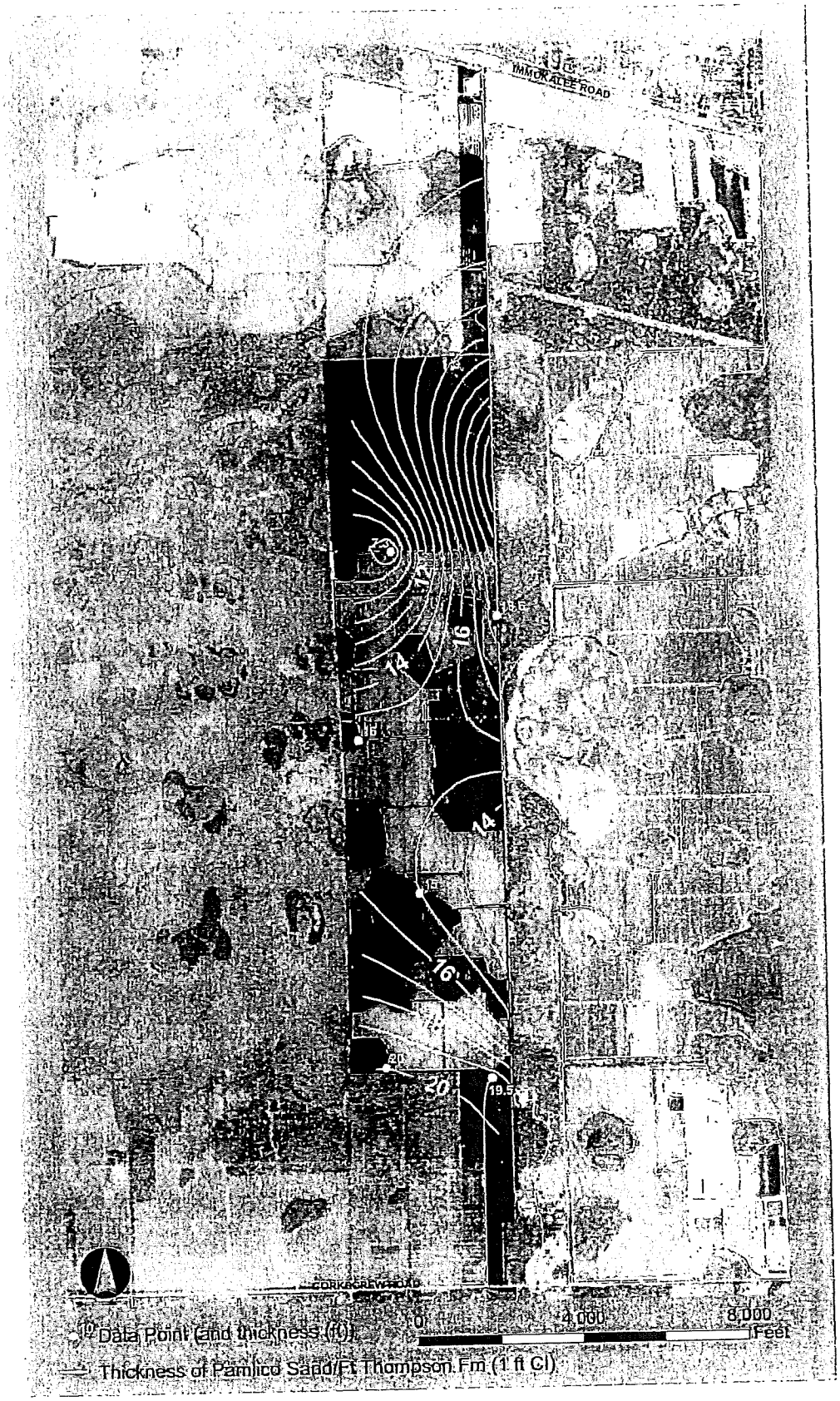

Figure 3-6

Hydrogeology of Troyer Brothers Florida, Inc.

Thickness of the Pamlico Sand/Fort Thompson Formation

MGS Missimer Groundwater Science
A Schlumberger company

Beneath the Troyer Brothers site, the Fort Thompson Formation is primarily a quartz sand unit with a few areas where there is a sandstone containing some aragonitic shell. There is no consistent, predominantly carbonate section of the unit underlying the surficial sands beneath the site. Therefore, the Fort Thompson is not differentiated as a geologic unit in this report, and the surficial sand is considered an approximate thickness of the unit.

3.4 Caloosahatchee Formation

The regional extent of the Caloosahatchee Formation has been open to debate for many years (Hunter, 1978). Again, the original formation was defined within the Caloosahatchee and Peace River basins as well as some areas in the Tampa Bay region and in central Sarasota County. Recent investigations have shown that the Pleistocene/Pliocene boundary runs through the formation, and there are distinctive differences in the molluscan fauna within the formation from the upper Pleistocene section to the underlying Pliocene section. Also, there are faunal similarities between the lower Caloosahatchee Formation and the underlying Pinecrest Member of the Tamiami Formation, which is also Pliocene in age (Missimer, 2001c, 2002). Beneath the Troyer Brothers site, there are lithologies similar to those described within the Caloosahatchee Formation; however, detailed analysis of these reefal and ramp lithologies by Meeder (1987) show the sediments to be contained within the Tamiami Formation. Therefore, no mapping of the Caloosahatchee Formation was necessary beneath the site.

3.5 Tamiami Formation

The Tamiami Formation was first described by Mansfield (1939) and termed the Tamiami limestone. Mansfield (1939) also recognized the overlap in molluscan fauna between the Caloosahatchee Formation and the upper Tamiami Formation and considered them both to be Pliocene in age. Later, Parker and Cooke (1944) renamed the unit the Tamiami Formation and designated the entire unit to be Late Miocene in age. Meeder (1987) contains a detailed history of various changes in the defined stratigraphic limits of the formation. The members of the Tamiami Formation that are detailed in this report were more recently defined by Missimer (1990; 1992; 1993). In central and eastern Lee County, there were four members of the Tamiami Formation recognized in these publications, including in order of stratigraphic position going from top to bottom, the Pinecrest Member, an unnamed member (mostly limestone), the Ochopee Member, and the Buckingham Member. Based on the occurrence of corals and unlithified sand and shell beds within both the Pinecrest and unnamed members, these units are grouped and termed the Pinecrest Member. The other two units are distinctive and are easily mapped.

3.5.1 Pinecrest Member

The Pinecrest Member was originally defined as the "Pinecrest Sand" by Olsson and Harbison (1953). A large number of shell and mixed shell and limestone deposits in the Sarasota County area are also defined as part of the Pinecrest Member of the Tamiami Formation (Allmon, 1992). Meeder (1987) performed detailed stratigraphic and

paleontological analyses on the reefal facies of the Pinecrest Member in central Lee and north-central Collier County.

The Pinecrest Member of the Tamiami Formation contains some of the highest quality limestone within the Troyer Brothers site. The member contains a number of lithologies, but the predominant ones are hard to very hard sandy molluscan wackestone, hard to very hard sandy molluscan packstone, shell and sand, marl with shell and sand, and marl. An isopach map showing the thickness of the Pinecrest Member of the Tamiami Formation is given in Figure 3-7.

3.5.2 Ochopee Member

The Ochopee Limestone Member was named for the original limestone cropping out in the ditches adjacent to the Tamiami Trail (U.S. 41) in Collier County near the town of Ochopee. It was made a formal member of the Tamiami Formation in Hunter (1968) and in Missimer (1992). The Ochopee Limestone Member of the Tamiami Formation is typically a medium hard to soft sandy molluscan wackestone to packstone.

Beneath the Troyer Brothers site, the Ochopee Limestone Member of the Tamiami Formation forms the basal part of the rock that can be used for construction materials. The unit ranges from 63 to 197 feet in thickness over the site. It does contain a variety of different lithologies including sandy molluscan packstone, sandy molluscan wackestone, and marl. Also, there are some parts of the member devoid of quartz sand. A map showing the thickness of the Ochopee Limestone Member of the Tamiami Formation is given in Figure 3-8.

3.5.3 Buckingham Member

The Buckingham Limestone Member of the Tamiami Formation forms the base of the economically viable material beneath the site. The top of this unit is marl consisting of lime mud with varying percentages of fine-grained quartz sand, calcitic shell, nodular and skeletal phosphorite, and limestone rock fragments. The sediment has a low hydraulic conductivity and does not have commercial value. A map showing the depth to the top of the Buckingham Limestone or Marl Member of the Tamiami Formation is given in Figure 3-9. The top of the Buckingham Limestone unit also forms the top of the confining unit between the water-table and Sandstone aquifers beneath the site.

3.6 Hawthorn Group-Peace River Formation

The Early Pliocene and Late Miocene-aged Peace River Formation disconformably underlies the Tamiami Formation beneath the site (Missimer, 2001c). This unit, defined by Scott (1988), is the uppermost formation within the Hawthorn Group. The formation contains a number of stratigraphic members based on substantial changes in lithologic characteristics.

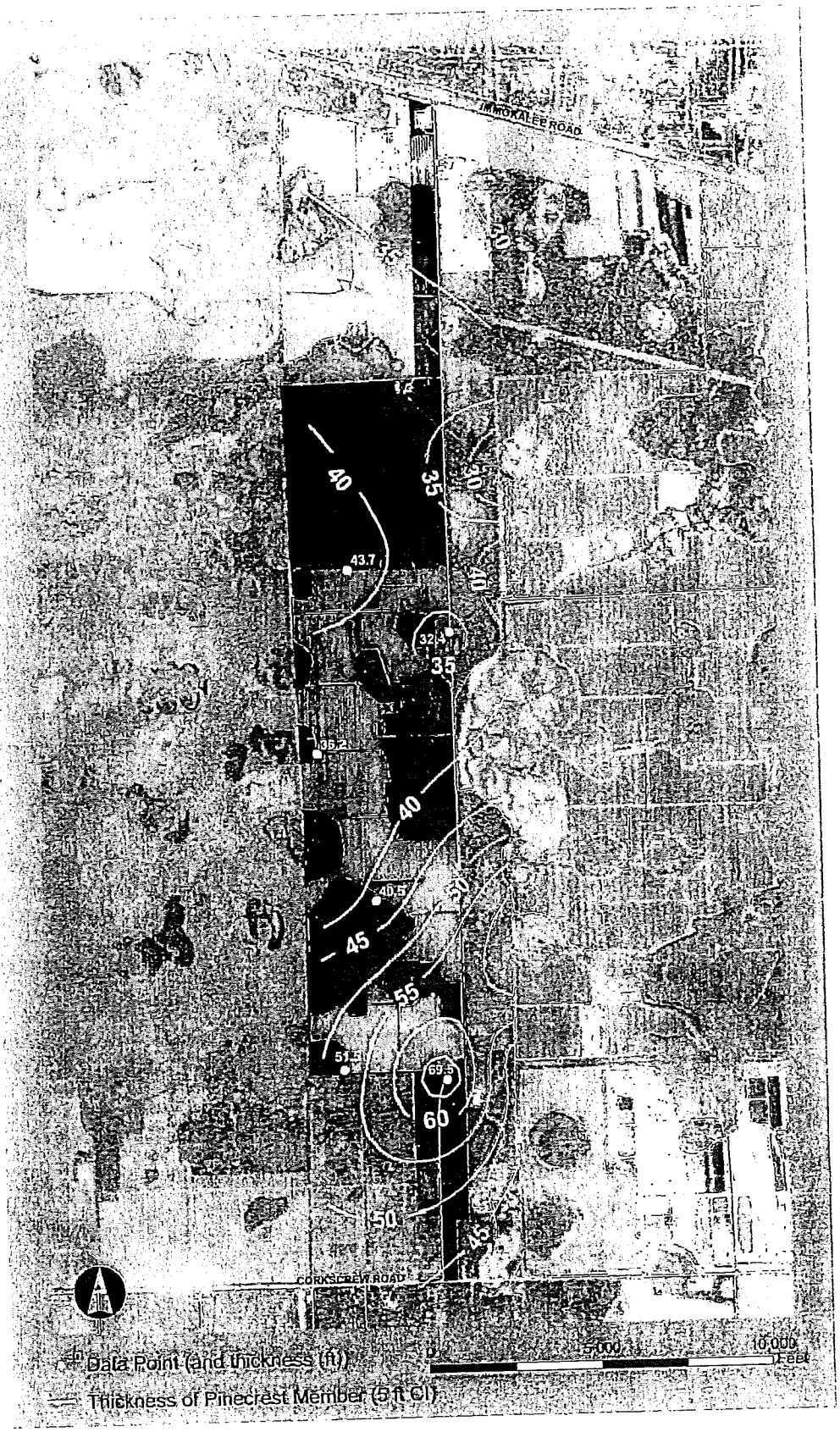

Figure 3-7

Hydrogeology of Troyer Brothers Florida, Inc.

Thickness of the Pinecrest Member of the Tamiami Formation

MGS Missimer Groundwater Science

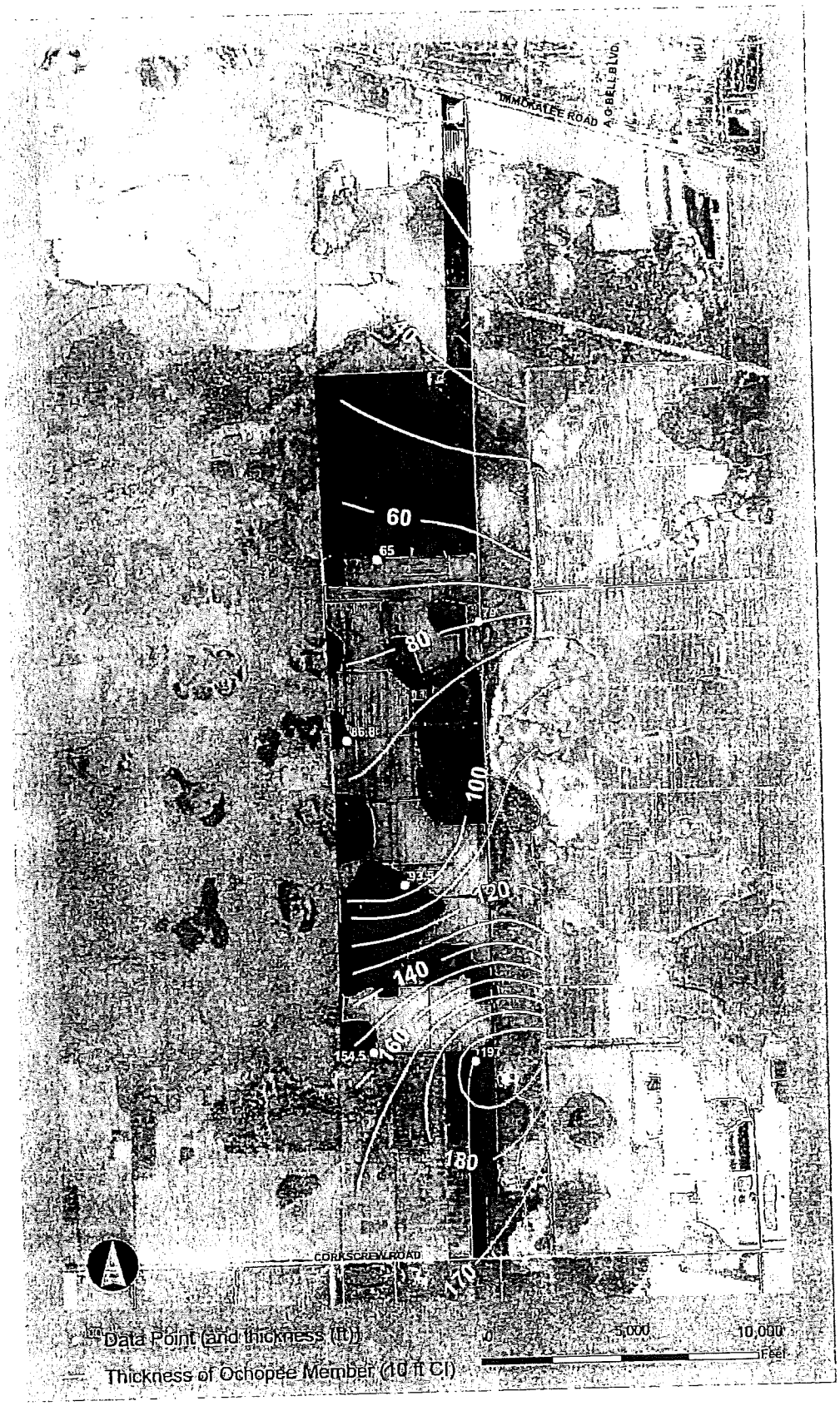

Figure 3-8

Hydrogeology of Troyer Brothers Florida, Inc.

Thickness of the Ochopee Member of the Tamiami Formation

MGS Missimer Groundwater Science

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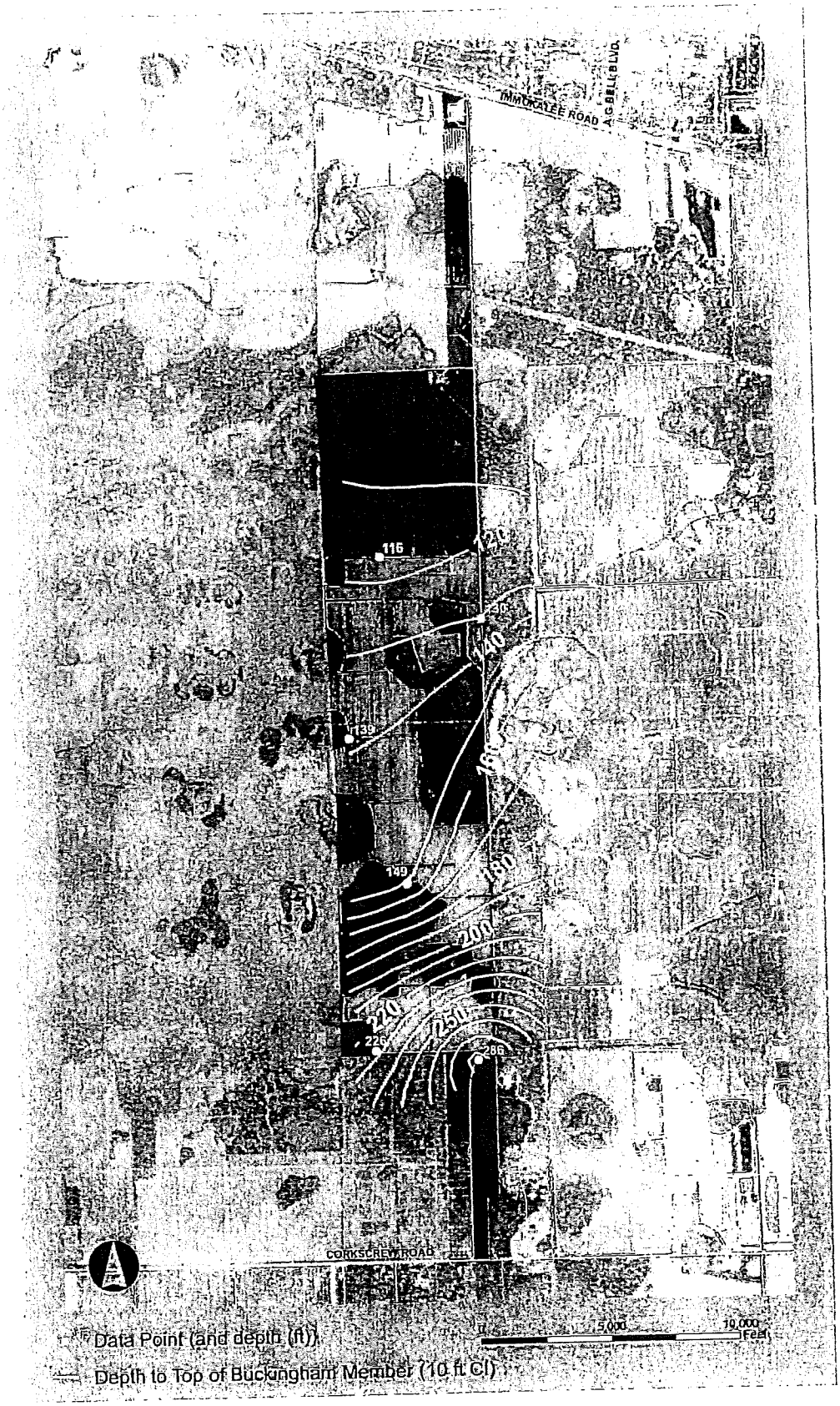

Figure 3-9

Hydrogeology of Troyer Brothers Florida, Inc.

Depth to the Top of the Buckingham Marl Member of the Tamiami Formation

MGS Missimer Groundwater Science
A Schlumberger company

3.6.1 Cape Coral Clay Member

The uppermost member of the Peace River Formation is termed the Cape Coral Clay Member (Missimer & Associates, Inc., 1978), which is equivalent to another member termed the Alva Clay (Meeder, 1987; Klinzing, 1980). It is a deltaic deposit containing a mix of lime mud, clay, fine-grained quartz sand and silt, calcitic shell, and nodular and skeletal phosphorite (Missimer and Gardner, 1976). It is a regional confining unit between the Surficial Aquifer System and the underlying Intermediate Aquifer System (Missimer and Martin, 2001). Although not important for mining, it separates the underlying Sandstone Aquifer from the Surficial Aquifer System throughout the site; therefore, giving protection to the Intermediate Aquifer System from surface activities.

3.6.2 Lehigh Acres Sandstone Member

The Lehigh Acres Sandstone Member is a Late Miocene-aged unit consisting of sandstone, sandy molluscan packstone, packstone, and unlithified coarse to fine-grained quartz sand (Missimer and Martin, 2001). This member forms what is termed the Sandstone Aquifer beneath the site. The Sandstone Aquifer is currently a source of water supply for irrigation and may be used for certain industrial applications associated with future mining activities.

3.6.3 Intermediate Lithologic Units

Within certain structures located on the southern part of the property, there are some additional limestone and sandstone units that are water-bearing. These units have not been formally defined with member names. Some exist beneath the Lee County Corkscrew Road Wellfield and may be present beneath the southern portion of the property. These units may be additional sources of water supply.

3.6.4 Fort Myers Clay Member

The Fort Myers Clay Member is the basal unit of the Peace River Formation and lies immediately above the Arcadia Formation. It is characterized by flat-bedding and contains a mixture of clay, quartz sands, and nodular and skeletal phosphorite. It has an overall low hydraulic conductivity.

3.7 Hawthorn Group-Arcadia Formation

The Arcadia Formation lies disconformably beneath the Peace River Formation. In the area beneath Troyer Brothers Florida, Inc., Lehigh Farms, it is known to be a marly phosphatic limestone. Attempts in the past to obtain irrigation water from this unit on this site were unsuccessful, and wells were drilled to greater depths. The limestone commonly developed within the top of the formation, which contains the Mid-Hawthorn Aquifer, is not productive beneath the site. Even deeper limestone units, which commonly form the Lower Hawthorn Aquifer, produce low yields in this area. The low productivity of this unit has also been observed at the C-43 aquifer storage and recovery test site located in

western Hendry County near the Lee County line (personal communication, SFWMD). Therefore, past agricultural water users drilled deep wells into the Ocala Formation to obtain irrigation water.

3.8 Suwannee Limestone

The geology of the Suwannee Limestone in the vicinity of the site is known solely from the few agricultural wells drilled for pasture irrigation during development of the nearby Baum Ranch located 1.5 miles to the east (near Old Corkscrew Plantation). The formation consists primarily of limestone, which is predominantly skeletal grainstones and packstones. Although the formation is Early Oligocene in age, it contained bedded quartz sand, which caused well construction problems. One of these wells, LM-797, was the first well in southern Florida shown to contain bedded quartz sand. Overall, the limestones within the formation did not have high values of hydraulic conductivity.

3.9 Ocala Formation

In 1974, three wells were originally drilled into the Ocala Formation to the east of site. The geology of the formation consisted of limestone, which was predominantly coarse grainstones and packstones.

Appendix A

Core Descriptions

TABLE A-1 Geological Log LS-6187
Troyer Brothers – TB-7

Location:
NW ¼, NE ¼, Sec. 21, Township 45 South, Range 27 East
Lee County Florida
Lat. 26° 27.881', Long. 81° 37.020'

Depth (ft bls)	Lithology
0 – 1	SAND, pinkish white (7.5YR 8/2), quartz, medium to fine grained, moderately sorted, subrounded, trace of organic material, medium hydraulic conductivity.
1-1.5	SAND, white (5Y 8/1), quartz, fine grained, moderately sorted, subrounded, medium hydraulic conductivity.
1.5 – 2	SAND, very dark gray (5Y 3/1), quartz, medium to fine grained, moderately sorted, subrounded, medium hydraulic conductivity.
2 -3.5	SAND, very dark grayish brown (2.5Y 3/2), quartz, medium to fine grained, moderately sorted, subrounded, trace of organic material, medium hydraulic conductivity.
3.5 – 5	SAND, dark gray (5Y 4/1), quartz, medium to fine grained (more fine grains), moderately sorted, subrounded, trace of organic material, medium to low hydraulic conductivity.
5 – 8	SAND, pale olive (5Y 6/3), quartz, medium grained, moderately sorted, subrounded, medium hydraulic conductivity.
8– 9	SAND, olive gray (5Y 5/2), quartz, medium grained, moderately sorted, subrounded, medium hydraulic conductivity.
9 – 12	SAND, pale yellowish (5Y 8/2), quartz, fine to very fine grained, moderately sorted, subrounded, medium hydraulic conductivity.
12 – 14.3	SAND, light brownish gray (2.5Y 6/2), quartz, fine grained, well sorted, subrounded, medium hydraulic conductivity.
14.3 – 19.5	LIMESTONE, pale yellow (5Y 8/2), packstone, shell fragments and coral fragments, medium hardness, some macropores (mostly intergranular pores), low hydraulic conductivity.

TABLE A-1 Geological Log LS-61
Troyer Brothers – TB-7

Depth (ft bls)	Lithology
19.5 – 23.5	MARL, pale yellow (5Y 8/4), sandy marl with 50% coral fragment and shell fragments (bivalve and gastropod), large piece of coral lithified with small pores (intragranular pores), fragments of shells, sandy mollusks, medium hardness, medium to high hydraulic conductivity.
23.5 – 25	MARL, pale yellow (5Y 8/3), light gray (5Y 7/1), 90% marl with about 10% hard, shelly, low macroporosity wackstone: 15% medium grained quartz sand, rare pores, low hydraulic conductivity.
25 – 30	MARL, light gray (5Y 7/2), 90% marl, 10% coral fragments and shells (lithified), low hydraulic conductivity.
30 – 33	MARL, gray (5Y 6/1), Marl and sandy molluskcan wackestone, about 75% of interval is marl, 25% is wackestone: hard, 15% quartz sand, some moldic and intergranular pores, low hydraulic conductivity.
33 – 34	LIMESTONE, light olive gray (5Y 6/2), quartz fossil wackestone/ packstone and marl, 85% limestone to 15% sticky marl, wackstone/packstone is very hard, 10-15% medium to fine grained quartz sand, over 50% small shell fragments; rare pores, medium to low hydraulic conductivity.
34 – 51	MISSING SAMPLES, likely sand and shell as below.
51 – 53	SAND and SHELL, light gray (5Y 7/2), little to no silt, over 70% shell fragments (bivalve and gastropod), sand is primarily fine to medium grained quartz, medium hydraulic conductivity.
53 – 54.5	SAND, light gray (5Y 7/1), marly and clayey sand (sticky) with approximately 5% shells, low hydraulic conductivity.
54.5– 56	LIMESTONE, light gray (5Y 7/2), sandy molluscan packstone/wackestone, very hard, 12-15% medium to fine grained quartz sand, 5-10% phosphorite, large pieces of shell fragments, abundant moldic and intergranular pores, medium to high hydraulic conductivity.
56 – 61	LIMESTONE, light gray (5Y 7/2), sandy molluscan wackestone, very hard, 10-15% medium grained quartz sand, 10% phosphorite, dense and heavy, some shell fragments, some small pores (intergranular pores), medium hydraulic conductivity.
61 – 62	MARL, light gray (5Y 7/2), sandy marl, soft, 5-6% phosphorite, small shells (10% fragments), medium hydraulic conductivity.

TABLE A-1 Geological Log LS-61[illegible]
Troyer Brothers – TB-7

Depth (ft bls)	Lithology
62 – 76	LIMESTONE, light gray (5Y 7/2), sandy skeletal wackestone, moderately hard, less dense than above, 12-15% medium to fine grained quartz sand, over 10% phosphorite, abundant macropores medium to low hydraulic conductivity.
76 – 78	LIMESTONE, light gray (5Y 7/2), sandy wackestone, hard, light (density), 5-10% medium grained quartz sand, 5-10% phosphorite, , 15-20% silt and mud, moderate sized moldic pores, medium hydraulic conductivity.
78 – 79	LIMESTONE, light olive gray (5Y 6/2), sandy skeletal wackestone and mudstone, medium hardness, 5-8% phosphorite, abundant macropores, medium hydraulic conductivity.
79-86	LIMESTONE, light olive gray (5Y 7/2), wackestone and mudstone, hard, about 60% to 40% ratio, relatively light, relatively light, 5% phosphorite, some macroporosity, medium to low hydraulic conductivity.
86 – 86.5	MARL, light greenish gray (10Y 8/1), sandy, clayey sediments, reacted to acid, light density, soft, 30-50% small pieces of shell fragments, 20-25% silt and mud, 20-25% medium grained quartz sand, medium to low hydraulic conductivity.
86.5 – 89	LIMESTONE, light yellowish brown (2.5Y 6/1), mudstone, very hard, dense, 1-5% fine grained quartz sand, 1-2% phosphorite, little visible pores, low hydraulic conductivity.
89 – 95.2	LIMESTONE, greenish gray (10Y 6/1), sandy molluscan packstone/wackestone, light (density), moderately hard, 5-8% fine grained quartz sand, some barnacles preserved, small bioturbated channels (small), 10-15% wackestone, medium hydraulic conductivity.
95.2 – 96	SAND, light greenish gray (10Y 8/1), silty sand, 2-5% phosphorite, 15-20% medium to fine grained quartz sand, medium to low hydraulic conductivity.
96 – 116	LIMESTONE, greenish gray (10Y 6/1), sandy molluscan wackestone/packstone, medium hardness, dense, 10-15% fossiliferous wackstone and remainder packstone some lithified shells, few pores except for small moldic pores, medium hydraulic conductivity.
116 – 118.5	LIMESTONE, light greenish gray (10Y 7/1), sandy molluscan wackestone, hard, dense, moldic porosity, no phosphorite, no aragonite preserved, 15-20% fine grained quartz sand, low hydraulic conductivity.

TABLE A-1 Geological Log LS-618
Troyer Brothers – TB-7

Depth (ft bls)	Lithology
118.5- 122	MARL and SAND, light greenish gray (5GY 8/1) to very dark gray (2.5Y 3/1), for the more organic deposits, silty sand, approximately 50%:50% distribution of sand and marl. Small fragments of shells and snails located in darker gray organic sediments, 15-20% medium grained quartz sand, medium to high hydraulic conductivity, freshwater deposits.
122 – 126	LIMESTONE, light greenish gray (10Y 7/1), sandy wackestone, hard, 10% medium to fine grained quartz sand, abundant moldic pores, no aragonite, no channel burrows, medium hydraulic conductivity; trace of marl.
126 – 135	LIMESTONE, light greenish gray (10Y 8/1), sandy molluscan wackestone/packstone, very hard, no aragonite remaining, 10% nodular phosphorite, moldic porosity, medium to low hydraulic conductivity.
135 – 146	LIMESTONE, light brownish gray (2.5Y 6/2), sandy molluscan wackestone, very hard, abundant bioturbated channels and moldic pores, molds of shells and snails (no aragonite remaining), 5-10% nodular phosphorite, high hydraulic conductivity.
146 – 153.5	LIMESTONE, light greenish gray (5GY 8/1), sandy molluscan wackestone, very hard, many less shell molds compared to above, no aragonite remaining, moldic pores and some inter-granular burrows)—small.
153.5 – 156	LIMESTONE, light gray (2.5Y 7/2), sandy molluscan wackestone, very hard, no aragonite remaining, moldic pores and some intergranular burrows –mostly small in size, medium hydraulic conductivity.
156 – 161	LIMESTONE and MARL, light brownish gray (2.5Y 6/2), sandy wackestone and lime mud, hard to moderately hard, no aragonite preserved, nodular phosphorite, 60% of interval is marl, medium to low hydraulic conductivity.
161 – 166	LIMESTONE, light gray (5Y 7/2), sandy skeletal wackestone, hard to moderately hard, 5-10% nodular phosphorite, no aragonite remaining, abundant moldic and intergranular pores, medium hydraulic conductivity, limestone is 90% of interval, 10% marly sand, light gray (5Y 7/2).
166 – 171	LIMESTONE, light olive gray (5Y 6/2), sandy skeletal wackestone, hard, 10-15% mudstone infilling vugs and moldic pores, abundant intergranular pores, 5% nodular phosphorite, no aragonite remaining, medium hydraulic conductivity.
171 – 188	LIMESTONE, light gray (5Y 7/2), sandy molluscan wackestone, hard, abundant moldic and intergranular pores, some vugs, 5-10% nodular

TABLE A-1 Geological Log LS-618
Troyer Brothers – TB-7

Depth (ft bls)	Lithology
	phosphorite, no aragonite remaining, medium to high hydraulic conductivity.
188 – 200	LIMESTONE, light olive gray (5Y 6/2), sandy molluscan wackestone, hard, intergranular pores and moldic pores, some channel porosity and vugs, less grains (more matrix than above), 1% nodular phosphorite, no aragonite remaining, medium to high hydraulic conductivity.
200 – 209.5	LIMESTONE, light gray (5Y 7/2), sandy molluscan wackestone, hard, intergranular pores, some vugs and moldic pores, some lithified shells and oysters, less dense relative to above, high hydraulic conductivity.
209.5 – 212	LIMESTONE and MARL, light gray (5Y 7/2), sandy molluscan wackestone, hard, intergranular and moldic porosity, 1% nodular phosphorite, no aragonite remaining, some mudstone filling vugs and burrows, medium to high hydraulic conductivity.
212 – 218	LIMESTONE, light greenish gray (10Y 8/1), sandy molluscan wackestone, medium hard to hard, some intergranular and moldic pores, but less than above, more sand and silt, 1% nodular phosphorite, no aragonite remaining, medium to high hydraulic conductivity.
218 – 220.5	LIMESTONE with MARL, light greenish gray (10Y 7/1), sandy molluscan wackestone/packstone, hard, some moldic and intergranular porosity, no aragonite remaining, medium to high hydraulic conductivity, 90% of interval is limestone, 10% marl, pale grayish yellow (10Y 7/2).
220.5 – 226	MARL, light gray (5Y 7/2), lime mud with 30% medium to fine grained quartz sand, <5% calcitic shell fragments, low hydraulic conductivity.
226 – 236	LIMESTONE with MARL, light olive gray (5Y 6/2), sandy molluscan wackestone, moderately hard, moldic and intergranular porosity, 5-10% medium to fine grained quartz sand, no aragonite remaining, mostly medium to low hydraulic conductivity, 90% of interval is limestone.
236 – 246	LIMESTONE, light olive gray (5Y 6/2), sandy molluscan wackestone, moderately hard to soft, some trace of phosphorite, some calcitic shells, relatively low hydraulic conductivity.
246 – 256	LIMESTONE, pale yellow (5Y 8/2), sandy molluscan wackestone, hard, abundant moldic and intergranular porosity, no aragonite remaining, 1-2% nodular phosphorite, 5% medium to fine grained quartz sand, high hydraulic conductivity, trace amount of marl.

TABLE A-1 Geological Log LS-618
Troyer Brothers – TB-7

Depth (ft bls)	Lithology
256 – 260	LIMESTONE with MARL, grayish brown (10YR 5/2), mudstone to wackestone, moderately hard to hard, some moldic and intergranular porosity, 5-8% medium to fine grained quartz sand, no aragonite remaining, medium to low hydraulic conductivity, limestone is 85% of interval, marl 15%.
260 – 261.5	MARL, olive gray (5Y 4/2), lime mud containing very fine sand to silt, phosphorite, and some calcitic shell fragments, low hydraulic conductivity.
261.5 – 263	MARL, gray (5Y 6/1), lime mud mixed composition of clay, phosphorite, calcitic shell fragments, and medium to fine grained quartz sand; low hydraulic conductivity.
263 – 272	LIMESTONE, light gray (5Y 7/1), silty wackestone (90%), hard, 10% of marl with mixed composition of fine silt, clay and medium to fine grained quartz sand, low hydraulic conductivity.
272 – 273.5	CLAY, olive gray (5Y 5/2), mixed composition of clay and medium to fine quartz sand, low hydraulic conductivity.
273.5 – 276	MARL, dark olive gray (5Y 4/2), mixed composition of fine sand and silt, clay, shell fragments, phosphorite, and 15-20% medium to fine grained quartz sand and 1-3% carbonate sand, more siltier than above, low hydraulic conductivity.
276 – 279	MARL, olive (5Y 5/3), mixture of clay, shells, phosphorite, and some poorly lithified mudstone (soft), low hydraulic conductivity.
279 – 282	LIMESTONE and MARL, olive (5Y 5/3), mudstone and marl, with the ratio of 50% to 50%, mudstone is moderately hard to soft, while marl is similar to the composition of above: mixed composition of clay, shell, phosphorite, 10-15% fine grained sand and 1% carbonate sand, more siltier than above layer, low hydraulic conductivity.
282 – 286	SANDSTONE, pale olive (5Y 6/3), borderline limestone/sandstone, moderately hard to hard, is a mixture of sand, silt, and sandstone rock, medium to fine grained quart sand (20-25%), fine silt (10-15%), some oyster shells (5%), some intergranular and little moldic porosity, no aragonite remaining, medium hydraulic conductivity.
286 – 296	MISSING SAMPLE, mostly like the sample above.

TABLE A-2 Geological Log LS-6188
Troyer Brothers – TB-6

Location: SW ¼, SW ¼, Sec. 16, Township 46 South, Range 27 East
Lee County Florida
Lat. 26° 27.925', Long. 81° 37.490'

Depth (ft bls)	Lithology
0 – 0.5	SAND, very dark grayish brown (10YR 3/2), quartz, medium to fine grained, moderately sorted, subrounded, trace of phosphorite, 5-10% carbonate grains, medium hydraulic conductivity.
0.5 – 1	SAND, dark gray (2.5Y 4/1), quartz, medium to fine grained, moderately sorted, subrounded, 5-10% phosphorite, medium hydraulic conductivity.
1 – 1.5	SAND, dark grayish brown (10YR 4/2), medium to fine grained quartz sand, mostly subrounded, trace of phosphorite (<2%), medium hydraulic conductivity.
1.5 – 4	SAND, brown to dark brown (10YR 4/3 to 10YR 3/3), quartz, mostly medium to fine grained, subrounded, trace of phosphorite (5-10%), some carbonate grains, medium hydraulic conductivity.
4 – 4.5	SAND, dark yellowish brown (10YR ¾), quartz, medium to fine grained, subrounded, some darker organic material, 5-10% phosphorite, medium hydraulic conductivity.
4.5 – 8.5	SAND, light gray (5Y 7/1), quartz, medium to fine grained, rounded to subrounded, mixed with <5% darker organic material, trace of carbonate grains and phosphorite (<5%), medium hydraulic conductivity.
8.5– 10.5	SAND, grayish brown (2.5Y 5/2), quartz, medium to fine grained (more fine grains), subrounded, 5% phosphorite, 10% carbonate grains, medium hydraulic conductivity.
10.5 – 28	MISSING SAMPLE, likely sand and/or marl.
28 – 29	MARL, olive yellow (2.5Y 6/8), mixed composition of sand, silt, clay, small pieces of shell and lime mud, 40% medium to fine grained quartz sand, medium to low hydraulic conductivity.
29 – 32	LIMESTONE, light gray (5Y 7/2), mixed layer of mudstone and wackestone, very hard, very little intergranular porosity, some moldic porosity, no aragonite remaining, less than 1% nodular phosphorite, some

TABLE A-2 Geological Log LS-618'
Troyer Brothers – TB-6

Depth (ft bls)	Lithology
	shell fragments, for wackestone, some vuggy and channel porosity, medium hydraulic conductivity.
32 – 34.5	MARL and LIMESTONE, light gray (2.5Y 7/1), mixed composition of shells, gastropods, ostracods, 30% silty clay, 10-15% phosphorite, 20-25% medium to fine grained sand, 80% of interval is marl; limestone (20%), wackestone, very hard, some shell fragments, no aragonite remaining, 5% phosphorite, some intergranular and moldic porosity, very dense, medium hydraulic conductivity.
34.5 – 36	MARL, light gray (2.5Y 7/1), mixture of small shell fragments, silt, clay, lime mud, medium to fine grained quartz sand, trace of phosphorite, low hydraulic conductivity.
36 – 38	LIMESTONE and MARL, light greenish gray (5GY 7/1), sandy molluscan wackestone, moderately hard, abundant moldic and intergranular porosity, 15-20% medium to fine grained quartz sand, no aragonite remaining, 5-10% phosphorite, medium to high hydraulic conductivity.
38 – 38.5	MARL, light gray (2.5Y 7/1), mixed composition of small shell fragments, sand and silt, clay, lime mud, and approximately 10% medium to fine grained quartz sand, fresh water snails present, low hydraulic conductivity.
38.5 – 43	LIMESTONE, pale yellow (2.5Y 8/2), sandy molluscan wackestone, medium hardness, shelly, abundant moldic pores, intergranular pores, vugs, and channel porosity, high hydraulic conductivity.
43 – 43.5	LIMESTONE, pale yellow (2.5Y 8/2), sandy molluscan wackestone/packstone, medium hardness, abundant moldic pores, intergranular pores, vugs and channels, no aragonite remaining, high hydraulic conductivity.
43.5 – 46	MISSING SAMPLE, likely limestone.
46 – 47	LIMESTONE, light olive gray (5Y 6/2), sandy molluscan wackestone, moderately hard to hard, some moldic and intergranular porosity, less porous than above, some large shell fragments, medium hydraulic conductivity.
47 – 56.5	LIMESTONE, light greenish gray (10Y 7/1), sandy molluscan wackestone, moderately hard to hard, some moldic and intergranular porosity, 20-30% medium to fine grained quartz sand, nodular phosphorite, no aragonite remaining, medium hydraulic conductivity.

TABLE A-2 Geological Log LS-618
Troyer Brothers – TB-6

Depth (ft bls)	Lithology
56.5 – 57.5	LIMESTONE, light greenish gray (10Y 7/1), sandy molluscan wackestone to mudstone, moderately hard to hard, abundant moldic and intergranular pores, some vugs (some infilled), 10-15% medium to fine grained quartz sand, hydraulic conductivity varies from high to low.
57.5 – 58.5	LIMESTONE, yellowish brown (10YR 5/4), mostly well packed mudstone with 20% sandy molluscan wackestone, hard, little or no moldic or intergranular pores for the mudstone, 5-10% nodular phosphorite, no aragonite remaining, very low to medium hydraulic conductivity.
58.5 – 60	LIMESTONE, light brownish gray (2.5Y 6/2), very sandy molluscan wackestone, moderately hard, very shelly, very high moldic and intergranular porosity, no aragonite remaining, some marl, medium to high hydraulic conductivity.
60 – 61	LIMESTONE with MARL, light gray (2.5Y 7/1), sandy molluscan wackestone, moderately hard, high intergranular and moldic porosity, 20-30% medium grained quartz sand, no aragonite remaining, some small vugs, medium to high hydraulic conductivity, limestone is 80% of interval; 20% marl, light gray (2.5Y 7/1).
61 – 70.5	LIMESTONE, light olive gray (5Y 6/2), sandy molluscan wackestone, hard, high intergranular and moldic porosity, 30% medium to fine grained quartz sand, some vuggy and channel porosity, 5-10% nodular phosphorite, no aragonite remaining, high hydraulic conductivity.
70.5 – 71.5	LIMESTONE, light gray (5Y 7/2), sandy molluscan wackestone and light olive brown (2.5Y 5/2) mudstone (50% to 50%), hard, wackestone contains 20% quartz, has intergranular and moldic porosity, no aragonite remaining, mostly medium to low hydraulic conductivity.
71.5 – 75.5	LIMESTONE, light gray (5Y 7/2), sandy molluscan wackestone, hard, moderate to high intergranular porosity, medium moldic porosity, few vugs, 20-30% medium to fine grained quartz sand, 1% nodular phosphorite, no aragonite remaining, medium hydraulic conductivity.
75.5 – 76.3	LIMESTONE, pale yellow (5Y 7/3), sandy molluscan wackestone, hard, high intergranular porosity, medium to high moldic porosity, 5% nodular phosphorite, no aragonite, abundant oyster fragments coated with precipitated sand and silt, 20-30% large to medium grained quartz sand, medium hydraulic conductivity.
76.3 – 89	LIMESTONE, pale yellow (5Y 8/2), sandy molluscan wackestone, very hard, very high moldic porosity, high intergranular porosity, some small

TABLE A-2 Geological Log LS-618
Troyer Brothers – TB-6

Depth (ft bls)	Lithology
	vugs, 10-15% medium to fine grained quartz sand, some nodular phosphorite, abundant shell molds, no aragonite remaining, high hydraulic conductivity.
89 – 92	LIMESTONE, light olive gray (5Y 6/2), sandy molluscan wackestone/ packstone, medium hard to hard, high moldic and intergranular porosity, some vugs, no channel, 20% medium to fine grained quartz sand; shells and snails lithified and well set in the matrix; no aragonite preserved, 1% nodular phosphorite, high hydraulic conductivity.
92 – 95.5	LIMESTONE, pale olive (5Y 6/3), sandy molluscan wackestone/ packstone, hard, high inter-granular porosity, medium moldic porosity, no vug or channel; 20-25% medium to fine grained quartz sand, 5% pore-lining phosphorite, no aragonite, medium hydraulic conductivity.
95.5 – 98	LIMESTONE, light yellowish brown (2.5Y 6/3), sandy molluscan wackestone/packstone, hard, high intergranular and moldic porosity, no vug and channel, 20-30% medium to fine grained quartz sand, very large pieces of oysters were founded coated with precipitated sandy materials; 5-10% nodular phosphorite, 1% pore-lining phosphorite, no aragonite preserved, medium hydraulic conductivity.
98 – 115.5	LIMESTONE, light yellowish brown (2.5Y 6/3), sandy molluscan wackestone and mudstone, hard to soft, high intergranular and moldic porosities, no vug and channel, 20-30% medium to fine grained quartz sand, very large pieces of oysters were founded coated with precipitated sandy materials; 5-10% nodular phosphorite, 1% pore-lining phosphorite, no aragonite preserved, medium hydraulic conductivity.
115.5 – 120	LIMESTONE, pale olive (5Y 6/4), sandy molluscan wackestone, moderately hard to soft, high intergranular and moldic porosity, some vugs, no channel, 30-35% medium to fine grained quartz sand, very large oyster shells lithified and coated with sandy materials, formed heavy relatively dense rock, 1-5% nodular phosphorite, no aragonite, medium hydraulic conductivity.
120 – 127	LIMESTONE, olive gray (5Y 5/2), sandy molluscan wackestone, moderately hard to soft, high intergranular and modlic porosity, some vugs and channels, which were half filled by sandy deposits on top, 25-30% medium to fine grained quartz sand, 5% fine silt, no phosphorite and aragonite, medium to high hydraulic conductivity.

TABLE A-2 Geological Log LS-618
Troyer Brothers – TB-6

Depth (ft bls)	Lithology
127 – 132	LIMEMUD, light brownish gray (10YR 6/2), mixed composition of sand, silt, clay, and oyster shells; sand is approximately 40-45% fine grained quartz sand and silt; 25-30% calcitic shells, 1% phosphorite, low hydraulic conductivity.
132 – 137	LIMESTONE and LIMEMUD, yellowish brown (10YR 5/4), wackestone and limemud; wackestone is about 85% of the interval, moderately hard to soft; limemud (15%) mixed composition of 35% - 40% medium to fine grained quartz sand and silt, 30-35% calcitic shells, found oysters and barnacles, 1% phosphorite, low hydraulic conductivity.
137 – 151	LIMESTONE, light brownish gray (2.5Y 6/2), sandy molluscan wackestone, hard, high intergranular and moderate to low moldic porosity, little vugs and channel porosity, 10-15% medium and fine grained quartz sand, shark tooth, lithified shells and sandy materials settled on top of oyster shells, formed this type of rock, 5% nodular phosphorite, 1% pore-lining phosphorite, no aragonite trace, medium to low hydraulic conductivity.
151 – 156	Missing sample, mostly like the formation above.
156 – 162	MARL, light olive gray (5Y 6/2), clayey marl with mixed composition of 40% medium to fine grained quartz sand and silt, silty and stiff, 30 – 35% calcitic shells, 1% pore-lining phosphorite, low hydraulic conductivity.
162 -166	LIMESTONE, light olive gray (5Y 6/2), sandy molluscan wackestone, hard, high intergranular and moldic porosity, some vugs, no distinctive channel, 30% medium to fine grained quartz sand, 5% nodular phosphorite, no aragonite, some large pieces of oyster shells lithified and coated with sandy molluscan precipitates, medium to high hydraulic conductivity.
166 – 180	LIMESTONE, light gray (5Y 7/2), sandy molluscan wackestone, moderately hard to hard, high intergranular, low moldic porosity, no vug and channel, 15-20% medium to fine grained quartz sand, 10-15% fine silt, more silty look than above layer core, medium to low hydraulic conductivity.
180 – 184	LIMESTONE and MARL, light gray (5Y 7/2), mixed formation of wackestone (65%) and marl (35%); for the limestone, it is hard, primarily sandy molluscan wackestone with 20% medium to fine grained quartz sand, 5-10% pore-lining nodular phosphorite, trace of aragonite, good intergranular and moldic porosity, some vugs, no distinctive channels;

TABLE A-2 Geological Log LS-61
Troyer Brothers – TB-6

Depth (ft bls)	Lithology
	for the marl, it is mainly limemud with mixed composition of 40-45% medium to fine grained sand and silt, 10-15% calcitic shells, 5-10% nodular phosphorite, wackestone should have pretty high hydraulic conductivity , with the mixture of marl, the hydraulic conductivity of this layer is mostly medium level.
184 – 186	Missing sample, mostly similar to the formation above.
186 – 195	LIMESTONE and MARL, light olive gray (5Y 6/2), sandy molluscan wackestone (85%) and marl (15%), medium intergranular and low moldic porosity, no vug or channel porosity here, moderately hard, 20-25% medium to fine grained quartz sand, some calcitic shells and some large oyster shells infilled by sandy molluscan sediment inside (almost shell beds), 1% nodular phosphorite, medium hydraulic conductivity.
195 – 196	LIMESTONE, light olive brown (2.5Y 5/4), sandy molluscan wackestone (mixed with 10% mudstone), hard, blackish lithified oyster shells coated by layers of brownish silt, mud and sand, very dense, no phosphorite and no aragonite, 40-45% medium to fine grained sand, some intergranular porosity, as well as moldic porosity, high hydraulic conductivity.
196 – 198.5	LIMESTONE, pale yellow (2.5Y 7/3), wackestone and mudstone, moderately hard, 20-30% medium to fine grained quartz sand and silt (20-30%), moderate to low macro porosities (vuggy and channels'), medium to low intergranular porosity, no phosphorite, no aragonite, high hydraulic conductivity.
198.5 – 200	MARL/CLAY, grayish brown (2.5Y 5/2), silty marl and clay with 20-50% very fine grained quartz sand and silt, which has more silt than sand; 5-6% nodular phosphorite, 1-2% calcitic shells, foraminifera for its skeletal grain type, low hydraulic conductivity.
200 – 201.5	MARL, light gray (2.5Y 7/1), shelly marl with mixed composition of 40-45% shell fragments, 10-15% clay, 5-10% nodular phosphorite, calcitic shells, stiff, low hydraulic conductivity.
201.5 – 215	LIMESTONE, gray (5Y 6/1), mudstone and sandy molluscan wackestone, hard to moderately hard, 25-35% medium to fine grained quartz sand (mostly fine), no phosphorite and no aragonite, medium intergranular porosity and low moldic porosity, little vuggy porosity, no channel porosity, medium to low hydraulic conductivity.

TABLE A-2 Geological Log LS-618
Troyer Brothers – TB-6

Depth (ft bls)	Lithology
215 – 216	LIMESTONE, light gray (5Y 7/2), sandy molluscan wackestone, hard, 30-40% medium to fine grained quartz sand, 10-15% nodular phosphorite (fine to silty), no aragonite, low to medium moldic porosity, high intergranular porosity, no vuggy or channel porosities, some calcitic shells (15-20%), medium to high hydraulic conductivity.
216 – 223.5	Sample missing, mostly like sample below.
223.5 – 226	LIMESTONE, pale yellow (5Y 7/3), mudstone, moderately hard to soft, some lithified shells and calcitic shells as well (5-8%), 5-10% nodular phosphorite, no aragonite preserved, low macro porosity, low hydraulic conductivity.
226 – 237	MARL and CLAY, light olive gray (5Y 6/2), silty marl/clay with 30-50% fine grained quartz sand and silt (mostly silt), 10% nodular shells, foraminifera grain type, low hydraulic conductivity.
237 – 246	CLAY, olive (5Y 4/2), silty clay with mixed composition of 50-60% calcitic shells, 10-15% clay, 15-20% silt, 10-12% nodular and pore-lining phosphorite, trace of top-set and fore-set boundary deposits, medium hydraulic conductivity.
246 – 260	CLAY, dark grayish brown (2.5Y 4/2), clay, stiff, 10-15% nodular phosphorite, 1% calcitic shells, skeletal grain type tends to be like foraminifera, low hydraulic conductivity.
260 – 261	CLAY, very dark gray (5Y 3/1), clay composed of 30-45% shells, 10-15% clay, 10-20% fine sand and silt, shells are mostly white, 10-15% nodular phosphorite, some other black organic materials, mostly plants debris, low hydraulic conductivity.
261 – 276	CLAY, dark olive gray (5Y 3/2), clay mixed with some fine quartz silt, 1% nodular phosphorite, stiff and brittle, some calcitic shells (1%), very thinly laminated, very low hydraulic conductivity.
276 – 277.5	CLAY, dark olive gray (5Y 3/2), silty clay composed of 20-35% medium to fine grained quartz sand and silt, 20-25% nodular phosphorite, 1-2% calcitic shells, foraminifera, softer than previous core, medium to low hydraulic conductivity.
277.5 – 282	SANDSTONE, light gray (5Y 7/1) and light olive gray (5Y 6/2), calcareous sandstone (65%) and sand (35%), hard, coral molds and shell molds, 30-40% medium to fine grained quartz sand, 5-6% nodular and skeletal phosphorite, medium to high moldic porosity, bioturbated, no distinctive channels, medium hydraulic conductivity.

TABLE A-2 Geological Log LS-618
Troyer Brothers – TB-6

Depth (ft bls)	Lithology
282 – 286	SAND, white (5Y 8/1), quartz, medium to fine grained (mostly fine grained), moderately sorted, subrounded, 15-20% phosphorite, 5-8% calcitic shells, medium hydraulic conductivity.
286 – 296	MISSING SAMPLE, likely similar to the above formation.

TABLE A–3 Geological Log LS-6190
Troyer Brothers – TB-3

Location: NW ¼ NW ¼, Sec. 16, Township 46 South, Range 27E
Lee County Florida
Lat. 26° 28.617', Long. 81° 37.332'

Depth (ft bls)	Lithology
0 – 4.0	SAND, very dark gray (5 Y 3/1), quartz, medium to fine grained, medium sorting, subrounded, 1% phosphorite, medium hydraulic conductivity.
4.0 – 8.5	SAND, dark yellowish brown (10 YR 3/6), quartz, medium to fine grained, moderately sorted, subrounded, 5-10% phosphorite, medium hydraulic conductivity.
8.5 – 15.0	SAND, brown (10 YR 4/3), quartz, medium to fine grained, moderately sorted, subrounded, 1% phosphorite, trace of carbonate grains, medium hydraulic conductivity.
15.0 – 18.0	LIMESTONE, light gray (2.5 Y 7/1), sandy molluscan wackestone, hard and dense, 1% phosphorite, no aragonite, burrows infilled with mudstone material, some moldic porosity, low intergranular porosity, medium to low hydraulic conductivity.
18.0 – 23.0	LIMESTONE, light gray (2.5 Y 7/2), sandy molluscan wackestone, hard, 1-5% aragonite, no phosphorite, moldic and intergranular porosity, vuggy porosity, 5 -10% fine grained quartz sand, medium hydraulic conductivity.
23.0 – 25.0	LIMESTONE, pale yellow (2.5 Y 8/2), mudstone/wackestone, hard, dense, trace of quartz sand, some channel and vuggy porosity, little or no moldic and intergranular pores, medium to low hydraulic conductivity.
25.0 – 26.0	LIMESTONE, pale yellow (2.5 Y 8/2), sandy molluscan wackestone, moderately hard, 15–20% fine to very fine grained quartz sand, some silt, no phosphorite, 5 -8% aragonite, moldic and intergranular porosity, channel and vuggy porosities, medium to high hydraulic conductivity.
26.0 – 30.0	LIMESTONE and LIMEMUD, brown (10 YR 5/3) and very pale brown (10 YR 7/3), mudstone and limemud; mudstone---brownish color, hard, and dense, 1% phosphorite, 15% aragonite, moldic and vuggy porosities, channel porosities, little intergranular porosity; limemud---very pale brownish color, 30-40% medium to fine grained quartz sand, 30–40% shells and corals, some clay, medium to low hydraulic conductivity.

TABLE A–3. Geological Log LS-61.
Troyer Brothers – TB-3

Depth (ft bls)	Lithology
30.0 – 34.0	LIMEMUD, very pale brown (10 YR 7/3), limemud with mixed composition of 25–35% fine to very fine grained quartz sand and silt, 40 -50% shells and corals, 10–15% mudstone fragments, trace of phosphorite and aragonite, high hydraulic conductivity.
34.0 – 37.0	LIMESTONE, light olive gray (5 Y 6/2), sandy molluscan wackstone, hard and dense, 1-5% aragonite, 1% phosphorite, moldic porosity is high, intergranular porosity is low, some vuggy porosity, some calcitic shells, medium to low hydraulic conductivity.
37.0 – 40.0	CLAY and LIMESTONE, light gray (5 Y 7/1), marly clay and mudstone, hard, clay is stiff, while the mudstone is hard, clay and mudstone ratio is about 80% to 20%, trace of aragonite, no phosphorite, little/no visible porosity, low hydraulic conductivity.
40.0 – 41.5	LIMESTONE and LIMEMUD, light gray (5 Y 7/1), mudstone and limemud, mudstone (55-60%) is hard and low porosity, while limemud (40-45%) composed of over 50% fine to very fine grained quartz sand and silt, no aragonite and phosphorite, very silty, low hydraulic conductivity.
41.5 – 43.0	LIMEMUD, white (5 Y 8/1), limemud composed of 40–50% fine to very fine grained quartz sand and silt, trace of phosphorite, 1–5% shell fragments, low hydraulic conductivity.
43.0 – 44.0	LIMESTONE, light gray (5 Y 7/1), sandy molluscan wackestone/mudstone, hard, 1-5% aragonite, no phosphorite, low intergranular and moldic porosity, 15–20% fine to very fine grained quartz sand and silt, vuggy porosity, bioturbated, burrows infilled with bluish wackestone, some marl (<15-10%) low hydraulic conductivity.
44.0 – 46.0	LIMESTONE, light gray (5 Y 7/1), sandy molluscan wackestone, moderately hard, 15-20% medium to fine grained quartz sand, no aragonite and phosphorite, intergranular and moldic porosity, vuggy porosity, medium to low hydraulic conductivity.
46.0 – 48.0	LIMEMUD and LIMESTONE, light olive gray (5 Y 6/2) and pale yellow (2.5 Y 8/2), limemud (70-80%) and sandy molluscan wackestone (15-20%); sandy molluscan wackestone: moderately hard, 5 -10% nodular phosphorite, 4 - 8% pore-lining phosphorite, very shelly, moldic porosity and intergranular porosity; for the pale yellowish limemud, it is composed of 60–65% shells (gastropods, ostracods), some calcitic shells, 1-5% phosphorite, 20-30% medium to fine grained quartz sand, medium hydraulic conductivity overall.

TABLE A–3. Geological Log LS-619
Troyer Brothers – TB-3

Depth (ft bls)	Lithology
48.0 – 50.5	LIMEMUD, grayish brown (2.5 Y 5/2), limemud with composition of 60–70% shells, 30-35% medium to fine grained quartz sand and silt, gastropods, medium hydraulic conductivity.
50.5 – 51.5	LIMEMUD, light olive brown (2.5 Y 5/3), mixed composition of 60–65% shells, 30-35% fine to very fine grained quartz sand and silt, 1-5% phosphorite, gastropods and coral fragments, medium to high hydraulic conductivity.
51.5 – 54.5	CLAY, very dark gray (5 Y 3/1), clay with 40-50% medium to fine grained quartz sand and silt, 20-25% shells, 5–8% phosphorite, 5–10% blackish organic materials (mostly plants debris), low hydraulic conductivity.
54.5 – 55.5	MARL/CLAY, light gray (5 Y 7/2), clayey limemud with 50-60% fine to very fine grained quartz sand and silt, 10–20% shells, 5-10% phosphorite, and some small fragments of limestone rock, low hydraulic conductivity.
55.5 – 59.5	LIMESTONE and LIMEMUD, gray (5 Y 6/1), sandy molluscan wackestone (80-85%) and limemud (15-20%), hard, 20–25% medium to fine grained quartz sand, 1% nodular phosphorite, no aragonite, moldic and intergranular porosity, as well as some vuggy porosity, bioturbated, some burrows infilled with sandy wackestone/packstone materials, limemud is less than 15%, medium hydraulic conductivity.
59.5 – 66.0	MISSING SAMPLE, likely similar to the formation above.
66.0 – 75.0	LIMESTONE, light gray (5 Y 7/1), sandy molluscan wackestone, hard, 1–5% phosphorite, no aragonite, 15–20% fine to very fine grained quartz sand and silt, medium moldic and intergranular porosities, medium vuggy porosity, medium hydraulic conductivity.
75.0 – 78.0	LIMESTONE, light gray (5 Y 7/1), sandy molluscan wackestone/mudstone, hard, 15–20% medium to fine grained quartz sand, 1–5% phosphorite, no aragonite, moldic and intergranular porosities, some vuggy porosity, medium hydraulic conductivity.
78.0 – 79.5	LIMEMUD, light gray (5 Y 7/1), clayey limemud with 50-55% medium to fine grained quartz sand and silt, 25–35% shells, 5–10% phosphorite, medium to low hydraulic conductivity.
79.5 – 81.0	LIMESTONE, light gray (5Y 7/1), mudstone/sandy molluscan wackestone,

TABLE A–3. Geological Log LS-615
Troyer Brothers – TB-3

Depth (ft bls)	Lithology
	hard, some medium to fine grained quartz sand, some carbonate grains, some moldic, intergranular and vuggy porosities, no channel, 5-10% pore-lining and nodular phosphorite, medium hydraulic conductivity.
81.0 - 84.0	LIMESTONE, light gray (5 Y 7/1), sandy molluscan wackestone, hard, 20–25% medium to fine grained quartz sand, 5–8% pore-lining and nodular phosphorite, good intergranular and vuggy porosities, some moldic porosity, medium hydraulic conductivity.
84.0 – 86.0	LIMESTONE and LIMEMUD, pale yellow (5 Y 8/3) and light yellowish brown (2.5 Y 6/4), mudstone and limemud; limemud---pale yellowish color, composed of 50–60% medium to fine grained quartz sand and silt, 20-30% mudstone fragments, 5-10% phosphorites; mudstone---yellowish brown, little visible pores, except few vugs, hard and dense, low hydraulic conductivity.
86.0 – 90.0	LIMESTONE, light gray (2.5 Y 7/1), sandy molluscan wackestone, moderately hard, 10% fine grained quartz sand, some carbonate grains, 1–5% phosphorite, no aragonite, some vuggy, moldic, intergranular porosities, medium hydraulic conductivity.
90.0-90.5	LIMEMUD, light brownish gray (2.5 Y 6/2), limemud/marly clay with 55–65% medium to fine grained quartz sand, 25–30% shells, 1% phosphorite, low hydraulic conductivity.
90.5 – 99.0	LIMESTONE, light gray (5 Y 7/2), sandy molluscan wackestone/ packstone, medium hardness, 10-15% fine to very fine grained quartz sand, no phosphorite, and no aragonite, high intergranular porosity, medium moldic and vuggy porosities, medium hydraulic conductivity.
99.0 – 105.0	LIMESTONE, light gray (5Y 7/2), sandy molluscan wackestone/packstone, medium hardness, 10% fine grained quartz sand, no phosphorite and no aragonite, high moldic and intergranular porosities, some vuggy porosity, medium to high hydraulic conductivity.
105.0 – 112.0	LIMESTONE, light gray (5 Y 7/1), sandy molluscan wackestone, medium hardness, 15–20% medium to fine grained quartz sand, 1–5% phosphorite, trace of aragonite, medium high moldic and intergranular porosities, some vuggy porosity , medium hydraulic conductivity.
112.0 – 116.0	LIMESTONE, light olive gray (5 Y 6/2), sandy molluscan wackestone, hard, large pieces of oyster shells coated with sandy and silty sediments, ostracods, and some barnacles, high inter-granular porosity, medium

TABLE A–3. Geological Log LS-619
Troyer Brothers – TB-3

Depth (ft bls)	Lithology
	moldic porosity, no channel, medium hydraulic conductivity.
116.0 – 133.0	LIMESTONE, pale olive (5 Y 6/3), sandy molluscan wackestone, pale yellow (2.5 Y 8/2), medium hardness, 1-5% phosphorite, large oyster shells coated with sandy molluscan sediments, no aragonite, medium intergranular, vuggy, and moldic porosities, medium hydraulic conductivity.
133.0 – 136.0	Missing sample (mostly similar to the layer beneath it).
136.0 – 138.0	LIMEMUD, olive yellow (2.5 Y 6/6), limemud with mixed composition of 60–70% fine to very fine grained quartz sand and silt, 10% shells, 10–15% carbonates grains, 1-5% phosphorite, low hydraulic conductivity.
138.0 – 142.0	LIMEMUD, olive gray (5 Y 5/2), limemud with 30% shells (mostly are oyster shells), 40–50% medium to fine grained quartz sand and silt, 1–5% phosphorite, less than 10% limestone fragments (mostly wackestone), some calcitic shells, low hydraulic conductivity.
142.0 – 148.0	LIMESTONE, pale yellow (5 Y 7/4), sandy molluscan wackestone, soft to moderately hard, 1-5% phosphorite, no aragonite, some carbonate grains (< 10%) as well as quartz sand, some intergranular, moldic, and vuggy porosities, no channel, medium to low hydraulic conductivity.
148.0 – 149.0	LIMESTONE and LIMEMUD, light gray (5 Y 7/1), hard, wackestone (90%) and limemud (10%)---with 30% shells, 40–50% fine to very fine grained quartz sand and silt; wackestone---hard, low moldic porosity, no aragonite, low hydraulic conductivity.
149.0 – 156.0	Missing sample (mostly like the sample above).
156.0 – 159.0	LIMEMUD and LIMESTONE, light olive gray (5 Y 6/2), limemud (30-40%) and wackestone (65%), limemud---mixed composition of 40% shells (fragments of large oysters), 40% fine to very fine grained quartz sand, 1% phosphorite; wackestone---hard, low moldic porosity, mostly associated with oyster fragments, low hydraulic conductivity.
159.0 – 168.0	MARL, light gray (5Y 7/2), silty marl with mixed composition of 40–50% fine to very fine grained quartz sand and silt, 20% wackestone fragments, low hydraulic conductivity.
168.0 – 169.0	MARL and LIMESTONE, olive (5 Y 5/3), mixed composition of clayey marl (over 60-70%), fragments of mudstone (< 30-40%), 5–8%

TABLE A–3. Geological Log LS-619
Troyer Brothers – TB-3

Depth (ft bls)	Lithology
	nodular phosphorite, the percentage of clay increase as the increase of depth, low hydraulic conductivity.
169.0 – 176.0	MARL, olive (5 Y 5/3), silty and clayey marl, stiff, 60-65% very fine grained quartz sand and silt, 5-8% nodular phosphorite, 5% shells (in thin lenses), low hydraulic conductivity.

TABLE A–4 Geological Log LS-6191
Troyer Brothers – TB-2

Location: NW ¼ SW ¼, Sec. 9, Township 46 South, Range 27E
Lee County Florida
Lat. 26° 29.225', Long. 81° 37.592'

Depth (ft bls)	Lithology
0 – 2.2	SAND, very dark gray (10 YR 3/1), quartz, medium to fine grained, moderately sorted, subrounded, 1-5% phosphorite, 5-8% carbonate grains, medium hydraulic conductivity.
2.2 - 5.0	SAND, pale yellow (2.5 Y 8/3), quartz, medium to fine grained, medium sorted, subrounded, 1-2% phosphorite, medium hydraulic conductivity.
5.0 - 6.0	SAND, light brownish gray (10 YR 6/2), quartz, medium to fine grained, mixed with 10-15% fine sand and silt, 20-25% blackish organic materials, mostly plants debris; no trace of phosphorite, medium to low hydraulic conductivity.
6.0 – 7.5	SAND, dark grayish brown (10 YR 4/2), quartz, medium to fine grained, moderately sorted, subrounded, 1-5% phosphorite, 1% carbonate grains, medium hydraulic conductivity.
7.5 – 8.5	SAND, very pale brown (10 YR 8/2), quartz, medium to fine grained, moderately sorted, subrounded, 5% phosphorite, medium hydraulic conductivity.
8.5 – 10.7	SAND, light gray (10 YR 7/2), quartz, medium to fine grained, moderately sorted, subrounded, 20-25% very fine sand and silt, 5-8% phosphorite, medium to low hydraulic conductivity.
10.7 – 12.7	SAND, light brownish gray (10 YR 6/2), quartz, medium to fine grained, moderately sorted, subrounded, 5-10 % very fine sand and silt, 2-5% phosphorite, medium to low hydraulic conductivity.
12.7 – 15.0	SAND, white (5 Y 8/1), quartz, medium to fine grained, mostly are fine grained, moderately sorted, subrounded to somewhat rounded, 5 – 8% phosphorite, medium hydraulic conductivity.
15.0 – 16.0	SAND, light brownish gray (10 YR 6/2), quartz, medium to fine grained, moderately sorted, subrounded, 5-10 % very fine sand and silt, 5% phosphorite, 1% calcitic shells, medium to low hydraulic conductivity.

TABLE A–4. Geological Log LS-615
Troyer Brothers – TB-2

Depth (ft bls)	Lithology
16.0 – 16.2	LIMESTONE, pale yellow (2.5 Y 8/4), sandy skeletal wackstone, moderately hard, high intergranular porosity, and high vuggy porosity, no phosphorite or aragonite, medium to high hydraulic conductivity.
16.2 – 19.6	SAND and SHELL, pale yellow (2.5 Y 8/2), mixed composition of 35-45% shells, 55-65% medium to fine grained quartz sand and silt, no trace of phosphorite, medium hydraulic conductivity.
19.6 - 22	LIMESTONE, light gray (5 Y 7/1), sandy molluskan wackstone, hard, dense, 50-55% shells settled in the rock, 20 – 30 % medium grained quartz sand, medium intergranular and moldic porosity, low vuggy porosity, and no channel porosity, no trace of phosphorite, medium hydraulic conductivity.
22 – 24	LIMESTONE, pale yellow (2.5 Y 7/4) and grayish brown (2.5 Y 5/2), mixed layer of sandy molluskan wackstone (pale yellow), and mudstone (grayish brown), moderately hard to hard; sandy molluskan wackstone- 25-35% medium to fine grained quartz sand, 5% nodular phosphorite, high intergranular and moldic porosity, high vuggy porosity; mudstone- low intergranular porosity, little or no moldic, vuggy pores; overall, high hydraulic conductivity for the wackstone and low hydraulic conductivity for the mudstone part.
24 – 27.4	LIMESTONE, grayish brown (2.5 Y 5/2) and light gray (2.5 Y 7/2), mixed layer of muddy wackstone and sandy molluskan wackstone (light gray), hard; for the wackstone-30-40 % fine sand and silt, 45–55% small shells, 5–10% nodular phosphorite, little or no vuggy porosity, some intergranular and moldic porosity; for sandy wackstone- 20-25% medium to fine grained quartz sand, bioturbated, 30–40% shells, some trace of phosphorite, some gastropods, high intergranular and moldic porosity, high vuggy porosity; overall, the hydraulic conductivity of this layer changes from high to low with the transition of sandy molluskan wackstone to lower depth muddy wackstone.
27.4 – 27.7	LIMESTONE, brown (10 YR 5/3), mudstone / sandy molluskan wackstone (mostly mudstone), very hard, 1- 5% medium grained quartz sand, trace of aragonite, dense, some open burrows (mostly on the wackstone side), vertically oriented, very little visible pores on the mudstone part, but high moldic and intergranular porosity in the wackstone; overall, medium to low horizontal hydraulic conductivity, medium vertical hydraulic conductivity.

TABLE A–4. Geological Log LS-61
Troyer Brothers – TB-2

Depth (ft bls)	Lithology
27.7 – 28.7	LIMESTONE, pale yellow (2.5 Y 8/3), sandy molluskan wackstone, medium hardness, 1 -5 % fine grained quartz sand, 1 – 2 % pore-lining phosphorite, very high intergranular porosity, medium moldic porosity, and some channel porosity, very shelly and grainy look, high hydraulic conductivity.
28.7 – 31.1	LIMESTONE, light gray (5 Y 7/2), sandy skeletal wackstone, hard, 1% fine to very fine grained quartz sand, no phosphorite, very high intergranular and intragranular porosity, less shells compared with above layer sample, bioturbated, medium to vuggy porosity, less dense than previous core, high horizontal hydraulic conductivity, medium to high vertical hydraulic conductivity.
31.1 – 34.0	LIMESTONE, pale yellow (2.5 Y 8/2), muddy wackstone, moderately hard, no phosphorite, no aragonite, 15 – 20% fine sand and silt, little intergranular and moldic pores, some vug pores (some were filled by fine sand and mud), low hydraulic conductivity.
34.0 – 34.7	LIMESTONE, pale yellow (5 Y 8/2), sandy molluskan wackstone, hard, 5 – 10 % fine to very fine grained quartz sand, no phosphorite, trace of aragonite, medium moldic and intergranular porosity; some small burrows, bioturbated, partially infilled by sandy and silty precipitates, 5 – 8% fine sand / silt, medium to low hydraulic conductivity.
34.7 – 35.3	LIMESTONE, light gray (5 Y 7/2), sandy molluskan wackstone, very hard, dense, 10 – 15 % medium to fine grained quartz sand, no phosphorite, no aragonite, some calcitic shells, 15 – 20 % very fine sand / silt, some vugs and burrows, partially infilled by sandy and shelly sediments, medium moldic porosity, medium to low hydraulic conductivity.
35.3 - 36	Sample missing (most likely similar to the sample below)
36 – 38.5	SAND and SHELL, light gray (5 Y 7/1), composition: 70 – 80% shells, 20 - 25% medium to fine grained quartz sand, 5 – 10 % fine silt, some traces of phosphorite, very high hydraulic conductivity.
38.5 – 40.2	MARL and minor LIMESTONE , light gray (5 Y 7/1), sandy skeletal wackstone, moderately hard, 10 – 15 % medium to fine grained quartz sand, 1 % phosphorite (pore-lining), no aragonite, 40 – 50% shells, good intergranular porosity, bioturbated, some large burrows, vertically open; overall, relatively high vertical hydraulic conductivity, medium to low horizontal hydraulic conductivity.

TABLE A–4. Geological Log LS-615
Troyer Brothers – TB-2

Depth (ft bls)	Lithology
40.2 – 40.6	LIMESTONE, dark yellowish brown (10 YR 4/4), wackstone / mudstone, very hard, 15 – 20% medium to fine grained quartz sand, 1-2 % pore-lining phosphorite, 5 – 8 % nodular phosphorite, no aragonite, 25 – 30% very fine sand / silt, some shells (10 -15%), small moldic pores, medium to low ntergranular pores, medium vuggy porosity, low hydraulic conductivity.
40.6 - 42.6	MARL, light brownish gray (10 YR 6/2), mixed composition of 30 – 35% shell, 35-40% medium to fine grained quartz sand and silt, some shells are calcitic shells no phosphorite, some grastropods, low hydraulic conductivity.
42.6 – 45.0	MARL with LIMESTONE, grayish brown (2.5 Y 5/2) marl -85%, sandy molluskan wackstone, grayish brown (2.5 Y 5/2), very hard, dense, 10 -15 % fine grained quartz sand, 1-5 % pore-lining phosphorite, 1% nodular phosphorite, no aragonite, little to no intergranular pores, some good size moldic pores, no vugs or larger channels. 20 -25% calcitic shells; marl is composed of 20 -25% fine grained quartz sand and silt, shells, gastropods, no trace of phosphorite, low hydraulic conductivity.
45.0 – 47.0	SHELL and SAND, light gray (2.5 Y 7/1), composition: 60 – 70% shells, 25 – 30% medium to fine grained quartz sand and silt, 5 – 8% phosphorite, barnacles, gastropods, very high hydraulic conductivity.
47.0 – 49.0	LIMESTONE, light olive gray (5 Y 6/2), sandy molluskan wackstone, 15 – 20% medium to fine grained quartz sand, hard, 10 – 15% pore-lining phosphorite, 5 - 10% nodular phosphorite, medium intergranular pores, large channels and good sizes of vugs, high hydraulic conductivity.
49.0 – 52.2	LIMESTONE, light gray (5 Y 7/2), sandy molluskan wackstone /mudstone, hard, 10 -15% medium to fine grained quartz sand, high intergranular porosity, medium to high moldic porosity, some pore-lining phosphorite (< 2%), with depth increases, wackstone appeared to be more muddy look, small moldic pores, and little grains, medium to low hydraulic conductivity.
52.2 – 54.0	MARL, light yellowish brown (2.5 Y 6/3), mixed composition of 30 – 40% fine to very fine grained quartz sand and silt, 5 – 8% phosphorite, 1 – 5 % calcitic shells, low hydraulic conductivity.
54.0 – 56.0	Missing sample (most likely similar to the sample above).
56.0 – 60.5	LIMESTONE, gray (5 Y 6/1), sandy molluskan wackstone, very hard, 10 – 15% medium to fine grained quartz sand, some large moldic pores, and

TABLE A–4. Geological Log LS-619
Troyer Brothers – TB-2

Depth (ft bls)	Lithology
	open burrows, some calcitic shells, some blackish sediments, mostly from oyster shells, 1% nodular phosphorite, no aragonite, medium to high hydraulic conductivity.
60.5 – 61.0	LIMESTONE, gray (5 Y 6/1), sandy molluskan wackstone, medium hard to hard, 10- 15 % medium to fine grained quartz sand, no trace of phosphorite and aragonite high moldic and intragranular porosity, bioturbated, some burrows were infilled by sandy materials, high hydraulic conductivity.
61.0 – 62.5	MARL, olive gray (5 Y 5/2), mixed composition of 30 – 40% medium to fine grained quartz sand and silt (mostly fine grained), 20 -30% shells, 5 - 10% phosphorite, low hydraulic conductivity.
62.5 – 63.7	MARL and LIMESTONE, greenish gray (10 Y 6/1), composition: 25 – 30 % medium to fine grained quartz sand and silt, 40 – 50% shells, some large gastropods, barnacles, not as silty as the layer above, medium to low hydraulic conductivity. Limestone is a sandy molluscan wackestone, hard.
63.7 – 65.0	LIMESTONE, bluish black (5B 2.5/1), sandy molluskan wackstone, moderately hard, 20 – 25% medium to fine grained quartz sand, trace of phosphorite, no aragonite, some moldic and intergranular porosities, bioturbated, burrows infilled with grayish sandy molluskan materials, medium hydraulic conductivity.
65.0 – 66.0	LIMESTONE, white (5 Y 8/1), sandy molluskan wackstone, moderately hard to hard, no phosphorite, some aragonite (1 – 2%), 20 – 25% medium to fine grained quartz sand, medium to small moldic pores, medium intergranular pores, no distinctive vugs or channels, medium to low hydraulic conductivity.
66.0 – 69.0	LIMESTONE, light gray (5 Y 7/2), sandy molluskan wackstone, hard, 1% phosphorite, no aragonite, 30 -35% medium to fine grained quartz sand, some calcitic shells, medium moldic and intergranular pores, medium level moldic and intergranular porosities, medium size of vugs, medium hydraulic conductivity.
69.0 – 70.0	LIMESTONE, light greenish gray (10 Y 7/1), sandy molluskan wackstone, 10 -15% medium to fine grained quartz sand, no phosphorite, and no aragonite, large moldic and intergranular pores, bioturbated, some burrows were infillled with grainy packstone, high hydraulic conductivity.
70.0 – 71.5	LIMESTONE, greenish black (5 G 2.5/1), sandy molluskan wackstone, moderately hard, 10 -15% medium to fine grained quartz sand , high

TABLE A–4. Geological Log LS-619.
Troyer Brothers – TB-2

Depth (ft bls)	Lithology
	intergranular and moldic porosities and high vuggy porosity, very grainy, no phosphorite and aragonite, high hydraulic conductivity.
71.5 – 79.0	LIMESTONE, light brownish gray (2.5 Y 6/2), sandy molluskan wackstone, hard, 15 – 20% medium to fine grained quartz sand, moldic and intergranular porosity, no channels, some vuggy porosity, 5 – 10% nodular phosphorite, 1 – 5% aragonite, medium hydraulic conductivity.
79.0 – 83.2	LIMESTONE, olive (5 Y 5/3), sandy molluskan packstone / wackstone, hard, 10% fine to very fine grained quartz sand, high moldic and intergranular porosities, good channel and vuggy porosities, 1 - 5% nodular and pore-lining phosphorite, high hydraulic conductivity.
83.2 – 88.0	LIMESTONE, pale yellow (5 Y 8/2), sandy molluskan wackstone, moderately hard, 15 -20% medium to fine grained quartz sand, trace of aragonite, 5 -10% nodular and pore-lining phosphorite, moldic and intergranular porosity, some vugs, no distinctive channels, medium moldic and inter-granular porosities, medium hydraulic conductivity.
88.0 – 90.0	LIMESTONE, light gray (5 Y 7/2), sandy molluskan wackstone, 20% medium grained quartz sand, moderately hard to soft, no aragonite, 1 - 5% phosphorite, moldic and intergranular porosities, trace of corals, vuggy porosity, medium to high hydraulic conductivity.
90.0 – 96.0	LIMESTONE, light olive gray (5 Y 6/2), sandy molluskan wackstone, 10 – 20% fine to very fine grained quartz sand, moderately hard to soft, 1% nodular phosphorite, 1 - 5% aragonite, moldic, interganular and vuggy porosities, medium hydraulic conductivity.
96.0 –100.0	MARL, olive gray (5Y 5/2), mixed composition of 50 – 60% medium to fine grained quartz sand and silt, 10 -20% shells, no phosphorite and aragonite, some clay, low hydraulic conductivity.
100- 112.5	LIMESTONE and MARL, pale yellow (5Y 7/4), sandy molluskan wackstone / packstone, moderately hard to soft, 10 -15% fine to very fine grained quartz sand, 1% aragonite, no phosphorite, moldic, intergranular and vuggy porosity, medium to high hydraulic conductivity.
112.5-116.0	LIMESTONE, pale olive (5 Y 6/3), sandy molluskan wackstone, moderately hard to soft, 25% - 30% fine to very fine grained quartz sand and silt, 10 -15% phosphorite, no aragonite, calcitic shells, moldic and intergranular porosities, medium to low hydraulic conductivity.

TABLE A–4. Geological Log LS-619.
Troyer Brothers – TB-2

Depth (ft bls)	Lithology
116.0 -119.0	CLAY and MARL, pale olive (5Y 6/3), mixed composition of 60 – 70% fine to very fine grained quartz sand and silt, 15 – 20% shells, 5% phosphorite, no aragonite, low hydraulic conductivity.
119.0 – 120.5	MARL, pale olive (5 Y 6/4), composed of 40 - 50% fine to very fine grained quartz sand and silt, 15 - 25% shells, some dolosilt and clay, 1% aragonite, 1 – 2% phosphorite, low hydraulic conductivity.
120.5 – 124.0	LIMESTONE, light olive gray (5 Y 6/2), sandy molluskan wackstone / packstone, moderately hard, 10 - 15% medium to fine grained quartz sand, 5 - 10% pore-lining and nodular phosphorite, 1 – 5% aragonite, high moldic and interganular porosities, medium to high hydraulic conductivity.
124.0 – 126.5	LIMESTONE, yellowish brown (10 YR 5/4), mudstone, hard, dense, trace of quartz sand, little to no visible porosity, low hydraulic conductivity.
126.5 – 129.0	LIMESTONE, pale yellow (5 Y 8/3), sandy molluskan wackstone / packstone, 10 -15% fine to very fine grained quartz sand, 5 -10% phosphorite, no aragonite, high moldic and interganular porosity, high hydraulic conductivity.
129.0 – 132.0	LIMESTONE, pale olive (5 Y 6/3), sandy molluskan wackstone, soft, 20 – 25% medium to fine grained quartz sand, 5 -10% phosphorite, no aragonite, moldic and intergranular porosity, medium hydraulic conductivity.
132.0 – 139.0	LIMESTONE, pale yellow (5 Y 7/3), sandy molluskan wackstone, hard, 10 - 15% medium to fine grained quartz sand (more fine grains), 8 -15% phosphorite, 1% aragonite, higher moldic porosity compared with above sample, intergranular and vuggy porosities, medium to high hydraulic conductivity.
139.0 – 146.0	MARL, pale yellow (5 Y 7/4), composed of 50 -60% medium to fine grained quartz sand and silt, 10 -15% phosphorite, 1 - 2% carbonate grains, clay, no aragonite, low hydraulic conductivity.

TABLE A–5 Geological Log LS-6192
Troyer Brothers – TB-5

Location: NW ¼ SW ¼, Sec. 4, Township 46 South, Range 27E
Lee County Florida
Lat. 26° 29.977', Long. 81° 37.435'

Depth (ft bls)	Lithology
0 – 2.0	SAND, yellowish brown (10 YR 5/6), quartz, medium to fine grained, moderately sorted, subrounded, 5-10% phosphorite, some carbonate grains, medium hydraulic conductivity.
2.0 – 4.5	SAND and SILT, light gray (10 YR 7/2) and brownish yellow (10 YR 6/6), quartz, moderately sorted, subrounded, 60 – 70% light gray medium to fine grained quartz sand and silt, 20 – 25% brownish yellow, medium to fine grained quartz sand and silt (mostly medium grained), 10 – 15% blackish organic materials (decomposed plants), medium to low hydraulic conductivity.
4.5 – 6.0	SAND and SILT, light gray (10 YR 7/2), composition: 60 – 70% medium to fine grained quartz sand and silt, 15 – 20% shells, 5% blackish organic materials (from decomposed plants), 5 – 10% phosphorite, low hydraulic conductivity.
6.0 – 7.3	SAND, brownish yellow (10 YR 6/6), quartz, medium to fine grained, moderately sorted, subrounded, 5 – 8% phosphorite, very silty, 5% shells, medium to low hydraulic conductivity.
7.3 – 9.0	LIMESTONE, pale yellow (5 Y 7/3), sandy molluskan wackstone, hard, dense, 25 – 30% fine grained quartz sand, 1 – 5% nodular phosphorite, little intergranular porosity, some moldic and vuggy porosity, low hydraulic conductivity.
9.0 – 11.0	LIMESTONE, light gray (10 YR 7/2), sandy molluskan wackstone, hard, 10 -15% very fine grained quartz sand, 1% phosphorite, little intergranular porosity, lithified shells (contribute to over 40 – 50% of the rock), some moldic and vuggy porosities, low hydraulic conductivity.
11.0 – 13.0	SHELL and SAND, pale yellow (2.5 Y 8/2), 80% shells, 10–15% medium to fine grained quartz sand, 5 – 10% phosphorite, some gastropods, medium to high hydraulic conductivity.

TABLE A–5 Geological Log LS-619
Troyer Brothers – TB-5

Depth (ft bls)	Lithology
13.0 – 15.0	SHELLY SAND and LIMESTONE, light gray (5 Y 7/2) and pale yellow (2.5Y 8/2), sandy molluskan wackstone (30%) and shelly sand (70%); wackstone --- hard, 5% very fine grained quartz sand, 1 – 5% nodular phosphorite, little intergranular porosity, some moldic and vuggy porosity; SHELL and SAND--- mixed composition of 70 – 75% shells, 1 – 5% phosphorite, 15 – 20% medium to fine grained quartz sand and silt, some gastropods, calcitic shells; overall, medium to low hydraulic conductivity.
15.0 – 18.5	SAND and LIMESTONE, light gray (5 Y 7/2), composed of 30 % fine to very fine grained quartz sand, 60% wackstone fragments, 10% shells, 1- 2% phosphorite, low hydraulic conductivity.
18.5 – 20.2	SHELL and SAND, pale yellow (2.5 Y 8/2), shell and sand, composition: 70 – 80% shells (sizes vary a lot), 10 – 15% medium to fine grained quartz sand, 5% phosphorite, some carbonate grains, high hydraulic conductivity.
20.2 – 23.0	LIMESTONE, light gray (5 Y 7/1), sandy skeletal wackstone / packstone, moderately hard, high moldic and inter-granular porosity, some vuggy porosity, no aragonite, medium to high hydraulic conductivity.
23.0 – 24.0	LIMESTONE, pale yellow (5 Y 8/3), sandy molluskan wackstone, hard, less moldic porosity than previous layer core, some intergranular and vuggy porosity (very low level), 5% nodular phosphorite, some trace of aragonite, low hydraulic conductivity.
24.0 – 25.0	LIMESTONE; pale yellow (2.5 Y 8/2), lithified coral reef and wackestone, moderately hard, 1 –5% nodular phosphorite, 5–8% aragonite, some quartz sand and carbonate sand, high hydraulic conductivity.
25.0 – 28.0	SAND (90%), light gray (5Y 7/2), very fine grained with 5 % shell fragments and LIMESTONE (5%), light gray (5 Y 7/2), sandy molluskan wackstone, hard, 5 –10% nodular phosphorite, 1% aragonite, moldic and intergranular and some vuggy porosity, some calcitic shells, medium hydraulic conductivity.
28.0 – 32.0	LIMESTONE, pale yellow (2.5 Y 7/3), sandy molluskan wackstone, hard to very hard, 1% phosphorite, trace of aragonite, vuggy, intergranular, and moldic porosities, high density of shell fragments in the rock (over 60 – 70%), medium hydraulic conductivity.
32.0 – 33.0	LIMESTONE, dark brown (10 YR 3/3), mudstone, hard, 1% phosphorite, little visible porosity, trace of fine grained quartz sand, low hydraulic

TABLE A–5 Geological Log LS-619
Troyer Brothers – TB-5

Depth (ft bls)	Lithology
	conductivity.
33.0 – 35.0	LIMESTONE, light olive gray (5 Y 6/2), sandy molluskan wackstone / mudstone, hard, 1% phosphorite, no aragonite, some vuggy and moldic porosities, low intergranular porosity, low hydraulic conductivity.
35.0 – 36.0	LIMESTONE, pale yellow (2.5 Y 7/3), coral and sandy wackstone, moderately hard, no phosphorite, trace of aragonite, 50% corals, 40 – 50% sandy coral-rich wackstone, some coral pores infilled with sand, high hydraulic conductivity.
36.0 – 37.0	LIMESTONE, light olive gray (5 Y 6/2), sandy molluskan wackstone, moderately hard, 1% nodular phosphorite, no aragonite, some fine grained quartz sand (10 – 15%), very high channel porosity, medium high moldic and vuggy porosities, medium intergranular porosity, high hydraulic conductivity.
37.0 – 38.5	LIMESTONE, light gray (5 Y 7/1), sandy molluskan wackstone, moderately hard, 1 – 5% aragonite, 1% phosphorite, trace of fine grained quartz sand, high intergranular and moldic porosity, some vuggy pores, no channels, some calcitic shells, medium to high hydraulic conductivity.
38.5 – 41.0	LIMESTONE, light yellowish brown (10 YR 6/4), mudstone, hard and dense, no aragonite, no phosphorite, some medium size vugs and small channels trending from the top of the sampled core to little or no visible pores at the bottom end, medium to very low hydraulic conductivity.
41.0 – 41.8	LIMESTONE, light gray (5 Y 7/1), sandy molluskan wackstone, hard to very hard, 1% phosphorite, no aragonite, 5 – 8% fine to very fine grained quartz sand, some moldic, intergranular and vuggy porosities (relatively low), low hydraulic conductivity.
41.8 – 42.1	LIMESTONE, light gray (5 Y 7/2), sandy molluskan wackstone, hard, dense, 1% phosphorite, no aragonite, shells composed of over 50 – 60% of the wackstone rock, some moldic, intergranular porosities, low hydraulic conductivity.
42.1 – 42.6	SHELL and SAND, light gray (10 YR 7/2), mixed composition of: 50 – 60% shells (mostly pale yellow in color), some gastropods, 1% phosphorite, 40 – 50% fine to very fine grained sand and silt.
42.6 – 50.0	LIMESTONE (70%) and MARL (30%), pale yellow (2.5 Y 8/2) mudstone and marl, moderately hard to soft, dense, 5% pore-lining phosphorite, trace

TABLE A–5 Geological Log LS-619?
Troyer Brothers – TB-5

Depth (ft bls)	Lithology
	of aragonite, 20 – 30% fine to very fine grained quartz sand and silt in the marl, some burrows infilled with medium grained quartz sand, a few vuggy pores, low hydraulic conductivity.
50.0 – 51.0	LIMESTONE (60%) and MARL (40%), light gray (2.5 Y 7/2), marl- mixed composition of 60 – 70% fine to very fine grained quartz sand and silt, 5 – 8% phosphorite, some bryozoan fragments, trace of aragonite; wackstone / mudstone - very hard, dense, 1 – 5% phosphorite, 1 – 5% aragonite, some vuggy pores, low hydraulic conductivity.
51.0 – 51.2	LIMESTONE (80%) and MARL (20%), light gray (5Y 7/1), marl (20%) composition : 40% fine grained quartz sand and silt, 10 -12% shell and 50% lime mud; wackestone fragments -80% (phosphorite rich), low hydraulic conductivity.
51.2 – 53.2	LIMESTONE, light gray (5 Y 7/1), sandy molluskan wackstone, moderately hard, 1% nodular and pore-lining phosphorite, 1% aragonite, 10 –15% fine to very fine grained quartz sand and silt, some calcitic shells, medium high vuggy porosity, medium intergranular porosity, some moldic and potentially small channels, medium to low hydraulic conductivity.
53.2 – 54.8	LIMESTONE, light gray (5 Y 7/1) and very dark greenish gray (5 G 3/1), moderately hard, trace of phosphorite and aragonite, 10 -12% fine to very fine grained quartz sand and silt, bioturbated, burrows infilled with light grayish sandy molluskan wackstone, some moldic, intergranular and vuggy porosities, some potential channels, medium to high horizontal hydraulic conductivity, medium vertical hydraulic conductivity.
54.8 – 55.0	LIMESTONE, very dark greenish gray (5 G 3/1), sandy molluskan wackstone, hard to very hard, 8 -12% nodular phosphorite,5 -10 % pore-lining phosphorite, 15 – 20% fine infilled with light grayish color sandy and shelly wackstone units, some moldic, intergranular, and vuggy porosities, overall, fairly low hydraulic conductivity.
55.0 – 56.0	Missing sample – likely limestone.
56.0 – 65.7	LIMESTONE, dark greenish gray (10 Y 4/1), sandy molluskan wackstone, hard, 5% phosphorite, no aragonite, trace of fine grained quartz sand, high density of large lithified shells (over 50%), some burrows infilled with bluish shells and sandy materials, moderately high moldic, intergranular, and vuggy porosities, medium to high hydraulic conductivity.
65.7 – 73.0	LIMESTONE, pale yellow (2.5 Y 8/2), sandy molluskan wackstone,

TABLE A–5 Geological Log LS-619.
Troyer Brothers – TB-5

Depth (ft bls)	Lithology
	medium hardness, 15 – 20% medium to fine grained quartz sand, 5 – 10% phosphorite, 1% aragonite, large oyster shells coated with sandy molluskan precipitates, high moldic, intergranular, and vuggy porosities, medium to high hydraulic conductivity.
73.0 – 76.0	LIMESTONE and MARL, light gray (2.5 Y 7/2), sandy molluskan wackstone and marl; sandy molluskan wackstone (85 – 90%) -10 –15% phosphorite, some aragonite, moderately hard, large intergranular porosity, some moldic and vuggy porosity; marl (10 - 15%) --- 10 – 15% fine to very fine grained quartz sand and silt, 20 – 30% shells, some phosphorite; overall, medium to low hydraulic conductivity.
76.0 – 79.5	LIMESTONE, light gray (2.5 Y 7/1), sandy molluskan wackstone, 1 –5% phosphorite, trace of aragonite, some intergranular, moldic and vuggy porosities, 20 – 30% medium to fine grained quartz sand and silt (mostly fine grained), 1% phosphorite; overall, low hydraulic conductivity.
79.5 – 85.0	LIMESTONE, greenish gray (10 Y 5/1), sandy molluskan wackstone, 1% phosphorite, little moldic, intergranular and some vuggy porosities, hardness varies from soft to moderately hard.
85.0 – 86.0	Missing sample (most likely similar to the sample above)
86.0 – 92.3	LIMESTONE, pale yellow (5 Y 7/3), sandy molluskan wackstone, hard to moderately hard, 1 – 3% phosphorite, some large oyster shells lithified and coated with sandy and silty molluskan sediments, high intergranular porosity, some moldic and vuggy porosities, medium to low hydraulic conductivity.
92.3 – 96.0	Missing sample
96.0 – 98.5	LIMESTONE, light gray (5 Y 7/2), sandy molluskan wackstone, moderately hard, 10 – 15% phosphorite (mostly pore-lining), no aragonite, large oyster shells composed over 30% of the wackstone, moldic, intergranular and vuggy porosities, medium to low hydraulic conductivity.
98.5 – 100.3	LIMESTONE and MARL, light olive gray (5 Y 6/2), sandy molluskan wackstone (90%), marl (10%); sandy molluskan wackstone -similar to the above layer wackstone, moderately hard to soft, 15% phosphorite, no aragonite, but more silty component than above layer sample, intergranular and some moldic porosity; Marl- 50 – 60% medium to fine grained quartz sand, 15 - 20% shells, some phosphorite; overall, low hydraulic conductivity.

TABLE A–5 Geological Log LS-619
Troyer Brothers – TB-5

Depth (ft bls)	Lithology
100.3 – 104.5	LIMESTONE, light gray (5 Y 7/2), sandy molluskan wackstone, moderately hard, dense, some fine grained quartz sand, 1 – 5% nodular phosphorite, no aragonite, large oyster shells composed over 40% of the wackstone rock, lithified coral fragments, moldic and intergranular porosities, medium to low hydraulic conductivity.
104.5 – 105.5	LIMESTONE, light brownish gray (2.5 Y 6/2), mudstone, hard, dense, from top the bottom of the core, first is a transition layer from sandy wackstone to mudstone, little visible pores, 1% nodular phosphorite, some trace of aragonite, low hydraulic conductivity.
105.5 – 106.0	LIMESTONE, light yellowish brown (2.5 Y 6/3), sandy molluskan wackstone, moderately hard, no phosphorite, trace of aragonite, 10 – 15% fine to very fine grained quartz sand and silt, intergranular, moldic and vuggy porosities, medium to low hydraulic conductivity.
106.0 – 112.0	LIMESTONE, pale olive (5 Y 6/3), sandy molluskan wackstone / packstone, medium hardness, 10 - 15% phosphorite, 1 – 5% aragonite, very high intergranular porosity, high hydraulic conductivity.
112.0 – 116.0	Missing sample
116.0 – 119.5	LIMESTONE and MARL, light gray (5 Y 7/2), sandy molluskan wackstone (65 – 75%), marl (25 – 35%); sandy wackstone --- soft to moderately hard, 10% phosphorite, no aragonite, low inter-granular and moldic porosity; marl- 30 – 40% medium to fine grained quartz sand and silt, some phosphorite; overall, low hydraulic conductivity.
119.5 – 128.5	MARL, pale yellow (5Y 7/4), lime mud with mixed composition of 70 – 80% fine to very fine grained quartz sand and silt, 10 – 15% phosphorite, 5– 8% small shell fragments, low hydraulic conductivity.
128.5 – 133.0	CLAY, dark olive gray (5Y 3/2), clay mixed composition of 60 – 70% fine to very fine grained quartz sand and silt, 10 -15% phosphorite, 10 -12% shells, very low hydraulic conductivity.
133.0 – 136.0	CLAY, dark olive gray (5 Y 3/2), clay with mixed composition of 70 -80% fine to very fine grained quartz sand and silt (mostly silt), 10% nodular phosphorite, 15 -20% shells, very low hydraulic conductivity.
136.0 – 140.0	CLAY, very dark gray (5 Y 3/1), clay, composition: 75 – 80% fine to very fine grained quartz sand and silt, 8 – 12% nodular phosphorite, 5 – 8%

TABLE A–5 Geological Log LS-619
Troyer Brothers – TB-5

Depth (ft bls)	Lithology
	shells, very low hydraulic conductivity.
140.0 – 149.2	CLAY, dark olive gray (5 Y 3/2), clay, composition: some fine quartz silt, some dolosilt, 1% phosphorite, 1 – 2% calcitic shells, very low hydraulic conductivity.
149.2 – 149.5	SHELL and SILTY SAND, white (5 Y 8/1) and olive gray (5 Y 4/2), shells (50 – 60%) and sand (35 – 45%), 10 – 15% phosphorite, some aragonite, shells and mostly decomposed fragments, some calcitic shells, sand is mostly medium to fine grained quartz sand and silt, medium hydraulic conductivity.
149.5 – 161.0	CLAY, dark olive gray (5 Y 3/2), clay, composed of 30 – 40% medium to fine grained quartz sand and silt, mostly fine grained, 5 – 10% shells, 8 – 10% phosphorite, some aragonite, low hydraulic conductivity.
161.0 – 161.5	CLAY and SHELL, dark olive gray (5 Y 3/2), clay and shells, composition: 40 - 45% shells, 4 0 – 50% medium to fine grained quartz sand and silt, 15 – 20% phosphorite, some calcitic shells, low hydraulic conductivity.
161.5 – 164.0	CLAY, olive gray (5 Y 4/2), clay composed of 65 – 75% fine to very fine grained quartz sand and silt, 20 – 30% decomposed shells in the form of fine to very light grayish color sediments, 15 – 20% phosphorite, low hydraulic conductivity.
164.0 – 166.0	SANDSTONE (75%) and SAND (25%), light greenish gray (5 GY 7/1), sandy molluskan wackstone, hard, 10 -15% nodular phosphorite, 1 - 5% aragonite, 70 – 75% medium to fine grained quartz sand, some shells lithified and coated with sandy molluskan sediments, intergranular and moldic porosities, little vuggy pores, and no channel, medium to low hydraulic conductivity.
166.0 -167.0	SANDSTONE, light gray (5 Y 7/1), very sandy molluskan wackstone / packstone, hard, 1 – 5% phosphorite, 1 -5% aragonite, 65 – 75% medium to fine grained quartz sand, lithified shells composed over 50% of the rock, medium intergranular and moldic porosities, medium hydraulic conductivity.
167.0 – 172.5	SANDSTONE and SAND, light gray (5 Y 7/1), very sandy molluskan wackstone, soft to moderately hard, 5 – 8% phosphorite, trace of aragonite, 70 – 75% medium to fine grained quartz sand (mostly medium grained), much less lithified shells that above layer core, some intergranular porosity, very few moldic pores, low hydraulic conductivity.

TABLE A–5 Geological Log LS-619
Troyer Brothers – TB-5

Depth (ft bls)	Lithology
172.5 – 176.0	SANDSTONE (65%) and SAND (35%), light greenish gray (10 Y 8/1), very sandy molluskan wackstone, hard, 15 – 20% phosphorite, 70 – 75% medium to fine grained quartz sand (mostly fine grained), some moldic and intergranular porosities, medium to low hydraulic conductivity.

TABLE A–6 Geological Log LS-6194
Troyer Brothers – TB-4

Location: SW ¼ SE ¼, Sec. 4, Township 46 South, Range 27E
Lee County Florida
Lat. 26° 29.917', Long. 81° 36.969'

Depth (ft bls)	Lithology
0 – 2.5	SAND, dark yellowish brown (10 YR 4/4), quartz, medium sorting, medium to fine grained, subrounded, 2 – 4% phosphorite, some organic materials (plant roots, etc.) but less than 10%, medium hydraulic conductivity.
2.5 – 3.6	SAND, dark grayish brown (10 YR 4/2), quartz, medium to fine grained, medium sorting, subrounded, 1 - 3% phosphorite, some carbonate grains, medium hydraulic conductivity.
3.6 – 4.7	SAND, bluish black (5 PB 2.5/1), quartz, medium to fine grained, medium sorting, subrounded, 1% phosphorite, a few carbonate grains, medium hydraulic conductivity.
4.7 – 5.6	SAND, very dark gray (10 YR 3/1), quartz, medium to fine grained, medium sorting, subrounded, some phosphorite and carbonate grains, medium hydraulic conductivity.
5.6 – 10.5	SAND, dark reddish gray (2.5 YR 3/1), quartz, medium to fine grained, moderately sorted, subrounded, 1 – 5% phosphorite, 10 – 15% blackish organic material (mostly decomposed plants), medium hydraulic conductivity.
10.5 – 11.5	SAND, reddish brown (5YR 5/4), quartz, medium to fine grained, medium sorting, subrounded, 1 – 2% phosphorite, medium hydraulic conductivity.
11.5 – 13.5	SAND and SILT, grayish brown (10 YR 5/2), quartz, medium to very fine grained, medium sorting, mostly subrounded, some are rounded, 1% phosphorite, 5% brownish organic materials (mostly from decomposed plants), medium to low hydraulic conductivity.
13.5 – 16.0	SAND, yellowish brown (10 YR 5/4), quartz, medium to fine grained, medium sorting, subrounded, 1% phosphorite, 1% blackish organic materials (decomposed plant leaves), medium hydraulic conductivity.
16.0 – 17.6	SAND, very pale brown (10 YR 7/3), quartz, medium to fine grained quartz sand, moderately sorted, subrounded, 2 – 4% phosphorite, 5 – 8% small

TABLE A–6. Geological Log LS-619 .
Troyer Brothers– TB-4

Depth (ft bls)	Lithology
	shell fragments, 5 – 8% decomposed plants, medium hydraulic conductivity.
17.6 – 18.6	SAND and SHELLl, pale yellow (2.5 Y 8/2), 70 – 75% shells, 20 –25% medium to fine grained quartz sand and silt, 1% phosphorite, some gastropods and ostracods, medium to high hydraulic conductivity.
18.6 – 20.0	LIMESTONE, pale yellow (2.5 Y 8/2), sandy wackestone, hard, 1% phosphorite, no aragonite, some fine grained quartz sand, low intergranular and moldic porosities, low vuggy porosity, low hydraulic conductivity.
20.0 – 21.2	LIMESTONE, pale yellow (2.5 Y 8/2), sandy molluscan wackestone, hard, 1% phosphorite, no aragonite, moldic, intergranular and vuggy porosities, much more shells than previous layer core, medium hydraulic conductivity.
21.2 – 22.0	SHELL with minor SAND, light gray (2.5 Y 7/2), mixed composition of 80 – 90% of shells, 10 – 20% fine to very fine grained quartz sand and silt, 2 – 4% phosphorite, some calcitic shells, medium hydraulic conductivity.
22.0 – 24.5	LIMESTONE, pale yellow (2.5 Y 7/3), sandy molluscan wackestone, moderately hard, 1% phosphorite, trace of aragonite (mostly < 2%), some fine grained quartz sand, high moldic and intergranular porosity, lithified shells (made up to over 60 – 70% of the wackestone rock), high hydraulic conductivity.
24.5 – 26.0	LIMESTONE, dark grayish brown (2.5 Y 4/2), sandy molluscan wackestone, moderately hard, less than 2% phosphorite, some aragonite, some light greenish gray (10 Y 8/1) color sandy molluscan wackestone materials filled the burrows of the dark grayish brown color wackestone, some vuggy porosity, as well as moldic porosity, little intergranular porosity, medium to low hydraulic conductivity.
26.0 – 28.0	LIMESTONE, pale yellow (2.5 Y 8/3), very sandy molluscan wackestone, soft to medium hardness, trace of phosphorite and aragonite, shells and decomposed shell fragments contributed to 70 – 75% of the rock, gastropods and some calcitic shells were found, medium high moldic and intergranular porosities, medium to high hydraulic conductivity.
28.0 – 29.0	LIMESTONE, pale yellow (2.5 Y 8/2), very sandy/shelly wackstone, soft to moderately hard, 1 – 2% nodular phosphorite, trace of aragonite, 70 – 80%

TABLE A–6. Geological Log LS-619.
Troyer Brothers– TB-4

Depth (ft bls)	Lithology
	shells and decomposed fragments (much smaller than above layer sample, large pieces are rare), some calcitic shells, some intergranular, moldic, and vuggy porosities, medium hydraulic conductivity.
29.0 – 32.2	SAND and SHELL, light gray (2.5 Y 7/2), mixed composition of 70 – 80% shells, 20 – 25% medium to fine grained quartz sand, 1 – 5% phosphorite, 1 – 5% brownish organic material (probably from decomposed plants), some calcitic shells, medium hydraulic conductivity.
32.2 – 33.0	LIMESTONE, light gray (2.5 Y 7/2) sandy molluskan wackstone (90%); 10% sand medium to fine grained quartz sand and silt; sandy molluskan wackestone, moderately hard, trace of phosphorite, some lithified shells coated with sandy and shelly sediments, some moldic and intergranular porosity, medium to low hydraulic conductivity.
33.0 – 34.2	SAND and SHELL, light gray (2.5 Y 7/2), mixed composition of 45-50 % shells, 45 -50% medium to fine grained quartz sand and silt, 5 – 8% phosphorite, medium to high hydraulic conductivity.
34.2 – 36.0	Missing sample (likely sand and shell).
36.0 – 37.2	SAND, light brownish gray (2.5 Y 6/2), 75-85% fine to very fine grained quartz sand and silt, 10 – 15% fine fragments of shells, 5 –10% phosphorite, medium to low hydraulic conductivity.
37.2 – 38.0	SHELL and SAND, light gray (2.5 Y 7/2), 75 – 80% shells and 15 – 20% medium to fine grained quartz sand, trace of phosphorite, some calcitic shells, high hydraulic conductivity.
38.0 – 38.6	SHELL and SAND, light gray (2.5 Y 7/2), 60 -70% shells (larger than previous layer's), 15 – 20% fine to very fine grained quartz sand and silt, 5 – 10% sandy molluskan wackstone fragments, 1 – 5% corals (infilled with sandy materials), 1 – 5% phosphorite, medium to low hydraulic conductivity.
38.6 – 39.0	LIMESTONE, light gray (5 Y 7/1), sandy molluskan wackestone, hard, relatively dense, no phosphorite, moldic porosity, likely bioturbated, burrows infilled with sandy molluskan wackstone and some blackish sandy wackstone, little intergranular pores, medium to low hydraulic conductivity.
39.0 – 39.1	LIMESTONE, light gray (2.5 Y 7/1), sandy molluskan wackestone, soft to moderately hard, relatively dense, some phosphorite, some moldic porosity; overall, low hydraulic conductivity.

ABLE A–6. Geological Log LS-619
Troyer Brothers– TB-4

Depth (ft bls)	Lithology
39.1 – 43.2	LIMESTONE, light yellowish brown (2.5 Y 6/4), mudstone, hard, dense, some trace of quartz sand, little or no visible pores, very low hydraulic conductivity. Trace amount of marl.
43.2 – 48.0	LIMESTONE, light gray (5 Y 7/2), sandy molluskan wackestone and lithified corals, moderately hard, no phosphorite, vuggy, moldic and some intergranular porosities, some fine to very fine grained quartz sand and silt, lithified corals, infilled with sandy sediments, medium to high hydraulic conductivity.
48.0 – 49.5	LIMESTONE, light brownish gray (2.5 Y 6/2), shelly packstone is soft, 80% shells, 10 – 15% fine grained quartz sand and silt, high intergranular, moldic and vuggy porosities, high hydraulic conductivity.
49.5 – 51.0	LIMESTONE and MARL, pale yellow (2.5 Y 7/3), 85 – 90% mudstone, 10 – 15% marl; mudstone- hard, no phosphorite, some small moldic and intergranular porosity, some vuggy and channel pores as well, medium to low hydraulic conductivity.
51.0 – 53.3	LIMESTONE and MARL, light gray (5 Y 7/2), sandy molluskan wackstone (60 – 70%) and marl (30 – 40%); wackstone - hard, 1 – 5% phosphorite, trace of aragonite, 70 – 75% lithified shells made up the rock, some moldic porosity; marl - 50 – 60% shells, 30 – 35% medium to fine grained quartz sand and silt, 5 -10% balckish wackstone fragments, low hydraulic conductivity.
53.3 – 54.0	MARL, light brownish gray (2.5 Y 6/2), lime mud with mixed composition of 30 - 40% coral fragments, 30 – 35% shells, 20 – 30% medium to fine grained quartz sand and silt, trace of phosphorite, some calcitic shells, medium hydraulic conductivity.
54.0 – 55.2	MARL, pale yellow (2.5 Y 8/2), lime mud with mixed composition of mud and some fine grained quartz sand and silt, 10 – 15% shells, 5 – 8% phosphorite, 5 -10% fragments of wackestone, low hydraulic conductivity.
55.2 – 56.0	Missing sample (most likely marl)
56.0 – 61.0	MARL and LIMESTONE, gray (5 Y 5/1), 80% marl and 20% sandy molluskan wackstone; wackstone: moderately hard; marl- medium to fine grained quartz sand and silt, 5 – 8% phosphorite, some lithified shells, inter-granular, moldic and vuggy porosity, medium hydraulic conductivity.

TABLE A–6. Geological Log LS-615
Troyer Brothers– TB-4

Depth (ft bls)	Lithology
61.0 – 66.0	MARL, olive gray (5Y 4/2), lime mud with mixed composition of 30 – 40% medium to fine grained quartz sand and silt, 30 -40% shelly wackestone fragments, some phosphorite, 25 – 35% shells, low hydraulic conductivity.
66.0 – 74.7	MARL, olive gray (5 Y 5/2): composition: 60 – 70% shells, 30 –35% medium to fine grained quartz sand and silt, 5 – 8% phosphorite, low hydraulic conductivity.
74.7 – 77.0	LIMESTONE and MARL, light olive gray (5Y 6/2) and light gray (5Y 7/2), sandy molluskan wackestone (70 – 80%) and marl (20 -30%); wackestone - hard, 3 – 5% phosphorite, very high moldic porosity, some intergranular porosity; Marl --- 50 - 60% medium to fine grained sand and silt, 15 – 20% shells, some phosphorite, medium hydraulic conductivity.
77.0 – 82.0	LIMESTONE, light olive gray (5 Y 6/2), sandy molluskan wackestone, moderately hard, dense, some fine to very fine grained quartz sand and silt, 10 – 15% phosphorite, intergranular moldic and vuggy porosity, medium to low hydraulic conductivity.
82.0 – 96.0	Missing sample (likely marl and/or limestone).
96.0 – 101.0	MARL and LIMESTONE, light gray (5 Y 7/2), wackestone (50%) hard and marl (50%) with mixed composition of 50 -60% medium to fine grained quartz sand and silt (mostly medium grained), 10-15% shells, 5 -10% phosphorite, low hydraulic conductivity.
101.0 – 109.0	LIMESTONE (90%), light gray (5 Y 7/2), wackestone, hard, low hydraulic conductivity; Marl (10%)- composed of 40 – 50% fine to very fine grained quartz sand and silt, 30 – 40% oyster shells' fragments, some phosphorite, low hydraulic conductivity.
109.0 – 110.5	LIMESTONE, light gray (5 Y 7/2), sandy wackestone, 30 - 40% medium to fine grained quartz sand and silt, 10 – 15% phosphorite, 15 – 25% shells, low hydraulic conductivity.
110.5 – 116.0	MARL, light gray (5 Y 7/2), composed of lime mud with 70 – 75% fine grained quartz sand and silt, 8 -10% phosphorite, 10 - 20% shells, low hydraulic conductivity.
116.0 – 124.0	LIMESTONE, light olive gray (5 Y 6/2), sandy molluskan packstone, moderately hard, 15 – 20% phosphorite, very grainy, high moldic intergranular, and possibly channel porosities, high hydraulic conductivity.

TABLE A–6. Geological Log LS-619.
Troyer Brothers– TB-4

Depth (ft bls)	Lithology
124.0 – 125.0	LIMESTONE, light gray (5 Y 7/1), sandy molluskan packstone / wackestone, moderately hard, 10 -15% phosphorite, aragonite (2 – 5%), high intergranular, moldic and vuggy porosities, medium to high hydraulic conductivity.
125.0 – 130.0	LIMESTONE, light gray (5 Y 7/1), sandy molluskan wackestone, moderately hard, 15 – 18% phosphorite, some fine grained quartz sand, high moldic, intergranular, and vuggy porosities, medium to high hydraulic conductivity.
130.0 – 131.5	LIMESTONE (60%) as above MARL (40%), light olive gray (5Y 6/2), lime mud with 70 – 75% medium to fine grained sand and silt (mostly fine grained), 10 -12% shells, 10 -15% phosphorite, low hydraulic conductivity.
131.5 – 136.0	MARL, olive gray (5 Y 5/2), clay and lime mud with 50 – 60% fine to very fine grained quartz sand and silt, 20 -25% phosphorite, 5 -10% fine shell fragments, low to very low hydraulic conductivity.

TABLE A–7 Geological Log LS-6229
Troyer Brothers – MW7D

Location: SW¼, SE ¼, Sec. 4, Township 46 South, Range 27 East
Lee County Florida
Lat. 26° 29.756', Long. 81° 36.972'

Depth (ft bls)	Lithology
0 – 4	SAND very pale brown (10YR 8/2), fine quartz sand, moderate to poorly sorted, sub-rounded, 1-2% phosphorite nodules, less than 1% iron staining, medium intergranular porosity, medium hydraulic conductivity.
4 – 5.5	SAND, brown (10YR 5/3), fine quartz sand, moderately sorted, trace phosphorite nodules, medium intergranular porosity, medium hydraulic conductivity.
5.5 – 10.3	SAND, pale brown (10YR 6/3), fine quartz sand, moderate poorly sorted, sub-angular, 1% phosphorite nodules, trace iron staining, medium intergranular porosity, medium hydraulic conductivity.
10.3 – 14.1	SAND, light brownish gray (10YR 6/2), fine to very fine quartz sand, moderately well sorted, sub-angular, 1-2% clay, 1% phosphorite nodules, medium intergranular porosity, medium hydraulic conductivity.
14.1 – 15.9	SAND, white (2.5Y 8/1), fine to very fine quartz sand, sub-rounded, moderate to poorly sorted, 1-3% phosphorite nodules, 1% shell fragments, most aragonite remaining, medium intergranular porosity, medium hydraulic conductivity.
15.9 – 16.3	SAND, mottled pale yellow (5Y 8/2) and dark grayish brown (10YR 3/6), fine to very fine quartz sand, 3-5% iron staining, 3% shell fragments, trace phosphorite nodules, moderately well sorted, sub-angular, medium intergranular porosity, medium hydraulic conductivity.
16.3 – 17.4	MARL, pale yellow (2.5 Y 8/2), 65-70% fine quartz sand, sub-rounded, moderately well sorted, 25-30% shells and shell fragments (Turitella), 2-5% lime mud, trace phosphorite nodules, medium intergranular porosity, medium hydraulic conductivity.
17.4 – 18.2	LIMESTONE, sandy wackestone, hard, pale yellow (2.5Y 8/3), 10-15% fine quartz sand, lime mud matrix, ~15% whole shell and fragments, most aragonite remaining, gastropod and bivalve molds, low moldic porosity, low hydraulic conductivity.

TABLE A – 7. Geological Log LS-6229
Troyer Brothers – MW-7D

Depth (ft bls)	Lithology
18.2 – 20.0	LIMESTONE, sandy fossil wackestone, medium hard, gray (5Y 6/1), 30-35% fine quartz sand, ~20% lime mud, large bivalve fossils, ~45% whole shell and fragments, ~20% aragonite remaining, medium moldic porosity, medium hydraulic conductivity.
20.0 – 21.5	SAND, pale yellow (2.5Y 8/2), fine to very fine quartz sand, whole shell and fragments (Chione), lime mud, 2-3% phosphorite nodules, intergranular porosity, medium hydraulic conductivity.
21.5 – 23.5	MARL, pale yellow (2.5Y 8/2), ~30% fine quartz sand, lime mud, shell fragments, ~50% aragonite remaining, some lithified pieces, medium intergranular porosity, moderate/low hydraulic conductivity.
23.5 – 26.0	MARL, light gray (5Y 7/1), ~50% quartz sand, ~30% whole shell and fragments, ~20% lime mud, much calcite replacement, ~20% aragonite remaining, medium intergranular porosity, medium to low hydraulic conductivity.
26.0 – 29.0	MARL, light gray (5Y 7/2), ~50% fine quartz sand, ~30% whole shell and fragments (Turitella), ~20% lime mud, most aragonite remaining, intergranular porosity, medium hydraulic conductivity.
29.0 – 30.0	MARL, same as above with small slightly lithified pieces.
30.0 – 33.0	MARL, light gray (2.5Y 7/1), ~20% fine quartz sand, ~10% lime mud, ~70% shells, most aragonite remaining, mostly whole bivalve shells, medium intergranular porosity, medium hydraulic conductivity.
33.0 – 34.5	MARL, light gray (2.5Y 7/2) with limestone (wackestone lithics), hard, ~50% sand, ~15% lime mud, 30-35% shells, most aragonite remaining, mostly bivalves, trace phosphorite nodules, very low channel porosity, medium hydraulic conductivity.
34.5 – 36.4	LIMESTONE, skeletal sandy wackestone, medium hard, pale yellow (2.5Y 7/3), ~30% sand, ~20% lime mud, ~50% shell, mostly bivalves, some gastropods, most aragonite remaining, some calcite replacement, low moldic and intergranular porosity, low hydraulic conductivity.
36.4 – 37.0	LIMESTONE, skeletal wackestone, hard, light yellowish brown (2.5Y 6/3), ~20% quartz sand, ~30% shell fragments, most aragonite remaining, 20-

TABLE A – 7. Geological Log LS-6229
Troyer Brothers – MW-7D

Depth (ft bls)	Lithology
	30% calcite replacement, 2-5% phosphorite nodules, lime mud, calcite filled mold/burrows, low moldic porosity, low hydraulic conductivity.
37.0-37.3	LIMESTONE, sandy molluscan wackestone, very hard, dark gray (2.5Y 4/1) and pale yellow (2.5Y 8/3), ~10% fine quartz sand, less than 10% shells, 20-30% aragonite remaining, irregular calcite replacement throughout, low moldic and channel porosity, low hydraulic conductivity.
37.3 – 37.8	LIMESTONE, sandy molluscan wackestone, very hard, dark gray (2.5Y 3/1) and pale yellow (2.5Y 8/2), ~5% fine quartz sand in lime mud matrix, ~10% whole shell and fragments in calcite matrix, bivalves (Chione) and few gastropods, ~20% aragonite remaining, some calcite and spar replacement, low moldic porosity, low vuggy porosity with calcite spar lining, low hydraulic conductivity.
37.8 – 39.5	LIMESTONE, clayey wackestone, soft, white (2.5Y 8/1), mostly lime mud with ~50% hard lithic fragments of sandy wackestone, [wackestone, hard, gray (2.5Y 6/1) and pale yellow (2.5Y 8/2), calcite replaced shell molds, 5-7% filled cavities with laminated rim, very low moldic porosity], low intergranular porosity, low/very low hydraulic conductivity.
39.5-43.2	LIMESTONE, wackestone, hard, light gray (2.5Y 7/1) and pale yellow (2.5Y 8/2), replaced shell casts, less than 1% aragonite remaining, mostly bivalves and coral, some spar lining, medium moldic and intergranular porosity, medium hydraulic conductivity.
43.2 – 43.5	LIMESTONE, skeletal wackestone, dark gray (2.5Y 4/1), very hard, ~15% whole shell and fragments with less than 20% aragonite remaining, mostly bivalves and gastropods, some spar lining, low moldic porosity, low hydraulic conductivity.
43.5 – 46.0	SAMPLE MISSING.
46.0 – 47.0	LIMESTONE, mudstone, gray (2.5Y 6/1), very hard, 5-10% shell molds and casts, almost no aragonite remaining, mostly bivalves, medium moldic and intragranular porosity, medium hydraulic conductivity.
47.0 – 49.2	LIMESTONE, wackestone, light gray (2.5Y 7/2), hard, 2-3% fine quartz sand, ~10% very small molds, most molds lined with calcite spar, mostly gastropods and bivalves, medium moldic and channel porosity, medium hydraulic conductivity.

TABLE A – 7. Geological Log LS-6229
Troyer Brothers – MW-7D

Depth (ft bls)	Lithology
49.2 – 51.3	LIMESTONE, mudstone/wackestone, light gray (2.5Y 7/1), hard, 3-5% very fine quartz sand, ~5% whole shells and fragments, mostly bivalves (Chione) and gastropods (Turitella), ~30% aragonite remaining, medium moldic and intergranular porosity, medium/low hydraulic conductivity.
51.3 – 53.1	LIMESTONE, mudstone, soft with hard limestone lithics: mudstone, pale yellow (2.5Y 8/2), lime mud, 2-3% fine quartz sand, 2-3% shell fragments, ~20% aragonite remaining; limestone, fossil wackestone, light brownish gray (2.5Y 6/2), hard, ~20% whole shell, calcite replacement, ~20% aragonite remaining, low moldic porosity, very low hydraulic conductivity.
53.1 – 56.2	LIMESTONE, fossil wackestone, gray (5Y 6/1), ~10 fine sand in lime mud matrix, ~10% whole and fragmented shells, molds and casts, ~5% aragonite remaining, some calcite spar, medium moldic and vuggy porosity, medium hydraulic conductivity.
56.2 – 58.7	LIMESTONE, molluscan wackestone, gray (10YR 5/1), hard, ~25% whole shell and fragments, ~30% aragonite remaining, medium moldic, channel and intragranular porosity, medium hydraulic conductivity.
58.7 – 59.8	LIMESTONE, skeletal wackestone/packstone, gray (2.5Y 6/1), hard 30-40% shell fragments, some whole shells, bivalves (Chione) and gastropods (Turitella), ~20% aragonite remaining, much calcite replacement, some calcite spar lining, medium moldic and vuggy porosity, medium hydraulic conductivity.
59.8 – 61.7	LIMESTONE, wackestone, very hard, gray (2.5Y 6/1), large and small shell molds, no aragonite remaining, mostly bivalves, low moldic porosity, low hydraulic conductivity.
61.7 – 65.6	LIMESTONE, skeletal wackestone, hard, light yellowish brown (2.5Y 6/3), fragment and whole shell molds, 2-3% aragonite remaining, larger molds lined with calcite spar, medium moldic porosity, medium hydraulic conductivity.
65.6 – 66.8	LIMESTONE, wackestone, medium hard, light gray (5Y 7/2), small shell molds and casts, no aragonite remaining, some calcite replacement, most molds replaced with lime mud and lined with calcite spar, trace phosphorite nodules, medium moldic porosity medium to low hydraulic conductivity.

TABLE A – 7. Geological Log LS-6229
Troyer Brothers – MW-7D

Depth (ft bls)	Lithology
66.8 – 69.5	LIMESTONE, same as above.
69.5 – 75.3	LIMESTONE, mudstone, soft, light gray (5Y 7/2), small molds and casts, no aragonite remaining, casts replaced with lime mud, 1-2% phosphorite nodules, medium intergranular and low moldic porosity, low hydraulic conductivity.
75.3 – 77.0	LIMESTONE, same as above.
77.0 – 85.5	LIMESTONE, same as above.
85.5 – 86.2	LIMESTONE, mudstone, light gray (5Y 7/2), 5-10% fine quartz sand in lime mud, 1-2% phosphorite nodules, medium intergranular porosity, low hydraulic conductivity.
86.2 – 96.4	SAMPLE MISSING.
96.4 – 97.7	LIMESTONE, skeletal mudstone, medium soft, light gray (5Y 7/2), lime mud, no aragonite remaining, trace calcite replacement, 2-3% phosphorite nodules, high moldic porosity, medium hydraulic conductivity.
97.7 – 100.4	LIMESTONE, same as above with large whole replaced shells,
100.4 – 102.3	LIMESTONE, skeletal wackestone , medium soft, pale yellow (5Y 7/2), lime mud, shells completely replaced with lime mud, ~30% oyster shells, medium moldic porosity, medium to low hydraulic conductivity.
102.3 – 105.3	LIMESTONE, molluscan mudstone, medium soft, pale olive (5Y 6/3), lime mud, shell molds replaced with lime mud, no aragonite remaining, few oysters, trace phosphorite nodules and needles, medium moldic porosity, medium hydraulic conductivity.
105.3 – 109.3	LIMESTONE, mudstone, medium hard with hard oyster shells, light olive gray (5Y 6/2), lime mud, ~1% phosphorite nodules, small shell molds, ~10% large oyster shells, low moldic porosity, low hydraulic conductivity.
109.3 – 114.2	LIMESTONE, skeletal wackestone, hard, light gray (5Y 7/2), lime mud, 2-3% phosphorite needles and nodules, small shell molds, bivalves and gastropods, no aragonite remaining, ~5% oyster shells, ~1% limestone lithics, some peloids replaced with lime mud, medium mold porosity, medium hydraulic conductivity
114.2 – 116.0	SAMPLE MISSING.

TABLE A – 7. Geological Log LS-6229
Troyer Brothers – MW-7D

Depth (ft bls)	Lithology
116.0 – 123.7	LIMESTONE, skeletal wackestone, hard, light gray (5Y 7/2), large and small shell and peloid molds and casts, most casts replaced with lime mud, no aragonite remaining, 2-3%, calcite replacement, 1-2% phosphorite nodules, trace spar lining, medium/high moldic porosity, medium hydraulic conductivity.
123.7 – 126	SAMPLE MISSING.
126 – 127.9	LIMESTONE, mudstone, soft, light olive gray (5Y 6/2), slightly indurated lime mud, ~2% shells, no aragonite remaining, few shell molds (mostly gastropods) replaced with lime mud, very low moldic porosity and low intergranular porosity, low hydraulic conductivity.
127.9 – 136	LIMESTONE, same as above.
136 – 139	MARL, dark gray (5Y 4/1), 15-20% very fine quartz sand, 5-7% phosphorite nodules, ~10% shell fragments, ~60% lime mud, medium intergranular porosity, medium to low hydraulic conductivity.
139-148	MARL, olive (5Y4/3), ~30% very fine quartz sand, ~10% phosphorite nodules, trace forams, trace shell fragments, ~60% lime mud, medium intergranular porosity, medium to low hydraulic conductivity.
148 – 150	MARL, dark olive, gray (5Y 3/2), ~30% very fine quartz sand, 10-15% phosphorite nodules, some nodules platy and some pebble sized, 5-10% shell fragments with ~20% aragonite remaining, trace clear fibrous material (looks like salt precipitate), ~45% lime mud, medium intergranular porosity, medium hydraulic conductivity.
150 – 156	LIMESTONE, mudstone, olive gray (5Y 4/2), soft, lenses of sand and shell fragments, ~5% fine quartz sand, 3-5% shell fragments, 2-3% phosphorite nodules, medium intergranular porosity, low hydraulic conductivity.
156 – 157	LIMESTONE, fossil wackestone, dark olive gray (5Y 3/2), soft, ~35% lime mud, 50-60% fossil shell fragments, 2-3% aragonite remaining, 3-5% phosphorite nodules, medium intergranular porosity, med hydraulic conductivity.
157 – 169	LIMESTONE, mudstone, soft, olive gray (5Y 4/2), ~5% very fine quartz sand, trace phosphorite nodules, ~10% centric diatoms, ~85% lime mud, medium intergranular porosity, low hydraulic conductivity

TABLE A – 7. Geological Log LS-6229
Troyer Brothers – MW-7D

Depth (ft bls)	Lithology
169 – 170.5	LIMESTONE with MARL: limestone, mudstone, medium hard, olive (5Y 5/3), ~1% phosphorite nodules, ~1% calcite filled pores, low intergranular porosity; marl, black (5Y 2.5/2), ~30% fine quartz sand, 15-20% phosphorite nodules, ~30% shell fragments, 2-5% aragonite remaining, medium/low intergranular porosity, medium to low hydraulic conductivity.
170.5 – 178	LIMESTONE, skeletal wackestone, hard, white (5Y 8/1), shell molds and casts, mostly bivalves and gastropods, 2-3% oyster shells, trace calcite spar, large and small whole and fragments shells, shell replaced with lime mud, no aragonite remaining, medium moldic porosity medium hydraulic conductivity.
178 – 181.5	LIMESTONE, sandy wackestone, medium hard, ~5% fine quartz sand, ~10% carbonate sand, 1-2% phosphorite nodules, some shell molds and casts replaced with limestone, trace aragonite remaining, medium to low moldic porosity, medium/low hydraulic conductivity.
181.5 – 187	LIMESTONE, skeletal wackestone, pale yellow (5Y 8/2), hard, shell molds and casts, mostly bivalves and gastropods, casts replaced with limestone, calcite and quartz sand in lime mud matrix, 2-3% quartz sand, ~20% calcite with 5% spar lining, no aragonite remaining, high moldic porosity, high hydraulic conductivity.
187 – 192	SAND, light gray (5Y 7/2), ~40% fine quartz sand, poorly sorted, sub-rounded, 5-10% phosphorite nodules, 5-10% carbonate sand, ~40% lime mud, trace calcite replaced shell fragments, medium intergranular porosity, medium/low hydraulic conductivity.
192 – 199	SAND, same as above with ~5% shell fragments.
199 – 200	SAND, light olive gray (5Y 6/2), 60-70% fine quartz sand, moderately well sorted, sub-rounded, ~1% phosphorite nodules, ~2% shell fragments, ~30% lime mud, medium intergranular porosity, medium to low hydraulic conductivity.

TABLE A–8. Geological Log LS-6230
Troyer Brothers – MW7S

Location: SW ¼, SE ¼, Sec. 4, Township 46 South, Range 27 East
Lee County Florida
Lat. 26° 29.771', Long. 81° 36.874'

Depth (ft bls)	Lithology
0 – 0.8	SAND, light olive brown (2.5Y 5/3), fine/very fine quartz sand, moderately poorly sorted, sub-rounded, slightly indurated, ~10% silt, ~50% iron staining, few rootlets, trace shell fragments, medium intergranular porosity, some organics, medium hydraulic conductivity
0.8 – 2.4	SAND, grayish brown (2.5Y 5/2), very fine quartz sand, moderate sorted, sub-rounded, ~5% silt, 2-3% iron staining, trace rootlets, trace phosphorite nodules, ~2% organic, medium hydraulic conductivity
2.4 – 4.5	SAND, pale yellow (2.5Y 8/2), very fine quartz sand, moderate well sorted, s-rounded, 2-3% iron staining, less than 1% phosphorite nodules, trace rootlets, medium hydraulic conductivity
4.5 – 5.5	SAND, grayish brown (2.5Y 5/2), fine/very fine quartz sand, ~5% lime mud, 2-3% shell fragments, bivalves, ~20% aragonite remaining, ~1% phosphorite nodules, trace organics, ~1% iron staining, medium/low hydraulic conductivity
5.5 – 7.1	SAND, brown (10YR 5/3), very fine quartz sand, moderately well sorted, sub-rounded, trace phosphorite nodules, trace shell fragments, 2-3% clay, medium intergranular, medium hydraulic conductivity
7.1 – 9.4	SAND, light grayish brown (10YR 6/2), very fine quartz sand, moderately well sorted, sub-rounded, 2-3% large shell fragments, 2-3% clay, slightly indurated, trace phosphorite nodules, medium intergranular porosity, medium hydraulic conductivity
9.4 – 11.1	MARL, white (10YR 8/1), fine/very fine quartz sand, moderately sorted, sub-rounded, ~50% whole shell and fragments, ~50% aragonite remaining, 1-2% phosphorite nodules, medium hydraulic conductivity
11.1 – 13.3	MARL, grayish brown (10YR 5/2), ~30% very fine quartz sand, 5-10% lime mud, trace iron staining and phosphorite nodules, ~60% whole shell and fragments, ~50% aragonite remaining, bivalves, medium intergranular porosity, medium hydraulic conductivity

TABLE A–8. Geological Log LS-6230
Troyer Brothers – MW7S

Depth (ft bls)	Lithology
13.3 – 17.6	MARL, pale yellow (2.5 8/2), a heterogeneous mixture of quartz and carbonate sand in lime mud with 20-30% whole shell and fragments, ~50% aragonite remaining, medium intergranular porosity, medium hydraulic conductivity
17.6 – 18.0	MARL, gray (2.5 6/1), heterogeneous mix of quartz and carbonate sand in lime mud with 20-30% whole shell and fragments, mostly bivalves and gastropods, some calcite replacement, medium intergranular porosity, medium hydraulic conductivity

TABLE A–9. Geological Log LS-6231
Troyer Brothers – MW6D

Location: SW¼, NE ¼, Sec. 16, Township 46 South, Range 27 East
Lee County Florida
Lat. 26° 28.550', Long. 81° 37.102'

Depth (ft bls)	Lithology
0 -2	SAND, dark olive gray (5Y 3/2), fine to very fine quartz sand, moderately well sorted, sub-rounded, trace rootlets, iron staining and phosphorite nodules, medium intergranular porosity, medium hydraulic conductivity.
2 – 3.2	SAND, brown (10YR 5/3), very fine quartz sand, moderately well sorted, sub-rounded, trace iron staining, phosphorite nodules and organics, medium intergranular porosity, medium hydraulic conductivity.
3.2 – 6.3	SAND, dark yellowish brown (10YR 4/4) with very dark brown (10YR 2/2) organic lenses (wood?), sub-rounded, moderately well sorted, 35-50% organic material, ~5% clay, trace phosphorite nodules and iron staining, medium intergranular porosity, medium hydraulic conductivity.
6.3 – 8.7	SAND, white (2.5Y 8/1), very fine quartz sand, sub-rounded, moderately well sorted, clean, ~2% phosphorite nodules, ~1% rootlets, trace iron staining, medium intergranular porosity, medium hydraulic conductivity.
8.7 – 9.3	SAND, pale yellow (5Y 8/2), very fine quartz sand, sub-rounded, moderately well sorted, 1-2% phosphorite nodules, trace rootlets, medium intergranular porosity, medium hydraulic conductivity.
9.3 – 13.8	SAND, light gray (5Y 7/1), very fine quartz sand, moderately well sorted, sub-rounded, ~1% phosphorite nodules, trace iron staining, 1-2% clay, medium intergranular porosity, medium hydraulic conductivity.
13.8 – 14.0	SAND, mottled light gray (5Y 7/1), and dark olive brown (5Y 3/3), very fine quartz sand, sub-rounded, moderately well sorted, trace phosphorite nodules, 1-2% organics, medium intergranular porosity, medium hydraulic conductivity.
14.0 – 18	SAMPLE MISSING.
18.0 – 18.5	MARL, light gray (2.5Y 6/3), very fine quartz sand, moderately well sorted, sub-rounded, ~5% lime mud, 5-7% shell fragments, ~30% aragonite remaining, ~1% phosphorite nodules, medium intergranular porosity, medium/low hydraulic conductivity.

TABLE A–9. Geological Log LS-6231
Troyer Brothers – MW6D

Depth (ft bls)	Lithology
18.5 – 20.2	MARL, pale yellow (2.5Y 8/2), ~45% fine quartz sand, moderately well sorted, sub-rounded, ~30% carbonate sand, 10-15% lime mud, ~10% shell fragments, ~20% aragonite remaining, trace phosphorite nodules, medium intergranular porosity, medium-low hydraulic conductivity.
20.2 – 21.9	LIMESTONE, skeletal wackestone, light yellowish brown (2.5Y 6/3), hard, ~30% gastropod and bivalve molds and casts, 5-10% aragonite remaining, medium-low moldic and vuggy porosity, low hydraulic conductivity.
21.9 – 22.6	LIMESTONE, molluscan wackestone, pale yellow (2.5Y 8/2), very small bivalve molds and casts, ~2% aragonite remaining, ~2% carbonate sand, calcite spar lining in few molds, irregular calcite replacement of matrix material, medium-low mold and vuggy porosity, medium hydraulic conductivity.
22.6 – 22.9	LIMESTONE, skeletal wackestone, grayish brown (2.5Y 4/2), ~40% shell molds and casts, bivalves and gastropods, 5-10% aragonite remaining, ~2% fine sand, medium moldic porosity, medium hydraulic conductivity.
22.9 – 25.5	LIMESTONE, wackestone, pale yellow (5Y 8/2), small bivalves molds, trace forams, no aragonite remaining, 2-3% sand, trace calcite spar, low moldic porosity, low hydraulic conductivity.
26.7 – 27.4	LIMESTONE, skeletal wackestone, medium hard, white (5Y 8/1) with very hard ~2%, light gray (5Y 7/1) limestone lenses, containing ~1% spar replacement, 5-10% sand, 30-40% shell molds and casts, most replaced with calcite, ~10% aragonite remaining, medium moldic and vuggy porosity, medium hydraulic conductivity.
27.4 – 29.1	LIMESTONE, molluscan wackestone, hard, light gray (5Y 7/1), 2-3% sand, ~30% shell molds and casts, 3-5% aragonite remaining, Chione, low moldic porosity, low hydraulic conductivity.
29.1 – 31.3	LIMESTONE, skeletal wackestone, very pale brown (10Y 7/4), very hard, 3-5% calcite replaced carbonate sand, appears to have a slight fabric, ~20% shell, ~30% aragonite remaining, mostly gastropods and some bivalves, 30-40% of molds and cavities lined with spar, medium moldic and vuggy porosity, medium-low hydraulic conductivity.
31.3 – 32.4	LIMESTONE, sandy skeletal wackestone, light gray (5Y 7/2), 40-50% carbonate sand, ~20% whole shell and fragments, bivalves and gastropods,

TABLE A–9. Geological Log LS-6231
Troyer Brothers – MW6D

Depth (ft bls)	Lithology
	~20% aragonite remaining, some calcite spar replacement of molds and matrix material, very low moldic porosity, very low hydraulic conductivity.
32.4 – 33	SAND, pale yellow (5Y 8/2), poorly sorted, sub-angular, slightly indurated, 60-70% carbonate sand, 20-25% whole shell and fragments, mostly bivalves with some gastropods, 10-15% lime mud, 1-2% phosphorite nodules, medium intergranular porosity, medium-low hydraulic conductivity.
33 – 38	SAMPLE MISSING.
38 – 39.2	SAND, pale yellow (5Y 8/2), 60-70% carbonate sand, poorly sorted, sub-angular, ~30% shell fragments, trace phosphorite nodules, 1-2% quartz sand, ~5% lime mud, medium intergranular porosity, medium hydraulic conductivity.
39.2 – 42.9	LIMESTONE, molluscan wackestone/packstone, hard, light olive brown (5Y 6/2), ~40% carbonate sand, ~40% whole shell and fragments, mostly bivalves, ~20% aragonite remaining, ~10% lime mud, ~10% calcite replacement of matrix material, some large corals, medium moldic and high/medium intragranular porosity, medium/high hydraulic conductivity.
42.9 – 45.8	LIMESTONE, sandy skeletal wackestone, pale yellow (5Y 8/3), 40-50% carbonate sand, 20-30% shell fragments, mostly bivalves and gastropods, 5-10% aragonite remaining, ~20% lime mud, trace calcite spar grain replacement, low moldic porosity, low hydraulic conductivity.
45.8 – 48.7	LIMESTONE, molluscan wackestone, hard, light gray (2.5Y 7/1), 30-40% carbonate sand, 20-30% whole shell and fragments, ~20% aragonite remaining, some molds lined with spar, ~2% calcite grain replacement, rare gastropods, low moldic porosity, low hydraulic conductivity.
48.7 – 49.4	LIMESTONE, wackestone, light gray (5Y 7/1), very hard, 2-3% carbonate sand with intraclasts of previous limestone, 5-10% whole shell and fragments, mostly bivalves, ~5% aragonite remaining, trace spar lining of molds, low moldic porosity, low hydraulic conductivity.
49.4 – 56	SAMPLE MISSING.

TABLE A–9. Geological Log LS-6231
Troyer Brothers – MW6D

Depth (ft bls)	Lithology
56 - 59.9	LIMESTONE, mudstone, pale yellow (5Y 8/2), hard, 5-10% shell molds and casts, no aragonite remaining, trace spar lining and phosphorite needles, low moldic porosity, low hydraulic conductivity.
59.9 – 64.3	LIMESTONE, sandy mudstone, pale yellow (5Y 8/2), ~10% sand, ~5% shell molds and casts, no aragonite remaining, sparse oyster shells, medium-low moldic porosity, low hydraulic conductivity.
64.3 – 64.5	SAND, gray (5Y 5/1), a heterogeneous mixture of carbonate sand, shell fragments, silt and clay, ~20% shell, ~20% aragonite remaining, medium intergranular porosity, low hydraulic conductivity.
64.5 – 65.0	LIMESTONE, skeletal wackestone , gray (5Y 6/1), ~5% sand, ~30% shell molds and casts, 2-3% aragonite remaining, bivalves (Chione) and gastropods (Turitella), trace phosphorite nodules, medium-high moldic porosity, medium-high hydraulic conductivity
65.0 – 67	SAMPLE MISSING.
67 -68.8	LIMESTONE, sandy wackestone, soft, light gray (5Y 7/1), 10-15% carbonate sand, 20-25% quartz sand, ~3% shell fragments, ~10% aragonite remaining, trace phosphorite nodules, lime mud matrix, medium intergranular porosity, medium-low hydraulic conductivity.
68.8 – 72.7	LIMESTONE, sandy molluscan wackestone, soft, gray (5Y 5/1), ~50% heterogeneous mix of quartz and carbonate sand, ~20% shell fragments, ~20% aragonite remaining, Chione, trace phosphorite nodules, medium intergranular porosity, low vuggy porosity, medium hydraulic conductivity.
72.7 – 75.1	LIMESTONE, skeletal wackestone, hard, light gray (5Y 7/2), ~10% sand, ~15% shell molds and casts, trace aragonite remaining, ~50% bivalves, ~50% disc shaped calcite replaced fossils (echinoderms?), sparse lenses of abundant sand, medium-low moldic porosity, low hydraulic conductivity.
75.1 – 76	LIMESTONE, sandy wackestone, medium hard, gray (5Y 5/1), heterogeneous mix of quartz and carbonate sand in a lime mud matrix, ~1% phosphorite nodules, ~1% shell fragments, ~5% aragonite remaining, medium intergranular porosity, medium-low hydraulic conductivity.

TABLE A–9. Geological Log LS-6231
Troyer Brothers – MW6D

Depth (ft bls)	Lithology
76 – 76.4	LIMESTONE, molluscan wackestone, soft, light gray (5Y 7/2), heterogeneous mix of carbonate sand and shells (bivalves) in a lime mud matrix, ~40% shell, ~5% aragonite remaining, medium intergranular porosity, low hydraulic conductivity.
76.4 – 78	LIMESTONE, hard, gray (5Y 6/1), trace sand, 5-10% shell molds and casts, no aragonite remaining, low moldic porosity, low hydraulic conductivity.
78-87	LIMESTONE, molluscan wackestone, hard, gray (5Y 6/1) and dark gray (2.5 Y 4/1), ~3% sand, 5-7% shell fragments, ~5% aragonite remaining, calcite replacement of shell and matrix material, trace spar lining of molds, medium-low moldic porosity, low hydraulic conductivity.
87 – 89	SAND, pale yellow (2.5 8/1), fine carbonate sand, poorly sorted, sub-angular-sub-rounded, ~2% coarse shell fragments, ~10% aragonite remaining, silt and lime mud, intergranular porosity, medium-low hydraulic conductivity.
89 – 90.8	LIMESTONE, molluscan wackestone, medium hard, light olive gray (5Y 6/2), 60-70% carbonate sand in lime mud matrix, ~20% shell molds and casts, ~5% aragonite remaining, no aragonite remaining, medium moldic and intergranular porosity, medium hydraulic conductivity.
90.8 – 108	LIMESTONE, skeletal wackestone, medium hard, light gray (5Y 7/2), ~1% sand, ~20% small shell molds and casts, bivalves and gastropods, no aragonite remaining, medium moldic porosity, medium-low hydraulic conductivity.
108 – 110	LIMESTONE, skeletal wackestone, hard, light gray (5Y 7/2), ~1% sand, 50-60% large shell molds and casts, bivalves and gastropods, no aragonite remaining, some calcite replacement, high moldic porosity, high hydraulic conductivity.

TABLE A–10. Geological Log LS-6232
Troyer Brothers – MW6S

Location: SW ¼, NE ¼, Sec. 16, Township 46 South, Range 27 East
Lee County Florida
Lat. 26° 28.554, Long. 81° 37.098'

Depth (ft bls)	Lithology
0 – 0.8	SAND, very dark grayish brown (2.5Y 3/2), very fine quartz sand, moderately well sorted, sub-rounded, rootlets, 3-5%phs nodules, ~2% iron staining, medium intergranular porosity, medium hydraulic conductivity
0.8 – 2.4	SAND, light brownish gray (10YR 6/2), very fine quartz sand, moderately sorted, sub-rounded, ~1% organics (wood?), ~2% phosphorite nodules, trace iron staining, medium intergranular porosity, medium hydraulic conductivity
2.4 – 4	SAND, dark brown (10YE 3/3), very fine quartz sand, moderately well sorted, sub-rounded, ~1% organics, ~50% iron staining, trace phosphorite nodules, medium intergranular porosity, medium hydraulic conductivity
4 – 5	SAND, dark grayish brown (10YR4/2), fine/very fine quartz sand, moderately well sorted, sub-rounded, ~1% phosphorite nodules, trace iron staining, medium intergranular porosity, medium hydraulic conductivity
5 – 6	SAND, black (10YR 2/1), fine quartz sand, moderately poorly sorted, sub-rounded, ~3% phosphorite nodules, ~5% clay, ~5% organics, medium intergranular porosity, medium hydraulic conductivity
6 – 7	SAND, very dark grayish brown (10YR 3/2), very fine quartz sand, moderately sorted, sub-rounded, rootlets, 10-15% silt and clay, 2-3% iron staining, trace phosphorite nodules, medium intergranular porosity, medium hydraulic conductivity
7 – 8.8	SAND, very pale brown (10YR 7/3), fine/very fine quartz sand, well sorted, sub-rounded, ~1% phosphorite nodules, some pieces slightly indurated, medium intergranular porosity, medium hydraulic conductivity
8.8 – 11.8	SAND, while (5Y 8/1), fine quartz sand, moderately well sorted, sub-rounded, 1-2% phosphorite nodules, clean, medium intergranular porosity, medium hydraulic conductivity

TABLE A–10. Geological Log LS-6232
Troyer Brothers – MW6S

Depth (ft bls)	Lithology
11.8 – 14.6	SAND, light gray (2.5Y 7/2), very fine quartz sand, moderately well sorted, sub-rounded, 1%phs nodules, trace iron staining, clean, moderately indurated, medium intergranular porosity, medium hydraulic conductivity
14.6 – 15	SAND, light gray (5Y 7/2), fine quartz sand, ~1% phosphorite nodules, trace, iron staining, well sorted, sub-rounded, slightly indurated, medium intergranular porosity, medium hydraulic conductivity