N60508.AR.002001
NAS WHITING FIELD
5090.3a

LETTER REPORT REGARDING RECLAIMED WASTER DISTRIBUTION AND COLLECTION SYSTEM NAS WHITING FIELD FL

4/22/2011

GEOTECHNICAL ENGINEERING

April 22, 2011

Mr. Scott Jernigan
Baskerville Donovan, Inc.
449 West Main Street
Pensacola, FL 32502

SUBJECT: Whiting Field Reclaimed Water Distribution and Collection System
Santa Rosa County, Florida
LMJ File # 10-216

Legal questions?

Dear Scott:

This letter forwards the results of our work on the distribution system for Whiting Field and summarizes our discussions during the 13 April meeting in Milton. **Figure #1** shows the boring location plan for the borings drilled in the general areas under consideration and **Figure #2** shows the prior borings which we redrafted to our current AutoCAD format and the recently drilled borings (B-48 to B-60).

We understand that is desired to dose the below grade rapid infiltration basins (RIBs) at the maximum allowable amount and that will be an annual average of 5.6 gal/day/ft^2. This will require 8.2 acres of basin for 2 MGD of reclaimed water. With a 50% on and 50% off loading schedule, that would result in the maximum allowable loading rate of 11.2 gal/day/ft^2 during the dosing periods and the RIBs must be designed to distribute and then collect the water for ultimate disposal into chimneys at select locations across the site, which will include areas outside the basins because the conditions for high rate chimneys appear to be more isolated than anticipated based on the earlier borings. Based on our discussions on the 20th of April we understand that you are looking at establishing 4 separate basin areas and would plan to dose them 2 on and 2 off, probably on a 1 or 2 week rotation.

Conditions are not suitable for high rate loading in the surficial soils, and the basin soils will need to be undercut and replaced with clean sand soils. This will allow the basins to be placed at any convenient location. As a result of our discussions on the 13th of April, we think that calling for a clean sand with a maximum of 2% fines with a minimum vertical permeability of 40 foot/day when compacted to 100% of the Standard Proctor Test (ASTM D698) energy will be the best all around solution. Because of the high rate of loading, a washed gravel bed will need to be placed on top of the sand beds to facilitate distribution of the treated water. We recommend a 1 foot thick washed gravel bed and any washed clean gravel should have a minimum horizontal permeability of 150 foot/day.

We understand that suitable perforated pipe is available for the basin distribution system, and we think that is going to be the best approach. Appropriate valves will be needed to control the amount of water to the bed systems. The distribution pipes in the washed clean gravel beds should be placed on maximum 11 foot centers. When we discussed bed thickness for the RIBs, Keith Hill indicated that he would rather have less bed thickness and closer spaced pipes for the collection system. Because the

system will be gravity drained as much as practical, appropriate slope will be needed to facilitate as uniform of distribution as practical. Collection pipes will need to be placed at the bottom of the sand bed in the basin to collect the water for transfer to the chimneys. **Table #1** below shows the appropriate bed thickness, pipe spacing, and daily collection volumes the collection pipes will need to be designed for (the table values have no factor of safety and an appropriate factor of safety should be used in sizing the pipes).

Table #1: Design Table For Collection System In Dosing Beds

Horizontal Sand Permeability (ft/day)	40		
Dosing Rate	11.2 gal/day/ft² (1.5 ft/day)		
Height of Sand Bed	3	5	8
Drain Spacing	17	32	64
Quantity ft³/ft of drain/day	27	48	96

Figure #3 shows a sketch a section through the typical basin layout if a 5 foot sand bed is used.

The prior borings indicated that there appears to be four good areas for chimneys to be established (west/southwest of B-2, B-3, B-4, and B-12). Of the current borings, only B-49, B-51, and possibly B-55 showed promise and may also prove to be reasonably good areas. Since the lakes on site are leaking, locations near them are not advisable. All the other borings drilled had marginal to poor conditions for chimneys and were drilled in the areas which had been designated by the Navy for reclaimed water disposal. Clearly the chimney locations must be placed in the best soil areas which for the most part will probably be remote from the basins. Because of the large volumes of water that we have to dispose of in the chimneys it will be necessary to drill one SPT boring to a depth of 75 feet for every 100 linear foot of chimney to establish the continuity of the good sand soils and to provide reasonable assurance that a sufficiently large area of mainly sand soils is available and that sufficient separation exists below the chimney between the upper lower permeability soils and the underlying moderate permeability soils for the system to function reasonably well. These borings must be done by LMJ drillers under the direct supervision of our engineering staff. A minimum depth of 25 foot of sand is advisable immediately beneath the bottom of the chimney in order for the water to spread out and soak into the underlying soils.

The ultimate capacity of the chimney will depend upon the width/length of the chimney allowed by the soil conditions, the underlying thickness of the primarily sand soils and the permeability of those soils. We think that at least the 2 MGD capacity is available on site, and will need to do the above noted additional detailed work at each proposed chimney location in order to verify loading and recovery periods and chimney configuration. We recommended that chimney locations be selected from the best boring locations drilled to date. We recommend at least 1.64 acres of total chimney area for RIBs at a system dosing rate of 2 MGD. Ample space should be provided at each of the four chimney areas to provide for changing orientation and configuration and as much separation as possible. We think that placing 2 chimneys on the either side of a fairway would be advisable and staggering those

as much as possible generally as shown on **Figure #4**. We recommend the typical chimney to be 224 long by 20 feet wide, and four chimneys should be connected to each RIB for a minimum of 16 separate chimneys. Each chimney should be keyed a minimum of 3 feet into the underlying sands. The chimneys should be separated as much as practical (at least 224 to 300 feet) and generally in an end to end configuration to minimize interaction. These dimensions, separation and/or orientation may need to be modified depending upon the actual soil conditions encountered at the chimney locations as well as other constraints possibly imposed by the Navy. They should be connected to be able to run either independently or together. **Figure #5** shows a sketch of a typical chimney installation. Field obstruction by a representative of our staff will be required to evaluate the actual conditions in the chimney during construction and to allow adjustments to be made if needed to best fit the in ground conditions encountered. Samples of basin sand, basin gravel, and chimney backfill should be provided to LMJ for laboratory testing and approval prior to being brought to the site.

We hope that this letter provides sufficient information for your current requirements, and we thank you for choosing LMJ on this project. If you have any questions or comments, please do not hesitate to call.

Respectfully yours,
LARRY M. JACOBS & ASSOCIATES, INC. (LMJ)

Terry Niemann

TERRY NIEMANN
Project Manager

4.22.11

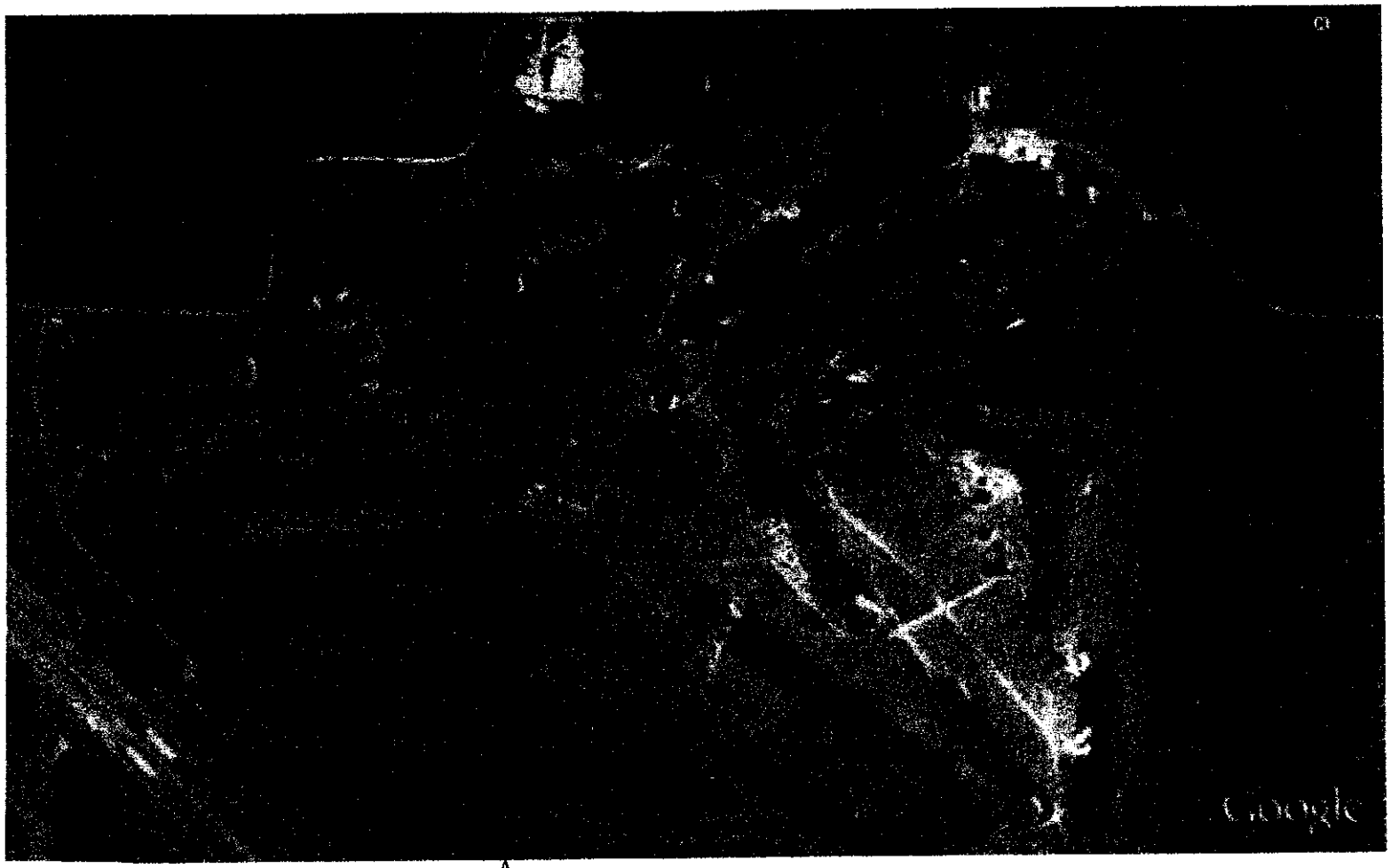
LARRY M. JACOBS, P.E.
Principal Geotechnical Engineer
Florida Reg. #19690

CC:

Attachments

BORING LOCATION PLAN

Figure #1



STANDARD PENETRATION TEST BORING

ALL BORING LOCATIONS ARE APPROXIMATE

Project #: 10-216	Scale: 1" ≈ 400'
Date: 04/21/11	Checked By: TDN
Project: Whiting Field Infiltration	
Location: Santa Rosa County, Florida	

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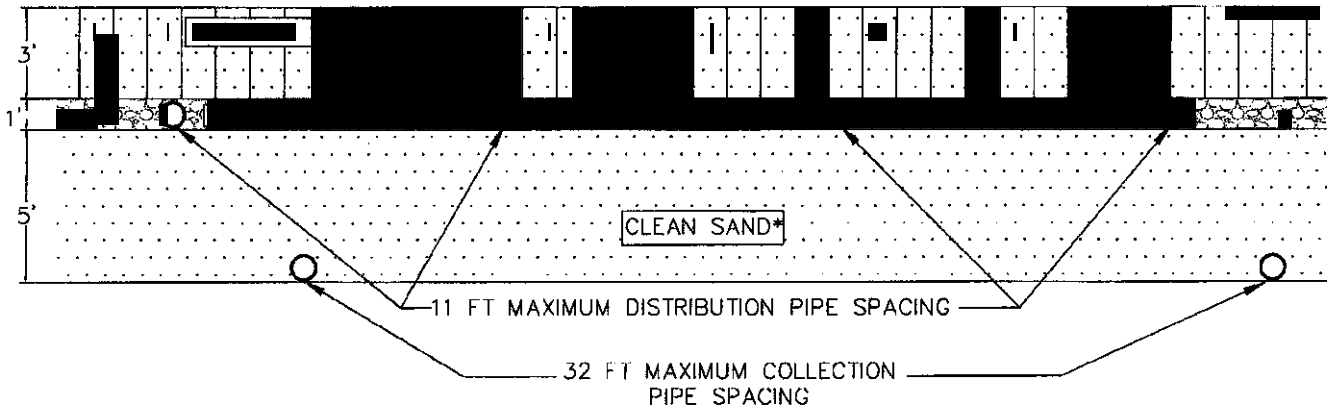
TYPICAL SECTION FOR BELOW GRADE RAPID INFILTRATION BASIN

Figure #3



*CLEAN SAND WITH MINIMUM 40 FOOT/DAY VERTICAL PERMEABILITY WHEN COMPACTED TO 100% OF STANDARD PROCTOR TEST ENERGY

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Figure #4

SUGGESTED TYPICAL CHIMNEY LOCATION PLAN

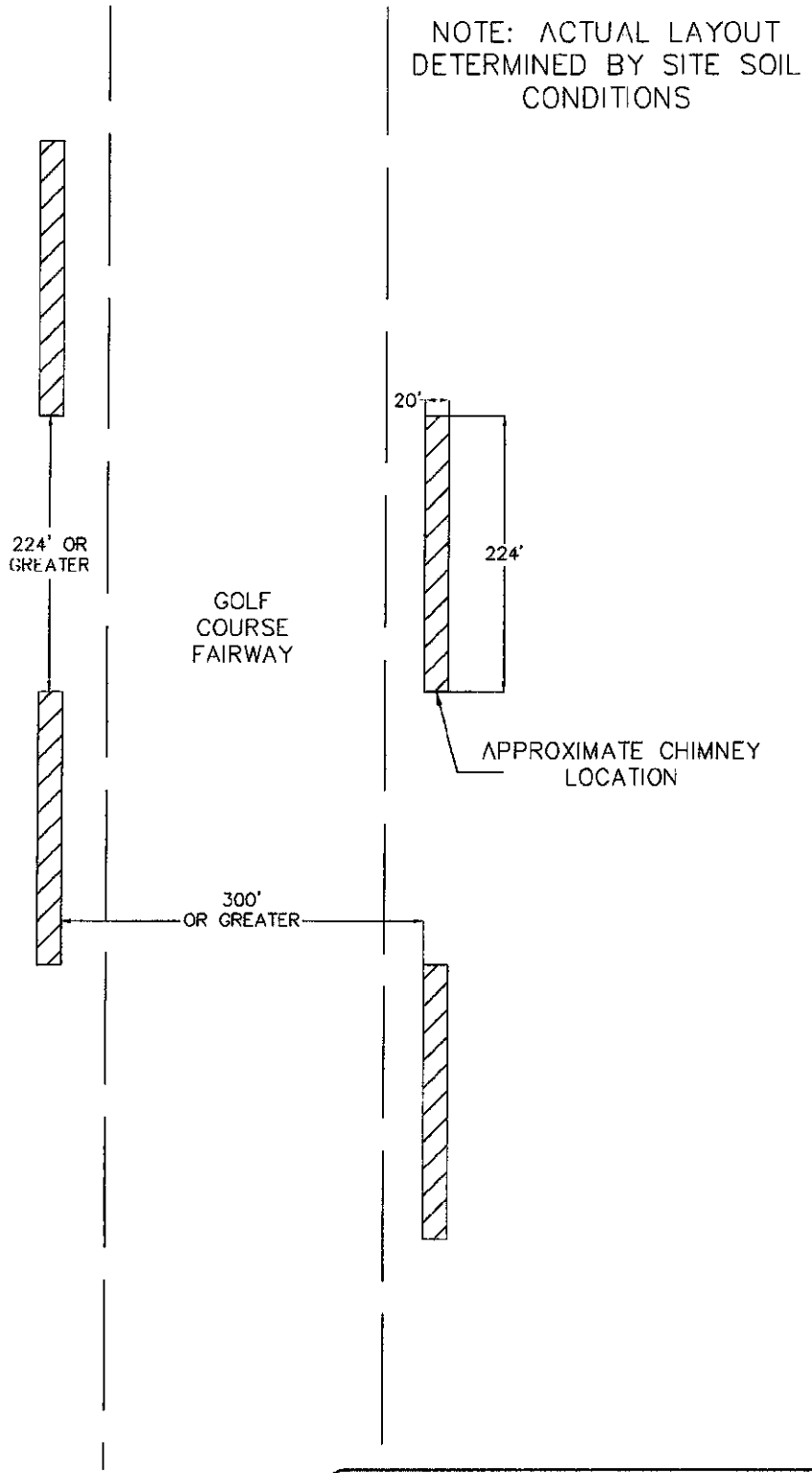

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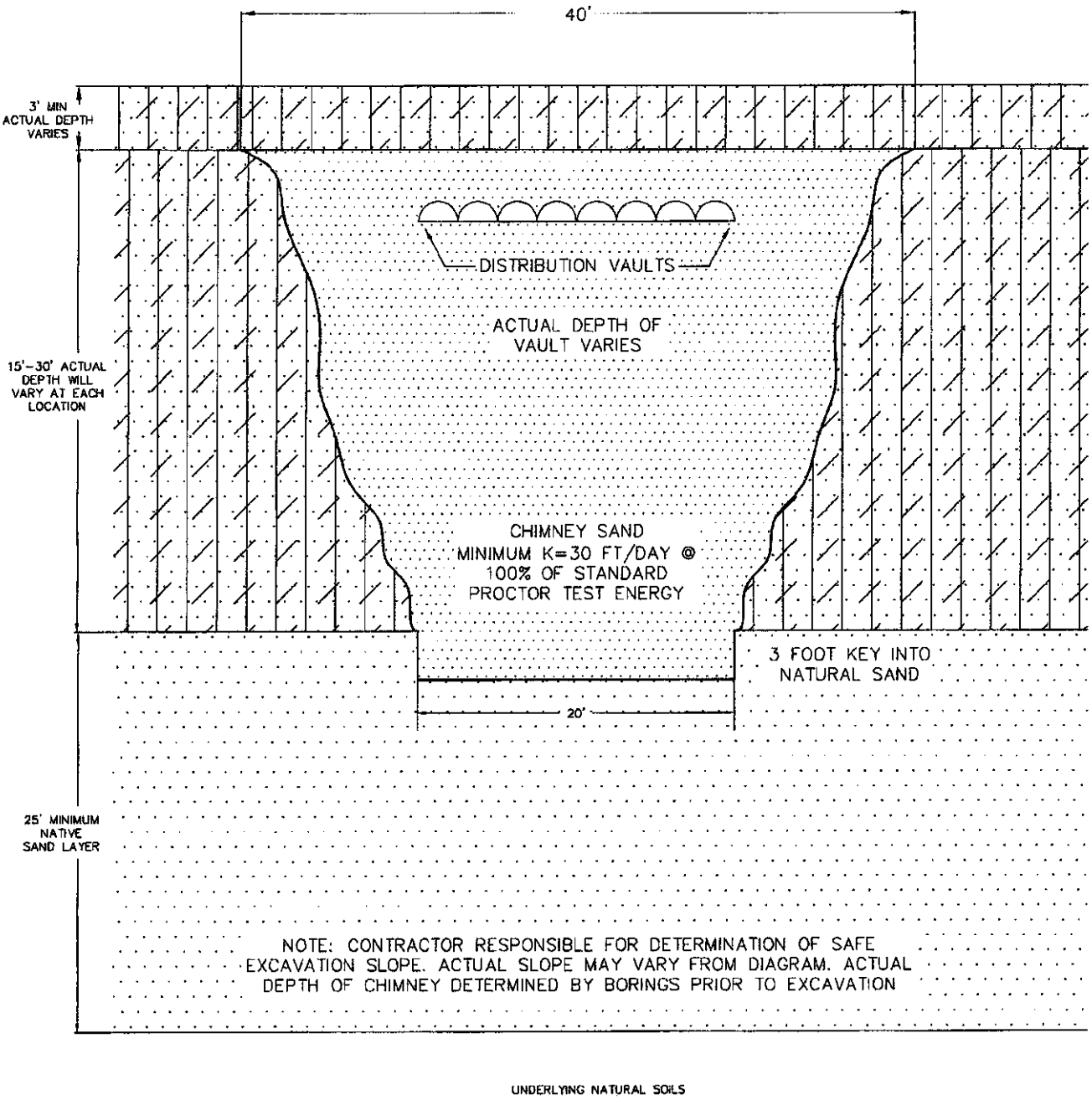
Figure #5

SECTION THROUGH TYPICAL CHIMNEY



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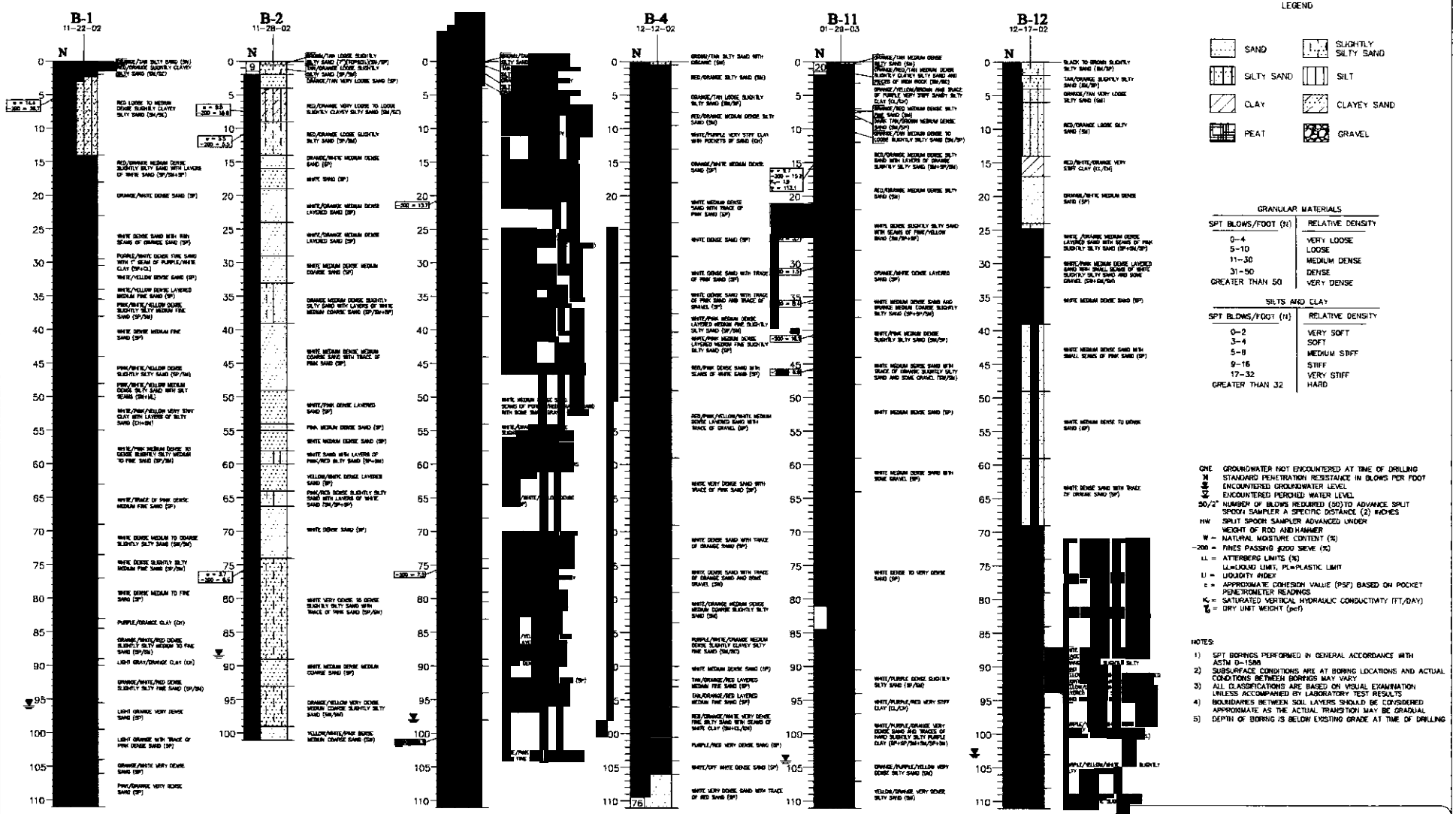
BORING LOGS

Figure #2



LEGEND

SAND
SLIGHTLY SILTY SAND
SILTY SAND
SILT
CLAY
CLAYEY SAND
PEAT
GRAVEL

GRANULAR MATERIALS

SPT BLOWS/FOOT (N)	RELATIVE DENSITY
0-4	VERY LOOSE
5-10	LOOSE
11-30	MEDIUM DENSE
31-50	DENSE
GREATER THAN 50	VERY DENSE

SILTS AND CLAY

SPT BLOWS/FOOT (N)	RELATIVE DENSITY
0-2	VERY SOFT
3-4	SOFT
5-8	MEDIUM STIFF
9-16	STIFF
17-32	VERY STIFF
GREATER THAN 32	HARD

GNE GROUNDWATER NOT ENCOUNTERED AT TIME OF DRILLING
N STANDARD PENETRATION RESISTANCE IN BLOWS PER FOOT
▽ ENCOUNTERED GROUNDWATER LEVEL
▽ ENCOUNTERED PERCHED WATER LEVEL
50/2" NUMBER OF BLOWS REQUIRED (50) TO ADVANCE SPLIT SPOON SAMPLER A SPECIFIC DISTANCE (2) INCHES
HW SPLIT SPOON SAMPLER ADVANCED UNDER WEIGHT OF ROD AND HAMMER
W = NATURAL MOISTURE CONTENT (%)
-200 = FINES PASSING #200 SIEVE (%)
LL = ATTERBERG LIMITS (%)
LL=LIQUID LIMIT, PL=PLASTIC LIMIT
LI = LIQUIDITY INDEX
c = APPROXIMATE COHESION VALUE (PSF) BASED ON POCKET PENETROMETER READINGS
K_v = SATURATED VERTICAL HYDRAULIC CONDUCTIVITY (FT/DAY)
γ_d = DRY UNIT WEIGHT (pcf)

NOTES:

1) SPT BORINGS PERFORMED IN GENERAL ACCORDANCE WITH ASTM D-1586
2) SUBSURFACE CONDITIONS ARE AT BORING LOCATIONS AND ACTUAL CONDITIONS BETWEEN BORINGS MAY VARY
3) ALL CLASSIFICATIONS ARE BASED ON VISUAL EXAMINATION UNLESS ACCOMPANIED BY LABORATORY TEST RESULTS
4) BOUNDARIES BETWEEN SOIL LAYERS SHOULD BE CONSIDERED APPROXIMATE AS THE ACTUAL TRANSITION MAY BE GRADUAL
5) DEPTH OF BORING IS BELOW EXISTING GRADE AT TIME OF DRILLING

[redacted] #: 10-216 Scale: NTS

Date: 04/14/11 Checked By: LMI/TDN

Project: Whiting Field Infiltration

Location: Santa Rosa County, Florida

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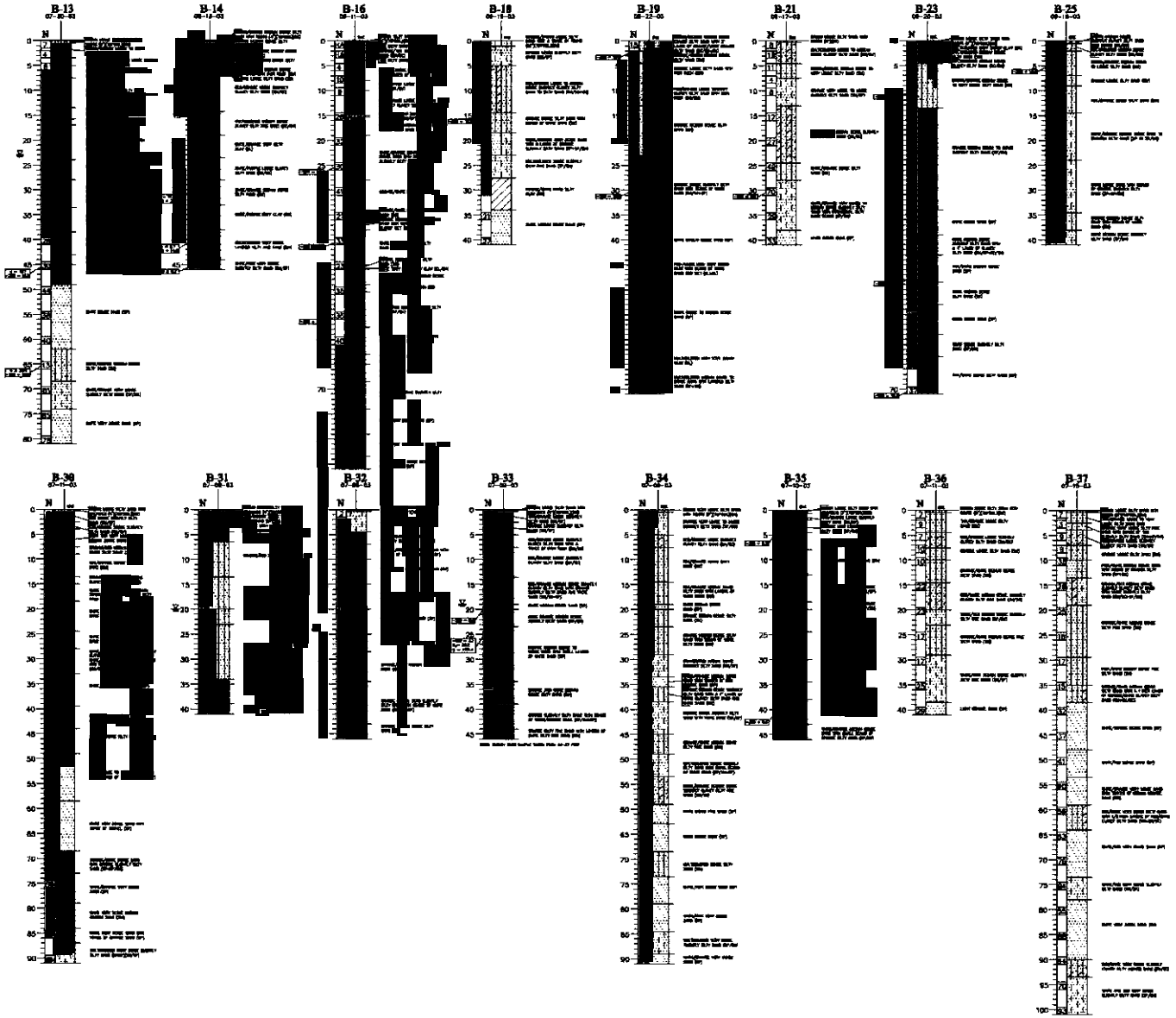
Construction Services
Materials Testing
LMI

BORING LOGS

Figure #2



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Geotechnical Engineering

BORING LOGS

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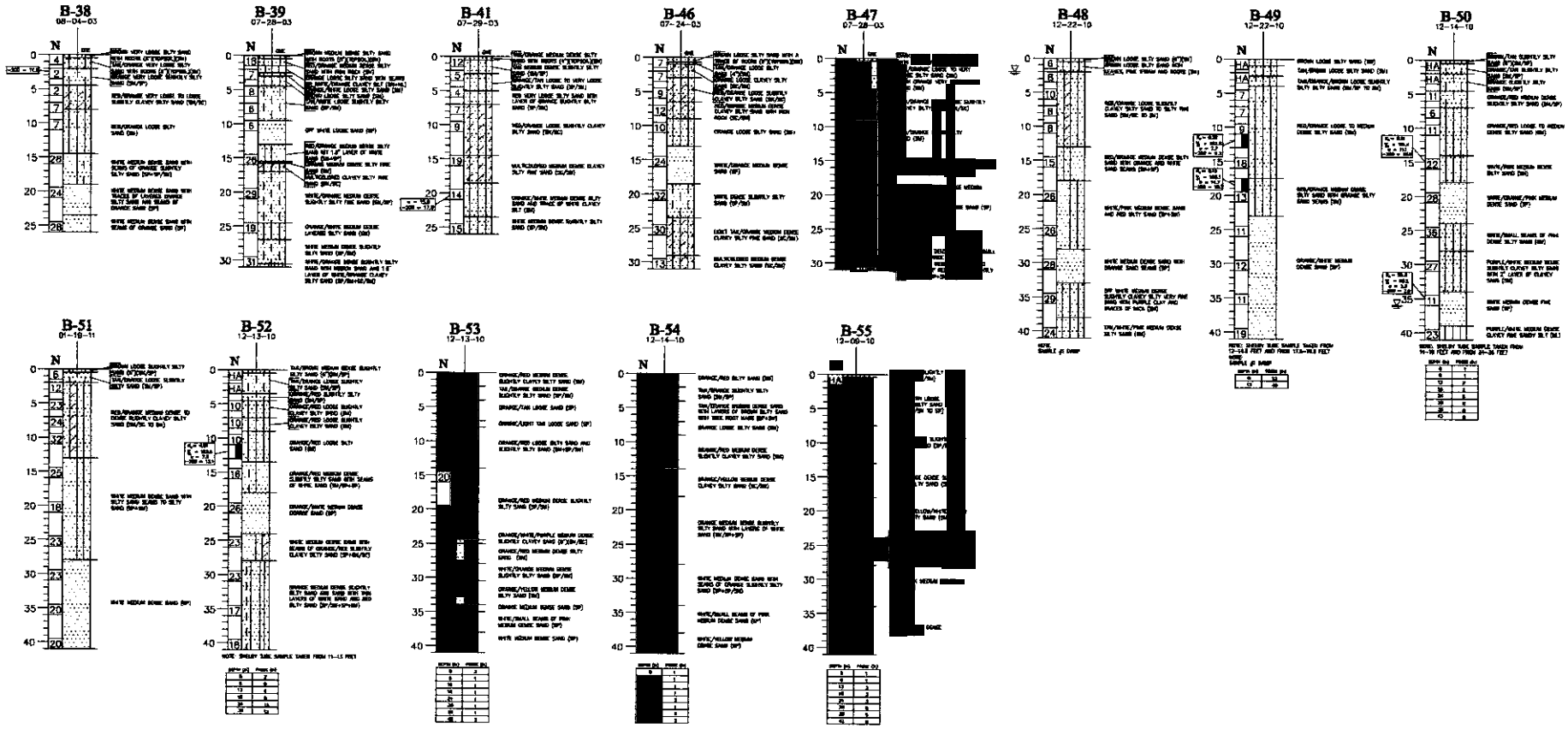

Project #: 10-216 Scale: NTS	Geotechnical Engineering
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BORING LOGS

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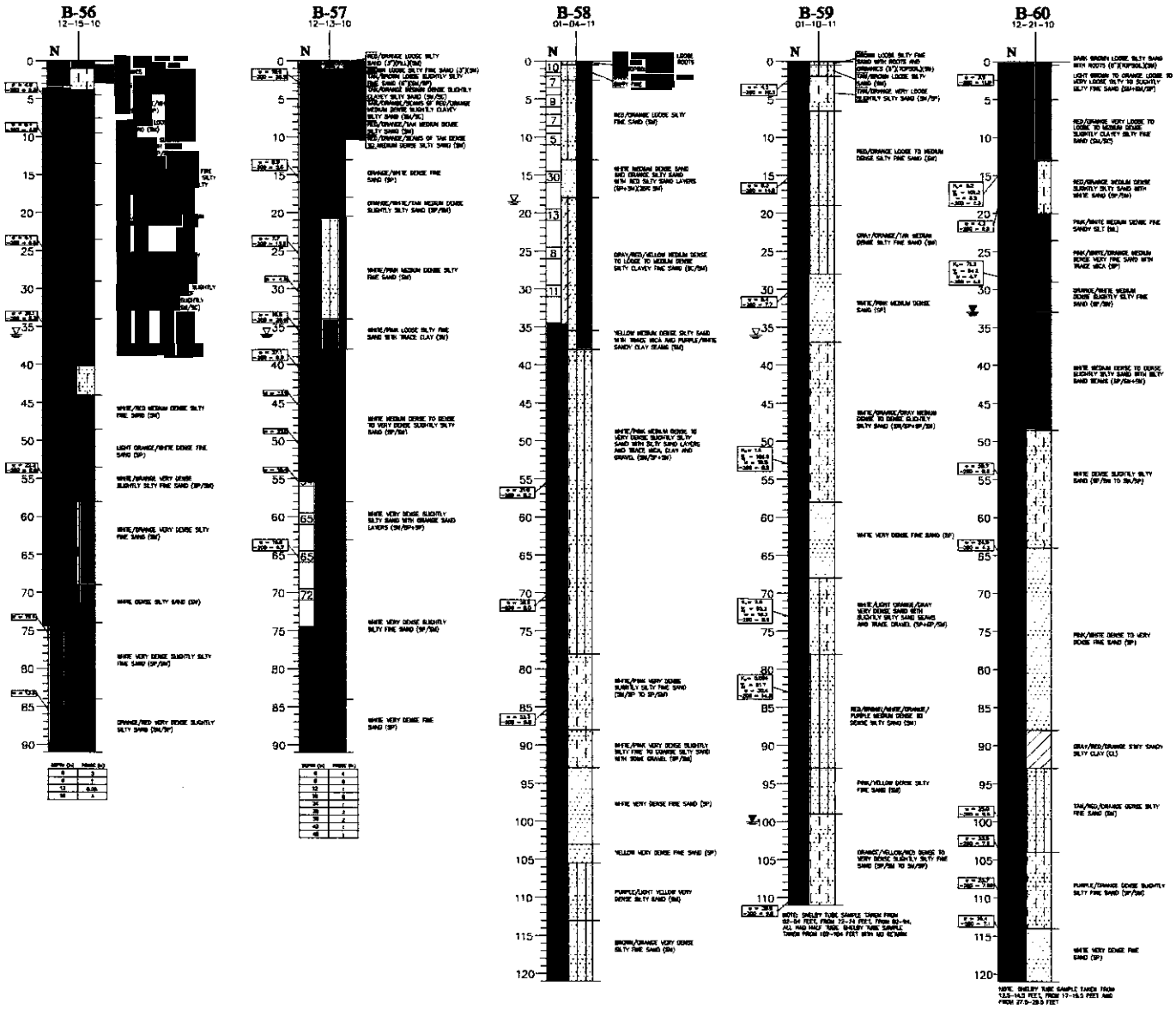

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