41193

May 9, 2011

Susan J. Pelz, P.E.
Program Manager, Solid Waste
Department of Environmental Protection
13051 North Telecom Parkway
Temple Terrace, Florida 33637-0926

Dept. Of Environmental Protection
MAY 09 2011
Southwest District

Subject: Summary Report
Stage 1 Sinkhole Stabilization Plan Compaction Grouting
Hillsborough County Southeast County landfill
FDEP Permit No. 35435-014-SO/01

Dear Ms. Pelz:

On behalf of Hillsborough County Public Utilities Department, Solid Waste Management Group (SWMG), HDR Engineering, Inc. (HDR) hereby submits one copy of the Stage 1 –Sinkhole Stabilization Plan summary report, prepared by SDII Global Corporation (SDII), for the compaction grouting conducted at the Southeast County Landfill (SCLF). The Stage 1 Plan was submitted to the Florida Department of Environmental Protection – Southwest District (FDEP) on January 12, 2011, and was subsequently accepted by the FDEP for implementation by SWMG.

The implementation of the Stage 1 – Sinkhole Stabilization Plan began on March 7, 2011, and final completion was achieved by the contractor on April 7, 2010. The Stage 1 work included drilling inclined holes from a safe area east of the sinkhole for use in the compaction grouting. Approximately 509 cubic yards of grout was injected in the soil/waste material beneath the sinkhole depression. SDII provided engineering oversight during the compaction grouting process and as shown in the attached summary report, concluded that the Stage 1 compaction grouting program was sufficient to provide a reasonable degree of safety for the Stage 2 Plan for cut, fill, and waste relocation within the proximity of the sinkhole.

As previously discussed with the FDEP, the County's engineering consultants are preparing the Stage 2 – Cut, Fill, and Waste Relocation Plan to further stabilize and fill sinkhole area for providing a safe and adequate surface area for the Stage 3 geotechnical and geophysical investigation

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For clarification and as stated in the Sinkhole Action Plan (SAP), dated December 22, 2010, submitted and accepted by the FDEP, the County will submit to the FDEP a written plan for each Stage of the work prior to implementation of each Stage. Moreover, the FDEP will be notified if during the implementation of each Stage changes occur that requires a modification to the plan.

Please call me if you have any questions or require additional information.

Sincerely,
HDR ENGINEERING, INC.

Richard Siemering
Solid Waste Section Manager

Attachment

cc: Patricia V. Berry, PUD
Megan M. Miller, PUD
Larry E. Ruiz, PUD
Steven H. Meiggs, SDII

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Dept. Of Environmental Protection
MAY 09 2011
Southwest District

May 6, 2011

Mr. Richard A. Siemering
HDR Engineering, Inc.
5426 Bay Center Drive; Suite 400
Tampa, Florida 33609-3444

Subject: **Interim Stage 1 Sinkhole Stabilization Report**
Hillsborough County Southeast County Landfill
Lithia, Hillsborough County, Florida
SDII Project No.: 3027462

Dear Mr. Siemering:

SDII Global Corporation (SDII) is pleased to present this interim report summarizing the results of the Stage 1 sinkhole stabilization performed at the Hillsborough County Southeast Landfill in Lithia, Florida.

BACKGROUND INFORMATION

A sinkhole occurred at the Southeast Landfill on December 14, 2010. In response to this event, the *"Stage 1 – Sinkhole Stabilization Plan"*, dated January 12, 2011 (Appendix A) was developed by SDII and HDR to provide sufficient stabilization of the apparent sinkhole to allow for a geotechnical investigation and subsequent remediation efforts to be conducted above the apparent sinkhole feature. The future work efforts include earthwork to re-grade the area for equipment and personnel access, geotechnical/geophysical investigation, and final remediation of the sinkhole.

SDII provided engineering oversight to perform the following activities during the Stage 1 compaction grouting program:

- Monitor the compaction grouting contractor, Hayward Baker, Inc. (HBI) field operations;
- Provide recommendations during the compaction grouting operation to adjust the operations, as necessary;
- Develop grout hole logs documenting the information obtained from the installation and completion of each grout hole; and
- Confirm that the compaction grouting program was completed in substantial compliance with the *Stage 1 – Sinkhole Stabilization Plan.*

COMPACTION GROUT HOLE INSTALLATION DATA

Between March 9 and April 1, 2011, HBI installed nine (9) compaction grout holes as shown on Figures 1 and 2. The grout holes were began in a stable area east of the sinkhole feature and drilled at a 35 degree angle from the horizontal into the subsurface vicinity of the sinkhole. The grout holes generally encountered materials that were previously identified in the two sonic core holes B-SH-1 and B-SH-2 (Appendix B). This included:

- Landfill clay liner that appears to have been displaced from its location as identified in B-SH-2;
- Areas that likely contain voids and/or very loose materials in the general area beneath the sinkhole feature;
- Losses of drilling fluid circulation adjacent to the apparent sinkhole feature; and
- Transition from drilling with no to relatively little resistance to substantial resistance near the termination of each grout hole.

The pertinent data obtained from each grout hole are summarized and included in Tables 1 and 2 and the grout hole logs are included in Appendix C. Compaction grout was injected in each grout hole from the bottom of the hole to the ground surface. The compaction grout volume generally increased in areas with relatively low grout injection back-pressures and correspondingly decreased in areas with relatively high grout injection back-pressures.

The following pertinent information was obtained during the compaction grouting:

- A total of approximately 509 cubic yards of low-slump, compaction grout was injected in the 9 holes;
- An average of approximately 56 cubic yards of compaction grout was injected in each hole (refer to Table 1);
- The average grout injection pressure generally increased for the upper row of grout holes (GH-1 through GH-5) that were installed after the lower row of grout holes (GH-6 through GH-9); and
- The ready mix compaction grout slump of 3 to 6-3/4 inches generally met the required values of 3 to 6 inches in the specifications.

The compaction grout volumes per foot of depth and the corresponding grout injection pressures for each grout hole are plotted on Figures 3 through 7 for grout holes GH-1 through GH-9, respectively. The compaction grout volume was generally low near the bottom of the grout hole with a corresponding high grout pressure. This was an indication that the holes were drilled into firm native material outside of the disturbed sinkhole material. Above a depth of about 160 to 180 feet (depths are inclined down hole depths) for the lower row of grout holes, GH-6 through GH-9, the grout volume generally increased with a decrease in grout pressure. For the upper row of grout holes, GH-1 through GH-4A, the higher grout volume and lower grout pressure occurred at a shallower depth of about 120 to 140 feet. At a depth of approximately 10 feet below the pre-sinkhole, landfill-liner elevation observed during the installation of each grout hole, the injected grout volumes and pressures were reduced to avoid hydraulic fracturing of, or other impacts to, the liner system. This is indicated on Figures 3 through 7 at a grout injection depth of about 100 to 120 feet where the grout volume per foot of depth is relatively low.

The compaction grout laboratory compressive strength results are shown in Table 2. The required compressive strength based on the grout mix design was a minimum of 1,500 psi at 28-days. Based on the results presented in Table 2, it appears some of the grout did not attain the specified 28-day strength; most significantly, the average compressive strength for the samples from GH-4A was 1,130 psi. However, it is SDII's opinion that the lower strength grout is acceptable for the Stage 1 grouting program. It should be noted that the grout has a relatively high fly ash content that generally retards the gain in compressive strength; consequently the strength gain should continue with time.

APPARENT STABILITY OF SINKHOLE DEPRESSION

From December 14, 2010 to March 22, 2011 the sinkhole depression appeared to be relatively stable except for minor sloughing of the sidewalls of the depression. The width of the catalogued tension cracks around the perimeter of the sinkhole remained relatively constant indicating that additional movement was not occurring. The readings from the two vertical displacement gauges (Figures 8 and 9) placed in the bottom of the depression generally did not indicate continued movement with the exception of approximately 3.5 feet of settlement of the south displacement gauge on February 20, 2011. However, on March 22, 2011, after the completion of grout hole GH-1, additional subsidence occurred in the form of shifting and collapse of the sidewalls of the sinkhole. The north and south displacement gauges settled 8 to 13.5 ft relatively quickly before the gauge cables broke. The aerial dimensions of the sinkhole feature increased as shown on Figures 1 and 2. This subsidence was not unexpected as the grout was intended to cause the soil and waste within the sinkhole column to move as they were being stabilized. It is likely that a layer of loose waste materials and soil that may include void spaces occupies the base of the sinkhole above the upper row of grout holes.

CONCLUSIONS AND RECOMMENDATIONS

Based on the above information, it is SDII's opinion that the compaction grouting program was completed in substantial compliance with the *Stage 1 - Sinkhole Stabilization Plan*. It is our opinion that the area around the sinkhole is relatively safe for the proposed work activities; however, continued monitoring of the sinkhole is required. The site health and safety plan should be updated to include a monitoring plan and response plan in the event unanticipated movement of the sinkhole occurs.

Because of the additional movement of the sinkhole on March 22, 2011, the layer of loose soil above the upper row of grout holes could settle due to the weight of the earth-fill required to grade the area. This settlement could cause issues regarding the future stability of the sinkhole. For this reason, we recommend that the base of the sinkhole depression be filled to elevation 115 ft. (NGVD) with a Controlled Low Strength Material (CLSM). This would require about 790 cubic yards of material. The CLSM plug would be approximately 20 feet thick with a diameter of about 60 feet, with a compressive strength of no less than 300 psi. The CLSM plug should provide certain benefits that include:

- A relatively large mass of material that will be difficult to displace or move;
- Compaction of the loose material above the upper row of grout holes that should reduce the potential of additional settlement;

- A reduction in the possibility for a sudden downward movement that could potentially threaten personnel and/or equipment;
- Possible permeation of the upper wastes in the sinkhole column, thus adding additional stability to the waste mass; and
- A substantial barrier to surface water infiltration.

In our opinion, the CLSM plug is a necessary precaution to allow placement of personnel or equipment directly above the sinkhole.

A monitoring plan will be developed under separate cover to measure settlement of the CLSM plug as well as the settlement of the materials beneath the CLSM plug. Settlement data will be collected and evaluated while work is occurring above the sinkhole feature, and appropriate actions will be included in the health and safety plan if unexpected movement should occur.

LIMITATIONS AND CERTIFICATIONS

The contents of this report are intended for the use of HDR and their representatives or clients. SDII assumes no liability for the misuse of this information by others. The professional opinions and/or recommendations included within this report are based on the interpretations of the testing and/or data collection activities performed at the site by SDII. SDII reserves the right to update this report should additional information become available.

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

Sincerely,

SDII Global Corporation
4509 George Road, Tampa, Florida 33634
FBPE Certification of Authorization #8778

Steven H. Meiggs, P.E., PG, PSSC
Principal Geological/Geotechnical Engineer
State of Florida License 64832
State of Florida License PG2352

Sam B. Upchurch, Ph.D., P.G.
Vice President and Senior Principal Geologist
State of Florida License PG4

ATTACHMENTS:
Table 1 – Compaction Grout Hole Installation Data
Table 2 – Compaction Grout Compressive Strength Data
Figure 1 – Sinkhole Area – Plan View
Figure 2 – Grout Holes and Sonic Borings – Profile View
Figures 3 through 7 – Grouting Volume and Pressure Data
Figures 8 – Stage 1 Vertical Displacement Gauge Data (North)
Figures 9 – Stage 1 Vertical Displacement Gauge Data (South)
Appendix A – Stage 1 Stabilization Plan
Appendix B – Sonic Core Boring Logs
Appendix C – Grout Hole Drilling and Injection Logs

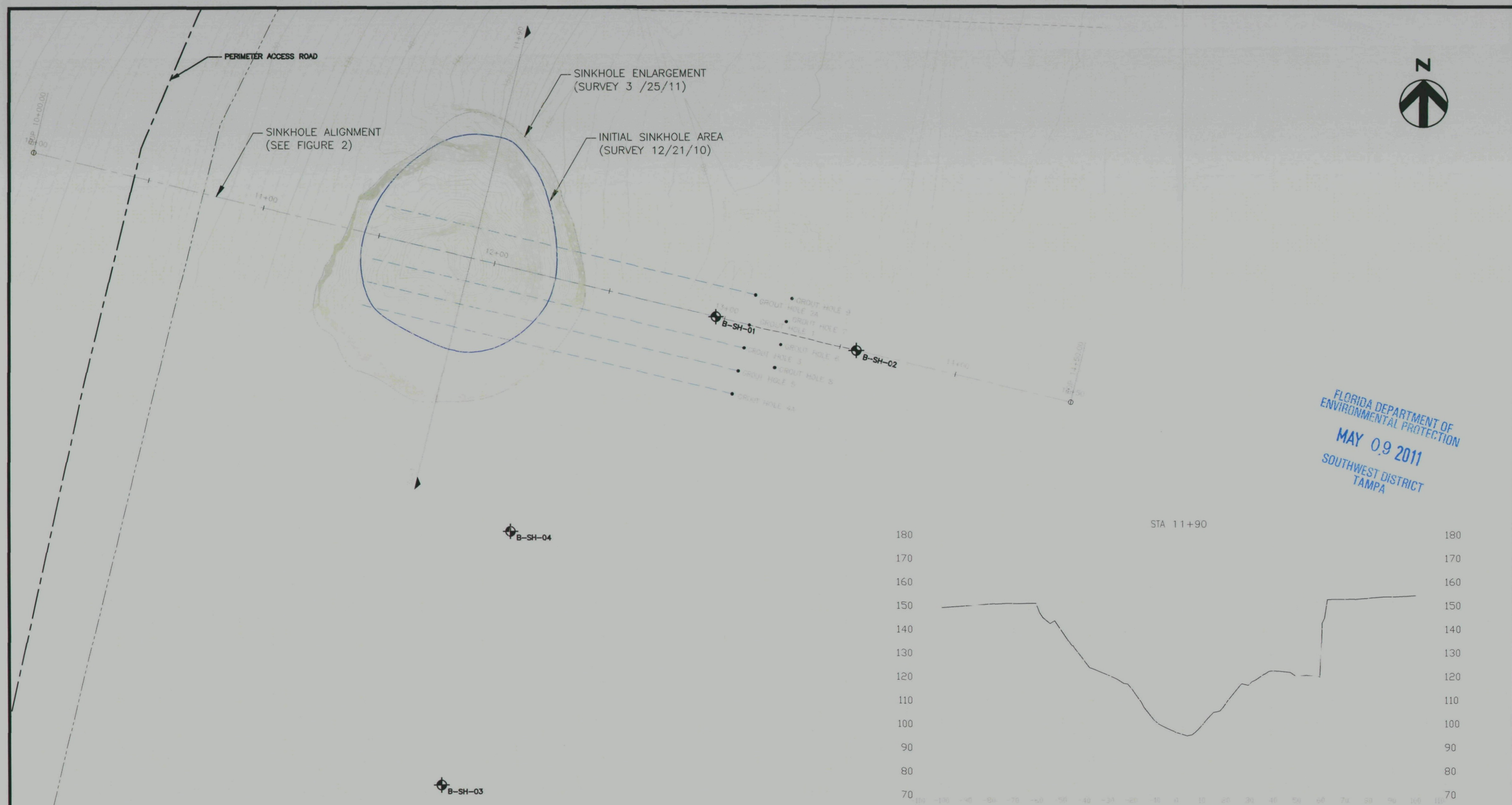
Tables

SDII Global Corporation				Table 1 Compaction Grout Hole Installation Data			
Compaction Grout Hole	Row Location	Grout Hole Depth ** (ft)	Installation Sequence	Completion Date	Grout Volume (cy)	Average Grout Pressure (psi)	Range Grout Slump (in)
GH-1	Upper	177	5	3/22/2011	59.86	156	3 – 4 ¾
GH-2A	Upper	177	7	3/29/2011	47.01	227	3 ¾ - 5
GH-3	Upper	181	6	3/25/2011	51.72	228	3 ¾ - 5 ¾
GH-4A	Upper	173	8	3/30/2011	57.48	261	3 ½ - 5
GH-5	Upper	173	9	4/01/2011	57.87	226	3 ¾ - 4 ¾
GH-6	Lower	215	1	3/15/2011	56.87	187	4 ¼ - 6 ¾
GH-7	Lower	198	2	3/18/2011	67.56	205	3 ½ - 5 ¼
GH-8	Lower	193	3	3/18/2011	57.35	181	3 – 5
GH-9	Lower	191	4	3/21/2011	53.09	181	3½ - 5 ½

** Grout hole depth measured along the 35° angle

SDII Global Corporation				Table 2 Compaction Grout Compressive Strength Data				
Compaction Grout Hole	Row Location	Range Grout Slump (in)	Grout Compressive Strength (PSI)					
			3-day	7-day	28-day			Average (psi)
GH-1	Upper	3 – 4 ¾	670	770	1,470	1,410	1,450	1,440
GH-2A	Upper	3 ¾ - 5	660	610	1,240	1,150	1,200	1,200
GH-3 (1 of 2)	Upper	3 ¾ - 5 ¾	640	700	1,540	1,470	1,510	1,510
GH-3 (2 of 2)			630	750	1,590	1,720	1,930	1,750
GH-4A	Upper	3 ½ - 5	580	610	1,200	1,110	1,090	1,130
GH-5	Upper	3 ¾ - 4 ¾	510	690	1,350	1,130	1,360	1,280
GH-6 (1 of 2)	Lower	4 ¼ - 6 ¾	770	n/a	1,310	1,330	1,280	1,310
GH-6 (2 of 2)			570	800	1,160	1,250	1,230	1,210
GH-7 (1 of 2)	Lower	3 ½ - 5 ¼	1,020	960	1,630	1,630	1,800	1,690
GH-7 (2 of 2)			750	820	1,450	1,400	1,460	1,440
GH-8	Lower	3 – 5	870	930	1,480	1,740	1,500	1,570
GH-9	Lower	4½ - 5 ½	640	970	1,810	1,850	1,820	1,830

Figures



FLORIDA DEPARTMENT OF
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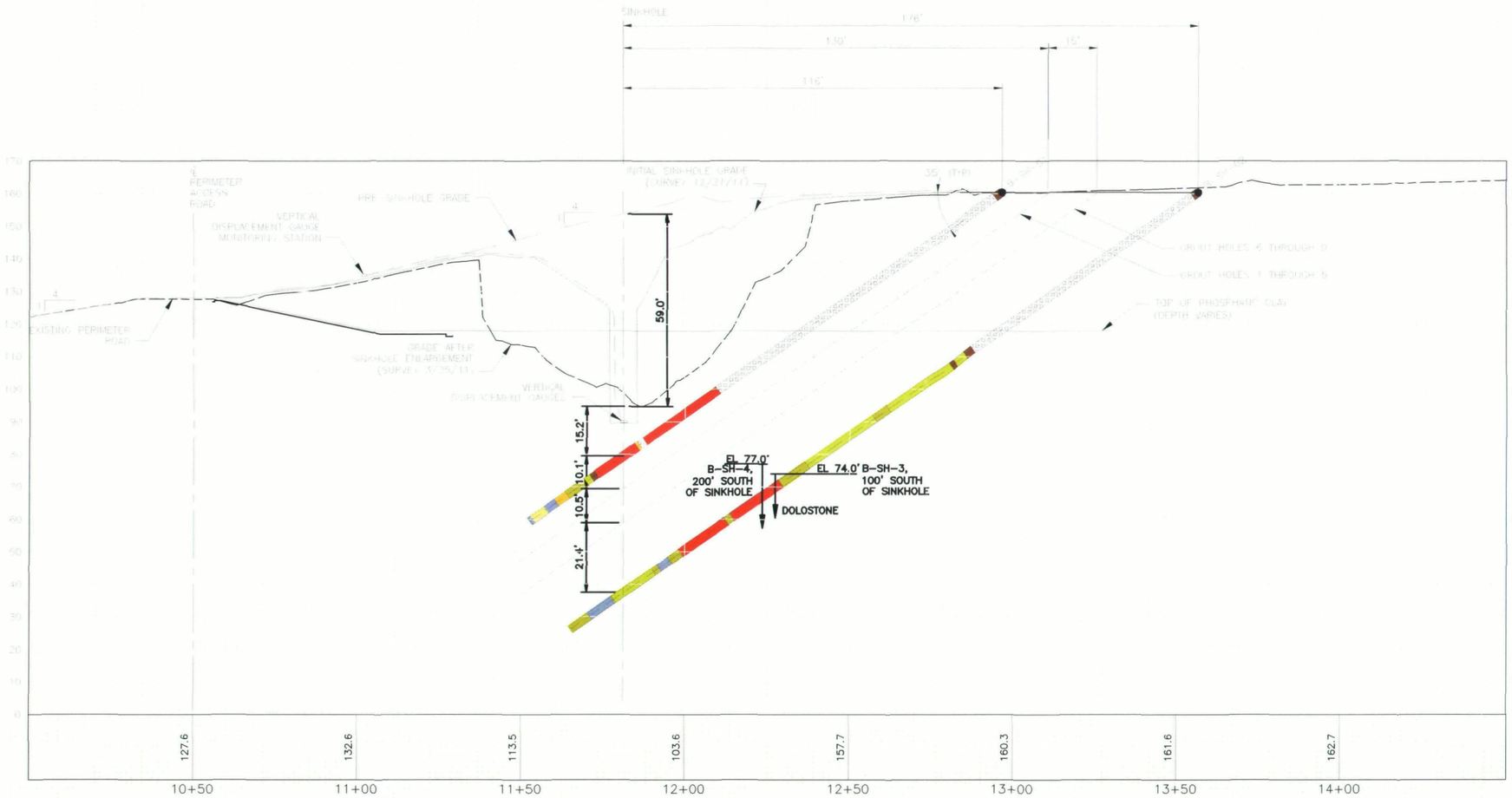
MAY 09 2011
SOUTHWEST DISTRICT
TAMPA

SCALE: 1"=20'

SOUTHEAST COUNTY LANDFILL SINKHOLE

SINKHOLE AREA – PLAN VIEW

FIGURE 1



LEGEND

POORLY GRADED SAND	CLAY
WASTE	CLAYEY SAND
NO RECOVERY	DOLOSTONE
SILTY SAND	CEMENTED SAND

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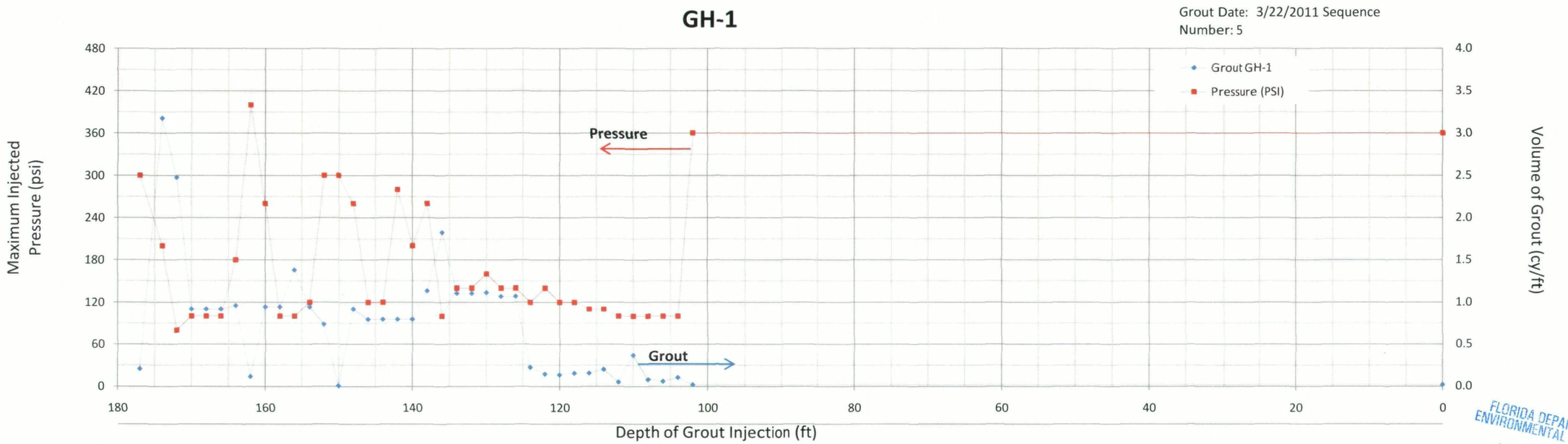
TAMPA

SCALE: 1"=20'

SOUTHEAST COUNTY LANDFILL SINKHOLE

GROUT HOLES AND SONIC BORINGS – PROFILE VIEW

FIGURE 2



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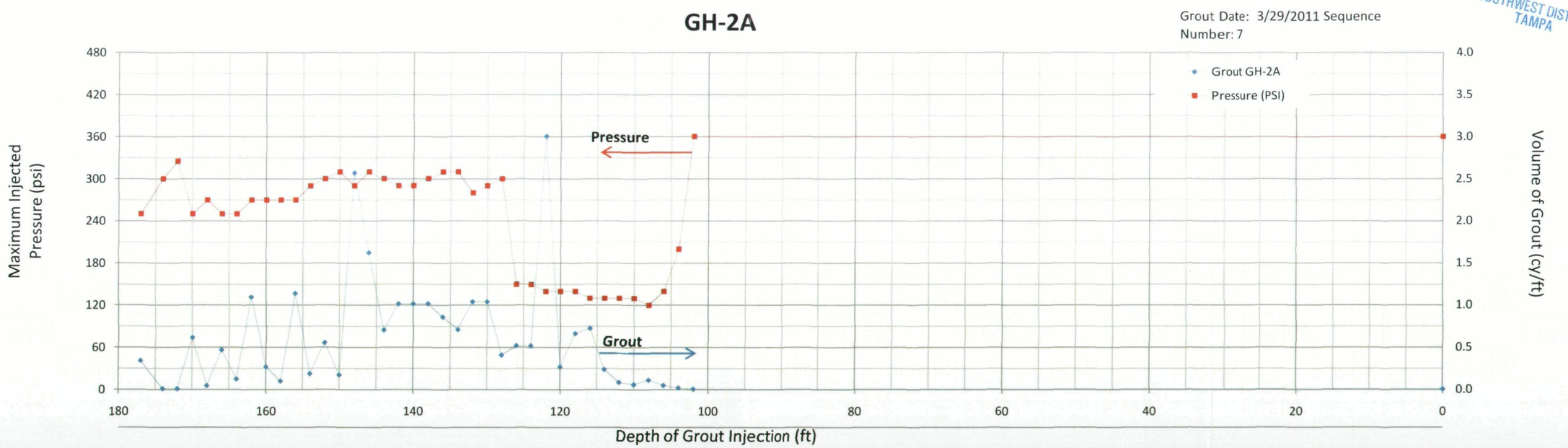
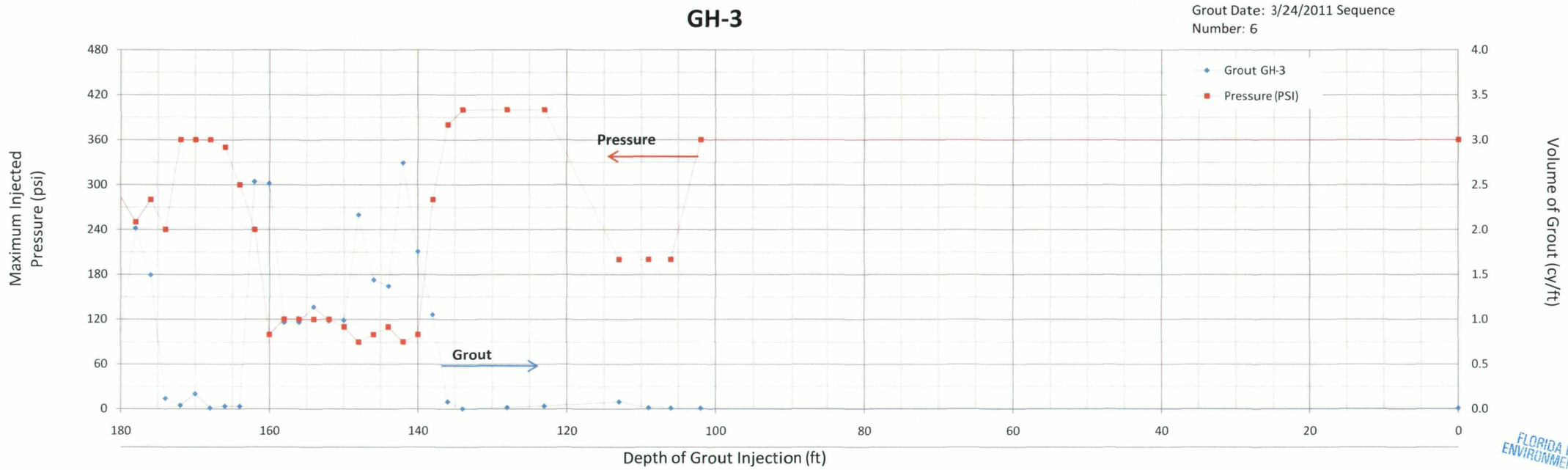


HDR

SOUTHEAST COUNTY LANDFILL SINKHOLE
GROUTING VOLUME AND PRESSURE DATA

DATE
MAY 2011

FIGURE
3



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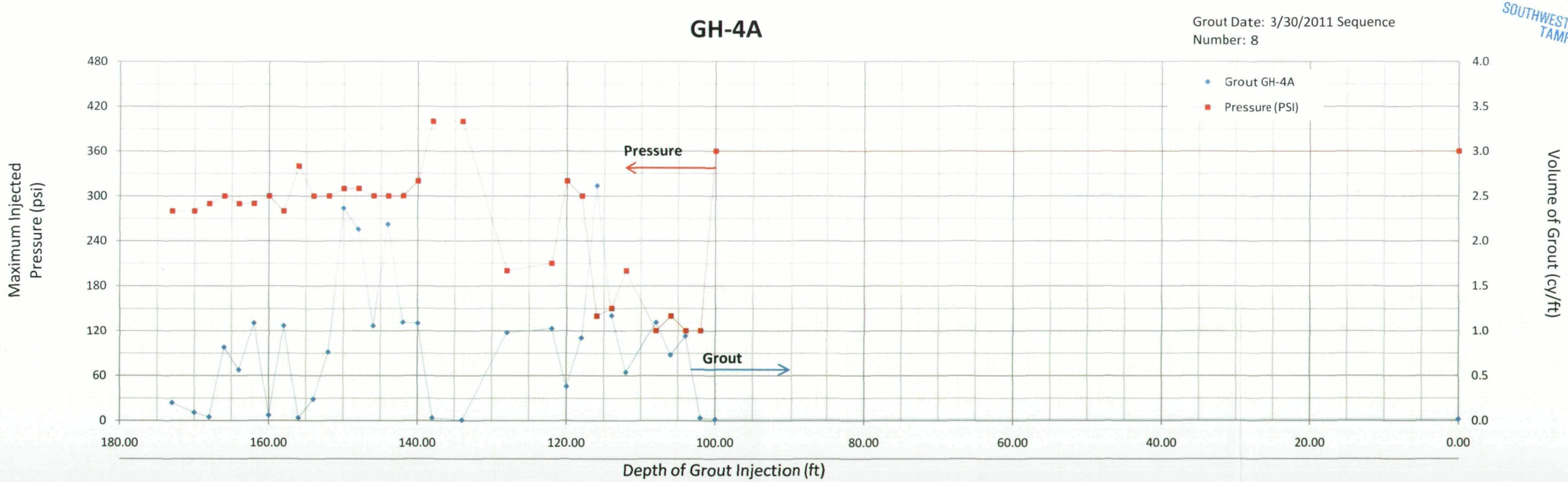

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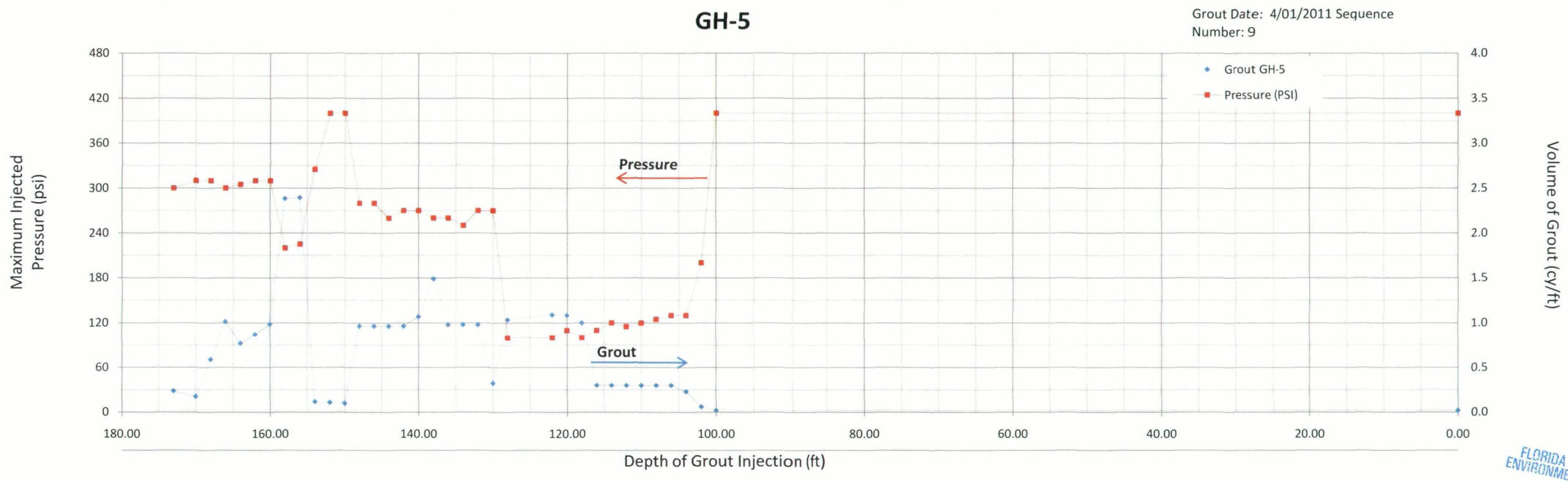
SOUTHEAST COUNTY LANDFILL SINKHOLE
GROUTING VOLUME AND PRESSURE DATA

DATE
MAY 2011

FIGURE
4



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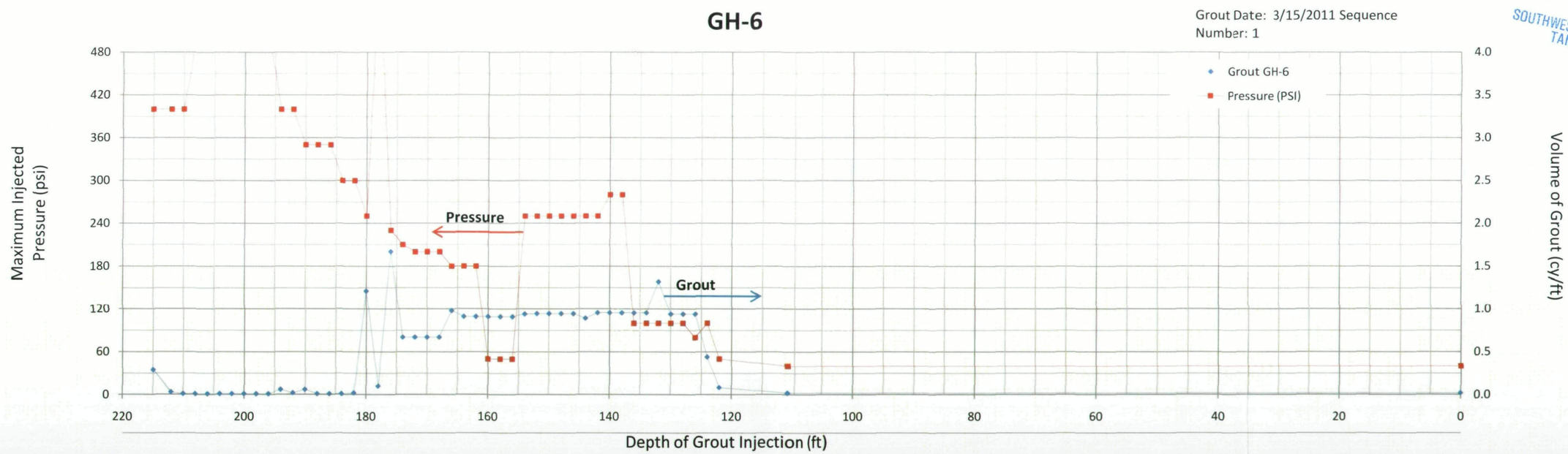

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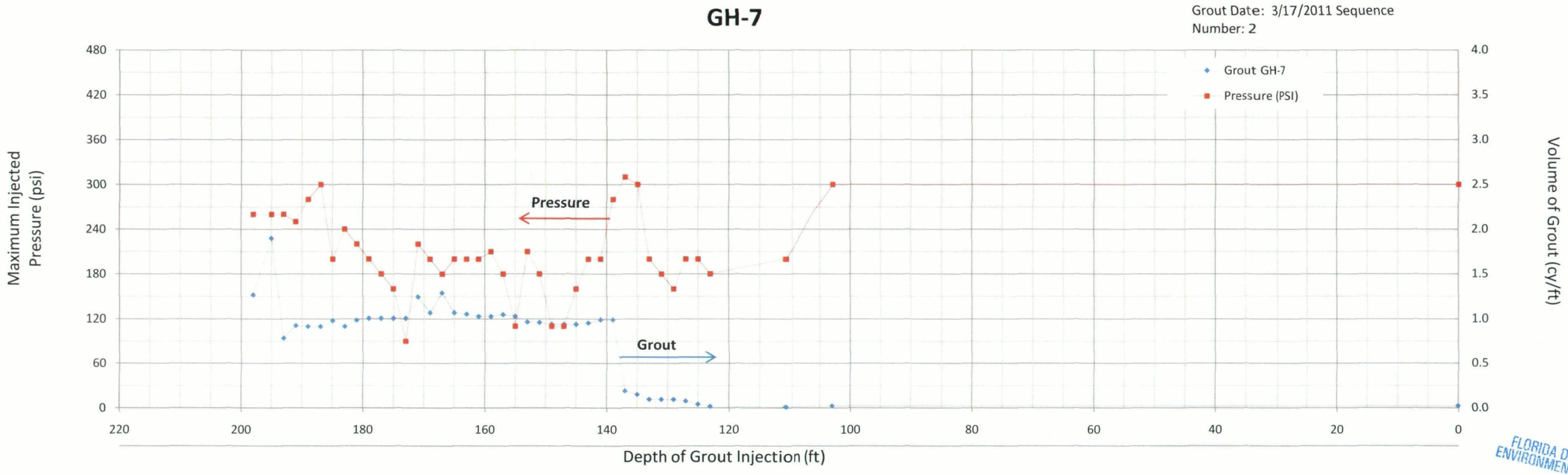
SOUTHEAST COUNTY LANDFILL SINKHOLE
GROUTING VOLUME AND PRESSURE DATA

DATE
MAY 2011

FIGURE
5



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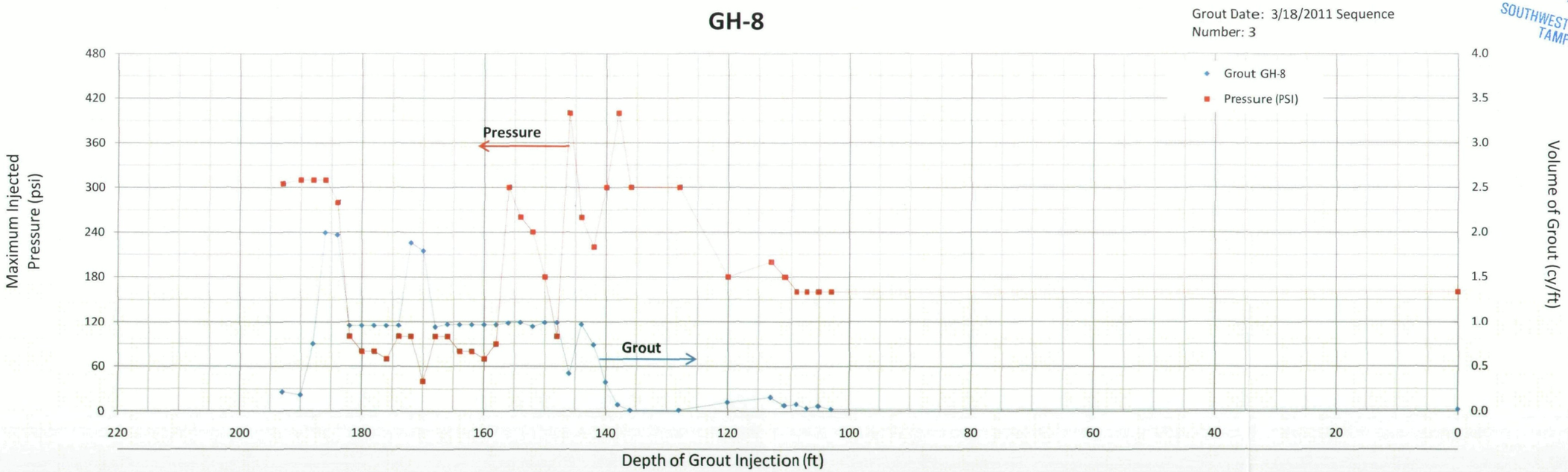

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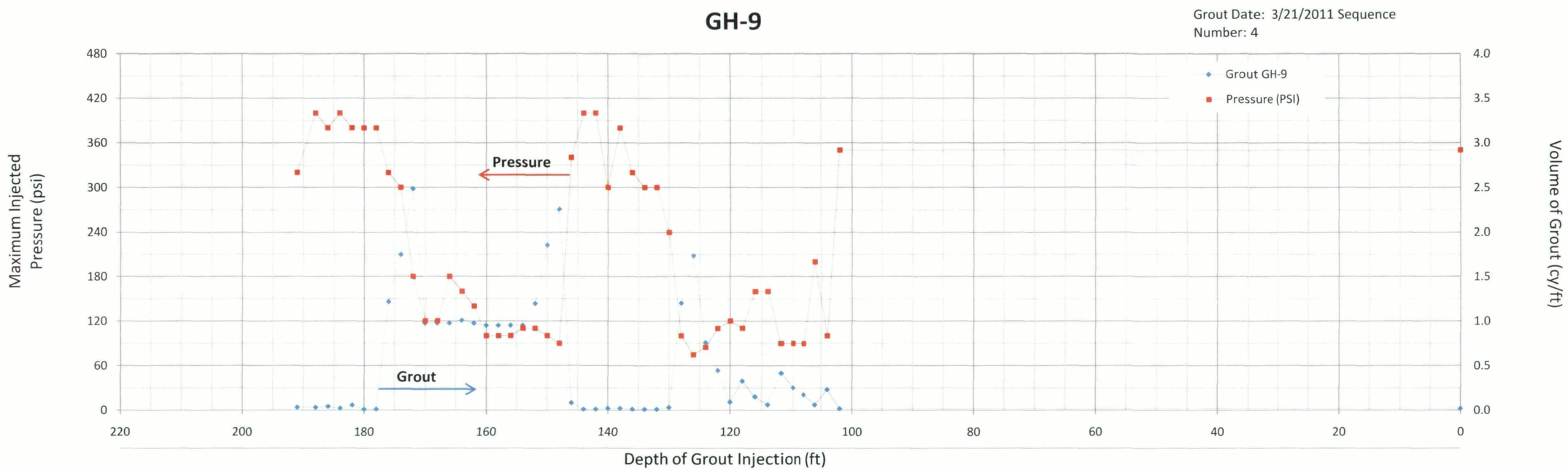
SOUTHEAST COUNTY LANDFILL SINKHOLE
GROUTING VOLUME AND PRESSURE DATA

DATE
MAY 2011

FIGURE
6



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MAY 09 2011
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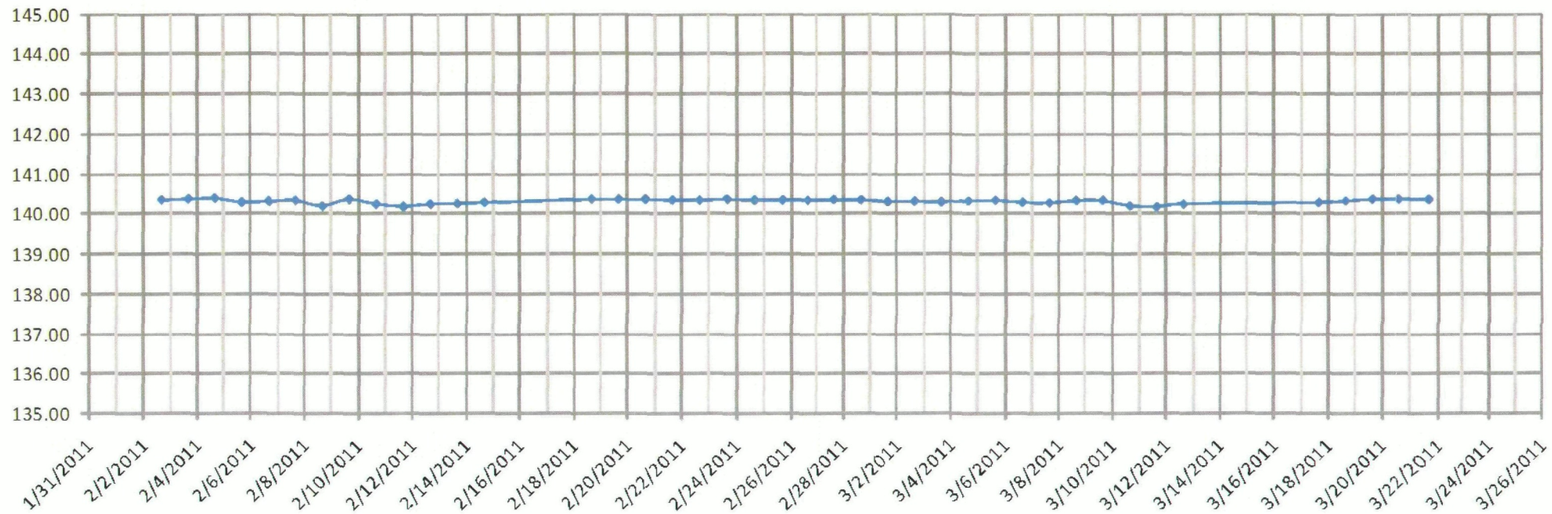
SOUTHEAST COUNTY LANDFILL SINKHOLE
GROUTING VOLUME AND PRESSURE DATA

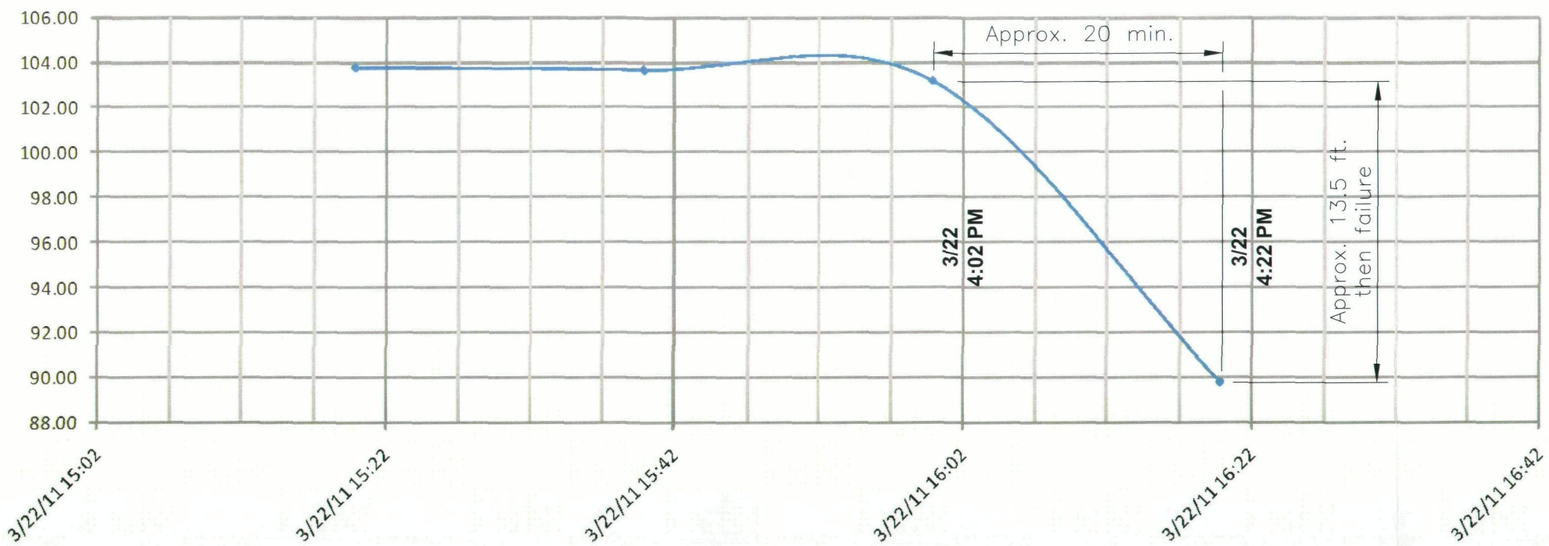
DATE
MAY 2011

FIGURE
7

North Displacement Gauge



North Displacement Gauge During Enlargement



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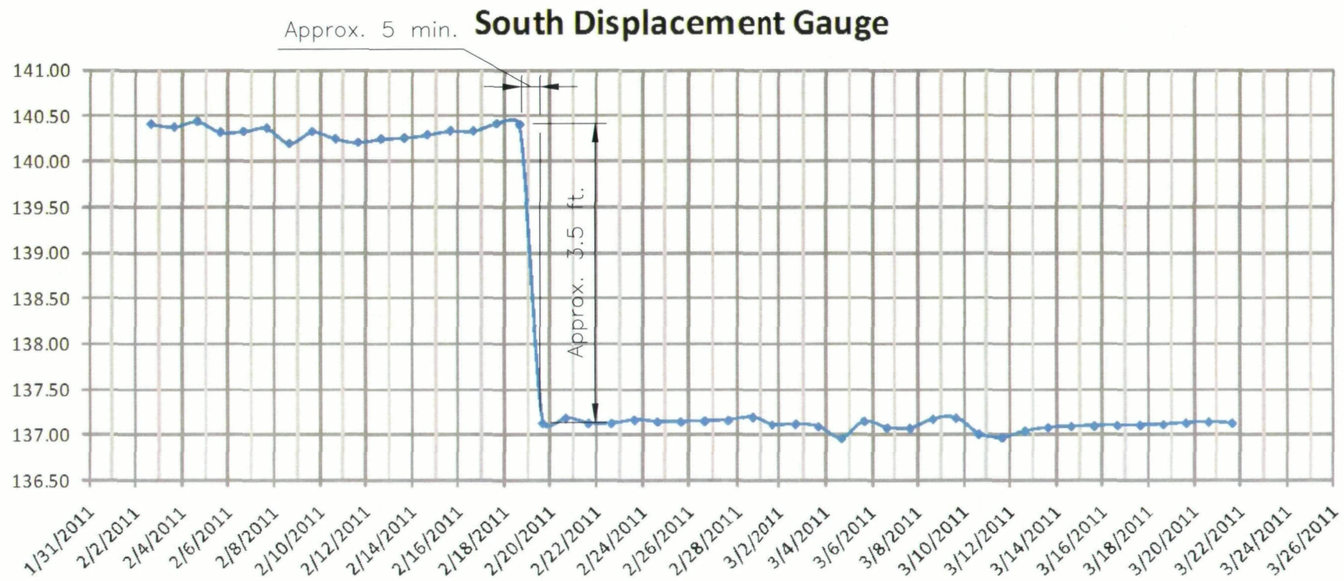
HDR

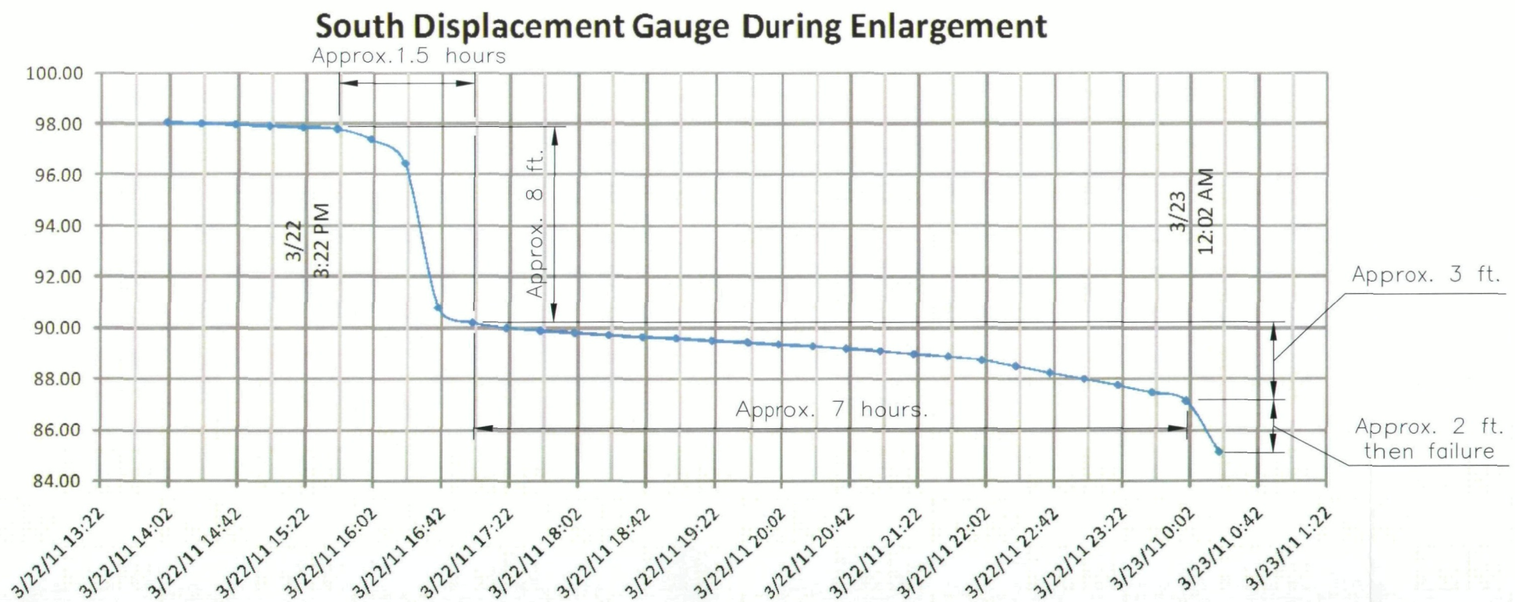
SOUTHEAST COUNTY LANDFILL SINKHOLE

STAGE 1 VERTICAL DISPLACEMENT GAUGE DATA

DATE
MAY 2011

FIGURE
8





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SOUTHEAST COUNTY LANDFILL SINKHOLE

STAGE 1 VERTICAL DISPLACEMENT GAUGE DATA

DATE
MAY 2011

FIGURE
9

Appendix A
Stage 1 Stabilization Plan

FLORIDA DEPARTMENT OF
ENVIRONMENTAL PROTECTION
MAY 09 2011
SOUTHWEST DISTRICT
TAMPA

HDR ONE COMPANY | *Many Solutions*

January 12, 2011

Ms. Susan Pelz, P.E.
Program Manager, Solid Waste
Department of Environmental Protection
13051 North Telecom Parkway
Temple Terrace, Florida 33637-0926

RE: **Stage 1 - Sinkhole Stabilization Plan**
Hillsborough County Southeast County Landfill
FDEP Permit No. 35435-014-SO/01

Dear Ms. Pelz:

On behalf of Hillsborough County Public Utilities Department, Solid Waste Management Division, (SWMD), HDR Engineering, Inc. (HDR) and SDII Global Corporation (SDII) are pleased to submit four copies of the *Stage 1 – Sinkhole Stabilization Plan* (Stage 1 Plan) and four full size sets of the Stage 1 Plan drawings. The Stage 1 Plans and drawings are signed and sealed by a Professional Engineer, registered in the state of Florida. The Stage 1 Plan is intended to stabilize the sinkhole which is located on the west side of Phase VI, within Phases I-VI, at the Southeast County Landfill, in order to provide access and a safe working environment for the subsequent geotechnical/geophysical investigation.

As you are aware, SWMD, HDR, and SDII staff met with the FDEP on January 11, 2011, to briefly review and discuss the Stage 1 Plan for assisting the FDEP with their review, minimize the need for additional information, and to expedite FDEP's review process.

The County would appreciate your timely review of the enclosed Stage 1 Plan so that the sinkhole can be stabilized for further investigation and final remediation. More importantly, stabilizing (grouting) the sinkhole will reduce the potential for impacts to the environment.

Please let us know if you have any questions or require additional information.

Sincerely,

HDR ENGINEERING, INC.

Richard Siemering
Senior Project Manager
Solid Waste Section Manager

SDII GLOBAL CORPORATION

Steven H. Meiggs, PE
Principal Engineer
Florida License #64832

Enclosures

cc: Patricia Berry, PUD/SWMD
Larry Ruiz, PUD/SWMD
Dave Adams, PUD/SWMD
Michelle Van Dyke, PUD

STAGE 1 – SINKHOLE STABILIZATION PLAN

Southeast County Landfill
Hillsborough County, Florida

Prepared for:

Hillsborough County
Public Utilities Department
Solid Waste Management Division

Prepared by:

SDII Global Corporation
4509 George Road
Tampa, FL 33634

Submitted to:

Florida Department of Environmental Protection
Southwest District

January 12, 2011

Steven H. Meiggs, PE
Principal Engineer
Florida License #64832
SDII Global Corporation
Certificate of Authorization No. 8778

STAGE 1 - SINKHOLE STABILIZATION PLAN NARRATIVE

SOUTHEAST COUNTY LANDFILL

HILLSBOROUGH COUNTY, FLORIDA

JANUARY 12, 2011

The initial stabilization of the landfill is required to provide safe access to the area of concern in order to complete a full subsidence/geotechnical investigation to determine the mechanism of the subsurface failure that led to the development of the apparent sinkhole (presumed sinkhole as defined by §627.706 Florida Statue), the extent of the subsurface impacts, to develop a thorough and complete remedial design for full subsurface stabilization, arrest the migration of material down the throat of the apparent sinkhole, etc. This initial stabilization is recommended to consist of compaction grouting.

Inclined Boreholes

The installation of two inclined boreholes will provide initial, although limited, insight into the subsurface conditions that underlie the area of concern. The boreholes will be advanced using the sonic technique that provides a continuous core sample and does not require the injection of drilling fluid (i.e. water) into the borehole. The borehole locations (B-SH-01 and B-SH-02) are shown on Sheets C-04 and C-05 (see Attachment C). The boreholes have been positioned to intersect the throat of the sinkhole. It is highly likely the upper borehole will intersect the sinkhole throat, but it is possible the lower borehole may not if the throat of the sinkhole is inclined to the north or south. If it does not, the borehole will be backfilled with grout and one or two additional boreholes will be advanced in an effort to locate the throat. The third borehole (B-SH-03) will be advanced 10 ft to the north and at the same elevation as B-SH-02. If this borehole does not intersect the throat, a fourth, B-SH-04, will be advanced 10 ft to the south of BH-SH-02. A 2-inch SCH 40 PVC casing will be installed in the two boreholes that intersect the throat, and boreholes that do not intersect it would be backfilled with grout.

Borehole Survey

After grouting the casing into the boreholes, a Reflex Instruments EZ-Shot downhole survey tool will be used to obtain 3D positioning of the casing. This will allow a more thorough evaluation of the core samples and provide a baseline measurement of the casing position prior to

compaction grouting. Borehole surveys will be performed during the grouting program and bi-weekly after completion of the grouting program.

Vertical Displacement Gauges

Two vertical displacement gauges will be placed in the base of the sinkhole that is approximately 64 ft below the original landfill surface. These gauges will be placed using a cable and pulley system to maintain personnel safety. The hydraulic gauges will measure change in elevation relative to a reference point that is a sufficient distance away from the sinkhole as shown on Sheet C-04. The reference point will be surveyed periodically to confirm it is stable.

Compaction Grouting

The initial stabilization will be accomplished through compaction grout injection to densify the soils beneath the sinkhole (see Attachment A - Technical Specification and Attachment C - Drawings). The compaction grout stabilization will utilize nine injection points spaced approximately 10 feet apart as shown on Sheet C-04. As shown on Sheet C-05, five of the injection points will be approximately 20 ft below the in-filled portion of the sinkhole and four injection points will then be placed at a relative depth of 30 ft. The grout points will be inclined at approximately a 35 degree angle as shown on Sheet C-05. As shown on the drawings, the initial orientation of the grout holes are east to west. However, based on the findings of the sonic boreholes and/or the compaction grouting, additional grout holes may be required in a south to north orientation.

Grout point casing installation and extraction shall be performed using rotary duplex drilling. This process involves the advancement of an outer casing, inner drill rod, and drill bit at the same time. Rotary duplex drilling will be required based on the following advantages:

1) Lowest risk of ground loss in the landfill and underlying soils as the hole will be cased full length
2) Minimize water from being introduced into the landfill given that the water and cuttings travel up the interior of the casing rather than the casing exterior as is common with conventional compaction grouting equipment.
3) Greater accuracy positioning the grout injection points.
4) Ability to sample the drill cuttings at the drill head; drill cuttings can be used to further characterize the landfill material and soils.
5) Drill bits can be changed by removing the inner drill rod during injection point installation if an obstruction is encountered (i.e. outer casing remains in place).

The outer casing will have a minimum inside diameter of 4.5 inches with an approximate outside diameter of 5.5 inches to allow for the injection of the low slump grout.

The drill rig to be utilized for the drilling will have a minimum of 12,000 ft/lbs of torque. Due to the angles of the inclined casing anticipated for this project, all of the pulling and grouting of the casing will be done with the drill.

Drilling in the casing will require approximately 100 gallons of water per minute and will generate a similar quantity of water and drill cuttings. As shown on Sheet C-03, a bermed temporary infiltration area will be constructed near the drilling activities (away from the sinkhole) to collect and allow for the infiltration of the flushing water into the landfill to avoid pumping and transport of the water to the County's on-site Leachate Treatment Plant and/or a County owned WWTP. The infiltration area was established based on an assumed infiltration rate of 2.835 ft/day (see Attachment B). During the course of the workday, the infiltration pond will allow for minor infiltration of the discharge water within the limits of the lined area of Phases I-VI. At the end of the work day, the residual water in the holding pond (not including the sedimentation pond area) will be pumped into a tanker truck for disposal. In addition, if the turbidity of the water in the holding pond appears to be reasonably low, the residual water may be pumped into the existing Phases I-VI leachate collection system at a sufficient distance away and down gradient from the sinkhole area. The volume of the water stored in the holding pond will be monitored to ensure adequate storage capacity for grout operations and for the potential occurrence of a rainfall event.

In order to supply water for the drilling, water will be accessed from the maintenance facility supply well. Water will be transferred via a jet pump to a 22,000 gallon holding tank near the drilling activities as shown on Sheet C-03.

A temporary access road will be constructed for drilling rig and ready-mix truck access. The driveway will extend from the Phase I area of the landfill to the drilling/injection site as shown on Sheet C-03. This roadway can be constructed from excess hardpan material available from within the landfill.

A compaction grout with sufficient silt sizes to develop internal friction to not enter soil pores but remain in a homogenous mass that can give controlled displacement of loose soils will be used. The material blend per cubic yard will consist of:

- 250 pounds of Portland cement (ASTM C150 Type I/II),
- 2,250 to 2,270 pounds of FDOT fine aggregate silica sand,

- 750 pounds of flyash (ASTM C618, Class F) with a fineness (amount retained on 325 sieve) of greater than 20%,
- Water (estimated 400 pounds) and admixtures (estimated 10 pounds) to achieve a pumpable, thixotropic, viscous grout with a 3 to 6 inch slump, to enable pumping at high pressure and remain intact after injection.

The strength of the grout is designed to have a minimum compressive strength of 1,500 pounds per square inch (psi) at 28 days and to provide a permanent, non-erodible material.

Grout mix design submittals will include the following:

1) Sieve analysis and source of fine aggregates.
2) Test for aggregate organic impurities.
3) Test for deleterious aggregate per ASTM C289.
4) Proportioning of all materials.
5) Type of cement with mill certificate for cement.
6) Type of fly ash with certificate of conformance to specification requirements and mill certificate.
7) Slump.
8) Air content.
9) Brand, type, ASTM designation, and quantity of each admixture proposed for use.
10) 28-day cylinder compressive test results of trial mixes per ACI 318 and as indicated herein.
11) Standard deviation value for concrete production facility.

The project geotechnical engineer will approve all grout mix design submittals prior to use. Adjustment of grout mix designs when material characteristics, job conditions, weather, strength, test results, or other circumstances warranted will not occur unless approved by the project geotechnical engineer.

Ready-mixed concrete batch plants will be certified by the National Ready Mixed Concrete Association (NRMCA). A delivery ticket for each load of ready-mixed concrete shall include:

1) Truck operator shall hand ticket to Construction Administrator or Laboratory Technician at the time of delivery.
2) Ticket to show:
    a. Mix identification mark.
    b. Quantity delivered.
    c. Amount of each material in batch.
    d. Outdoor temperature in the shade.
    e. Time at which cement was added.

f. Numerical sequence of the delivery.
g. Approved amount of water (if any) added.

The grout will be pumped at a relatively slow rate such that the grout will densify the formation and reduce the risk of hydraulic fracturing. The injection pressures (near the top of pipe) should be limited to between 300 to 500 psi. The grouting contractor will provide mechanical and electronic instrumentation to monitor grout pressure, flow rate of grout, and the volume of grout injected. Calibration information will be provided for all instrumentation.

Each point will be injected with compaction grout from the terminal depth of pipe to the ground surface. At a depth of 10 ft below the landfill liner, the grout pressure will be reduced so that the hole created by the drill casing is being filled and grout is not being forced into the landfill. In addition, the injected grout will change to a cement-bentonite grout to be mixed onsite. The material blend will consist of water, cement, and bentonite in a weight to ratio mixture of 2.5:1.0:0.3 (i.e. 30 gallons of water: 1 cubic foot of Portland (ASTM C150 Type I/II): 25 pounds of sodium bentonite powder (QUIK-GEL 200-mesh, premium-grade, high-yielding Wyoming sodium bentonite or equal). The water and cement will be mixed prior to the addition of the bentonite. The cement-bentonite grout is designed to have a minimum compressive strength of 50 pounds per square inch (psi) at 28 days and bulk modulus (equilateral resistance to compression) of 10,000 psi.

The project geotechnical engineer will approve all grout mix design submittals prior to use. Adjustment of grout mix designs when material characteristics, job conditions, weather, strength, test results, or other circumstances warranted will not occur unless approved by the project geotechnical engineer.

Since the purpose of the grouting program is to provide a stable working platform to enable completion of the geotechnical investigation program and sinkhole grouting program, each grout point will be limited to approximately 30 cubic yards of compaction grout. The grout pressure is expected to increase as the grouting program progresses indicating the formation is being densified.

Instrumentation Measurements During Grouting

At the completion of each grout hole, a downhole survey of the PVC pipe installed in the two boreholes will be performed with the Reflex Instruments EZ-Shot logging tool to determine the 3D position of the casing. The casing position relative to the initial position will provide information regarding the movement of the PVC pipe/formation in response to the compaction grouting.

The vertical displacement gauges will be monitored during the grouting program to see if the soil/waste in the base of the sinkhole (approximately 64 ft below original landfill surface) moves during grout pumping. Excessive heaving of the sinkhole base would indicate the grout point may be too shallow and the formation is not being densified. These gauges will also be monitored after grouting to confirm the soil base within the sinkhole maintains stability.

Health and Safety Plan

The grouting contractor will be required to submit an acceptable Health and Safety Plan to the Owner/Engineer for review prior to commencing with the work. The Health and Safety Plan will include, but not be limited to, monitoring of landfill gases, monitoring subsidence within the sinkhole area, precautions for placement of loads within the proximity of the sinkhole area, and other potential environmental issues associated with working on or near a Class I landfill and sinkhole formation.

Attachment A

Technical Specification

SECTION 02341
COMPACTION GROUT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Compaction grout injection.
   2. Grout mixes, proportioning, and source quality control.

B. Related Sections include, but are not necessarily limited to:
   1. Division 1 - General Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Concrete Institute (ACI):
      a. 116R, Cement and Concrete Terminology.
      b. 212.3R, Chemical Admixtures for Concrete.
      c. 318, Building Code Requirements for Structural Concrete.
   2. American Society for Testing and Materials (ASTM):
      a. C31, Standard Practice for Making and Curing Concrete Test Specimens in the Field.
      b. C33, Standard Specification for Concrete Aggregates.
      c. C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
      d. C94, Standard Specification for Ready-Mixed Concrete.
      e. C138, Standard Method of Test for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete.
      f. C143, Standard Test Method for Slump of Hydraulic Cement Concrete.
      g. C150, Standard Specification for Portland Cement.
      h. C172, Standard Practice for Sampling Freshly Mixed Concrete.
      i. C173, Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
      j. C231, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
      k. C260, Standard Specification for Air Entraining Admixtures for Concrete.
      l. C289, Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method).
      m. C494, Standard Specification for Chemical Admixtures for Concrete.
      n. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
      o. E329, Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
   3. Federal Specification (FS):
      a. CEGS 03300, Vegetable Fiber.
   4. Florida Building Code, current edition.
   5. Florida Department of Transportation, 2010:
      a. Section 902 - Fine Aggregate

B. Quality Control:
   1. Grout testing agency.
      a. Contractor to employ and pay for services of an independent testing laboratory to:
         1) Perform materials evaluation.
         2) Perform retests due to initial failing tests.

b. See 3.4 "Field Quality Control" for Owner employment of testing laboratory.
c. Grout testing agency to meet requirements of ASTM E329 and be approved by Engineer.

2. Do not begin concrete production until proposed concrete mix design has been approved by Engineer.
   a. Approval of grout mix design by Engineer does not relieve Contractor of his responsibility to provide grout that meets the requirements of this Specification.
3. Adjust grout mix designs when material characteristics, job conditions, weather, strength test results or other circumstances warrant.
   a. All adjustments to be properly documented by Contractor
   b. Do not use revised concrete mixes until submitted to and approved by Engineer.

C. Qualifications:
1. Ready mixed concrete batch plant certified by National Ready Mixed Concrete Association (NRMCA).

1.3 DEFINITIONS

A. Per ACI 116R except as modified herein:
1. Grout Testing Agency: Testing agency employed to perform materials evaluation, design of concrete mixes or testing of concrete placed during construction.
2. Indicated: Indicated by Contract Documents.
3. Required: Required by Contract Documents.
4. Specified strength: Specified compressive strength at 28 days.
5. Submitted: Submitted to Project Geotechnical Engineer (Engineer).

1.4 SUBMITTALS

A. Shop Drawings:
1. See Section 01340.
2. Equipment to be utilized to include:
   a. Injection pump
   b. Drill rig
   c. Mechanical and electrical instrumentation
   d. Drill bits
   e. Casing
   f. Drill bit attachments
3. Grout mix designs proposed for use. Grout mix design submittal to include:
   a. Sieve analysis and source of fine and coarse aggregates.
   b. Test for aggregate organic impurities.
   c. Test for deleterious aggregate per ASTM C289.
   d. Proportioning of all materials.
   e. Type of cement with mill certificate for cement.
   f. Type of fly ash with certificate of conformance to specification requirements and mill report.
   g. Slump.
   h. Air content.
   i. Brand, type, ASTM designation, and quantity of each admixture proposed for use.
   j. 3, 7 and 28 day cylinder compressive test results of trial mixes per ACI 318 and as indicated herein.
   k. Standard deviation value for concrete production facility.
4. Strength test results of newly placed concrete, including slump, air content and concrete temperature.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery:
   1. Ready-mix Grout:
      a. Prepare a delivery ticket for each load for ready-mixed grout.
      b. Truck operator shall hand ticket to Construction Administrator Technician at the time of delivery.
      c. Ticket to show:
         1) Mix identification mark.
         2) Quantity delivered.
         3) Amount of each material in batch.
         4) Outdoor temp in the shade.
         5) Time at which cement was added.
         6) Numerical sequence of the delivery.
         7) Approved amount of water (if any) added.
         8) Time of completion of unloading

PART 2 - PRODUCTS

2.1 MATERIALS

A. Drilling Rig
   1. Klemm KR 806-3 or 802-1 (or equal) to have the following attachments/capabilities:
      a. 12,000 ft-lbs of torque
      b. Rotary Duplex Drilling
      c. Steel Outer drill casing of 5.5-inch outside diameter and 4.5-inch inside diameter
         1) Minimum onsite casing of 450 linear feet
      d. Steel Inner drill pipe with integrated flushing system
         1) Minimum onsite drill pipe of 450 linear feet
      e. Multiple drill head attachments for the end of the inner drill casing capable of advancement through multiple materials to include steel, clay, sand, concrete, wood, and plastic sheets and strands.
      f. Integrated injection system to allow for compaction grout injection from separate pump
   2. Trailer Concrete /Grout Pump - Reed Model C70S (or equal) capable of the following:
      a. Concrete output of 6 to 70 cy ft/hour
      b. Theoretical horizontal pumping distance of 1000 ft
      c. Variable-volume and RPM control
      d. Hydraulic outriggers
      e. Calibration capacity

B. Portland Cement: Conform to ASTM C150 Type I and Type II.

C. Fly Ash:
   1. ASTM C618, Class F.
   2. Minimum material retained on 325 sieve to be 20% from mill certification
   3. Nonstaining.
      a. Hardened concrete containing fly ash to be uniform light gray color.
   4. Maximum loss on ignition: 4 percent.
   5. Compatible with other concrete ingredients.
   6. Obtain proposed fly ash from a source approved by the State Highway Department in the state where the Project is located for use in bridge concrete.

D. Admixtures:
   1. Air entraining admixtures: ASTM C260.
   2. Water reducing, retarding, and accelerating admixtures:
      a. ASTM C494 Type A through E.
      b. Conform to provisions of ACI 212.3R.

c. Do not use retarding or accelerating admixtures unless specifically approved in writing by Engineer and at no cost to Owner.
d. Follow manufacturer's instructions.
e. Use chloride free admixtures only.

3. Maximum total water soluble chloride ion content contributed from all ingredients of concrete including water, aggregates, cementitious materials and admixtures by weight percent of cement:
   a. 0.10 all concrete.
4. Do not use calcium chloride.
5. Provide admixtures of same type, manufacturer and quantity as used in establishing required concrete proportions in the mix design.

E. Water: To be supplied by Hillsborough County.
1. Contractor to supply 22,000 holding tank for drilling water
2. Contractor to supply jet pump for water transfer from supply well tank to holding tank

F. Aggregates:
1. Normal weight concrete: ASTM C33, except as modified below.
2. Fine aggregate: Clean natural silica sand.
   a. No manufactured or artificial sand.
   b. FDOT specification code F01 fine aggregate sand

G. Concrete strength test results
1. Strength test - frequency:
   a. Not less than one test each day concrete placed.
   b. Not less than one test for each 50 CY or major fraction thereof placed in one day.
   c. Not less than one test for each type of concrete poured.
2. Not less than one test for each delivery where water addition has been approved at the jobsite.

2.2 CONCRETE MIXES

A. General:
1. All concrete to be ready mixed concrete conforming to ASTM C94 with all components and additives blended in at plant, unless otherwise approved.
2. Provide concrete of specified quality capable of being placed without segregation and, when cured, of developing all properties required.
3. All concrete to be normal weight concrete.
4. Mix shall contain fly ash.

B. The material blend per cubic yard will consist of:
1. 250 pounds of Portland cement (ASTM C150 Type I/II),
2. 2250 to 2270 pounds of FDOT fine aggregate silica sand,
3. 750 pounds of flyash (ASTM C618, Class F) with a fineness (amount retained on 325 sieve) of greater than 20%
4. Water (estimated 400 pounds) and admixtures (estimated 10 pounds) to achieve a pumpable, thixotropic, viscous grout with a 3 to 6 inch slump, to enable pumping at high pressure and remain intact after injection.

C. Strength:
1. Provide specified strength for grout as follows:

AREA	WEIGHT	SPECIFIED STRENGTH*
Injection points	Normal weight	1,500 psi

*Minimum 28-day compressive strength.

D. Air Entrainment: Provide air entrainment in all concrete resulting in a total air content percent by volume as follows:

TOTAL AIR CONTENT PERCENT
5% +/- 1 ½%

1. Air content to be measured in accordance with ASTM C231, ASTM C173, or ASTM C138.

E. Slump: 6 IN maximum, 3 IN minimum.
1. Measured just before injection point.
2. Pumped concrete:
   a. Provide additional water at batch plant or at site to allow for slump loss due to pumping.
      1) For site addition, hold back water from batch plant quantity.
   b. Provide only enough additional water so that slump of concrete at injection point does not exceed maximum slump specified above.
      1) Do not exceed approved mix design's water content.
3. Determine slump per ASTM C143.

PART 3 - EXECUTION

3.1 INJECTION OF CONCRETE (GROUT)

A. General:
1. Grout point casing installation and extraction shall be performed using rotary duplex drilling
   a. Drill rig capable of 12,000 foot-pounds of torque (Kleem 800 series or equal) equipped with the following:
      1) Outer casing outer diameter of 5.5 inches
      2) Outer casing inner diameter of 4.5 inches
      3) Flush system incorporated into inner drill casing
         a) Discharge to be piped to holding area by Contractor
      4) Inner casing tip with drill bit
2. Contractor is responsible for all injection equipment and casing
3. Provide capacity to return cuttings to surface for inspection
4. Flushing system to be capable of utilizing air or water
5. Drilling equipment must be able to install points as well as extract during injection
6. Multiple drill bit types necessary to penetrate waste material in landfill including
   a. Clay
   b. Steel
   c. Concrete
   d. Wood
   e. Plastic sheets and strands

B. Testing Grout Equipment:
1. Pump a minimum 3 CY of grout through 200 linear feet of casing placed on the ground surface.
2. Measure grout pressure at three pumping rates of approximately 0.1, 0.25 and 0.5 cy/minute.
3. Measure slump on a minimum of three samples obtained at the discharge end of pipe corresponding to the three pumping rates.

C. Placing Grout:
1. Place in a continuous operation during casing extraction
2. Injection pressures to be between 300 to 500 psi near top of injection point prior to casing extraction unless excessive heaving is noted.
3. Injection pressures and casing extraction as per Project Geotechnical Engineer

D. Consolidation:
   1. Not required.

3.2 FIELD QUALITY CONTROL

A. Contractor will employ and pay for services of a concrete testing laboratory to perform testing of concrete placed during construction.
   1. Contractor to provide Owner with test results as soon as results are available.

B. Tests During Construction:
   1. Strength test - procedure:
      a. Four cylinders, 6 IN DIA x 12 IN high, will be taken from each sample per ASTM C172 and C31.
      b. Cylinders will be tested per ASTM C39:
         1) One at 3 days.
         2) One at 7 days.
         3) Two at 28 days.
         4) One held in reserve.
   2. Strength test - frequency:
      a. Not less than one test each day concrete placed.
      b. Not less than one test for each 50 CY or major fraction thereof placed in one day.
      c. Not less than one test for each type of concrete poured.
      d. Not less than one test for each delivery where water addition has been approved at the jobsite.
   3. Slump test: Per ASTM C143.
      a. Determined for each strength test sample.
      b. Minimum 1 per truck load delivered
      c. Additional slump tests may be taken.
   4. Air content: Per ASTM C231, C173, and C138.
      a. Determined for each strength test sample.
   5. Temperature: Determined for each strength test sample.

C. Evaluation of Tests:
   1. Strength test results: Average of 28-day strength of two cylinders from each sample.
      a. If one cylinder manifests evidence of improper sampling, molding, handling, curing or testings, strength of remaining cylinder will be test result.
      b. If both cylinders show any of above defects, test will be discarded.

D. Acceptance of Grout:
   1. Strength level of each type of concrete shall be considered satisfactory if both of the following requirements are met:
      a. Average of all sets of three consecutive strength tests equals or exceeds the required specified 28-day compressive strength.
      b. No individual strength test falls below the required specified 28-day compressive strength by more than 500 psi.
   2. If tests fail to indicate satisfactory strength level, perform additional tests and/or corrective measures as directed by Engineer.
      a. Perform additional tests and/or corrective measures at no additional cost to Owner.

END OF SECTION

Attachment B

Discharge Water Calculations

HDR | ONE COMPANY *Many Solutions*™

Memo

To: Hillsborough County SWMD	
From: HDR Engineering, Inc.	Project: Hillsborough County Sink Hole Grouting Discharge Water Calculations
CC:	
Date: January 8, 2010	Job No:

RE: ICPR Model Discharge Water Calculations

The ICPR model was generated to model a sedimentation pond for storage capacity for 15,000 gallons of water from a grouting operation (estimated by Hayward Baker) in a 10-hour working day. The sedimentation pond size is 64 ft. by 64 ft. by 2 foot depth. In order to demonstrate adequate storage capacity the model was broken into three (3) stages. The stages are described below.

Stage 1

In this stage 15,000 gallons were inputted into the model with no infiltration was allowed through the bottom of the pond. The model output generated a water level elevation of 163.5 ft. See Attachment 1 for model outputs. This was doubled checked by hand calculating:

15,000 gal / 7.4805 gal/ ft^3 = 2005.2 ft^3

2005.2 ft^3 / 4096 sf = 0.49 ft

Bottom of pond = 163 ft. + 0.49 ft. = <u>163.49 ft.</u>

Stage 2

Stage 2 inputted 15,000 gallons into the model but allowed infiltration through a 1 ft. thick layer of sand at vertical conductivity of $1x10^{-3}$. The model output elevation is 163.19 ft. See Attachment 1 for model outputs. This was doubled checked by calculating storage capacity in the sand

4096 sf x 1 ft. = 4096 ft^3

4096 ft^3 x 0.3 = 1228.8 ft^3

1228.8 ft^3 x 7.4805 gal/ ft^3 = 9,192 gal

0.19 ft. x 4096 sf = 778.24 ft^3

778.24 ft^3 x 7.4805 gal/ ft^3 = 5,821.62 gal

5,821.62 gal + 9,192 gal = <u>15,013.62 gal</u>

Stage 3

This final stage inputted 15,000 gallons into the model for 2-consecutive days and allowed infiltration through a 1 ft. thick layer of sand. The output elevation is 163.65.

Summary

The Stage 1 model demonstrates that a proposed pond has capacity to accommodate a 10-hour working day of inflow from a grouting operation without infiltration through the bottom of the pond. Stage 2 model demonstrated the anticipated actual working conditions of the pond with infiltration through the bottom of the pond. Stage 2 demonstrates that there is over 1 ft. of freeboard in the pond. Stage 3 demonstrates that the pond has reserve capacity for two consecutive days of inflow from the grouting operations.

Attachment 1

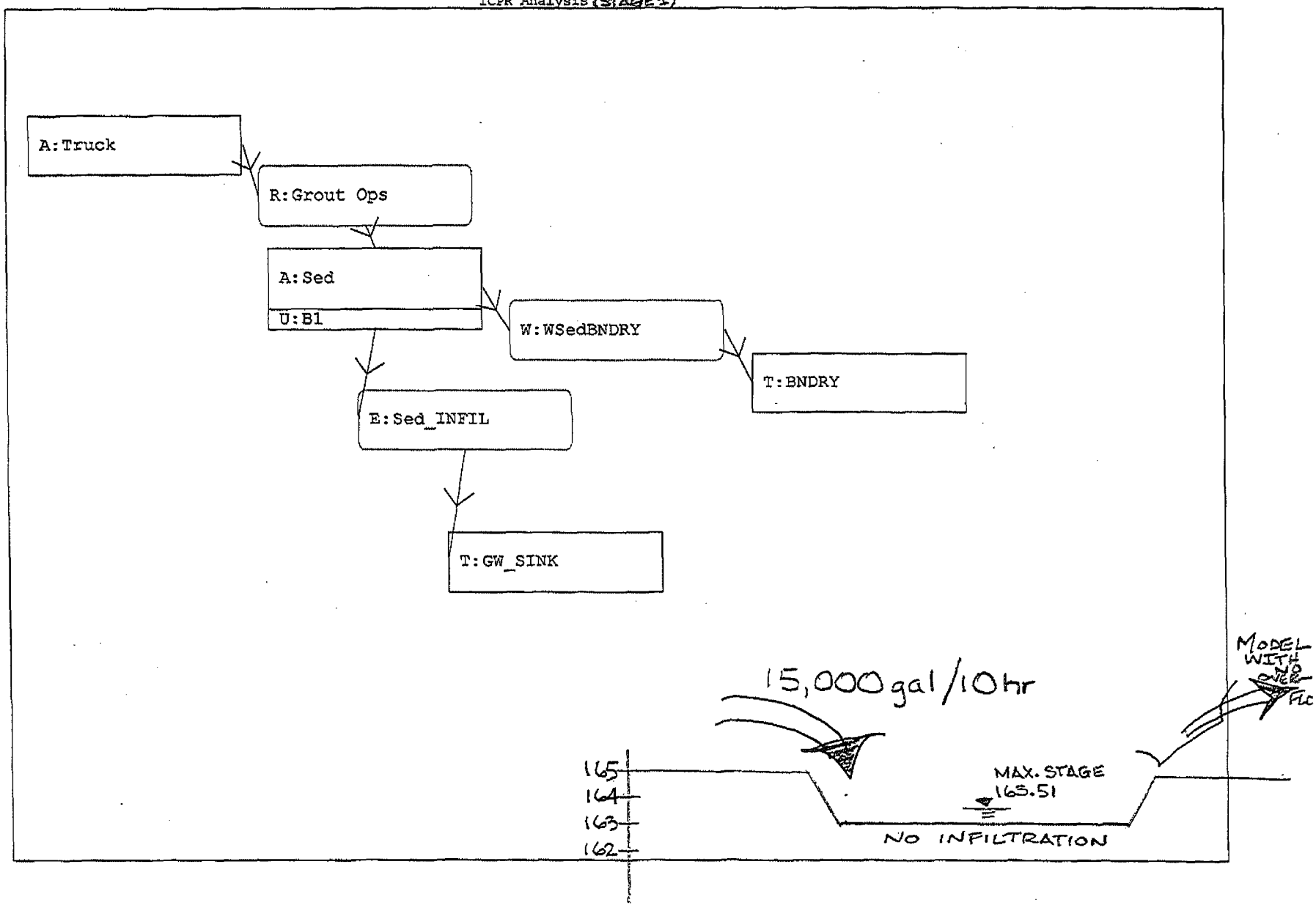
Stage 1

Hillsborough County
Phase I Sink Grouting
ICPR Analysis (STAGE 1)

Nodes
A Stage/Area
V Stage/Volume
T Time/Stage
M Manhole

Basins
O Overland Flow
U SCS Unit CN
S SBUH CN
Y SCS Unit GA
Z SBUH GA

Links
P Pipe
W Weir
C Channel
D Drop Structure
B Bridge
R Rating Curve
H Breach
E Percolation
F Filter
X Exfil Trench



Basins

Name: B1
Group: BASE
Node: Sed
Type: SCS Unit Hydrograph CN
Status: Onsite

Unit Hydrograph: Uh484
Rainfall File: Flmod
Rainfall Amount(in): 0.000
Area(ac): 0.023
Curve Number: 100.00
DCIA(%): 0.00

Peaking Factor: 484.0
Storm Duration(hrs): 24.00
Time of Conc(min): 6.00
Time Shift(hrs): 0.00
Max Allowable Q(cfs): 999999.000

Nodes

Name: BNDRY
Group: BASE
Type: Time/Stage
Base Flow(cfs): 0.000
Init Stage(ft): 165.000
Warn Stage(ft): 165.000

Time(hrs)	Stage(ft)
0.00	165.000
999.00	165.000

Name: GW_SINK
Group: BASE
Type: Time/Stage
Base Flow(cfs): 0.000
Init Stage(ft): 162.000
Warn Stage(ft): 162.000

Time(hrs)	Stage(ft)
0.00	162.000
999.00	162.000

Name: Sed
Group: BASE
Type: Stage/Area
Base Flow(cfs): 0.000
Init Stage(ft): 163.000
Warn Stage(ft): 164.000

Stage(ft)	Area(ac)
163.000	0.0900
165.000	0.0900

Name: Truck
Group: BASE
Type: Stage/Area
Base Flow(cfs): 0.000
Init Stage(ft): 165.000
Warn Stage(ft): 0.000

Stage(ft)	Area(ac)
165.000	0.0000
170.000	0.0000

Operating Tables

Name: Grout Ops
Group: BASE
Type: Rating Curve
Function: Time vs. Discharge

Time(hrs)	Discharge(cfs)
0.00	0.06
10.00	0.06
10.01	0.00

==== Weirs ====

```
        Name: WSedBNDRY          From Node: Sed
       Group: BASE                 To Node: BNDRY
        Flow: Both                   Count: 1
        Type: Vertical: Mavis     Geometry: Trapezoidal

         Bottom Width(ft): 1.00
     Left Side Slope(h/v): 3.00
    Right Side Slope(h/v): 3.00
              Invert(ft): 165.000
   Control Elevation(ft): 165.000
  Struct Opening Dim(ft): 9999.00
                                        TABLE
         Bottom Clip(ft): 0.000
            Top Clip(ft): 0.000
     Weir Discharge Coef: 3.200
  Orifice Discharge Coef: 0.600
```

==== Rating Curves ====

```
        Name: Grout Ops          From Node: Truck                 Count: 1
       Group: BASE                 To Node: Sed                    Flow: Both

             TABLE          ELEV ON(ft)     ELEV OFF(ft)
         #1: Grout Ops      165.000         165.000
         #2:                0.000           0.000
         #3:                0.000           0.000
         #4:                0.000           0.000
```

==== Percolation Links ====

```
        Name: Sed_INFIL          From Node: Sed                    Flow: None
       Group: BASE                 To Node: GW_SINK               Count: 1

     Surface Area Option: Use 1st Point in Stage/Area Table
 Vertical Flow Termination: Horizontal Flow Algorithm
    Aquifer Base Elev(ft): 162.000                  Perimeter 1(ft): 256.000
     Water Table Elev(ft): 162.000                  Perimeter 2(ft): 382.000
****************************0.000                  Perimeter 3(ft): 758.000
 Horiz Conductivity(ft/day): 1.400               Distance 1 to 2(ft): 10.000
  Vert Conductivity(ft/day): 2.835               Distance 2 to 3(ft): 40.000
    Effective Porosity(dec): 0.300                  Num Cells 1 to 2: 76
          Suction Head(in): 7.000                   Num Cells 2 to 3: 152
       Layer Thickness(ft): 1.000
```

==== Hydrology Simulations ====

```
        Name: HILLS_SNKSTGI
    Filename: C:\Program Files\Icpr3\HILLS_SNKSTGI.R32

     Override Defaults: No

Time(hrs)        Print Inc(min)
---------------- ---------------
30.000           2.00
```

==== Routing Simulations ====

```
        Name: HILLS_SNKSTG1       Hydrology Sim: HILLS_SNKSTGI
    Filename: C:\Program Files\Icpr3\HILLS_SNKSTG1.I32

     Execute: Yes          Restart: No            Patch: No
 Alternative: No

      Max Delta Z(ft): 1.00                       Delta Z Factor: 0.00500
  Time Step Optimizer: 10.000
```

Start Time(hrs): 0.000
Min Calc Time(sec): 0.5000
Boundary Stages:

End Time(hrs): 24.00
Max Calc Time(sec): 24.0000
Boundary Flows:

Time(hrs)	Print Inc(min)
999.000	15.000

Group	Run
BASE	Yes

Hillsborough County
Phase I Sink Grouting
ICPR Analysis

Name	Group	Simulation	Max Time Stage hrs	Max Stage ft	Warning Stage ft	Max Delta Stage ft	Max Surf Area ft2	Max Time Inflow hrs	Max Inflow cfs	Max Time Outflow hrs	Max Outflow cfs
BNDRY	BASE	HILLS_SNKSTG1	0.00	165.00	165.00	0.0000	0	0.00	0.00	0.00	0.00
GW_SINK	BASE	HILLS_SNKSTG1	0.00	162.00	162.00	0.0000	0	0.00	0.00	0.00	0.00
Sed	BASE	HILLS_SNKSTG1	24.00	163.51	164.00	0.0001	3920	10.00	0.06	0.00	0.00
Truck	BASE	HILLS_SNKSTG1	0.00	165.00	0.00	0.0000	113	0.00	0.00	0.00	0.06

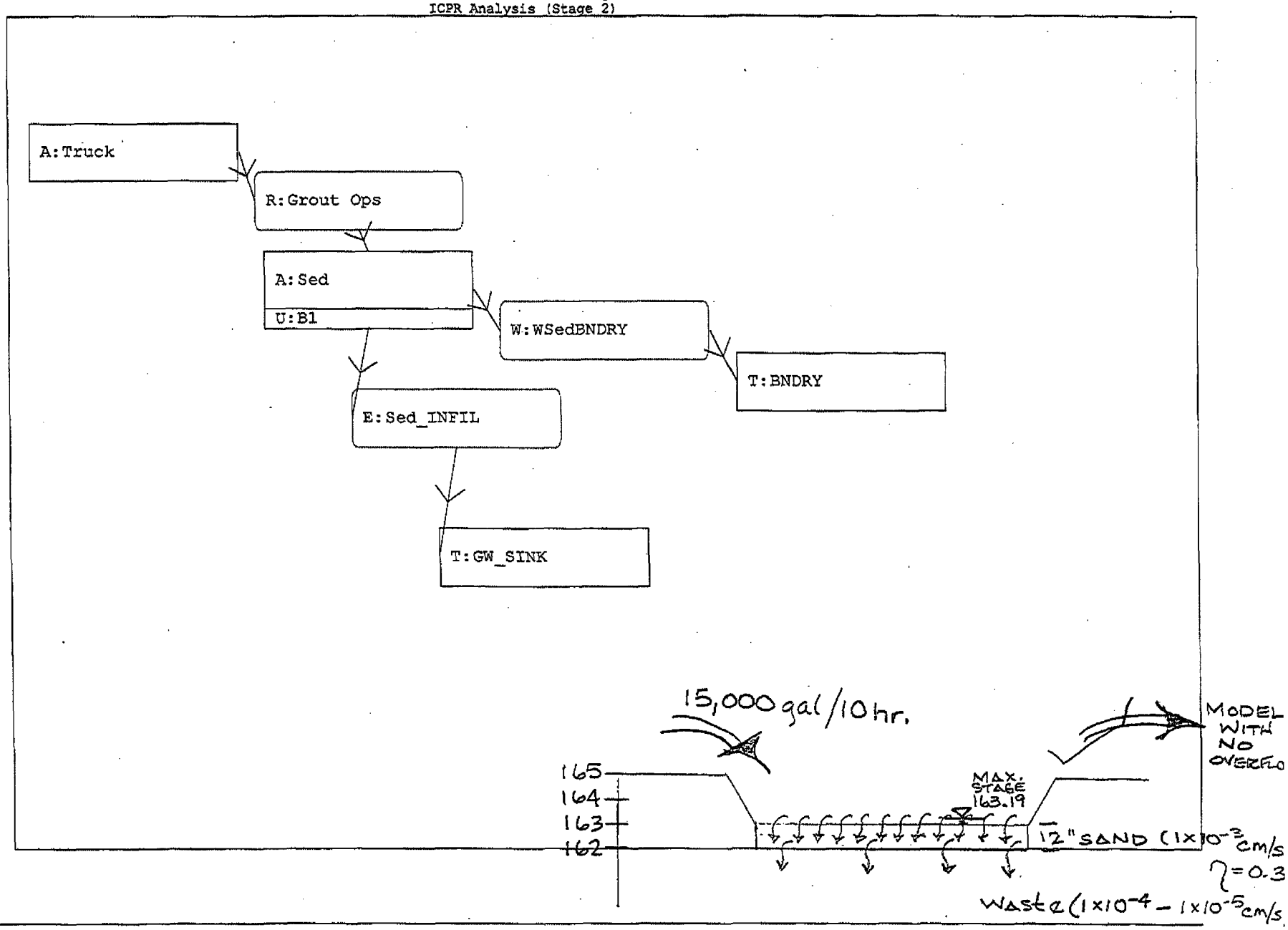
Stage 2

Hillsborough County
Phase I Sink Grouting
ICPR Analysis (Stage 2)

Nodes
A Stage/Area
V Stage/Volume
T Time/Stage
M Manhole

Basins
O Overland Flow
U SCS Unit CN
S SBUH CN
Y SCS Unit GA
Z SBUH GA

Links
P Pipe
W Weir
C Channel
D Drop Structure
B Bridge
R Rating Curve
H Breach
E Percolation
F Filter
X Exfil Trench



Basins

Name: B1
Group: BASE
Node: Sed
Type: SCS Unit Hydrograph CN
Status: Onsite

Unit Hydrograph: Uh484
Rainfall File: Flmod
Rainfall Amount(in): 0.000
Area(ac): 0.023
Curve Number: 100.00
DCIA(%): 0.00
Peaking Factor: 484.0
Storm Duration(hrs): 24.00
Time of Conc(min): 6.00
Time Shift(hrs): 0.00
Max Allowable Q(cfs): 999999.000

Nodes

Name: BNDRY
Group: BASE
Type: Time/Stage
Base Flow(cfs): 0.000
Init Stage(ft): 165.000
Warn Stage(ft): 165.000

Time(hrs)	Stage(ft)
0.00	165.000
999.00	165.000

Name: GW_SINK
Group: BASE
Type: Time/Stage
Base Flow(cfs): 0.000
Init Stage(ft): 162.000
Warn Stage(ft): 162.000

Time(hrs)	Stage(ft)
0.00	162.000
999.00	162.000

Name: Sed
Group: BASE
Type: Stage/Area
Base Flow(cfs): 0.000
Init Stage(ft): 163.000
Warn Stage(ft): 164.000

Stage(ft)	Area(ac)
163.000	0.0900
165.000	0.0900

Name: Truck
Group: BASE
Type: Stage/Area
Base Flow(cfs): 0.000
Init Stage(ft): 165.000
Warn Stage(ft): 0.000

Stage(ft)	Area(ac)
165.000	0.0000
170.000	0.0000

Operating Tables

Name: Grout Ops
Group: BASE
Type: Rating Curve
Function: Time vs. Discharge

Time(hrs)	Discharge(cfs)
0.00	0.06
10.00	0.06
10.01	0.00

==== Weirs ====

```
        Name: WSedBNDRY          From Node: Sed
       Group: BASE                 To Node: BNDRY
        Flow: Both                   Count: 1
        Type: Vertical: Mavis     Geometry: Trapezoidal

         Bottom Width(ft): 1.00
      Left Side Slope(h/v): 3.00
     Right Side Slope(h/v): 3.00
               Invert(ft): 165.000
   Control Elevation(ft): 165.000
  Struct Opening Dim(ft): 9999.00
                                        TABLE
          Bottom Clip(ft): 0.000
             Top Clip(ft): 0.000
      Weir Discharge Coef: 3.200
   Orifice Discharge Coef: 0.600
```

==== Rating Curves ====

```
        Name: Grout Ops          From Node: Truck                Count: 1
       Group: BASE                 To Node: Sed                   Flow: Both

              TABLE          ELEV ON(ft)     ELEV OFF(ft)
         #1: Grout Ops       165.000         165.000
         #2:                 0.000           0.000
         #3:                 0.000           0.000
         #4:                 0.000           0.000
```

==== Percolation Links ====

```
        Name: Sed_INFIL          From Node: Sed                  Flow: Both
       Group: BASE                 To Node: GW_SINK              Count: 1

       Surface Area Option: Use 1st Point in Stage/Area Table
  Vertical Flow Termination: Horizontal Flow Algorithm
     Aquifer Base Elev(ft): 162.000                  Perimeter 1(ft): 256.000
      Water Table Elev(ft): 162.000                  Perimeter 2(ft): 382.000
****************************0.000                   Perimeter 3(ft): 758.000
 Horiz Conductivity(ft/day): 1.400               Distance 1 to 2(ft): 10.000
  Vert Conductivity(ft/day): 2.835               Distance 2 to 3(ft): 40.000
    Effective Porosity(dec): 0.300                  Num Cells 1 to 2: 76
          Suction Head(in): 7.000                   Num Cells 2 to 3: 152
       Layer Thickness(ft): 1.000
```

==== Hydrology Simulations ====

```
        Name: HILLS_SNKSTG2
    Filename: C:\Program Files\Icpr3\HILLS_SNKSTG2.R32

     Override Defaults: No

Time(hrs)        Print Inc(min)
---------------  ---------------
30.000           2.00
```

==== Routing Simulations ====

```
        Name: HILLS_SNKSTG2       Hydrology Sim: HILLS_SNKSTG2
    Filename: C:\Program Files\Icpr3\HILLS_SNKSTG2.I32

     Execute: Yes         Restart: No            Patch: No
 Alternative: No

      Max Delta Z(ft): 1.00                      Delta Z Factor: 0.00500
  Time Step Optimizer: 10.000
```

Start Time(hrs): 0.000
Min Calc Time(sec): 0.5000
Boundary Stages:

End Time(hrs): 24.00
Max Calc Time(sec): 24.0000
Boundary Flows:

Time(hrs)	Print Inc(min)
999.000	15.000

Group	Run
BASE	Yes

Hillsborough County
Phase I Sink Grouting
ICPR Analysis (Stage 2)

Name	Group	Simulation	Max Time Stage hrs	Max Stage ft	Warning Stage ft	Max Delta Stage ft	Max Surf Area ft2	Max Time Inflow hrs	Max Inflow cfs	Max Time Outflow hrs	Max Outflow cfs
BNDRY	BASE	HILLS_SNKSTG2	0.00	165.00	165.00	0.0000	0	0.00	0.00	0.00	0.00
GW_SINK	BASE	HILLS_SNKSTG2	0.00	162.00	162.00	0.0000	0	5.87	0.06	0.00	0.00
Sed	BASE	HILLS_SNKSTG2	10.01	163.19	164.00	0.0001	3920	10.00	0.06	5.87	0.06
Truck	BASE	HILLS_SNKSTG2	0.00	165.00	0.00	0.0000	113	0.00	0.00	0.00	0.06

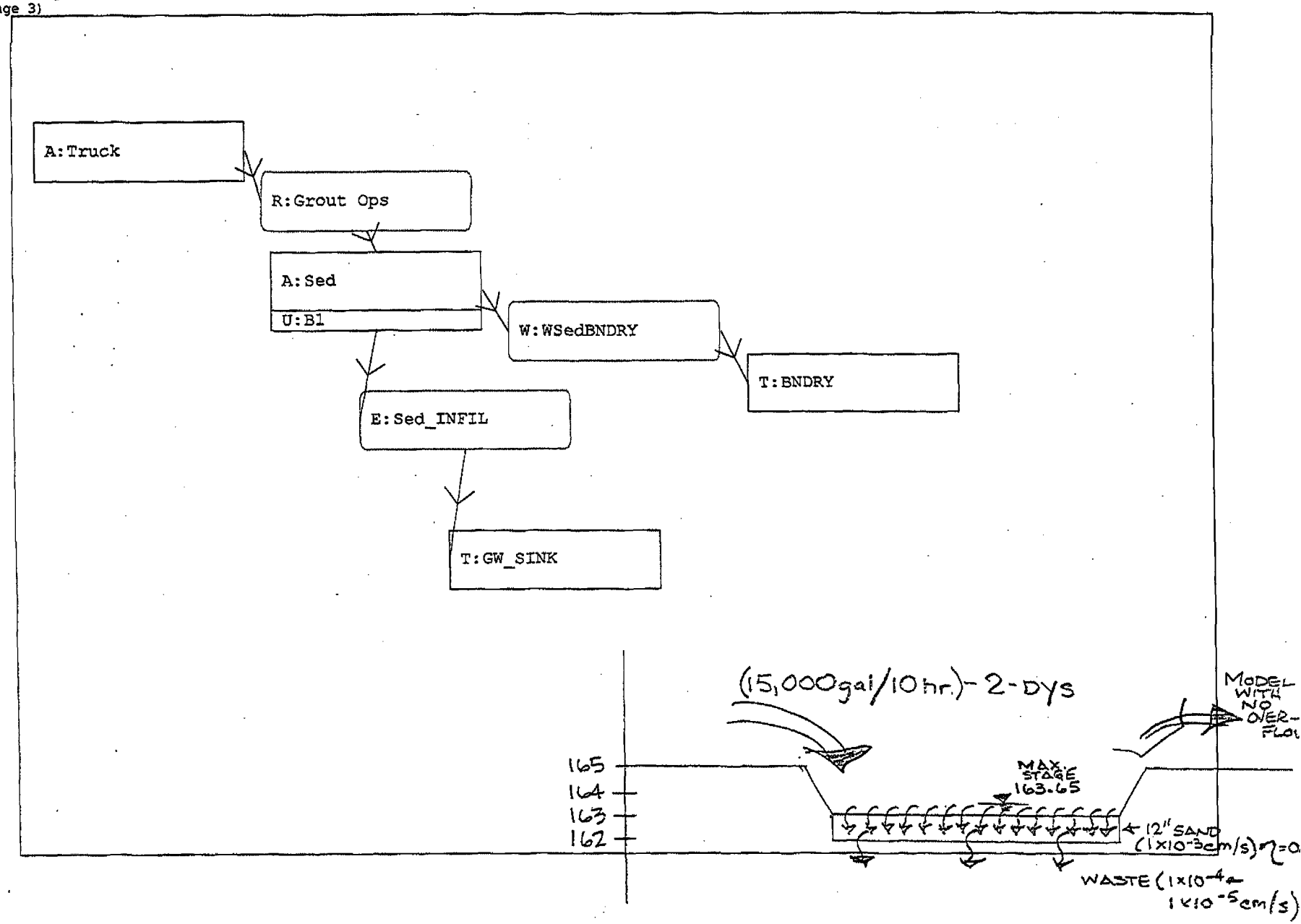
Stage 3

Hillsborough County
Phase I Sinkhole Grouting
ICPR Analysis (Stage 3)

Nodes
A Stage/Area
V Stage/Volume
T Time/Stage
M Manhole

Basins
O Overland Flow
U SCS Unit CN
S SBUH CN
Y SCS Unit GA
Z SBUH GA

Links
P Pipe
W Weir
C Channel
D Drop Structure
B Bridge
R Rating Curve
H Breach
E Percolation
F Filter
X Exfil Trench



Basins

Name: B1 | Node: Sed | Status: Onsite
Group: BASE | Type: SCS Unit Hydrograph CN

Unit Hydrograph: Uh484
Rainfall File: Flmod
Rainfall Amount(in): 0.000
Area(ac): 0.023
Curve Number: 100.00
DCIA(%): 0.00

Peaking Factor: 484.0
Storm Duration(hrs): 24.00
Time of Conc(min): 6.00
Time Shift(hrs): 0.00
Max Allowable Q(cfs): 999999.000

Nodes

Name: BNDRY | Base Flow(cfs): 0.000 | Init Stage(ft): 165.000
Group: BASE | Warn Stage(ft): 165.000
Type: Time/Stage

Time(hrs)	Stage(ft)
0.00	165.000
999.00	165.000

Name: GW_SINK | Base Flow(cfs): 0.000 | Init Stage(ft): 162.000
Group: BASE | Warn Stage(ft): 162.000
Type: Time/Stage

Time(hrs)	Stage(ft)
0.00	162.000
999.00	162.000

Name: Sed | Base Flow(cfs): 0.000 | Init Stage(ft): 163.000
Group: BASE | Warn Stage(ft): 164.000
Type: Stage/Area

Stage(ft)	Area(ac)
163.000	0.0900
165.000	0.0900

Name: Truck | Base Flow(cfs): 0.000 | Init Stage(ft): 165.000
Group: BASE | Warn Stage(ft): 0.000
Type: Stage/Area

Stage(ft)	Area(ac)
165.000	0.0000
170.000	0.0000

Operating Tables

Name: Grout Ops | Group: BASE
Type: Rating Curve
Function: Time vs. Discharge

Time(hrs)	Discharge(cfs)
0.00	0.06
10.00	0.06
10.01	0.00
31.99	0.00

32.00	0.06
42.00	0.06
42.01	0.00

==== Weirs ====

Name: WSedBNDRY
Group: BASE
Flow: Both
Type: Vertical: Mavis
From Node: Sed
To Node: BNDRY
Count: 1
Geometry: Trapezoidal

Bottom Width(ft): 1.00
Left Side Slope(h/v): 3.00
Right Side Slope(h/v): 3.00
Invert(ft): 165.000
Control Elevation(ft): 165.000
Struct Opening Dim(ft): 9999.00
TABLE
Bottom Clip(ft): 0.000
Top Clip(ft): 0.000
Weir Discharge Coef: 3.200
Orifice Discharge Coef: 0.600

==== Rating Curves ====

Name: Grout Ops
Group: BASE
From Node: Truck
To Node: Sed
Count: 1
Flow: Both

TABLE	ELEV ON(ft)	ELEV OFF(ft)
#1: Grout Ops	165.000	165.000
#2:	0.000	0.000
#3:	0.000	0.000
#4:	0.000	0.000

==== Percolation Links ====

Name: Sed_INFIL
Group: BASE
From Node: Sed
To Node: GW_SINK
Flow: Both
Count: 1

Surface Area Option: Use 1st Point in Stage/Area Table
Vertical Flow Termination: Horizontal Flow Algorithm
Aquifer Base Elev(ft): 162.000
Water Table Elev(ft): 162.000
**********0.000
Horiz Conductivity(ft/day): 1.400
Vert Conductivity(ft/day): 2.835
Effective Porosity(dec): 0.300
Suction Head(in): 7.000
Layer Thickness(ft): 1.000

Perimeter 1(ft): 256.000
Perimeter 2(ft): 382.000
Perimeter 3(ft): 758.000
Distance 1 to 2(ft): 10.000
Distance 2 to 3(ft): 40.000
Num Cells 1 to 2: 76
Num Cells 2 to 3: 152

==== Hydrology Simulations ====

Name: HILLS_SINK1
Filename: C:\Program Files\Icpr3\HILLS_SINK1.R32

Override Defaults: No

Time(hrs)	Print Inc(min)
30.000	2.00

==== Routing Simulations ====

Name: HILLS_SINK1
Hydrology Sim: HILLS_SINK1
Filename: C:\Program Files\Icpr3\HILLS_SINK1.I32

Execute: Yes
Restart: No
Patch: No

Alternative: No

Max Delta Z(ft):	1.00	Delta Z Factor:	0.00500
Time Step Optimizer:	10.000		
Start Time(hrs):	0.000	End Time(hrs):	60.00
Min Calc Time(sec):	0.5000	Max Calc Time(sec):	60.0000
Boundary Stages:		Boundary Flows:	

Time(hrs)	Print Inc(min)
999.000	15.000

Group	Run
BASE	Yes

Hillsborough County
Phase I Sinkhole Grouting
ICPR Analysis (Stage 3)

Name	Group	Simulation	Max Time Stage hrs	Max Stage ft	Warning Stage ft	Max Delta Stage ft	Max Surf Area ft2	Max Time Inflow hrs	Max Inflow cfs	Max Time Outflow hrs	Max Outflow cfs
BNDRY	BASE	HILLS_SINK1	0.00	165.00	165.00	0.0000	0	0.00	0.00	0.00	0.00
GW_SINK	BASE	HILLS_SINK1	0.00	162.00	162.00	0.0000	0	5.87	0.06	0.00	0.00
Sed	BASE	HILLS_SINK1	42.01	163.65	164.00	0.0001	3920	10.00	0.06	5.87	0.06
Truck	BASE	HILLS_SINK1	0.00	165.00	0.00	0.0000	113	0.00	0.00	0.00	0.06

Project:	Computed:	Date:
Subject:	Checked:	Date:
Task:	Page:	of:
Job #:	No:	

HDR | ONE COMPANY *Many Solutions*™

GIVEN: - 15,000 GAL PUMP INTO POND PER DAY
- 10 HR = 1 DAY
- 64' x 64' SETTLING POND (2' DEPTH) W/ 12" SAND LAYER
- POROSITY OF SAND (K_V) = 1×10^{-3} CM/S = 2.8346 FT/DAY

$K_H = \frac{K_V}{2} = \frac{2.8346}{2} = 1.4$ FT/DAY

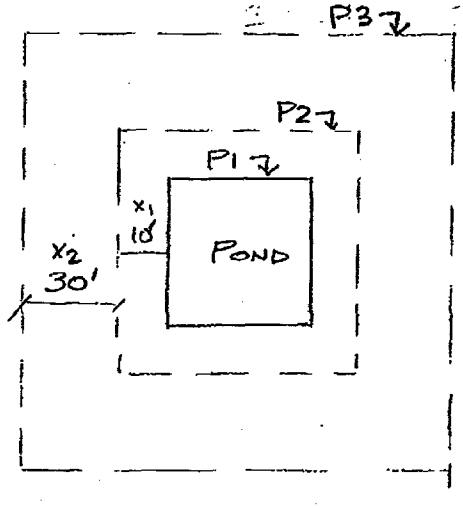
CONVERT: $\frac{15{,}000 \text{ gal.}}{10 \text{ hr}} \cdot \frac{1 \text{ cf}}{7.4805 \text{ gal}} \cdot \frac{1 \text{ hr}}{60 \text{ min}} \cdot \frac{1 \text{ min}}{60 \text{ sec}} = 0.5571 \text{ cfs}$

DISCHARGE IN 10 HR. DAY = 0.6 cfs

AREA OF POND = 64 FT x 64 FT = 4,096 SF OR 0.09 ac
- BOTTOM OF POND ELEV. = 163'
- TOP OF POND ELEV. = 165'
- AQUIFER ELEV. = 162'

PERCOLATION POND GEOMETRY CALCS:

FOR THE 64' x 64' POND:



$P1 = 2(64') + 2(64) = 256$

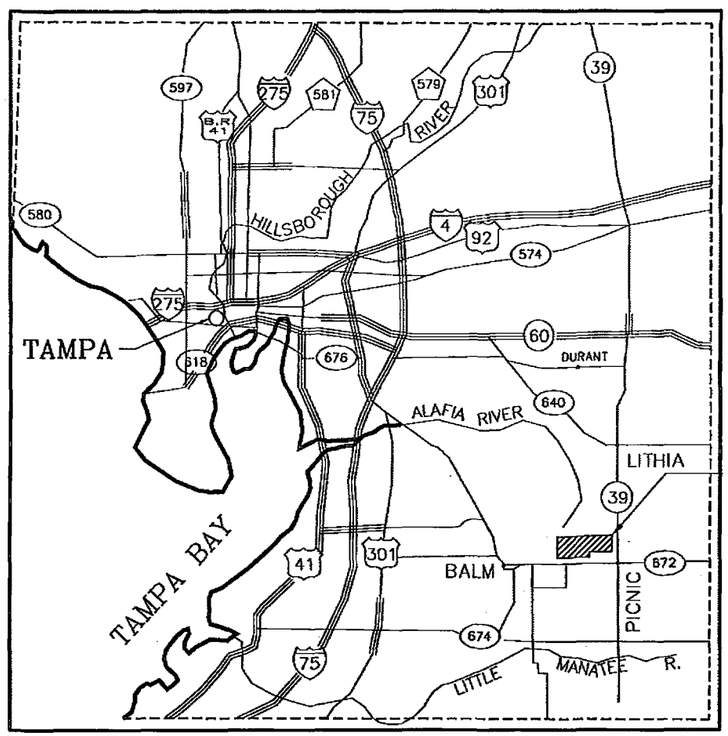
$P2 = P1 + 2\pi(x_1 \cdot 2)$
$= 256 + (2 \cdot 3.14 \cdot 20)$
$P2 = 382$

$P3 = P1 + 2\pi[(x_1 \cdot 2) + (x_2 \cdot 2)]$
$= 256 + (2 \cdot 3.14 \cdot 80)$
$P3 = 758$

Attachment C

Construction Drawings

Hillsborough County
Florida



PROJECT LOCATION

NOT TO SCALE

Construction Drawings For

STAGE 1 SINKHOLE STABILIZATION GROUTING PLAN

Project No.
096-149350-010

LITHIA, FLORIDA
JANUARY 2011

INDEX OF DRAWINGS

G-01	Cover Sheet
C-01	Existing Conditions
C-02	Sinkhole Area Plan
C-03	Sinkhole Grouting Layout Plan
C-04	Sinkhole Grout Hole and Core Hole Plan
C-05	Sinkhole Grouting Holes Sections
C-06	Grouting Water Discharge Basin Plan and Section
C-07	Details

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
MAY 09 2011
SOUTHWEST DISTRICT
TAMPA

SDII GLOBAL
STEVEN H. MEIGGS, PE
PRINCIPAL ENGINEER
FLORIDA LICENSE #64832

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FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
MAY 09 2011
SOUTHWEST DISTRICT
TAMPA

NOTES
1. TOPOGRAPHICAL INFORMATION COMPILED FROM EXISTING CONDITIONS SURVEY PERFORM BY PICKETT & ASSOCIATES DATED JULY 2010.
2. SINK HOLE AREA SURVEY BY PICKETT AND ASSOC., DATED DECEMBER 21, 2010.

SURVEYOR'S NOTES
1. NORTH, THE GRID, AND THE COORDINATES SHOWN HEREON ARE REFERENCED TO THE WEST ZONE OF THE FLORIDA STATE PLANE COORDINATE SYSTEM, NAD 83, 1990 ADJUSTMENT.
2. ELEVATIONS ARE TO NATIONAL GEODETIC VERTICAL DATUM OF 1929.

SDII GLOBAL

Hillsborough County

A	01/12/2011	ISSUED FOR FDEP REVIEW

PROJECT MANAGER	R. SIEMERING
REVIEWED BY	J. TIMMONS
DRAWN BY	B. JOHNSON

STEVEN H. MEIGOS, PE
PRINCIPAL ENGINEER

STAGE 1 SINKHOLE STABILIZATION GROUTING PLAN
SOUTHEAST COUNTY LANDFILL
HILLSBOROUGH COUNTY, FLORIDA

EXISTING CONDITIONS

0 1" 2"

FILENAME 00C-01.DWG
SCALE 1"=300'

SHEET C-01

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SINKHOLE AREA

PHASE V

LIMITED SINKHOLE AREA SURVEY BOUNDARY

TRUCK TURNAROUND AREA

PERIMETER ACCESS ROAD

PHASE VI

PHASE III

PROPOSED TEMPORARY STABILIZED ACCESS ROAD

PHASE IV

EXISTING LANDFILL ACCESS ROAD

PHASE I

W.E. 124.5

N

LEGEND

2-WAY TRAFFIC

NOTES
1. TOPOGRAPHICAL INFORMATION COMPILED FROM EXISTING CONDITIONS SURVEY PERFORM BY PICKETT & ASSOCIATES DATED JULY 2010.
2. LIMITED SINK HOLE AREA SURVEY BY PICKETT AND ASSOC., DATED DECEMBER 21, 2010.

SURVEYOR'S NOTES
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FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
MAY 09 2011
SOUTHWEST DISTRICT
TAMPA

SDI GLOBAL

Hillsborough County Florida

A	01/12/2011	ISSUED FOR FDEP REVIEW

PROJECT MANAGER	R. SIEMERING
REVIEWED BY	J. TIMMONS
DRAWN BY	B. JOHNSON

STEVEN H. MEIGGS, PE
PRINCIPAL ENGINEER

STAGE 1 SINKHOLE STABILIZATION GROUTING PLAN
SOUTHEAST COUNTY LANDFILL
HILLSBOROUGH COUNTY, FLORIDA

SINKHOLE AREA PLAN

0 1" 2"

FILENAME 00C-02.DWG
SCALE 1"=100'
SHEET C-02

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FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
MAY 09 2011
SOUTHWEST DISTRICT
TAMPA

NOTES
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SURVEYOR'S NOTES
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2. ELEVATIONS ARE TO NATIONAL GEODETIC VERTICAL DATUM OF 1929.

SDI GLOBAL

Hillsborough County Florida

ISSUE	DATE	DESCRIPTION
A	01/12/2011	ISSUED FOR FDEP REVIEW

PROJECT MANAGER	R. SIEMERING
REVIEWED BY	J. TIMMONS
DRAWN BY	B. JOHNSON
PROJECT NUMBER	[illegible]

STEVEN H. MEIGGS, PE
PRINCIPAL ENGINEER
FLORIDA LICENSE [illegible]

STAGE 1 SINKHOLE STABILIZATION GROUTING PLAN
SOUTHEAST COUNTY LANDFILL
HILLSBOROUGH COUNTY, FLORIDA

SINKHOLE GROUTING LAYOUT PLAN

0 1" 2"

FILENAME DDC-03.DWG
SCALE 1"=60'

SHEET C-03

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PHASE V

PERIMETER ACCESS ROAD

VERTICAL DISPLACEMENT MONITORING GAUGE STATION

SINKHOLE AREA

SINKHOLE GROUTING STAGING AREA

15' (TYP)

GROUT HOLE 4
GROUT HOLE 9
GROUT HOLE 2
GROUT HOLE 7
B-SH-01
GROUT HOLE 1
B-SH-02
GROUT HOLE 6
GROUT HOLE 3
GROUT HOLE 8
GROUT HOLE 5

VERTICAL DISPLACEMENT GAUGES

A
C-05

DISCHARGE WATER TANK AND PUMP

DRILLING WATER DISCHARGE BASIN (SEE SHEET C-06)

DRILLING WATER DISCHARGE BASIN PUMP AND PIPING

TEMPORARY STABILIZED ACCESS ROAD AND TRUCK TURNAROUND

DRILLING WATER SUPPLY TANK

TRUCK LOADING AREA

PHASE VI

N

BORING LOCATION TABLE		
LOCATION	NORTHING	EASTING
GROUT HOLE 1	1251417.28	595438.91
GROUT HOLE 2	1251427.00	595441.27
GROUT HOLE 3	1251407.56	595436.54
GROUT HOLE 4	1251436.71	595443.63
GROUT HOLE 5	1251397.85	595434.18
GROUT HOLE 6	1251408.88	595452.30
GROUT HOLE 7	1251418.59	595454.66
GROUT HOLE 8	1251399.16	595449.94
GROUT HOLE 9	1251428.31	595457.03
B-SH-01	1251420.70	595424.82
B-SH-02	1251408.89	595473.40

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
MAY 09 2011
SOUTHWEST DISTRICT
TAMPA

NOTES
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2. LIMITED SINK HOLE AREA SURVEY BY PICKETT AND ASSOC., DATED DECEMBER 21, 2010.

SURVEYOR'S NOTES
1. NORTH, THE GRID, AND THE COORDINATES SHOWN HEREON ARE REFERENCED TO THE WEST ZONE OF THE FLORIDA STATE PLANE COORDINATE SYSTEM, NAD 83, 1990 ADJUSTMENT.
2. ELEVATIONS ARE TO NATIONAL GEODETIC VERTICAL DATUM OF 1929.

SDI GLOBAL

Hillsborough County Florida

ISSUE	DATE	DESCRIPTION
A	01/12/2011	ISSUED FOR FDEP REVIEW

PROJECT MANAGER	R. SIEMERING
REVIEWED BY	J. TIMMONS
DRAWN BY	B. JOHNSON

STEVEN H. MEIGGS, PE
PRINCIPAL ENGINEER

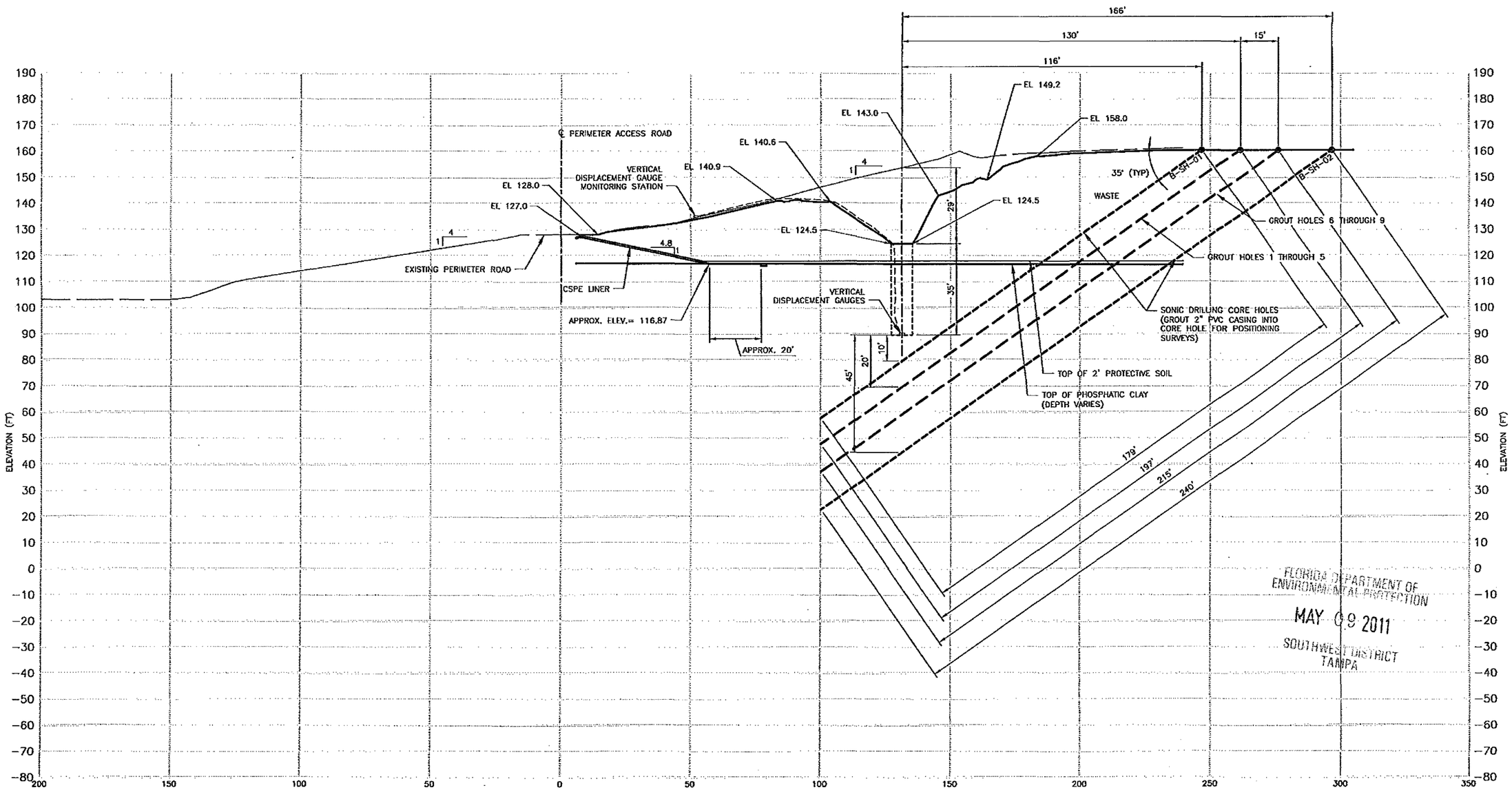
STAGE 1 SINKHOLE STABILIZATION GROUTING PLAN
SOUTHEAST COUNTY LANDFILL
HILLSBOROUGH COUNTY, FLORIDA

SINKHOLE GROUT HOLE AND CORE HOLE PLAN

0 1" 2"

FILENAME 00C-04.DWG
SCALE 1"=20'
SHEET C-04

c:\pwworking\tpald\0268510\00C-04.dwg, Plot, 1/12/2011 1:34:50 PM, BradJohn



FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
MAY 09 2011
SOUTHWEST DISTRICT
TAMPA

SECTION A / C-04

SCALE: 1"=20' HORIZ.
1"=20' VERT.

SURVEYOR'S NOTES
1. NORTH, THE GRID, AND THE COORDINATES SHOWN HEREON ARE REFERENCED TO THE WEST ZONE OF THE FLORIDA STATE PLANE COORDINATE SYSTEM, NAD 83, 1990 ADJUSTMENT.
2. ELEVATIONS ARE TO NATIONAL GEODETIC VERTICAL DATUM OF 1929.

NOTES
1. TOPOGRAPHICAL INFORMATION COMPILED FROM EXISTING CONDITIONS SURVEY PERFORM BY PICKETT & ASSOCIATES DATED JULY 2010.
2. LIMITED SINK HOLE AREA SURVEY BY PICKETT AND ASSOC., DATED DECEMBER 21, 2010.
3. APPROXIMATE SINKHOLE DEPTH FIELD MEASURED ON 12/16/2011.

SDI GLOBAL

Hillsborough County Florida

A	01/12/2011	ISSUED FOR FDEP REVIEW

PROJECT MANAGER	R. SIEMERING
REVIEWED BY	J. TIMMONS
DRAWN BY	B. JOHNSON

STEVEN H. MEIGGS, PE
PRINCIPAL ENGINEER

STAGE 1 SINKHOLE STABILIZATION GROUTING PLAN
SOUTHEAST COUNTY LANDFILL
HILLSBOROUGH COUNTY, FLORIDA

SINKHOLE GROUTING HOLES SECTIONS

0 1" 2"

FILENAME 00C-05.DWG
SCALE 1"=20' HORIZ.

SHEET C-05

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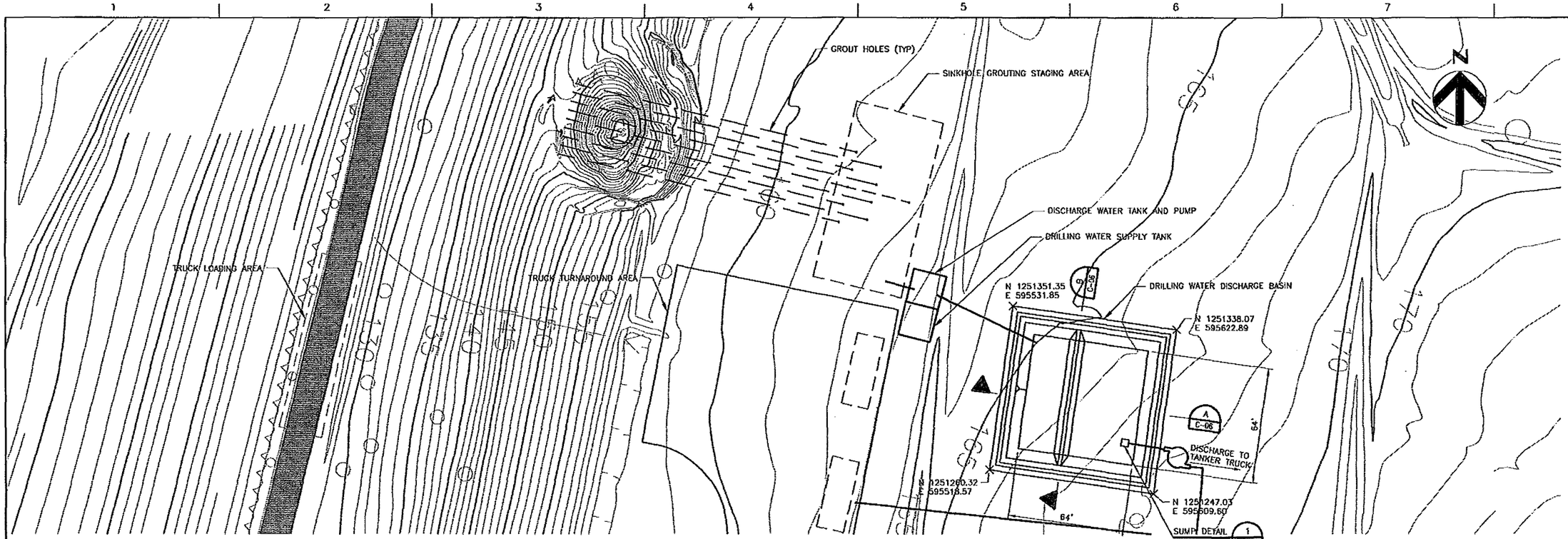
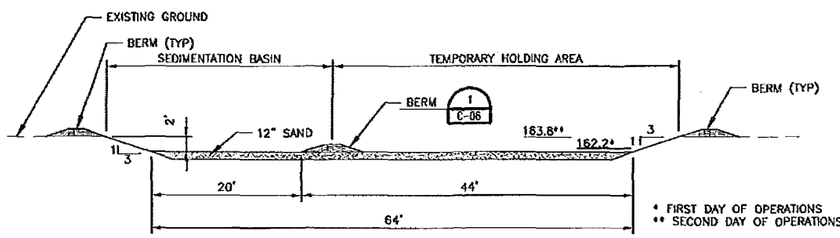


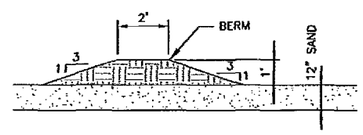
GROUT WATER DISCHARGE BASIN 1 C-03
1"=30'



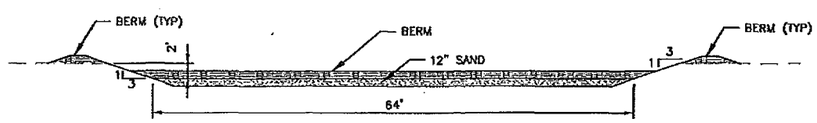
SECTION A C-06
1"=10'

* FIRST DAY OF OPERATIONS
** SECOND DAY OF OPERATIONS

NOTE:
5,000 GAL. TANKER TRUCK(S) TO BE PROVIDED BY COUNTY TO DRAIN WATER FROM TEMP. HOLDING AREA.



BERM DETAIL 1 C-06
1"=3'



SECTION B C-06
1"=10'

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
MAY 09 2011
SOUTHWEST DISTRICT
TAMPA

NOTES
1. TOPOGRAPHICAL INFORMATION COMPILED FROM EXISTING CONDITIONS SURVEY PERFORM BY PICKETT & ASSOCIATES DATED JULY 2010.
2. LIMITED SINK HOLE AREA SURVEY BY PICKETT AND ASSOC., DATED DECEMBER 21, 2010.

SURVEYOR'S NOTES
1. NORTH, THE GRID, AND THE COORDINATES SHOWN HEREON ARE REFERENCED TO THE WEST ZONE OF THE FLORIDA STATE PLANE COORDINATE SYSTEM, NAD 83, 1990 ADJUSTMENT.
2. ELEVATIONS ARE TO NATIONAL GEODETIC VERTICAL DATUM OF 1929.

SDII GLOBAL

Hillsborough County Florida

ISSUE	DATE	DESCRIPTION
A	01/12/2011	ISSUED FOR FDEP REVIEW

PROJECT MANAGER R. SIEMERING
REVIEWED BY J. TIMMONS
DRAWN BY B. JOHNSON

STEVEN H. MEIGGS, PE
PRINCIPAL ENGINEER
FLORIDA LICENSE 54833

STAGE 1 SINKHOLE STABILIZATION GROUTING PLAN
SOUTHEAST COUNTY LANDFILL
HILLSBOROUGH COUNTY, FLORIDA

GROUTING WATER DISCHARGE BASIN PLAN AND SECTION

0 1" 2"

FILENAME 00C-06.DWG
SCALE AS SHOWN
SHEET C-06

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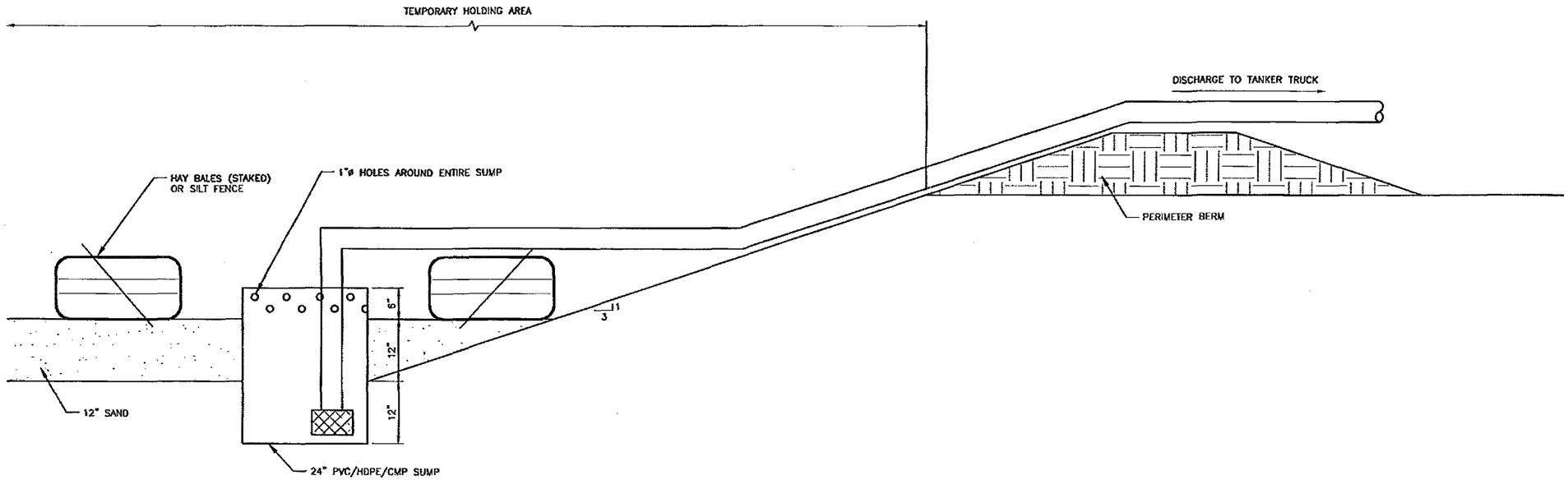

SUMP DETAIL 1 / C-06
1"=1'

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
MAY 09 2011
SOUTHWEST DISTRICT
TAMPA

NOTES
1. TOPOGRAPHICAL INFORMATION COMPILED FROM EXISTING CONDITIONS SURVEY PERFORM BY PICKETT & ASSOCIATES DATED JULY 2010.
2. LIMITED SINK HOLE AREA SURVEY BY PICKETT AND ASSOC., DATED DECEMBER 21, 2010.

ISSUE	DATE	DESCRIPTION
A	01/12/2011	ISSUED FOR FDEP REVIEW

PROJECT MANAGER	R. SIEMERING
REVIEWED BY	J. TIMMONS
DRAWN BY	B. JOHNSON
PROJECT NUMBER	[illegible]

STEVEN H. MEIGGS, PE
PRINCIPAL ENGINEER
FLORIDA LICENSE #64832

STAGE 1 SINKHOLE STABILIZATION GROUTING PLAN
SOUTHEAST COUNTY LANDFILL
HILLSBOROUGH COUNTY, FLORIDA

DETAILS

0 1" 2"

FILENAME 00C-07.DWG
SCALE 1"=20'
SHEET C-07

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Appendix B
Sonic Core Boring Logs

DEPTH (ft) BLS	SYMBOL	DESCRIPTION	PENETRATION blows per foot	BLOW COUNTS	N VALUE	COMMENTS Water Table Drilling Fluid Losses ft. = ft. bls (typical)
0		POORLY GRADED SAND (SP): Soil				Depth (Vertical)
		DEBRIS: Waste				
5						2.9'
10						5.7'
15			0 20 40 60 80 100			8.6'
20						11.5'
25						14.3'
30			0 20 40 60 80 100			17.2'
35						20.1'
40						22.9'
45			0 20 40 60 80 100			25.8'
50						28.7'
55						31.5'
60			0 20 40 60 80 100			34.4'

HDR ENGINEERING, INC.
TAMPA, FLORIDA

SDII GLOBAL

SPT BORING LOG

SITE NAME: SE HILLSBOROUGH CO. LANDFILL
SITE LOCATION: LITHIA, FLORIDA

DESIGNED BY:	BF	PROJECT NO:	3027462	BORING
CHECKED BY:	SM	BORING DATE:	02/02/11	S-BH-1
DRAWN BY:	MVK	PAGE NO.:	1 OF 3	

DEPTH (ft) BLS	SYMBOL	DESCRIPTION	PENETRATION blows per foot	BLOW COUNTS	N VALUE	COMMENTS Water Table Drilling Fluid Losses ft. = ft. bls (typical)
						Depth (Vertical)
65						37.3
70						40.2'
75			0 20 40 60 80 100			43.0'
80						45.9'
85						48.8'
90			0 20 40 60 80 100			51.6'
95						54.5'
100						57.4'
105			0 20 40 60 80 100			60.2
		NO RECOVERY				
110						63.1'
115						66.0'
120			0 20 40 60 80 100			68.8'

HDR ENGINEERING, INC.
TAMPA, FLORIDA

SDII GLOBAL

SPT BORING LOG

SITE NAME: SE HILLSBOROUGH CO. LANDFILL
SITE LOCATION: LITHIA, FLORIDA

DESIGNED BY:	BF	PROJECT NO:	3027462	BORING
CHECKED BY:	SM	BORING DATE:	02/02/11	S-BH-1
DRAWN BY:	MVK	PAGE NO.:	2 OF 3	

DEPTH (ft) BLS	SYMBOL	DESCRIPTION	PENETRATION blows per foot	BLOW COUNTS	N VALUE	COMMENTS Water Table Drilling Fluid Losses ft. = ft. bls (typical)
						Depth (Vertical)
125						71.7'
130						74.6'
		DEBRIS: Waste				
135		SILTY SAND (SM): Medium-brown, with trace phosphate and waste	0 20 40 60 80 100			77.4'
		NO RECOVERY				
140						80.3'
145						83.2'
150			0 20 40 60 80 100			86.0'
		POORLY GRADED SAND (SP): Brown				
		CLAY (CL/CH): Green to greenish-gray, with sand and phosphate				
155						88.9'
		CLAYEY SAND (SC): Green to gray, with trace to minor phosphate				
160		CLAYEY SAND (SC): Green, with granules of phosphate				91.8'
		SILTY SAND (SM): White to tan, with dolosilt, clayey sand and granule to sand sized phosphate				
165			0 20 40 60 80 100			94.6'
		SILTY SAND (SM): White with trace clay				
		DOLOSTONE : Gray to white, with sand and granule to sand sized phosphate				
170						97.5'
		CEMENTED SAND: Cream to white, with dolosilt matrix and abundant phosphate peloids				
175		DOLOSTONE : Cream to dark-green, with clay, and sand-sized phosphate pellets				100.4'
180						

HDR ENGINEERING, INC.
TAMPA, FLORIDA

SDII GLOBAL

SPT BORING LOG

SITE NAME: SE HILLSBOROUGH CO. LANDFILL
SITE LOCATION: LITHIA, FLORIDA

DESIGNED BY:	BF	PROJECT NO:	3027462	BORING
CHECKED BY:	SM	BORING DATE:	02/02/11	S-BH-1
DRAWN BY:	MVK	PAGE NO.:	3 OF 3	

DEPTH (ft) BLS	SYMBOL	DESCRIPTION	PENETRATION blows per foot	BLOW COUNTS	N VALUE	COMMENTS Water Table Drilling Fluid Losses ft. = ft. bls (typical)
0		POORLY GRADED SAND (SP): Soil				Depth (Vertical)
		DEBRIS: Waste				
5						2.6'
10						5.3'
15			0 20 40 60 80 100			7.9'
20						10.6'
25						13.2'
30			0 20 40 60 80 100			15.9'
35						18.5'
40						21.2'
45			0 20 40 60 80 100			23.8'
50						26.5'
55						29.1'
60			0 20 40 60 80 100			31.7'

HDR ENGINEERING, INC.
TAMPA, FLORIDA

SDII GLOBAL

SPT BORING LOG

SITE NAME: SE HILLSBOROUGH CO. LANDFILL
SITE LOCATION: LITHIA, FLORIDA

DESIGNED BY:	BF	PROJECT NO:	3027462	BORING
CHECKED BY:	SM	BORING DATE:	02/04/11	S-BH-2
DRAWN BY:	MVK	PAGE NO.:	1 OF 4	

DEPTH (ft) BLS	SYMBOL	DESCRIPTION	PENETRATION blows per foot	BLOW COUNTS	N VALUE	COMMENTS Water Table Drilling Fluid Losses ft. = ft. bls (typical)
						Depth (Vertical)
65						34.4'
70						37.0'
75			0 20 40 60 80 100			39.7'
80						42.3'
85		POORLY GRADED SAND (SP): White to brown, with trace phosphate from 84-85 ft.				45.0'
		CLAY (CL/CH): Brown				
90			0 20 40 60 80 100			47.6'
		POORLY GRADED SAND (SP): Yellow				
		CLAY (CL/CH): Grayish-green, with branch/root				
95		CLAY (CL/CH): Gray				50.3'
100		CLAY (CL/CH): Olive-green to light-gray				52.9'
		CLAY (CL/CH): Light-gray				
105		CLAY (CL/CH): Olive-green to light-gray	0 20 40 60 80 100			55.6'
110						58.2'
115		CLAY (CL/CH): Light-gray				60.8'
		CLAYEY SAND (SC): Light-brown				
120			0 20 40 60 80 100			63.5'
		CLAY (CL/CH): Light-brown, with sand, and trace				

HDR ENGINEERING, INC.
TAMPA, FLORIDA

SDII GLOBAL

SPT BORING LOG

SITE NAME: SE HILLSBOROUGH CO. LANDFILL
SITE LOCATION: LITHIA, FLORIDA

DESIGNED BY:	BF	PROJECT NO:	3027462	BORING
CHECKED BY:	SM	BORING DATE:	02/04/11	S-BH-2
DRAWN BY:	MVK	PAGE NO.:	2 OF 4	

DEPTH (ft) BLS	SYMBOL	DESCRIPTION	PENETRATION blows per foot	BLOW COUNTS	N VALUE	COMMENTS Water Table Drilling Fluid Losses ft. = ft. bls (typical)
		limestone gravel from 136-146 ft.				Depth (Vertical)
125						66.1'
130						68.8'
135			0 20 40 60 80 100			71.4'
140						74.1'
145						76.7'
		CLAYEY SAND (SC): Light-brown				
		CLAYEY SAND (SC): Grayish-green				
150			0 20 40 60 80 100			79.4'
155		CLAYEY SAND (SC): Green				82.0'
		NO RECOVERY				
160						84.7'
165			0 20 40 60 80 100			87.3'
170						89.9'
175		CLAYEY SAND (SC): Green				92.6'
		NO RECOVERY				
180			0 20 40 60 80 100			95.2'

HDR ENGINEERING, INC.
TAMPA, FLORIDA

SDII GLOBAL

SPT BORING LOG

SITE NAME: SE HILLSBOROUGH CO. LANDFILL
SITE LOCATION: LITHIA, FLORIDA

DESIGNED BY:	BF	PROJECT NO:	3027462	BORING
CHECKED BY:	SM	BORING DATE:	02/04/11	S-BH-2
DRAWN BY:	MVK	PAGE NO.:	3 OF 4	

DEPTH (ft) BLS	SYMBOL	DESCRIPTION	PENETRATION blows per foot	BLOW COUNTS	N VALUE	COMMENTS Water Table Drilling Fluid Losses ft. = ft. bls (typical)
185						97.9' Depth (Vertical)
190						100.5'
195		CLAYEY SAND (SC): Greenish-gray, with trace phosphate	0 20 40 60 80 100			103.2'
		CLAYEY SAND (SC): Tan				
200		DOLOSTONE : Light-tan dolosilt				105.8'
		CLAYEY SAND (SC): Tan				
205		CLAY (CL/CH): Greenish-gray, with trace phosphate from 205-218 ft.				108.5'
210			0 20 40 60 80 100			111.1'
215						113.8'
220		DOLOSTONE : Light-tan, with trace phosphate, and clay from 225-227 ft.				116.4
225			0 20 40 60 80 100			119.0'
		CLAYEY SAND (SC): Light-gray				
230						121.7'
235						
240						

HDR ENGINEERING, INC.
TAMPA, FLORIDA

SDII GLOBAL

SPT BORING LOG

SITE NAME: SE HILLSBOROUGH CO. LANDFILL
SITE LOCATION: LITHIA, FLORIDA

DESIGNED BY:	BF	PROJECT NO:	3027462	BORING
CHECKED BY:	SM	BORING DATE:	02/04/11	S-BH-2
DRAWN BY:	MVK	PAGE NO.:	4 OF 4	

Appendix C
Grout Hole Drilling and Injection Logs

SDII Global Corporation

GH-1

Installed at 35 degree incline from horizontal

Depth Down-hole	Equivalent Vertical Depth	Grout Injected (Yards)	Strokes	Truck and Date - Notes	Max PSI	General Boring Log
0 - 97	0 - 55.6	1.95	100	Truck #6 - 3/22/11 (514 strokes) - 6" casing to 113 feet. Pulling 3" casing after 114-116. 20 strokes to prime 6" casing. Grouting 6" casing starting at 112 to 114 feet	100-360	Waste
93 - 103	53.3 - 59.1					White Sand w/some brown clay
102 - 104	58.5 - 59.7	0.21	11		100	Grey Clay (liner) starting @ 103
104 - 106	59.7 - 60.8	0.12	6		100	
106 - 108	60.8 - 61.9	0.16	8		100	
108 - 110	61.9 - 63.1	0.74	38		100	
110 - 112	63.1 - 64.2	0.10	5		100	
112 - 114	64.2 - 65.4	0.40	2		110	Grey Clay (liner) RLOC @ 113
114 - 116	65.4 - 66.5	0.31	16		110	Green Grey clay to brown sandy clay/clayey sand cuttings apparent after regaining circulation starting at 122-138
116 - 118	66.5 - 67.7	0.31	16		120	
118 - 120	67.7 - 68.8	0.27	14		120	
120 - 122	68.8 - 70.0	0.29	15		140	
122 - 124	70.0 - 71.1	0.45	23		120	
124 - 126	71.1 - 72.3	2.14	110		140	
126 - 128	72.3 - 73.4	2.14	110		140	
128 - 130	73.4 - 74.6	2.23	100\20		160	
130 - 132	74.6 - 75.7	2.21	120	Truck #5 - 3/22/11 (544 strokes)	140	Brown sandy clay/clayey sand - some what appeared to be fly ash material just before losing circulation again - RLOC @ 138
132 - 134	75.7 - 76.9	2.21	120		140	
134 - 136	76.9 - 78.0	3.65	200		100	
136 - 138	78.0 - 79.2	2.27	106\4		260	
138 - 140	79.2 - 80.3	1.59	110	Truck #4 - 3/22/11 (691 strokes)	200	Unknown - Minimal to no drilling resistance
140 - 142	80.3 - 81.4	1.59	110		280	
142 - 144	81.4 - 82.6	1.59	110		120	
144 - 146	82.6 - 83.7	1.59	110		120	
146 - 148	83.7 - 84.9	1.84	127		260	
148 - 150	84.9 - 86.0	0.01	1		300	
150 - 152	86.0 - 87.2	1.47	71\18		300	
152 - 154	87.2 - 88.3	1.89	108	Truck #3 - 3/22/11 (572 strokes)	120	
154 - 156	88.3 - 89.5	2.76	158		100	

SDII Global Corporation

GH-1

Installed at 35 degree incline from horizontal

Depth Down-hole	Equivalent Vertical Depth	Grout Injected (Yards)	Strokes	Truck and Date - Notes	Max PSI	General Boring Log
156 - 158	89.5 - 90.6	1.89	108		100	
158 - 160	90.6 - 91.8	1.89	108		80-260	
160 - 162	91.8 - 92.9	0.23	13		400	
162 - 164	92.9 - 94.1	1.92	99\6		180	
164 - 166	94.1 - 95.2	1.84	100	Truck #2 - 3/22/11 (544 strokes)	100	Unknown - More resistant to drilling
166 - 168	95.2 - 96.4	1.84	100		100	
168 - 170	96.4 - 97.5	1.84	100		100	
170 - 172	97.5 - 98.7	4.95	95\145		80	
172 - 174	98.7 - 99.8	6.35	265	Truck #1 - 3/22/11 (417 strokes) - 31 used to prime line	200	
174 - 177	99.8 - 101.5	0.62	26		300	Unknown - Very resistant to drilling - hard
	Total Grout	59.86				

SDII Global Corporation

GH-2

Installed at 35 degree incline from horizontal

Depth Down-hole	Equivalent Vertical Depth	Grout Injected (Yards)	Strokes	Truck and Date - Notes	Max PSI	General Boring Log
0 - 85	0 - 48.8	1.92	96	Truck #1 - 3/24/11 (500 strokes estimated) - 6" casing to 123 feet. 3" casing sheared off below 136' - unable to advance GH further. Pulled all 3" prior to starting injection - 30 strokes to prime line	80-30	Waste - RLOC @ 73'
87 - 97	49.9 - 55.6					Very easy drilling - likely sand above liner
97 - 108	55.6 - 61.9					Unknown - likely clay/sand at top of liner
108 - 110	61.9 - 63.1	0.04	2		100	Grey Clay (liner) as identified by drill cuttings caked to inner drill string
110 - 112	63.1 - 64.2	0.06	3		110	
112 - 114	64.2 - 65.4	0.16	8		110	
114 - 116	65.4 - 66.5	0.04	2		100	
116 - 118	66.5 - 67.7	0.08	4		100	
118 - 120	67.7 - 68.8	0.12	6		100	
120 - 123	68.8 - 70.5	1.84	92		110	
123 - 136	70.5 - 78.0					Unknown - appeared to start to drill through grout at 126
	Total Grout	4.26				

SDII Global Corporation

GH-2A

Installed at 35 degree incline from horizontal - 3 feet north of GH-2

Depth Down-hole	Equivalent Vertical Depth	Grout Injected (Yards)	Strokes	Truck and Date - Notes	Max PSI	General Boring Log
0 - 85	0 - 48.8	0.62	30	Truck #5 - 3/29/11 (483 strokes)	100-360	Waste - RLOC @ 73'
87 - 97	49.9 - 55.6					Very easy drilling - likely sand above liner
97 - 102	55.6 - 58.5					Unknown - likely clay/sand at top of liner
102 - 104	58.5 - 59.7	0.04	2		200	
104 - 106	59.7 - 60.8	0.10	5		140	
106 - 108	60.8 - 61.9	0.23	11		130	Grey Clay (liner) as identified by drill cuttings caked to inner drill string from 106 to 123
108 - 110	61.9 - 63.1	0.12	6		120	
110 - 112	63.1 64.2	0.17	8		130	
112 - 114	64.2 65.4	0.48	23		130	
114 - 116	65.4 66.5	1.45	70		130	
116 - 118	66.5 67.7	1.33	64		140	
118 - 120	67.7 68.8	0.54	26		140	
120 - 122	68.8 70.0	6.01	90\200		140	
122 - 123	70.0 - 70.5	2.08	100	Truck #4- 3/29/11 (481 strokes) - 6" casing to 123 feet. Pulling 3" casing after 126. 34 strokes to prime 6" casing.	150	
123 - 126	70.5 - 72.3					Unknown - Minimal to no drilling resistance
126 - 128	72.3 - 73.4		41		300	
128 - 130	73.4 - 74.6	2.08	100		290	
130 - 132	74.6 - 75.7	2.08	100		280	
132 - 134	75.7 - 76.9	1.42	60\10		310	
134 - 136	76.9 - 78.0	1.72	85	Truck #3- 3/29/11 (493 strokes)	310	
136 - 138	78.0 - 79.2	2.03	100		300	
138 - 140	79.2 - 80.3	2.03	100		290	
140 - 142	80.3 - 81.4	2.03	100		290	
142 - 144	81.4 - 82.6	1.41	21\48		300	
144 - 146	82.6 - 83.7	3.25	158	Truck #2 - 3/29/11 (486 strokes)	310	
146 - 148	83.7 - 84.9	5.14	250		290	
148 - 150	84.9 - 86.0	0.35	17		310	
150 - 152	86.0 - 87.2	1.11	13\40		300	

SDII Global Corporation	GH-2A Installed at 35 degree incline from horizontal - 3 feet north of GH-2					
Depth Down-hole	**Equivalent Vertical Depth**	**Grout Injected (Yards)**	**Strokes**	**Truck and Date - Notes**	**Max PSI**	**General Boring Log**
152 - 154	87.2 - 88.3	0.38	17	Truck #1 - 3/29/11 (446 strokes) - 23 to prime	290	
154 - 156	88.3 - 89.5	2.29	102		270	
156 - 158	89.5 - 90.6	0.20	9		270	
158 - 160	90.6 - 91.8	0.54	24		270	
160 - 162	91.8 - 92.9	2.20	98		270	Unknown - More resistant to drilling
162 - 164	92.9 - 94.1	0.25	11		250	
164 - 166	94.1 - 95.2	0.94	42		250	
166 - 168	95.2 - 96.4	0.09	4		270	
168 - 170	96.4 - 97.5	1.23	55		250	
170 - 172	97.5 - 98.7	0.00	1		325	
172 - 174	98.7 - 99.8	0.02	1		300	Unknown - Very resistant to drilling - hard
174 - 177	99.8 - 101.5	1.03	46		250	
	Total Grout	46.99				

SDII Global Corporation

GH-3

Installed at 35 degree incline from horizontal

Depth Down-hole	Equivalent Vertical Depth	Grout Injected (Yards)	Strokes	Truck and Date - Notes	Max PSI	General Boring Log
0 - 93	0 - 53.3	1.00	50	Truck #2 - 3/25/11 (estimate 500 strokes) - 6" casing to 123 feet. Pulling 3" casing after 128. 35 strokes to prime 6" casing. Lost 35' of 88.9 casing and 25' of 5-1/2" casing	100-360	Waste - RLOC @ 83' regained for 3' @ 88' before RLOC again @ 91'
93 - 100	53.3 - 57.4					Very easy drilling - likely sand above liner
100 - 102	57.4 - 58.5					Unknown - likely clay/sand at top of liner
102 - 106	58.5 - 60.8	0.08	4		200	
106 - 109	60.8 - 62.5					Grey Clay (liner) as identified by drill cuttings caked to inner drill string from 106 to 123
109 - 113	62.5 - 64.8	0.32	16		200	
113 - 123	64.8 - 70.5	0.32	16		400	
123 - 128	70.5 - 73.4	0.08	4		400	Unknown - Minimal to no drilling resistance
128 - 134	73.4 - 76.9	0.02	1		400	
134 - 136	76.9 - 78.0	0.16	8		380	
136 - 138	78.0 - 79.2	2.10	105		280	
138 - 140	79.2 - 80.3	3.51	135\27		100	
140 - 142	80.3 - 81.4	5.48	250	Truck #1- 3/25/11 (456 strokes) - 34 to prime	90	
142 - 144	81.4 - 82.6	2.74	105\33		110	
144 - 146	82.6 - 83.7	2.88	150	Truck #5- 3/24/11 (520 strokes)	100	
146 - 148	83.7 - 84.9	4.33	225		90	
148 - 150	84.9 - 86.0	1.98	67\39		110	
150 - 152	86.0 - 87.2	1.96	107	Truck #4 - 3/24/11 (545 strokes)	120	
152 - 154	87.2 - 88.3	2.28	124		120	
154 - 156	88.3 - 89.5	1.93	105		120	
156 - 158	89.5 - 90.6	1.93	105		120	
158 - 160	90.6 - 91.8	5.03	223\37		100	
160 - 162	91.8 - 92.9	5.07	260	Truck #3 - 3/24/11 (513 strokes)	240	
162 - 164	92.9 - 94.1	0.06	3		300	
164 - 166	94.1 - 95.2	0.06	3		350	
166 - 168	95.2 - 96.4	0.02	1		360	Unknown - More resistant to drilling
168 - 170	96.4 - 97.5	0.34	11\6		360	
170 - 172	97.5 - 98.7	0.08	54	Truck #2 - 3/24/11 (501	360	

SDII Global Corporation	GH-3 Installed at 35 degree incline from horizontal					
Depth Down-hole	**Equivalent Vertical Depth**	**Grout Injected (Yards)**	**Strokes**	**Truck and Date - Notes**	**Max PSI**	**General Boring Log**
172 - 174	98.7 - 99.8	0.24	12	strokes) - 37 to prime	240	
174 - 176	99.8 - 100.9	2.99	150		280	
176 - 178	100.9 - 102.1	4.03	202		250	
178 - 181	102.1 - 103.8	0.70	35		300	Unknown - Very resistant to drilling - hard
	Total Grout	51.72				

SDII Global Corporation

GH-4A

Installed at 35 degree incline from horizontal - 12 feet south of original location of GH-5

Depth Down-hole	Equivalent Vertical Depth	Grout Injected (Yards)	Strokes	Truck and Date - Notes	Max PSI	General Boring Log
0 - 93	0 - 53.3	1.56	75	Truck #6 - 3/30/11 (Estimate 480 strokes)	100-360	Waste - RLOC between 80' and 83'
93 - 100	53.3 - 57.4					Very easy drilling - likely sand above liner
100 - 102	57.4 - 58.5	0.06	3		120	Unknown - likely clay/sand at top of liner
102 - 104	58.5 - 59.7	1.88	90		120	Likely clay liner - drilling a little more resistant but still easy to moderately resistant
104 - 106	59.7 - 60.8	1.46	70		140	
106 - 108	60.8 - 61.9	2.19	105		120	
108 - 112	61.9 - 64.2	2.15	103		200	
112 - 114	64.2 65.4	2.34	112	Truck #5 - 3/30/11 (478 strokes) Flushed at 118 d/t blockage - 20 strokes to reprime	150	
114 - 116	65.4 66.5	5.23	250		140	
116 - 118	66.5 67.7	1.84	88		300	
118 - 120	67.7 68.8	0.76	39	Truck #4- 3/30/11 (511 strokes) - 6" casing to 123 feet. Pulling 3" casing after 128. 13 strokes to prime 6" casing.	320	
120 - 122	68.8 70.0	2.05	105		210	
122 - 128	70.0 - 73.4	5.87	300		200	Unknown - Little to no resistance to drilling
128 - 134	73.4 - 76.9	0.04	2		400	
134 - 138	76.9 - 79.2	0.12	6		400	
138 - 140	79.2 - 80.3	2.17	55\55	Truck #3 - 3/30/11 (503 strokes) Flushed at 144 d/t blockage - 12 strokes to reprime	320	
140 - 142	80.3 - 81.4	2.19	110		300	
142 - 144	81.4 - 82.6	4.37	220		300	
144 - 146	82.6 - 83.7	2.11	106		300	
146 - 148	83.7 - 84.9	4.26	228	Truck #2 - 3/30/11 (535 strokes)Flushed at 150 d/t blockage - 15 strokes to reprime	310	
148 - 150	84.9 - 86.0	4.73	253		310	
150 - 152	86.0 - 87.2	1.52	39\39	Truck #1 - 3/30/11 (496 strokes) - 31 to prime	300	Unknown - More resistant to drilling
152 - 154	87.2 - 88.3	0.48	24		300	
154 - 156	88.3 - 89.5	0.06	3		340	
156 - 158	89.5 - 90.6	2.12	105		280	
158 - 160	90.6 - 91.8	0.12	6		300	
160 - 162	91.8 - 92.9	2.18	108		290	

SDII Global Corporation	GH-4A Installed at 35 degree incline from horizontal - 12 feet south of original location of GH-5					
Depth Down-hole	**Equivalent Vertical Depth**	**Grout Injected (Yards)**	**Strokes**	**Truck and Date - Notes**	**Max PSI**	**General Boring Log**
162 - 164	92.9 - 94.1	1.13	56		290	
164 - 166	94.1 - 95.2	1.63	81		300	Unknown - Very resistant to drilling - hard
166 - 168	95.2 - 96.4	0.08	4		290	
168 - 170	96.4 - 97.5	0.18	9		280	
170 - 173	97.5 - 99.2	0.60	30		280	
	Total Grout	57.48				

SDII Global Corporation

GH-5

Installed at 35 degree incline from horizontal - Installed 1 foot south of its original location @ midpoint between GH-3 and GH-4A

Depth Down-hole	Equivalent Vertical Depth	Grout Injected (Yards)	Strokes	Truck and Date - Notes	Max PSI	General Boring Log
0 - 93	0 - 53.3	2.02	101	Truck #6 - 4/1/11 (Estimate 500 strokes - 480 strokes used)	100-400	Waste - RLOC between 73' and 83'
93 - 100	53.3 - 57.4					Very easy drilling - likely sand above liner
100 - 102	57.4 - 58.5	0.12	6		200	Unknown - likely clay/sand at top of liner
102 - 104	58.5 - 59.7	0.46	23		130	Likely clay liner - drilling a little more resistant but still easy to moderately resistant - regained circulation @ 103'. RLOC again at 112'
104 - 106	59.7 - 60.8	0.60	30		130	
106 - 108	60.8 - 61.9	0.60	30		125	
108 - 110	61.9 - 63.1	0.60	30		120	
110 - 112	63.1 64.2	0.60	30		115	
112 - 114	64.2 65.4	0.60	30		120	
114 - 116	65.4 66.5	0.60	30		110	
116 - 118	66.5 67.7	2.00	100		100	
118 - 120	67.7 68.8	2.17	37\70		110	
120 - 122	68.8 70.0	2.18	105	Truck #5 - 4/1/11 (482 strokes)	100	
122 - 128	70.0 - 73.4	6.22	300		100	Unknown - Little to no resistance to drilling - able to push 3-1/2" casing 7 feet out of 6" casing with wash only until resistance was encountered
128 130	73.4 74.6	0.65	35	Truck #4- 4/1/11 (537 strokes) - 6" casing to 123 feet. Pulling 3" casing after 128. 40 strokes to prime 6" casing.	270	
130 - 132	74.6 - 75.7	1.96	105		270	
132 - 134	75.7 - 76.9	1.96	105		250	
134 - 136	76.9 - 78.0	1.96	105		260	
136 138	78.0 79.2	2.98	160		260	
138 - 140	79.2 - 80.3	2.14	89\27		270	
140 - 142	80.3 - 81.4	1.93	105	Truck #3 - 4/1/11 (545 strokes) Flushed at 150 d/t blockage - 13 strokes to reprime	270	
142 - 144	81.4 - 82.6	1.93	105		260	
144 - 146	82.6 - 83.7	1.93	105		280	
146 - 148	83.7 - 84.9	1.93	105		280	
148 - 150	84.9 - 86.0	0.20	11		400	
150 - 152	86.0 - 87.2	0.22	12		400	Unknown - More resistant to drilling fluctuation to easy drilling in between.
152 - 154	87.2 - 88.3	0.23	12	Truck #2 - 4/1/11 (524 strokes)	325	
154 - 156	88.3 - 89.5	4.79	251		225	

SDII Global Corporation	GH-5 Installed at 35 degree incline from horizontal - Installed 1 foot south of its original location @ midpoint between GH-3 and GH-4A					
Depth Down-hole	**Equivalent Vertical Depth**	**Grout Injected (Yards)**	**Strokes**	**Truck and Date - Notes**	**Max PSI**	**General Boring Log**
156 - 158	89.5 - 90.6	4.77	250		220	
158 - 160	90.6 - 91.8	1.97	91\11		310	
160 - 162	91.8 - 92.9	1.74	90		310	
162 - 164	92.9 - 94.1	1.54	80		305	
164 - 166	94.1 - 95.2	2.03	105	Truck #1 - 4/1/11 (518 strokes) - 36 to prime	300	Unknown - Very resistant to drilling - hard
166 - 168	95.2 - 96.4	1.18	61		310	
168 - 170	96.4 - 97.5	0.35	18		310	
170 - 173	97.5 - 99.2	0.71	37		300	
	Total Grout	57.87				

SDII Global Corporation

GH-6

Installed at 35 degree incline from horizontal

Depth Down-hole	Equivalent Vertical Depth	Grout Injected (Yards)	Truck and Date	Max PSI	General Boring Log
0 - 97	0 - 55.6	2.17	Truck #6 3/15/11 (Estimated 248 strokes for 5 yds)	40	Waste
97 - 99	55.6 - 56.8				Yellow Sand
99 - 111	56.8 - 63.7				Grey Clay (liner)
111 - 113	63.7 - 64.8	0.92		50	Grey Clay (liner) RLOC @ 113
113 - 122	64.8 - 70.0				Unknown but relatively easy drilling
122 - 124	70.0 - 71.1	0.88	Truck #5 3/15/11 (510 strokes)	100	
124 - 126	71.1 - 72.3	1.88		80	
126 - 128	72.3 - 73.4	1.88		100	
128 - 130	73.4 - 74.6	1.88		100	
130 - 132	74.6 - 75.7	2.64		100	
132 - 134	75.7 - 76.9	1.91	Truck #4 3/15/11 (502 strokes)	100	
134 - 136	76.9 - 78.0	1.91		100	
136 - 138	78.0 - 79.2	1.91		280	
138 - 140	79.2 - 80.3	1.91		280	
140 - 142	80.3 - 81.4	1.91		250	
142 - 144	81.4 - 82.6	1.78	Truck #3 3/15/11 (487 strokes)	250	
144 - 146	82.6 - 83.7	1.89		250	
146 - 148	83.7 - 84.9	1.89		250	
148 - 150	84.9 - 86.0	1.89		250	
150 - 152	86.0 - 87.2	1.89		250	
152 - 154	87.2 - 88.3	1.88	Truck #2 3/15/11 (484 strokes)	250	
154 - 156	88.3 - 89.5	1.82		50	
156 - 158	89.5 - 90.6	1.82		50	
158 - 160	90.6 - 91.8	1.82		50	
160 - 162	91.8 - 92.9	1.82		180	
162 - 164	92.9 - 94.1	1.82		180	
164 - 166	94.1 - 95.2	1.96	Truck #1 3/15/11 (448 strokes)	180	
166 - 168	95.2 - 96.4	1.34		200	
168 - 170	96.4 - 97.5	1.34		200	

SDII Global Corporation	GH-6 Installed at 35 degree incline from horizontal				
Depth Down-hole	**Equivalent Vertical Depth**	**Grout Injected (Yards)**	**Truck and Date**	**Max PSI**	**General Boring Log**
170 - 172	97.5 - 98.7	1.34		200	
172 - 174	98.7 - 99.8	1.34		210	
174 - 176	99.8 - 100.9	3.34		230	
176 - 178	100.9 - 102.1	0.2		600	
178 - 180	102.1 - 103.2	2.42		250	
180 - 182	103.2 - 104.4	0.04		300	
182 - 184	104.4 - 105.5	0.02	Truck #1 3/14/11 - Grout pipe plugged at depth - Need to pull and redrill	300	
184 - 186	105.5 - 106.7	0.02		350	
186 - 188	106.7 - 107.8	0.02		350	Unknown but drilling slightly more resistant
188 - 190	107.8 - 109.0	0.12		350	
190 - 192	109.0 - 110.1	0.04		400	
192 - 194	110.1 - 111.3	0.12		400	
194 - 196	111.3 - 112.4	0.02		500	
196 - 198	112.4 - 113.6	0.02		500	
198 - 200	113.6 - 114.7	0.02		500	
200 - 202	114.7 - 115.9	0.02		500	
202 - 204	115.9 - 117.0	0.02	Truck #1 3/11/11 6" Casing sticking - Rig cannot pull easily - Need to pull and redrill	500	Unknown but drilling more resistant
204 - 206	117.0 - 118.2	0.02		500	
206 - 208	118.2 - 119.3	0.02		500	
208 - 210	119.3 - 120.4	0.02		400	
210 - 212	120.4 - 121.6	0.06		400	
212 - 215	121.6 - 123.3	0.87		400	
	Total Grout	56.87			

SDII Global Corporation

GH-7

Installed at 35 degree incline from horizontal

Depth Down-hole	Equivalent Vertical Depth	Grout Injected (Yards)	Truck and Date	Max PSI	General Boring Log
0 - 95	0 - 54.5	2.30	Truck #1 3/18/11 (525 strokes)	300	Waste
95 - 102	54.5 - 58.5				Waste but easy drilling - some sand
102 - 103	58.5 - 59.1				Grey Clay (liner)
103 - 111	59.1 - 63.7	0.08		200	
111 - 123	63.7 - 70.5	0.19		180	
123 - 125	70.5 - 71.7	0.08		200	Greenish Grey Clay/Clayey sand - Trace limestone -No LOC
125 - 127	71.7 - 72.8	0.15		200	
127 - 129	72.8 - 74.0	0.19		160	
129 - 131	74.0 - 75.1	0.19		180	
131 - 133	75.1 - 76.3	0.19		200	Brown Sandy Clay - Very Soft - SLOC @ 135
133 - 135	76.3 - 77.4	0.30		300	
135 - 137	77.4 - 78.6	0.38		310	
137 - 139	78.6 - 79.7	1.98		280	
139 - 141	79.7 - 80.9	1.98		200	
141 - 143	80.9 - 82.0	1.91		200	
143 - 145	82.0 - 83.2	1.88	Truck #8 3/17/11 (552 strokes)	160	
145 - 147	83.2 - 84.3	1.88		110	
147 - 149	84.3 - 85.5	1.88		110	
149 - 151	85.5 - 86.6	1.92		180	
151 - 153	86.6 - 87.8	1.93		210	Greenish Grey clay with trace phosphate - Minimal drilling resistance
153 - 155	87.8 - 88.9	2.05	Truck #7 3/17/11 (527 strokes)	110	
155 - 157	88.9 - 90.1	2.09		180	
157 - 159	90.1 - 91.2	2.05		210	
159 - 161	91.2 - 92.3	2.05		200	
161 - 163	92.3 - 93.5	2.10		200	
163 - 165	93.5 - 94.6	2.13		200	
165 - 167	94.6 - 95.8	2.58	Truck #6 3/17/11 (507 strokes)	180	RLOC at 165
167 - 169	95.8 - 96.9	2.13		200	Unknown - Minimal to no drilling resistance
169 - 171	96.9 - 98.1	2.49		220	

SDII Global Corporation

GH-7

Installed at 35 degree incline from horizontal

Depth Down-hole	Equivalent Vertical Depth	Grout Injected (Yards)	Truck and Date	Max PSI	General Boring Log
171 - 173	98.1 - 99.2	2.01	Truck #4 3/17/11 (538 strokes)	90	
173 - 175	99.2 - 100.4	2.01		160	
175 - 177	100.4 - 101.5	2.01		180	
177 - 179	101.5 - 102.7	2.01		200	
179 - 181	102.7 - 103.8	1.97	Truck #3 (547 strokes) + 24 strokes from truck 2 which was returned - out of spec	220	
181 - 183	103.8 - 105.0	1.83		240	
183 - 185	105.0 - 106.1	1.96		200	
185 - 187	106.1 - 107.3	1.83		300	
187 - 189	107.3 - 108.4	1.83		280	
189 - 191	108.4 - 109.6	1.85	Truck #1-3/17/11 (527 strokes)	250	
191 - 193	109.6 - 110.7	1.57		260	
193 - 195	110.7 - 111.8	3.80		260	
195 - 197	111.8 - 113.0	3.80		260	Unknown - More resistant to drilling
197 - 198	113.0 - 113.6				Unknown - Very resistant to drilling - hard
	Total Grout	67.56			

Truck #2 rejected - 7.25" inch slump at 81 degrees

Truck #5 rejected - 2" slump at 87 degrees

SDII Global Corporation

GH-8

Installed at 35 degree incline from horizontal

Depth Down-hole	Equivalent Vertical Depth	Grout Injected (Yards)	Truck and Date	Max PSI	General Boring Log
0 - 93	0 - 53.3	2.04	Truck #7 3/18/11 (540 strokes - est.)		Waste
89 - 91	51.0 - 52.2				White Sand
91 - 93	52.2 - 53.3				Brown Clay
93 - 103	53.3 - 59.1				Grey Clay (liner)
103 105	59.1 60.2	0.11		160	
105 107	60.2 61.4	0.06		160	
107 109	61.4 62.5	0.15		160	
109 111	62.5 63.7	0.13		180	
111 113	63.7 64.8	0.31		200	
113 - 120	64.8 68.8	0.69		180	
120 - 123	68.8 - 70.5				Brown Clayey sand/sandy clay SLOC @ 120'
123 - 128	70.5 - 73.4	0.08		300	
128 - 136	73.4 - 78.0	0.06		300	RLOC @ 135'
136 - 138	78.0 - 79.2	0.15		400	Unknown - Minimal to no resistance to drilling
138 - 140	79.2 - 80.3	0.65		300	
140 - 142	80.3 - 81.4	1.48		220	
142 - 144	81.4 - 82.6	1.94		260	
144 - 146	82.6 - 83.7	0.84	Truck #6 3/18/11 (530 strokes)	400	
146 - 148	83.7 - 84.9	1.98		100	
148 - 150	84.9 - 86.0	1.98		180	
150 - 152	86.0 - 87.2	1.89		240	
152 - 154	87.2 - 88.3	1.98		260	
154 - 156	88.3 - 89.5	1.97	Truck #5 3/18/11 (544 strokes)	300	
156 - 158	89.5 - 90.6	1.93		90	
158 - 160	90.6 - 91.8	1.93		70	
160 - 162	91.8 - 92.9	1.93		80	
162 - 164	92.9 - 94.1	1.93		80	
164 - 166	94.1 - 95.2	1.94		100	
166 - 168	95.2 - 96.4	1.88	Truck #4 3/18/11 (558 strokes)	100	Unknown - Moderate Resistance to drilling

SDII Global Corporation	GH-8 Installed at 35 degree incline from horizontal				
Depth Down-hole	**Equivalent Vertical Depth**	**Grout Injected (Yards)**	**Truck and Date**	**Max PSI**	**General Boring Log**
168 - 170	96.4 - 97.5	3.58		40	Unknown - Minimal to no resistance to drilling
170 - 172	97.5 - 98.7	3.76		100	
172 - 174	98.7 - 99.8	1.91		100	
174 - 176	99.8 - 100.9	1.91	Truck #3 3/18/11 (549 strokes)	70	
176 - 178	100.9 - 102.1	1.91		80	
178 - 180	102.1 - 103.2	1.91		80	
180 - 182	103.2 - 104.4	1.91		100	
182 - 184	104.4 - 105.5	3.94		280	
184 - 186	105.5 - 106.7	3.99		310	
186 - 188	106.7 - 107.8	1.50	Truck #2-3/18/11 (526 strokes)	310	Unknown - More resistant to drilling
188 - 190	107.8 - 109.0	0.36		310	
190 - 193	109.0 - 110.7	0.64		305	Unknown - Very Resistant to drilling
	Total Grout	57.35			

SDII Global Corporation

GH-9

Installed at 35 degree incline from horizontal

Depth Down-hole	Equivalent Vertical Depth	Grout Injected (Yards)	Strokes	Truck and Date	Max PSI	General Boring Log
0 - 95	0 - 54.5	1.58	82	Truck #6 - 3/21/11 (260 strokes - 5 yds) 61 stokes to prime lines and 6" casing	100-350	Waste
93 - 97	53.3 - 55.6					Waste but easy drilling (preceded by 5 to 10 feet of very resistant drilling
97 - 102	55.6 - 58.5					
102 - 103	58.5 - 59.1	0.46	24		100	
103 - 104	59.1 - 59.7					Grey Clay (liner)
104 - 106	59.7 - 60.8	0.12	6		200	
106 - 108	60.8 - 61.9	0.35	18		90	
108 - 110	61.9 - 63.1	0.50	26		90	
110 - 112	63.1 - 64.2	0.83	43		90	
112 - 114	64.2 - 65.4	0.12	6	Truck #5 - 3/21/11 (505 strokes)	160	
114 - 116	65.4 - 66.5	0.30	15		160	
116 - 118	66.5 - 67.7	0.65	33		110	
118 - 120	67.7 - 68.8	0.18	9		120	
120 - 122	68.8 - 70.0	0.89	45		110	
122 - 124	70.0 - 71.1	1.52	77		85	Greenish Grey Clay/Clayey sand - Roots -No LOC
124 - 126	71.1 - 72.3	3.47	175		75	
126 - 128	72.3 - 73.4	2.40	121		100	
128 - 130	73.4 - 74.6	0.06	3		240	
130 - 132	74.6 - 75.7	0.02	1		300	Brown Sandy Clay/Clayey Sand - Very Soft - SLOC @ 125 - 6" casing to 133' bls, RLOC @145'
132 - 134	75.7 76.9	0.02	1		300	
134 - 136	76.9 - 78.0	0.02	1		320	
136 - 138	78.0 - 79.2	0.04	2		380	
138 - 140	79.2 - 80.3	0.04	2		300	
140 - 142	80.3 - 81.4	0.02	1		400	
142 - 144	81.4 - 82.6	0.02	1		400	
144 - 146	82.6 - 83.7	0.16	8		340	
146 - 148	83.7 - 84.9	4.51	244	Truck #4 3/21/11 (541 strokes)	90	Unknown - Minimal to no drilling resistance
148 - 150	84.9 - 86.0	3.70	200		100	

SDII Global Corporation

GH-9

Installed at 35 degree incline from horizontal

Depth Down-hole	Equivalent Vertical Depth	Grout Injected (Yards)	Strokes	Truck and Date	Max PSI	General Boring Log
150 - 152	86.0 - 87.2	2.39	34\97		110	
152 - 154	87.2 - 88.3	1.90	108		110	
154 - 156	88.3 - 89.5	1.90	108	Truck #3 3/21/11 (567 strokes)	100	
156 - 158	89.5 - 90.6	1.90	108		100	
158 - 160	90.6 - 91.8	1.90	108		100	
160 - 162	91.8 - 92.9	1.95	9\101		140	
162 - 164	92.9 - 94.1	2.01	109		160	
164 - 166	94.1 - 95.2	1.95	106	Truck #2 3/21/11 (543 strokes)	180	
166 - 168	95.2 - 96.4	1.95	106		120	
168 - 170	96.4 - 97.5	1.95	106		120	
170 - 172	97.5 - 98.7	4.97	158\107		180	
172 - 174	98.7 - 99.8	3.49	184		300	
174 - 176	99.8 - 100.9	2.43	128		320	
176 - 178	100.9 - 102.1	0.02	1		380	
178 - 180	102.1 - 103.2	0.02	1		380	
180 - 182	103.2 - 104.4	0.11	6	Truck #1 3/21/11 (527 strokes) - 35 strokes to prime	380	
182 - 184	104.4 - 105.5	0.04	2		400	
184 - 186	105.5 - 106.7	0.08	4		380	Unknown - More resistant to drilling
186 - 188	106.7 - 107.8	0.06	3		400	
188 - 190	107.8 - 109.0	0.09	5		320	
190 - 191	109.0 - 109.6					Unknown - Very resistant to drilling - hard
	Total Grout	53.09				