ROADWAY PROJECTS WITH FOCUS ON SUBSURFACE / DRAINAGE & LITIGATION-RELATED ISSUES

Florida Association of County Engineers and Road Superintendents (FACERS)

2011 FACERS Annual Conference

Presented by:

- Devo Seereeram, Ph.D., P.E.
  Devo Engineering

FACERS
Florida Association of County Engineers & Road Superintendents

When: Wednesday June 22nd 2011
Where: Hilton Orlando Bonnet Creek

DEVO Engineering
CONSULTING GEOTECHNICAL ENGINEERS

Discussion Topics:

1.0 PAVEMENT DISTRESS

1.1 - Low Pavement Grades & High Groundwater
1.2a - High Groundwater Artificially Raised by Over Irrigation (Main Road)
1.2b - High Groundwater Artificially Raised by Over Irrigation (Subdivision)
1.3 - High Tailwater in Stormwater System or Constricted Outfall
1.4 - Embankment Washout Due to Storm-Induced Wave Action
1.5 - Buried Muck Compressing During Extreme Drought
1.6 - Corroding Sand-shell-cement Base
1.7 - Cracking of Soil-Cement Base

2.0 WIDENING OF ROADWAY EMBANKMENT

2.1 - Widening Fill Embankments Without Box-cut

3.0 ROADWAY-ASSOCIATED STORMWATER FACILITES

3.1 - Flooding Associated with Land-locked Systems
3.2 - Seepage Through Pond Berms
3.3 - Water Table Mounding from Ponds Affecting Roads & Offsite Property
3.4 - Pipe Joint Opening Due to Muck Subgrade

Discussion Topics (cont'd):

4.0 UNUSUAL PROBLEMS

4.1 - Relic Horizontal Sock Drain Causing "Inexplicable Spring"

4.2 - Strong Seepage Across Road Causing Subgrade Movement Due to Barrier Caused by Large Diameter Pipe

4.3 - Perched Water Table Due to Low Permeability Fill

5.0 MAJOR SINKHOLES AFFECTING COUNTY ROAD

5.1 - Sinkholes on roadways

5.2 - Sinkholes in ponds

6.0 STORM & SANITARY SEWER/MANHOLE ISSUES

6.1 - Soil-loss in manholes

6.2 - Dumping loose fill around the sediment removal structure & hydroconsolidation of loosely placed sand backfill

7.0 OTHER DISCUSSION ITEMS

7.1 - Crushed concrete base – those counties with aggressive sidewalk rehab programs can recycle

7.2 - Reinforcement in asphalt overlays to increase SN

Topic 1.1

Low Pavement Grades & High Groundwater

Community Area - Reflections Subdivision in Ocoee

Photo date: 2000 (during drought)

Community Area - Reflections Subdivision in Ocoee

Photo date: 2000 (during drought)

Cool Spring Circle - Reflections Subdivision in Ocoee

Photo date: 2000 (during drought)

Econ River Estates in East Orange County

Photo date: 2000 (during drought)

Topic 1.2a

High Groundwater Artificially Raised by Over Irrigation (Main Road)

Central Florida Parkway

Photo date: 2005

Hiawassee Road

Photo date: 2005

Hiawassee Road

Photo date: 2005

Hiawassee Road

Photo date: 2005

Topic 1.2b

High Groundwater Artificially Raised by Over Irrigation (Subdivision)

Infrastructure failure from reclaimed water overirrigation - Country Club

Leaching Over Curb

Infrastructure failure from reclaimed water overirrigation - Country Club

Leaching Over Curb

Infrastructure failure from reclaimed water overirrigation - Country Club

Leaching Over Curb

Infrastructure failure from reclaimed water overirrigation - Country Club

Leaching Over Curb

Infrastructure failure from reclaimed water overirrigation - Country Club

Limerock Pumping From Base

Infrastructure failure from reclaimed water overirrigation - Country Club

Pavement Distress

Topic 1.3

High Tailwater in Stormwater System or Constricted Outfall

Pond NWL and Pavement Grade Separation - Waterford Chase

Pond NWL and Pavement Grade Separation - Waterford Chase

Pond NWL and Pavement Grade Separation - Waterford Chase

Topic 1.4

Embankment Washout Due to Storm-Induced Wave Action

CR 561 Clermont

Photo date: 2004 (Hurricane Jeanne)

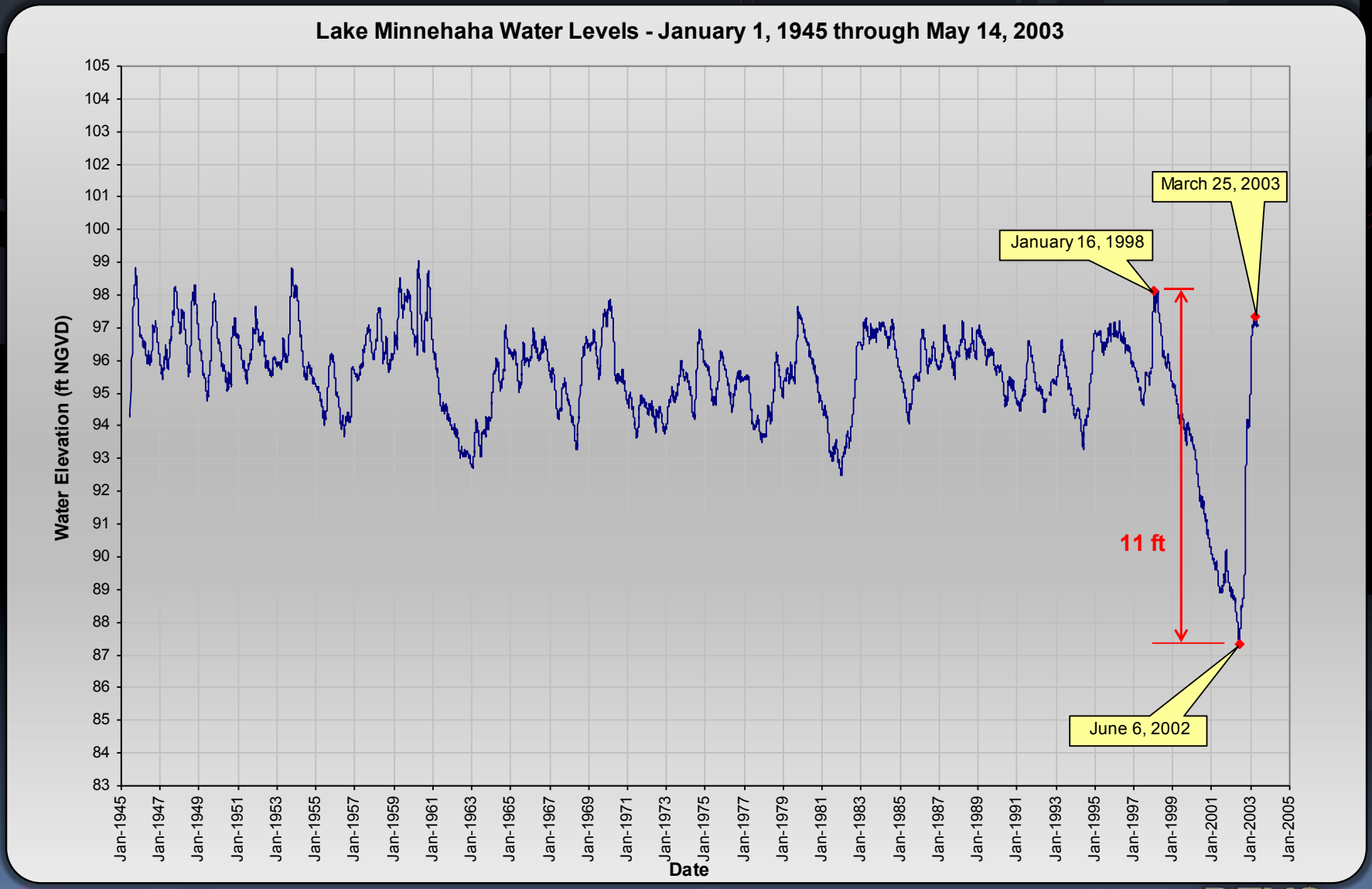
CR 561 Clermont

Photo date: 2004 (Hurricane Jeanne)

Topic 1.5

Buried Muck Compressing During Extreme Drought

Clermont Chain of Lakes – Lake Minnehaha



Country Road 561

Pavement Distress

Country Road 561

Pavement Distress

Country Road 561

Continued pavement distress after patch

Country Road 561

Geogrid installation during repair

Country Road 561

Finished product

Country Road 561

Finished Product

Lake Pleasant Road

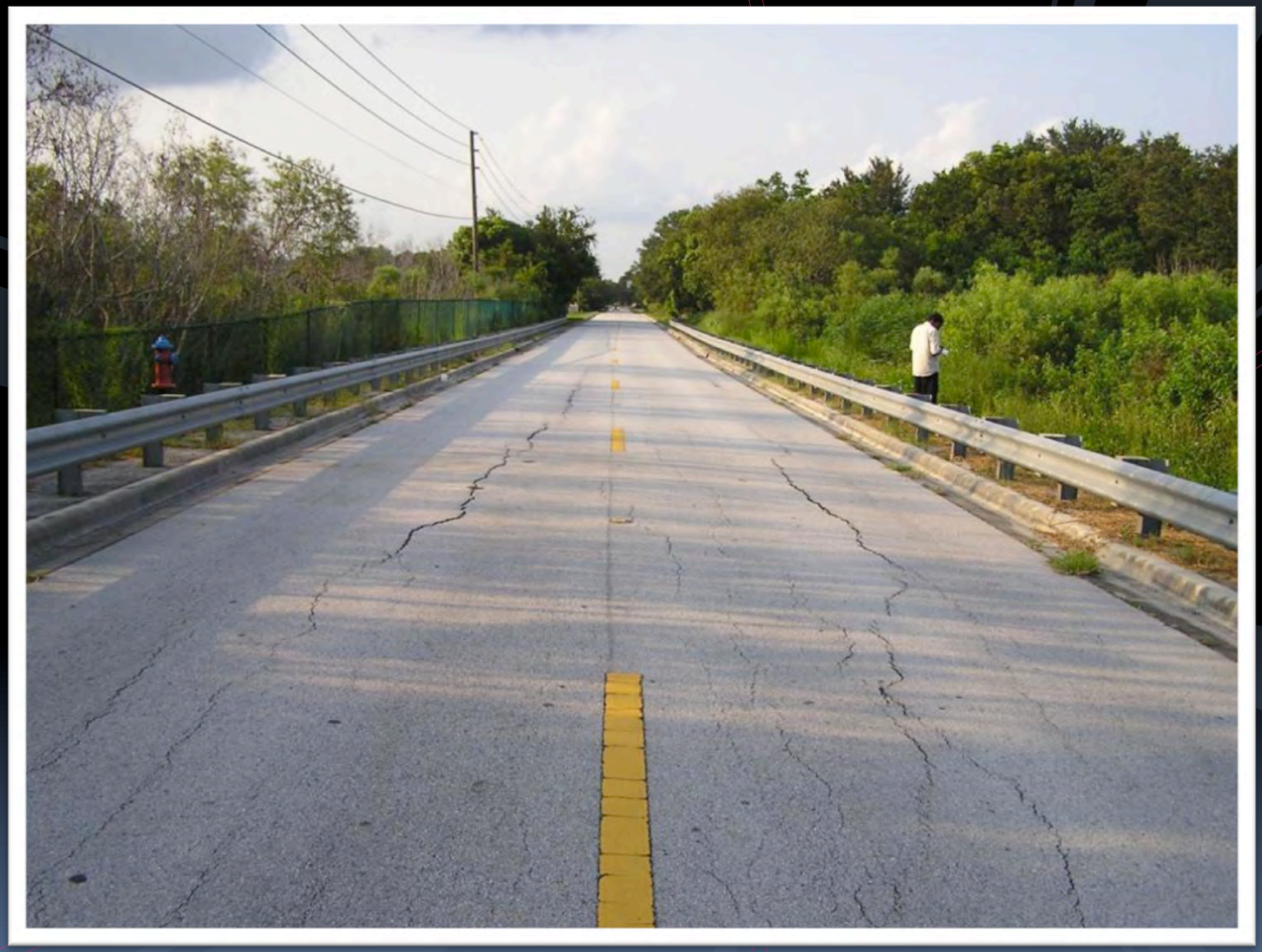
Lake Pleasant Road

Distress Photos

Lake Pleasant Road

Distress Photos

Lake Pleasant Road

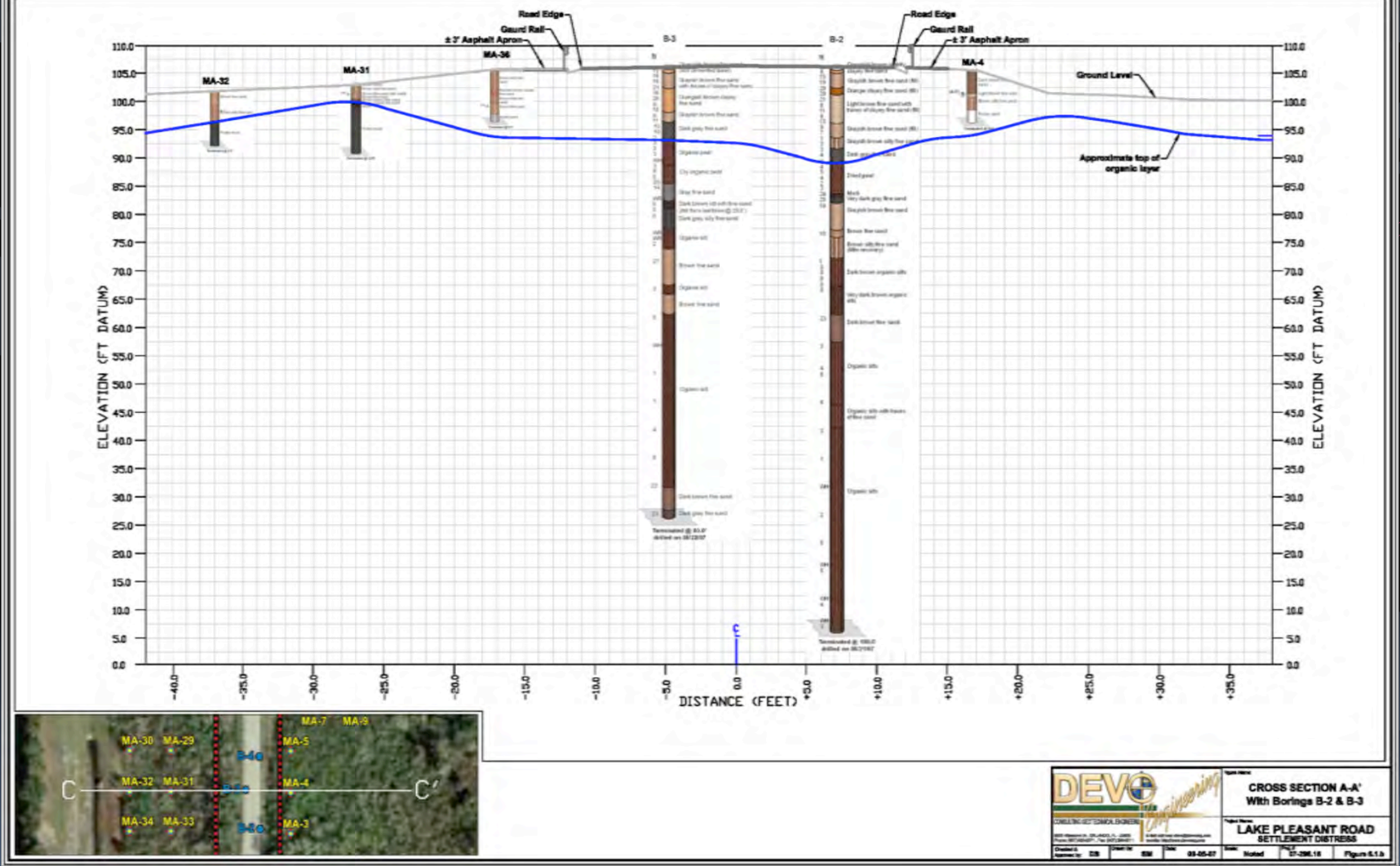


Distress Photos

Lake Pleasant Road

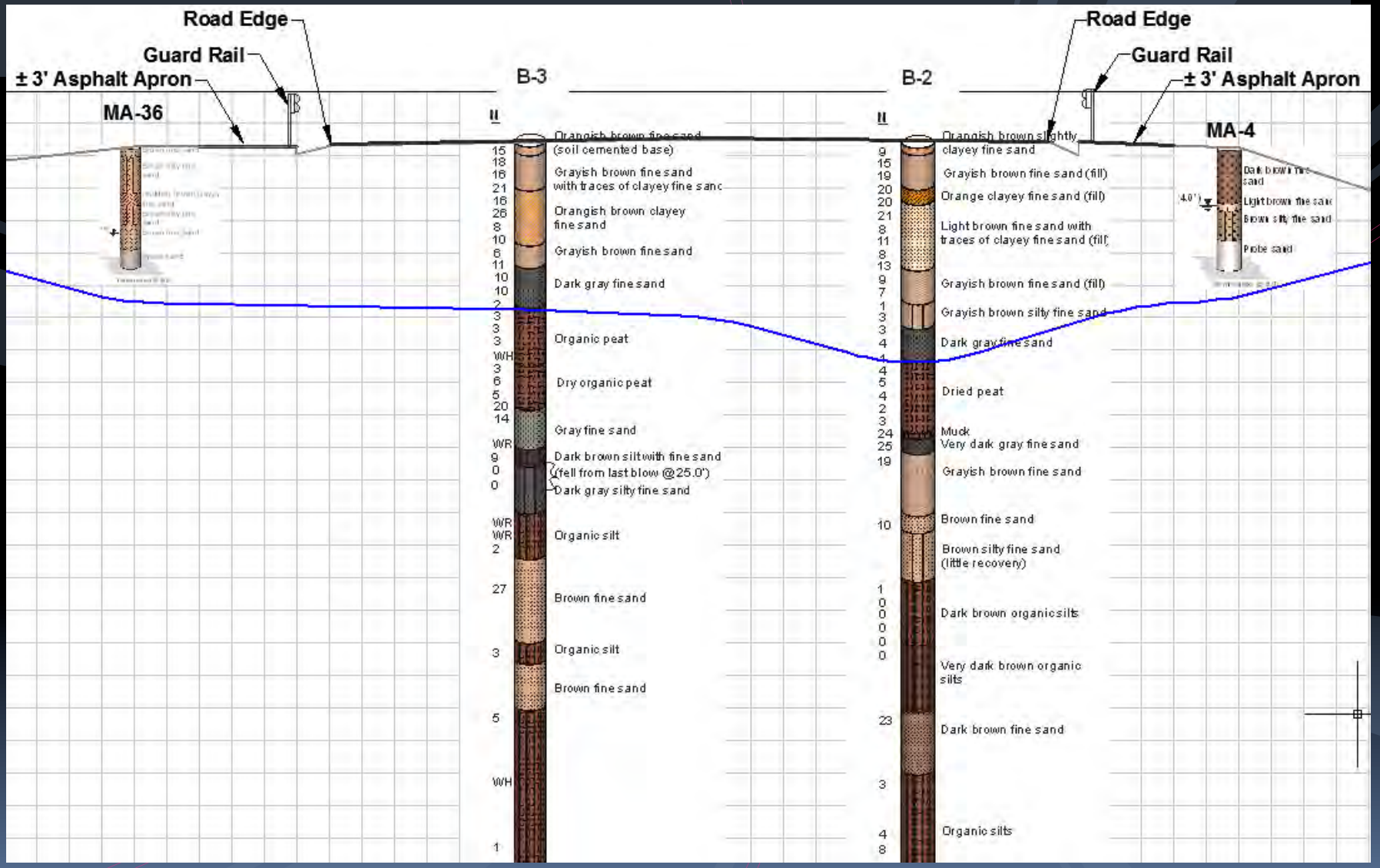
Investigation Photos

Lake Pleasant Road



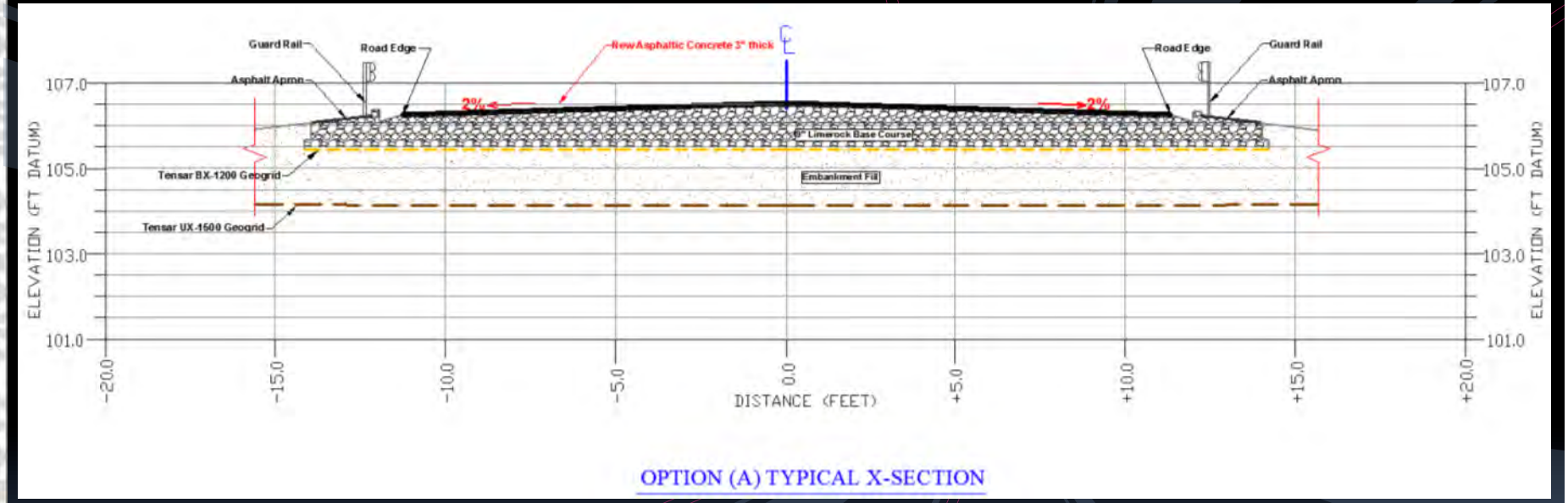
Cross Section

Lake Pleasant Road



Cross Section

Lake Pleasant Road



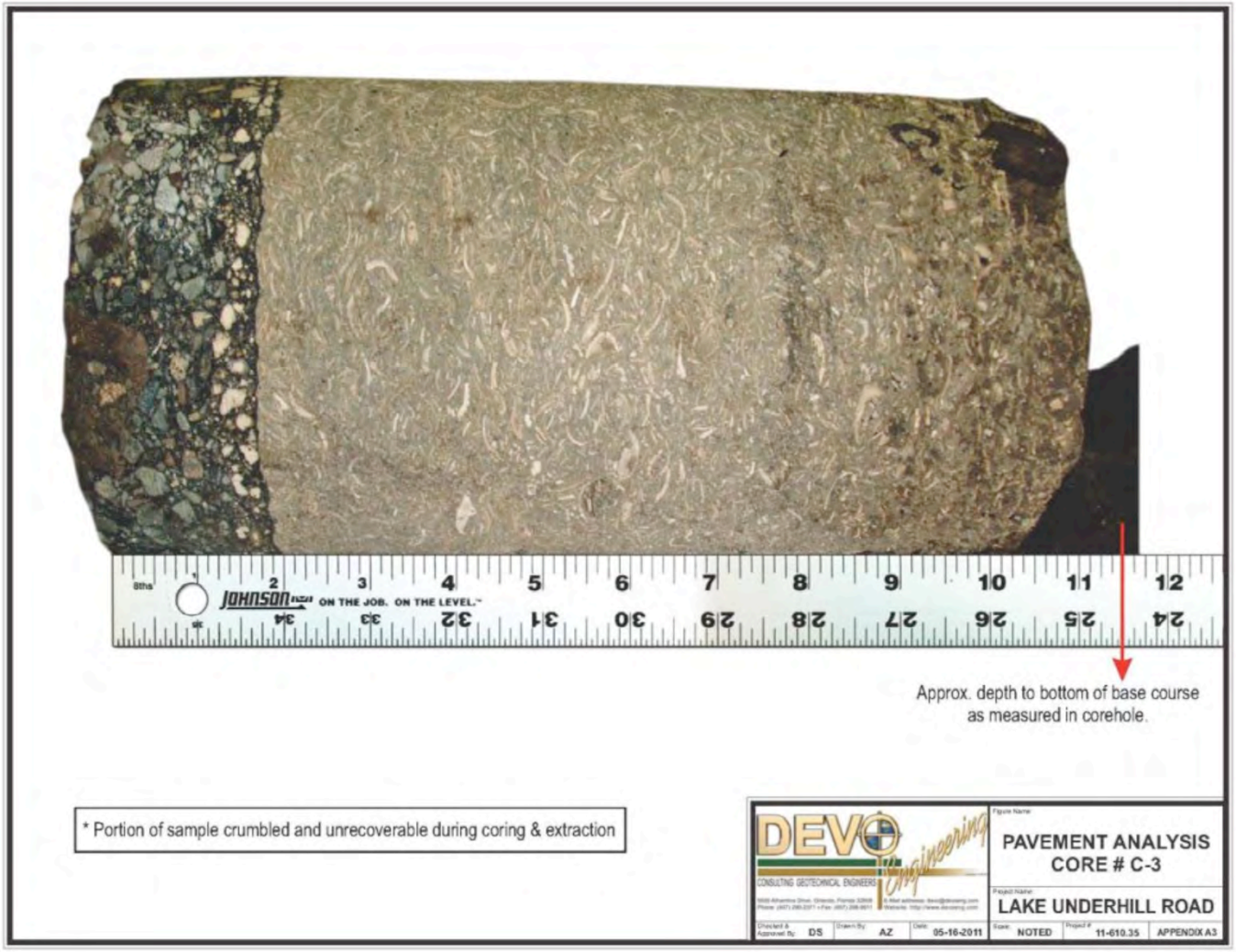
OPTION (A) TYPICAL X-SECTION

Cross Section

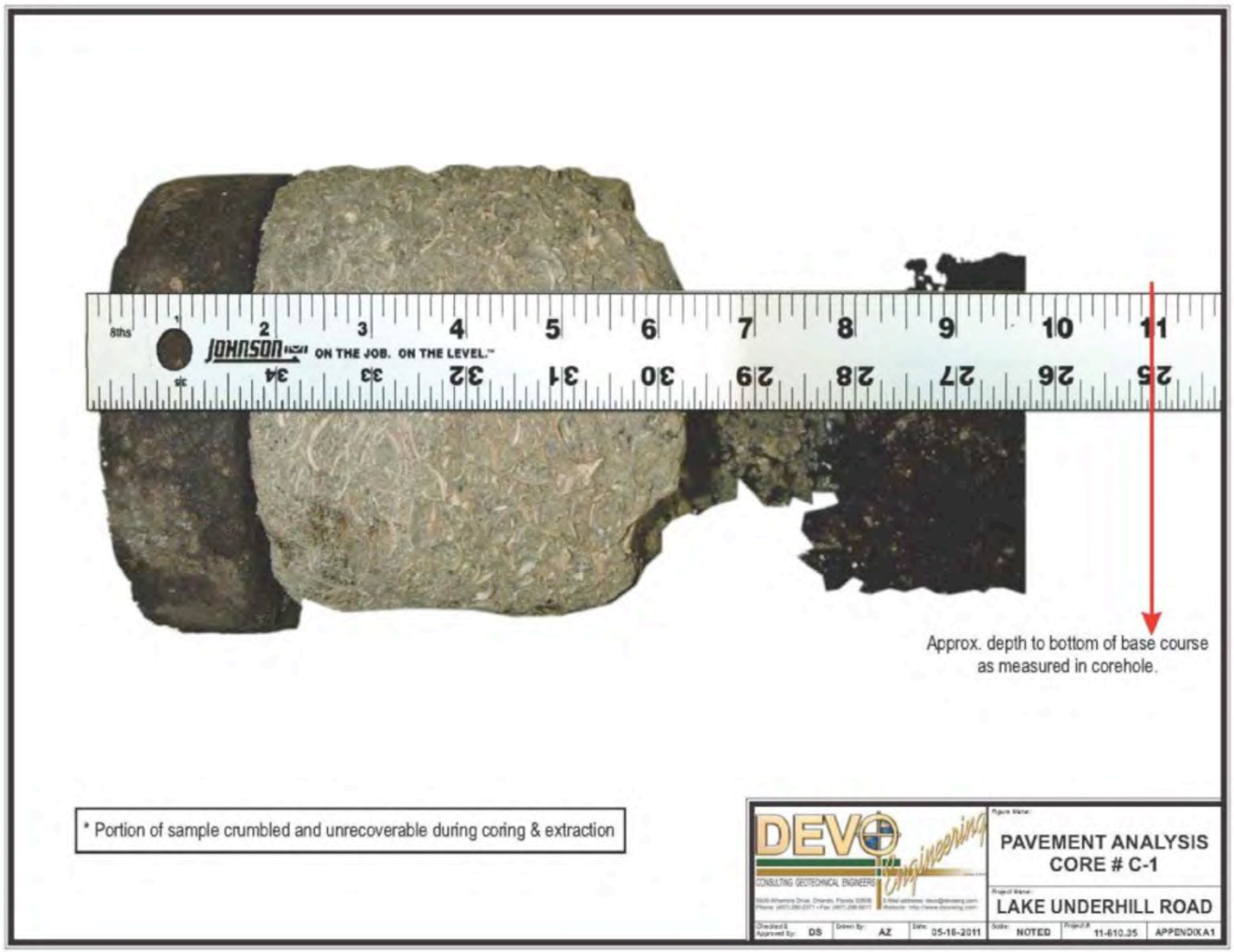
Topic 1.6

Corroding Sand-Shell-Cement Base

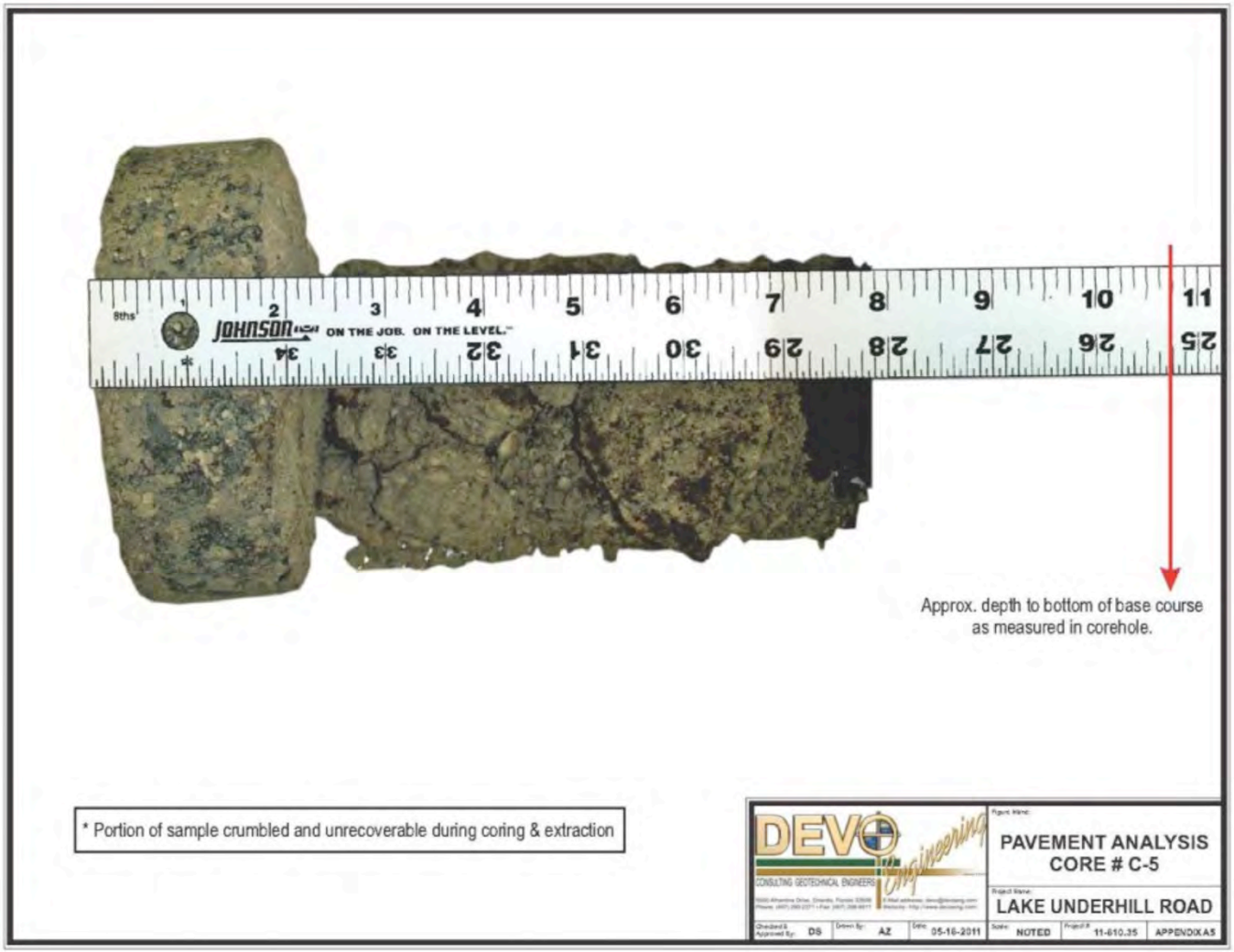
Lake Underhill Road



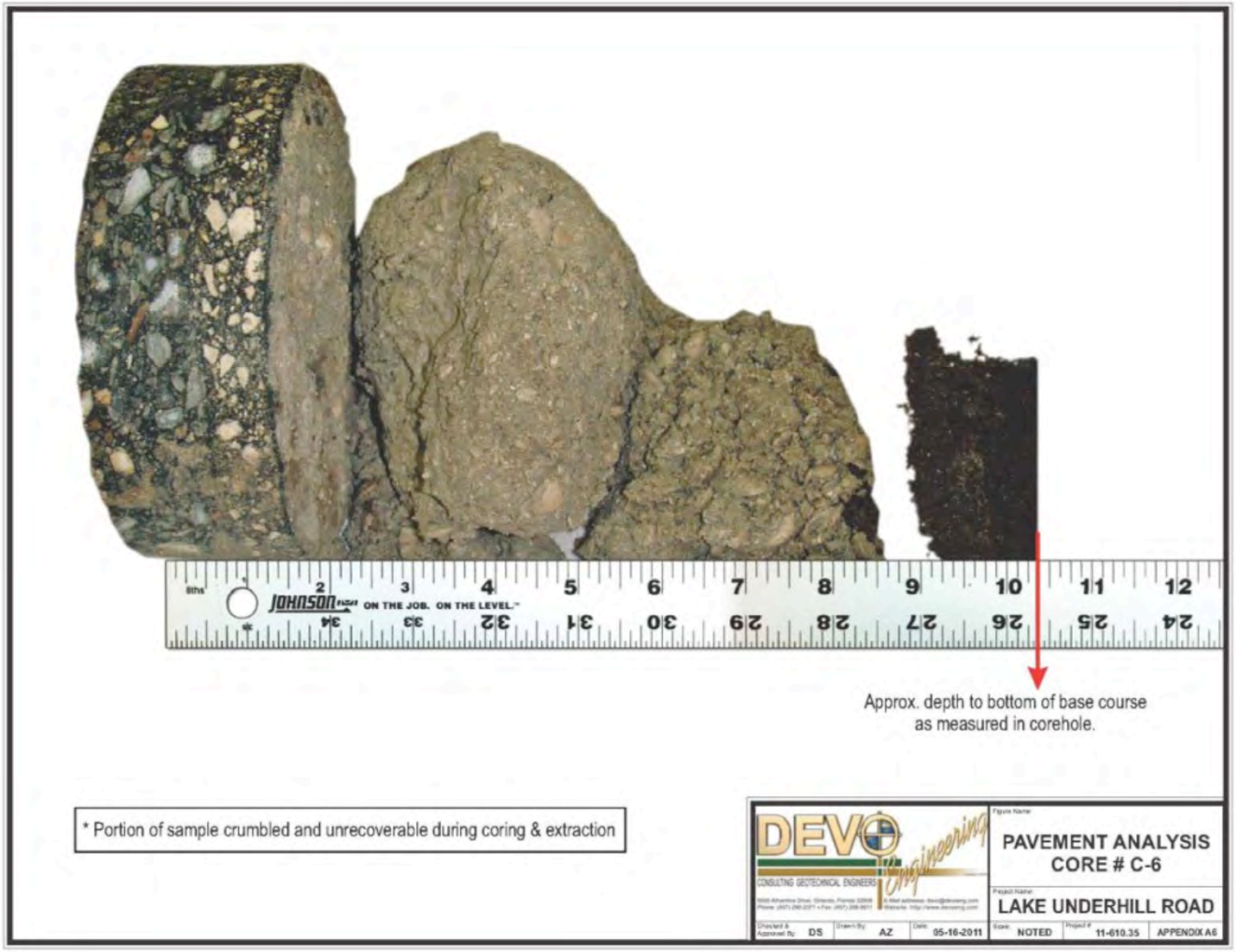
Lake Underhill Road



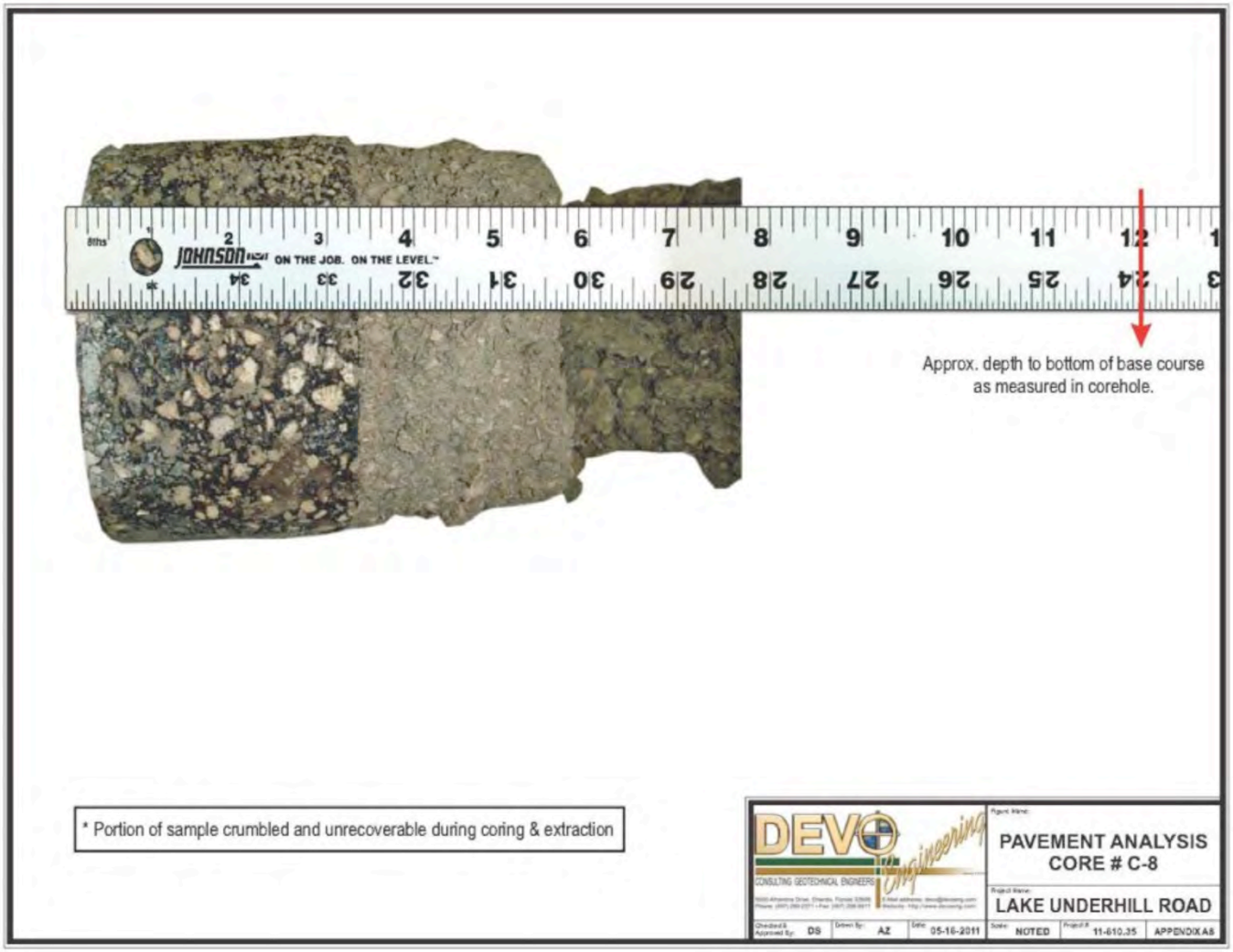
Lake Underhill Road



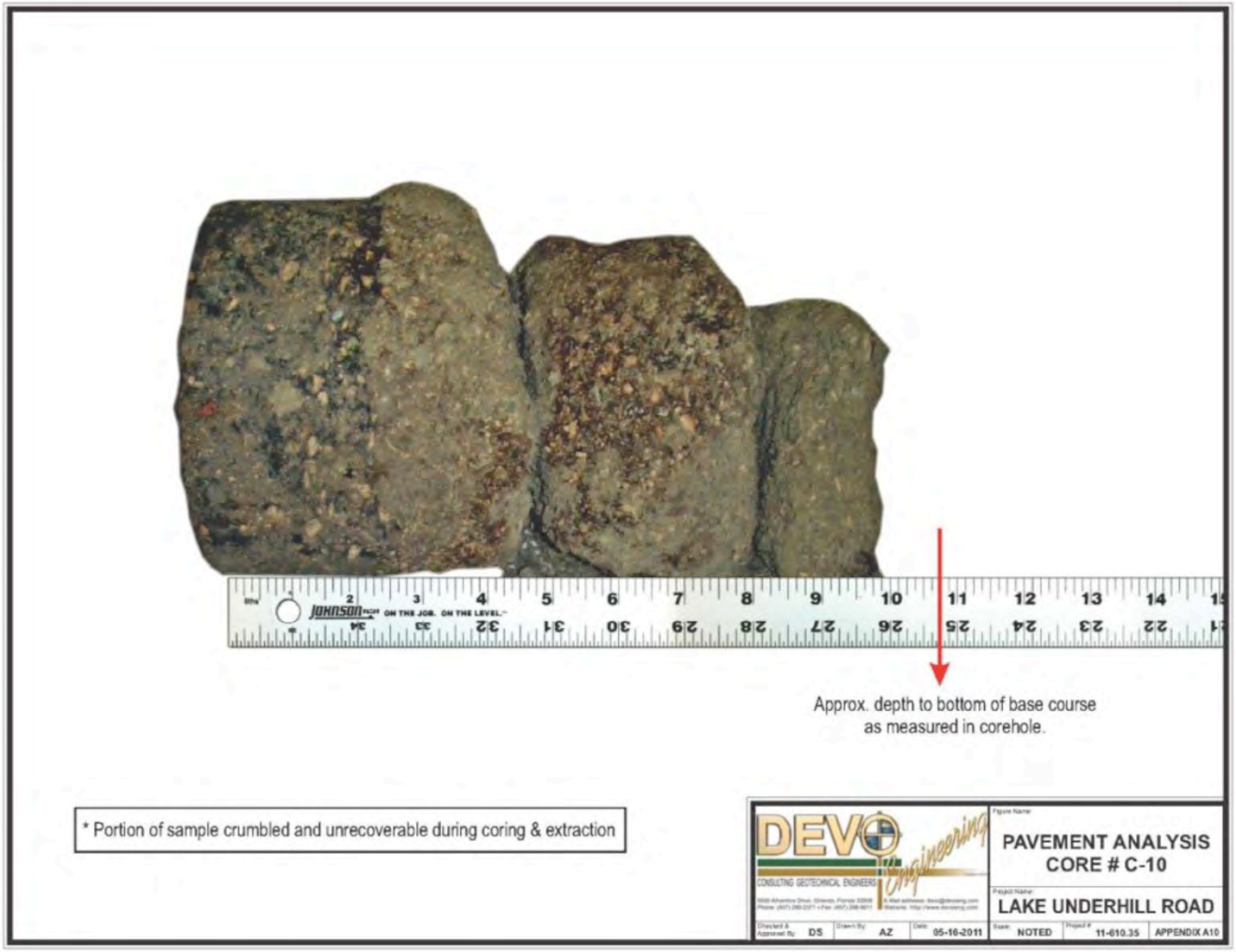
Lake Underhill Road



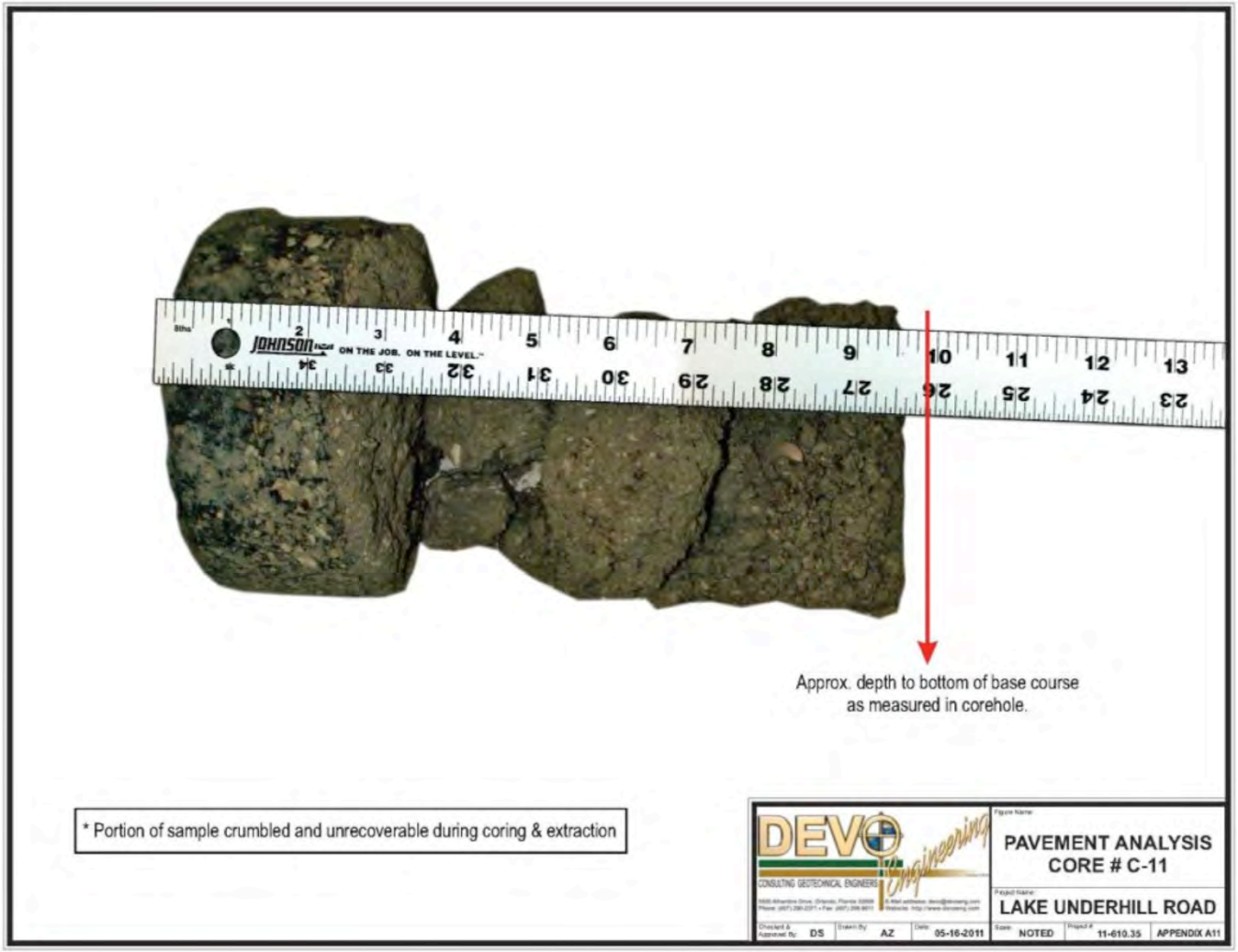
Lake Underhill Road



Lake Underhill Road



Lake Underhill Road



Lake Underhill Road

* Portion of sample crumbled and unrecoverable during coring & extraction

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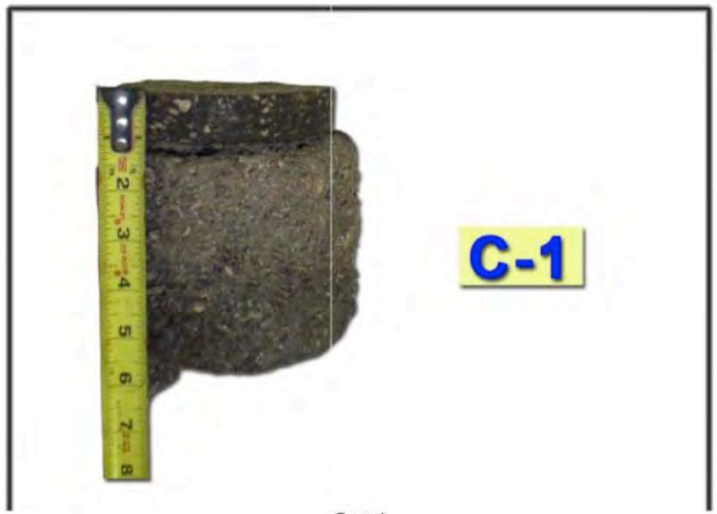
PAVEMENT ANALYSIS
CORE # C-12

LAKE UNDERHILL ROAD

Checked & Approved By:	Drawn By:	Date	Scale:	Project #	
DS	AZ	05-16-2011	NOTED	11-610.35	APPENDIX A12

Waterford Chase



Core-1

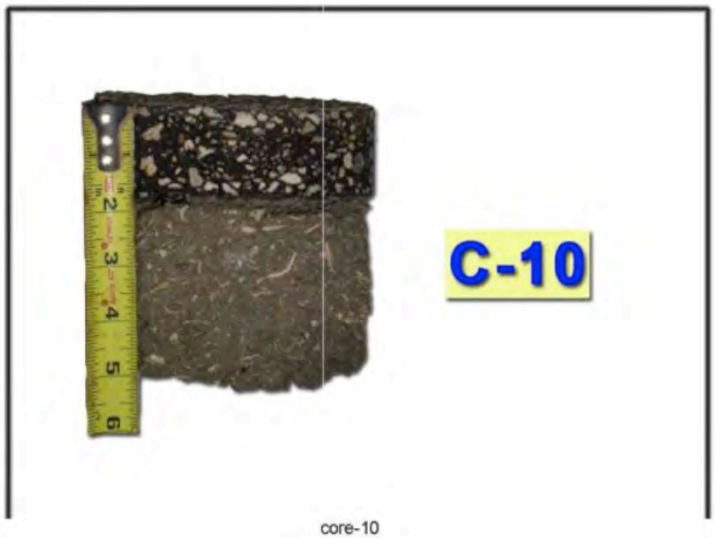
core-2

Waterford Chase

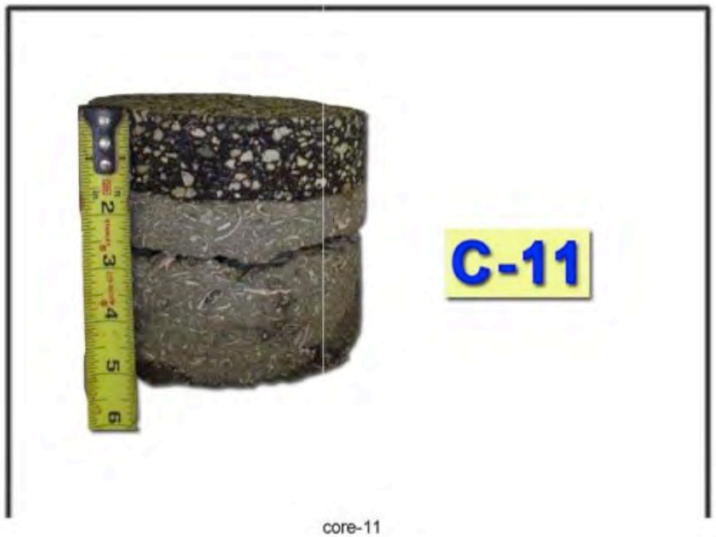
core-3

core-4

Waterford Chase



core-10



core-11

Waterford Chase

core-18

core-19

Waterford Lakes

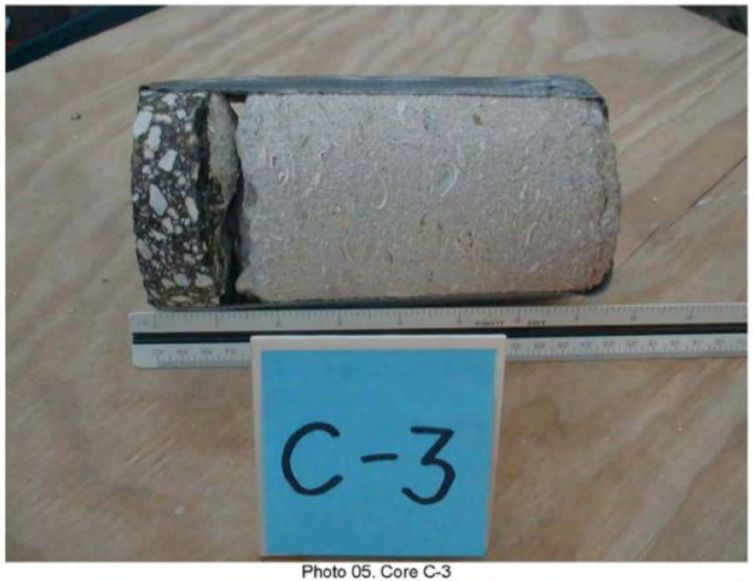


Photo 05. Core C-3

Photo 06. Core C-3

Waterford Lakes

Photo 15. Core C-8

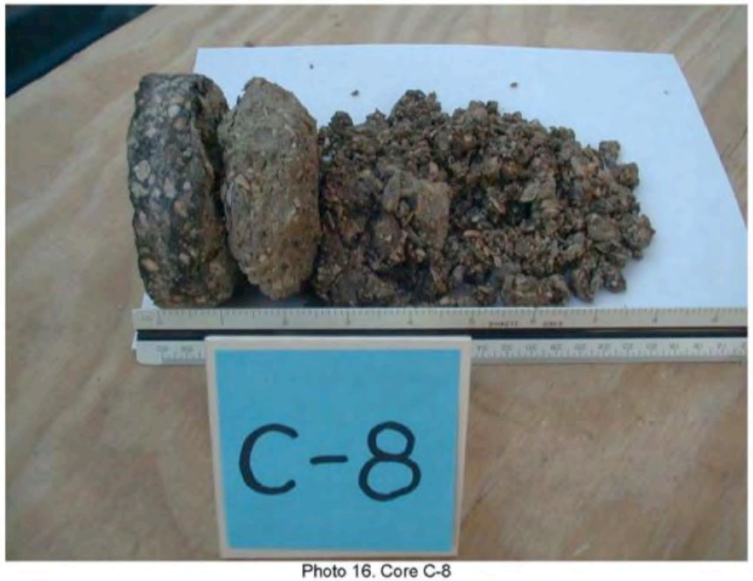


Photo 16. Core C-8

Waterford Lakes

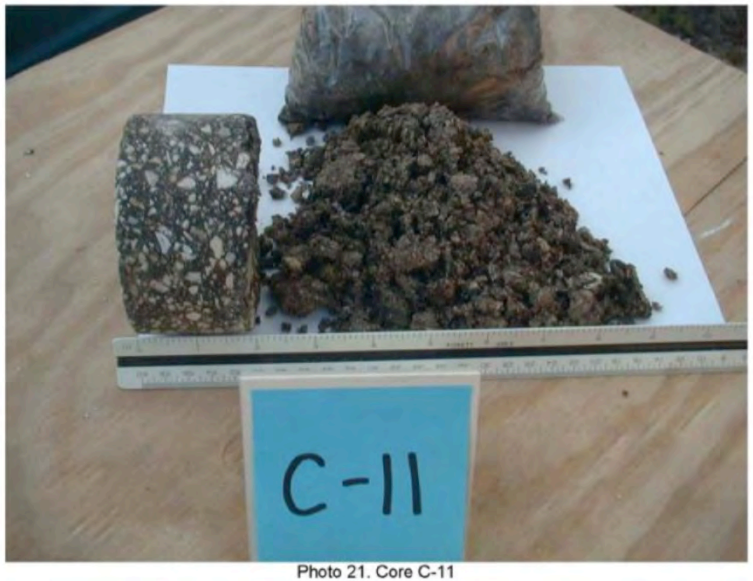


Photo 21. Core C-11

Photo 22. Core C-11

Waterford Lakes

Photo 23. Core C-12

Photo 24. Core C-12

Topic 1.7

Cracking of Soil-Cement Base

Compass Bay

Compass Bay

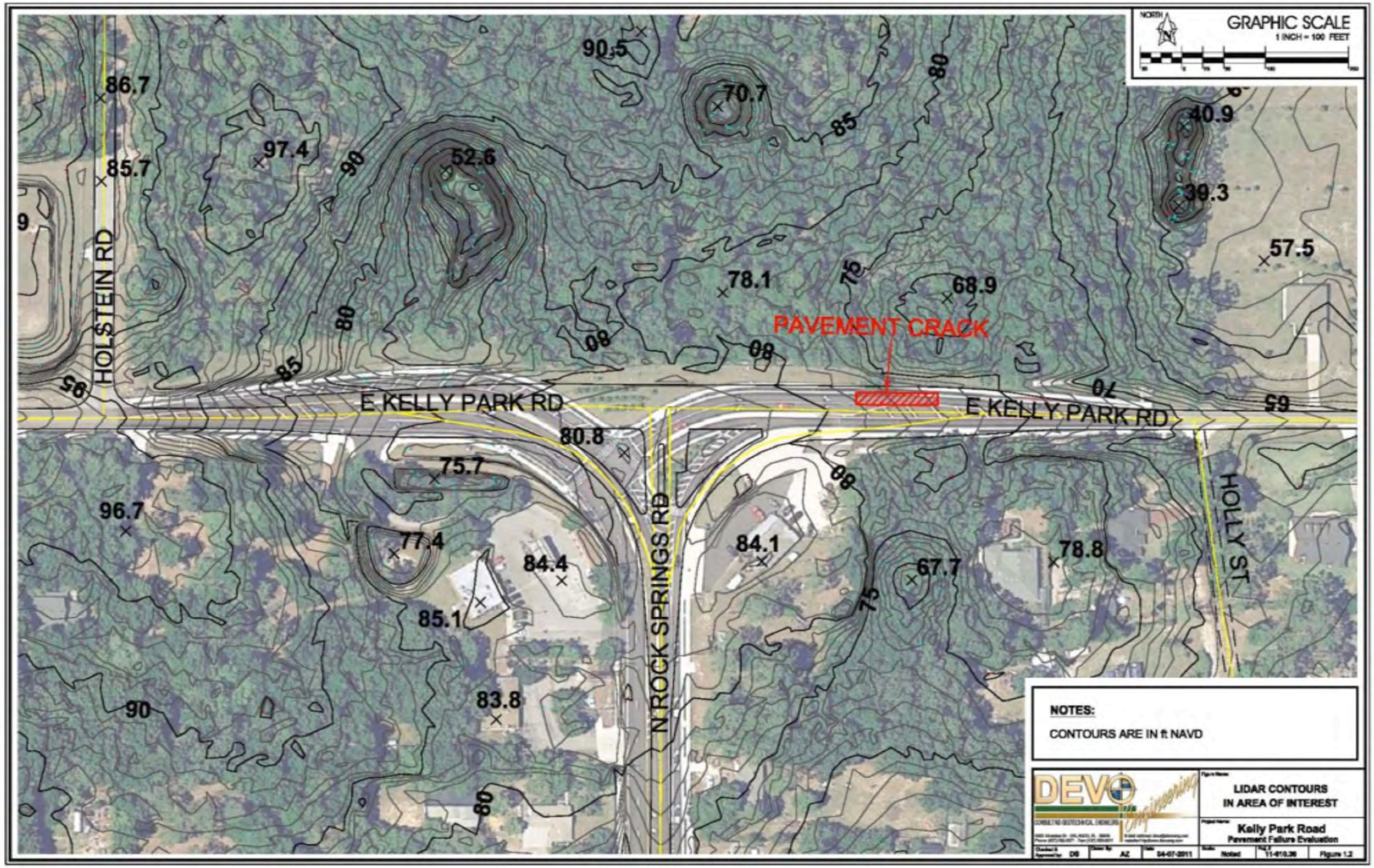
Compass Bay

Compass Bay

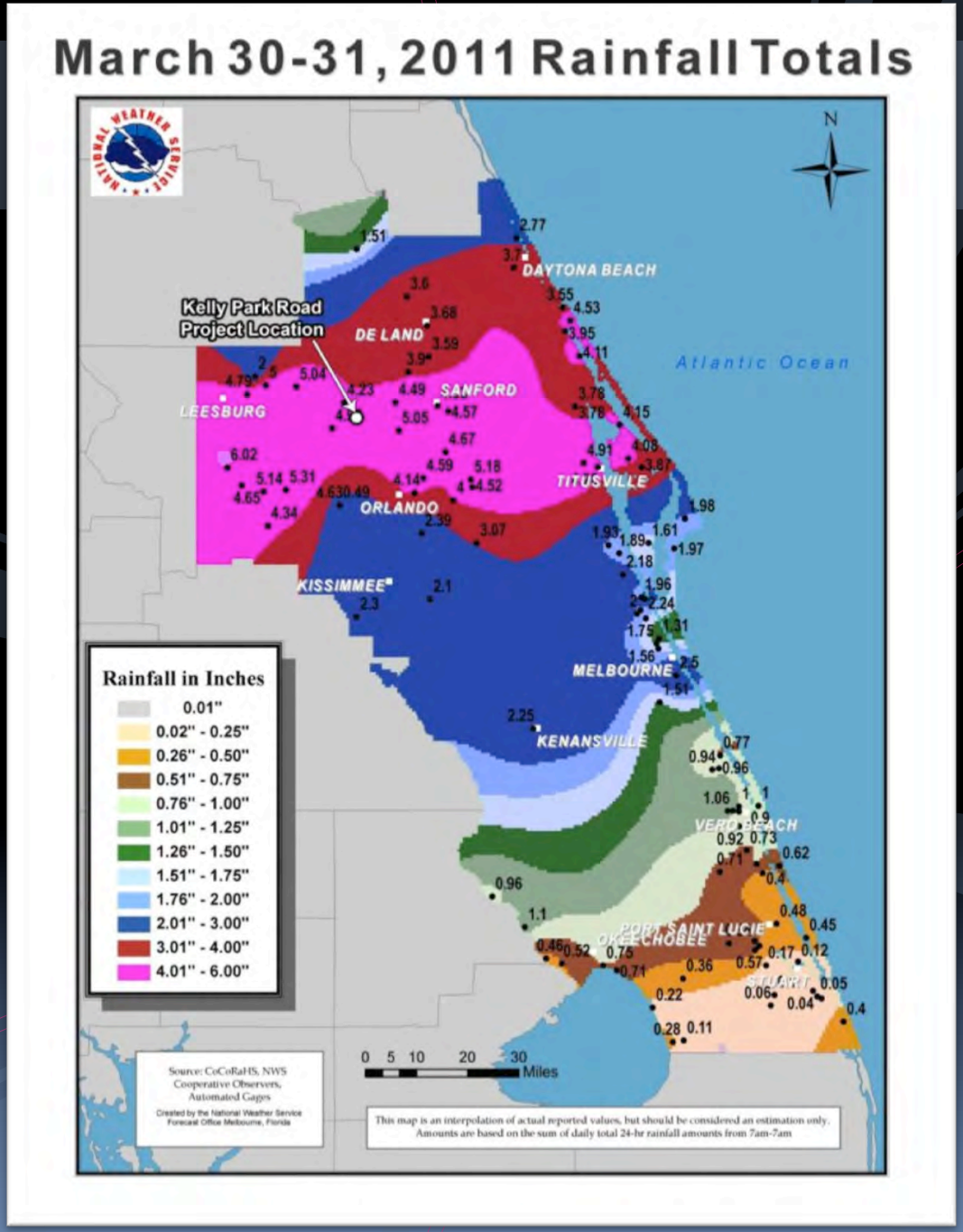
Topic 2.1

Widening Fill Embankments Without Box-cut

Kelly Park Road Widening



Kelly Park Road Widening



Kelly Park Road Widening

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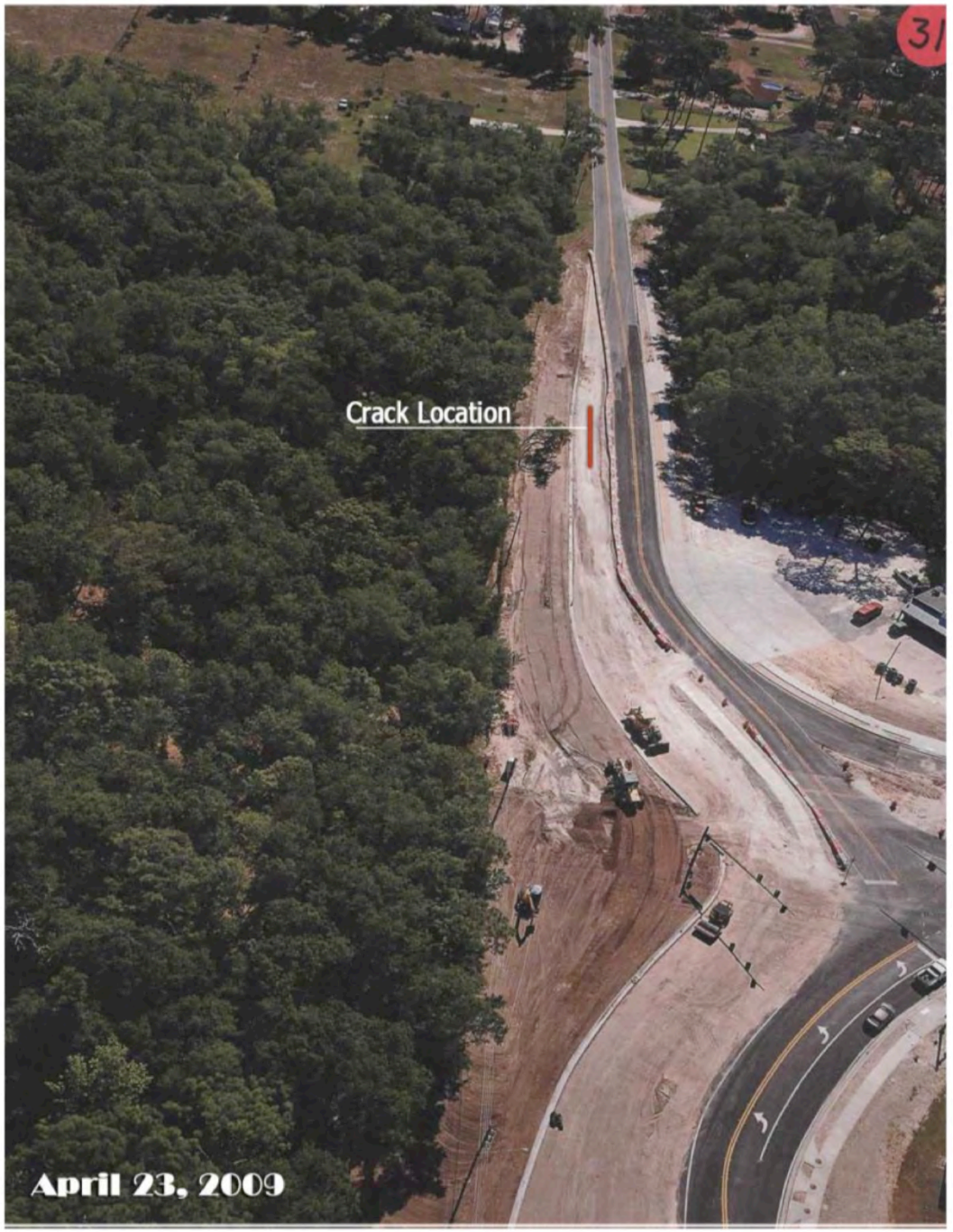
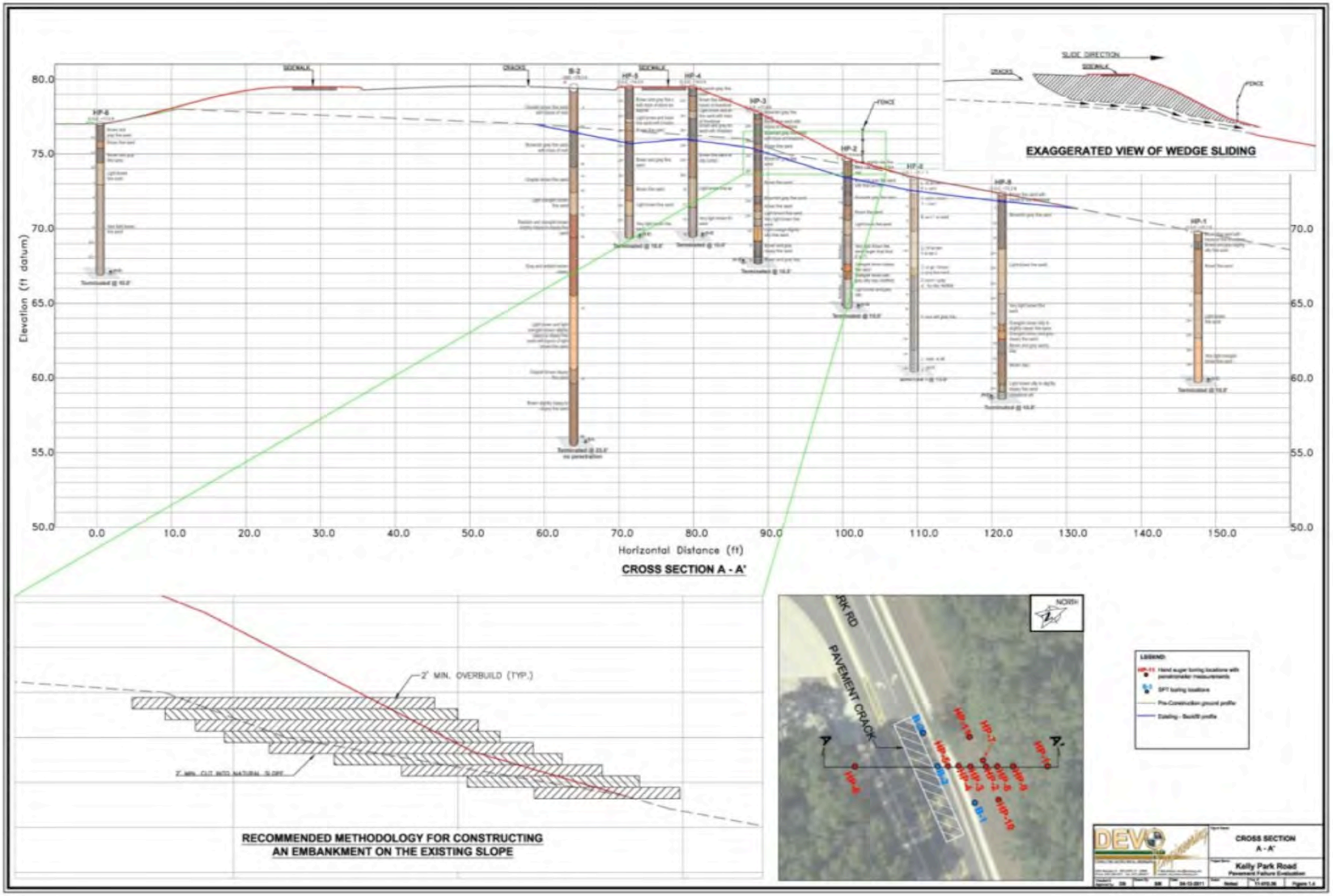
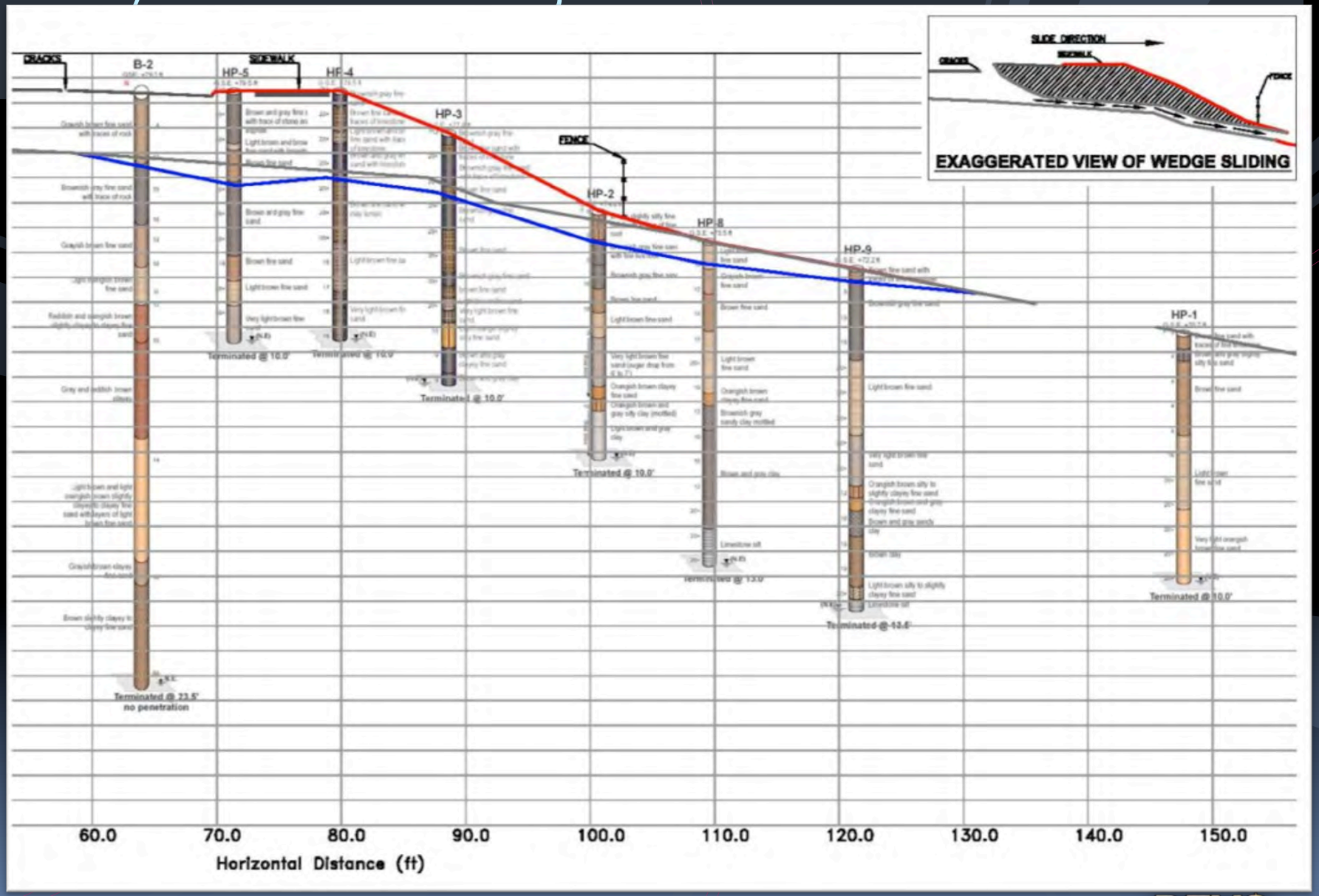


Kelly Park Road Widening



Kelly Park Road Widening



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Shingle Creek

View of slope failure before any attempt to reshape

Shingle Creek

Failure of filled slope due to improper locking

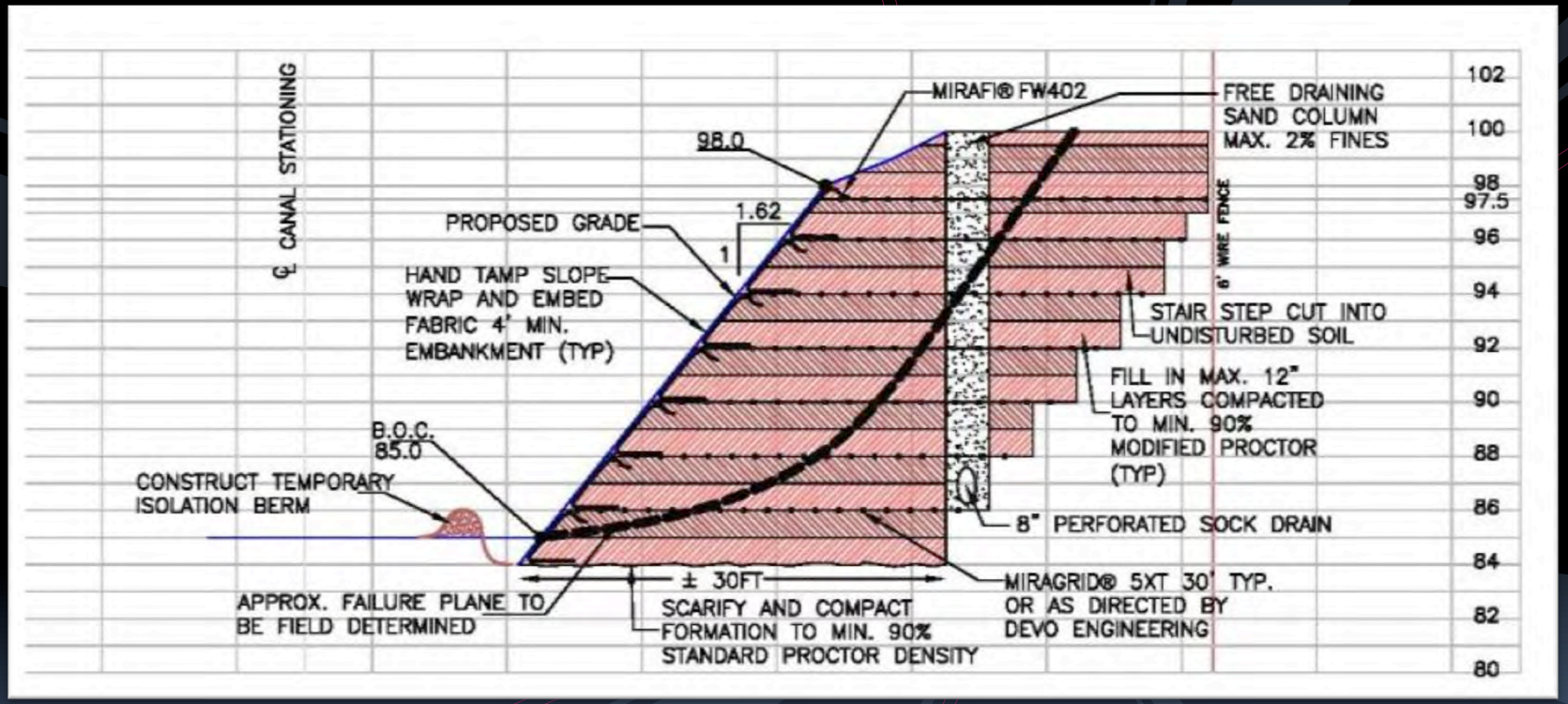
Shingle Creek

Failure due to pretty surcharge load

Shingle Creek

Another view of failed slope

Shingle Creek



Shingle Creek

Laying geogrid

Shingle Creek

Laying geogrid

Shingle Creek

Slope Work Nearing Completion

Shingle Creek

Slope Upon Completion

Shingle Creek

Completion Photo 6 months after construction

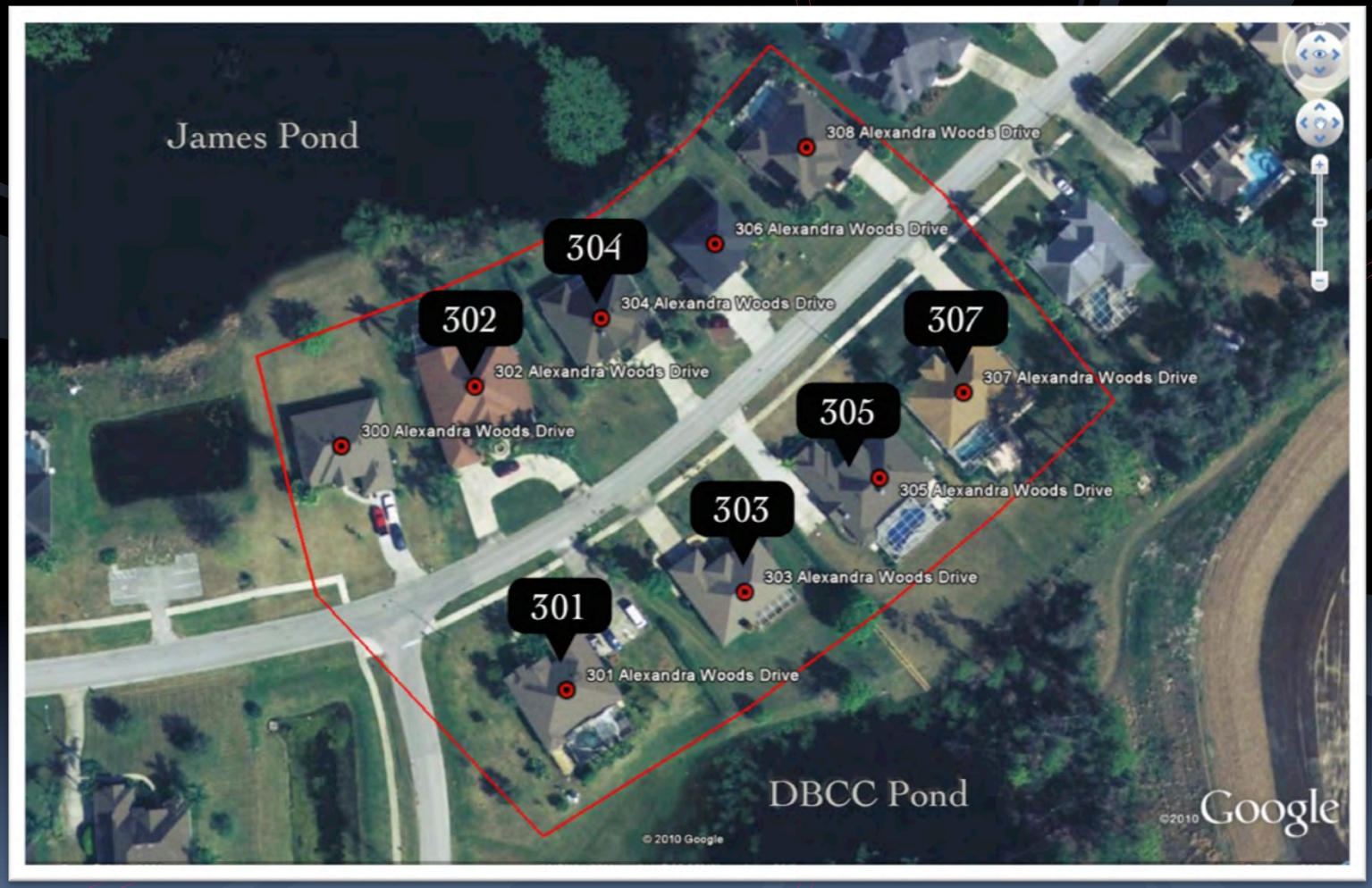
Topic 3.1

Flooding Associated with Roadway Ponds Discharging to Land-locked Lakes

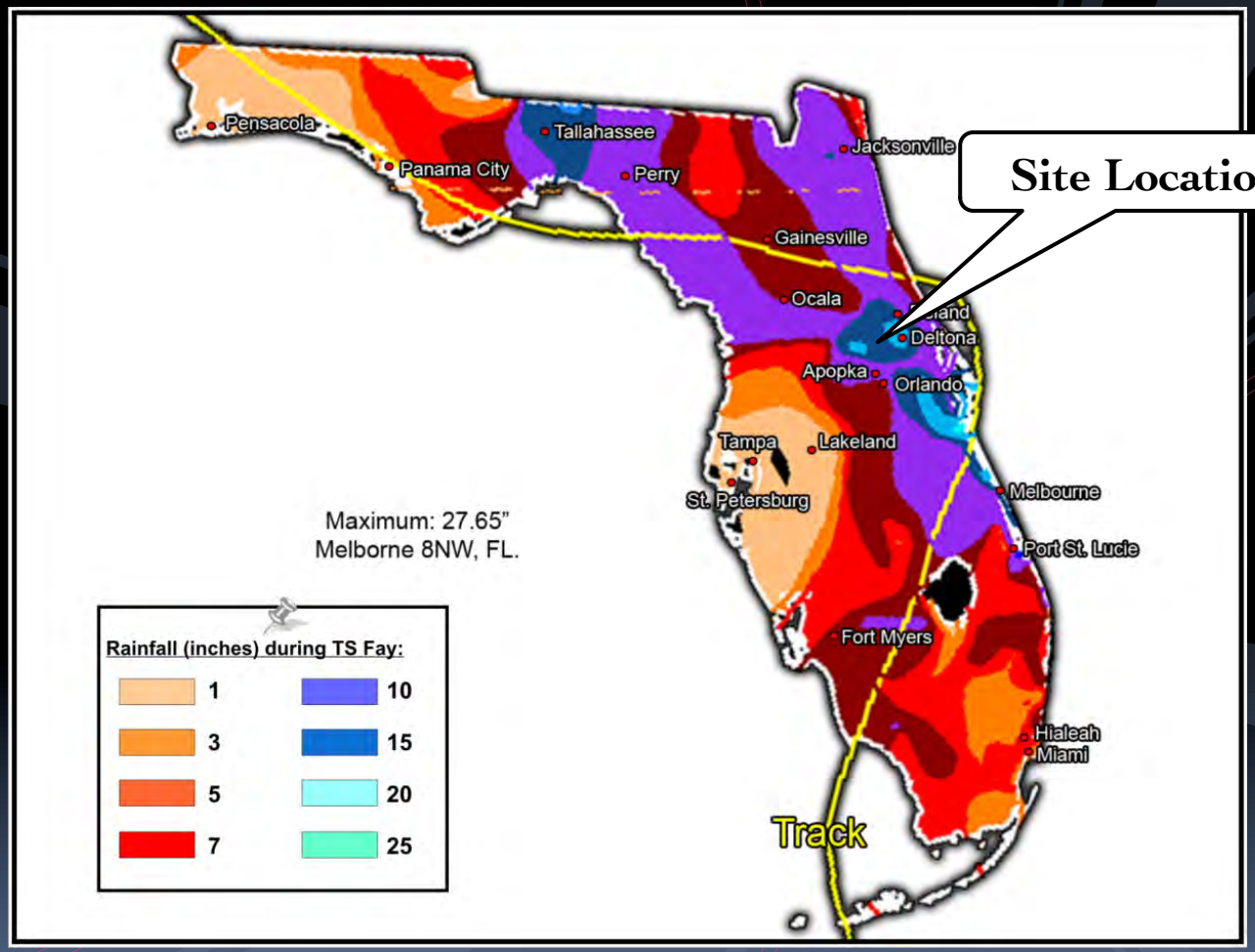
Highbanks Enterprise Road Pond

Location

Highbanks Enterprise Road Pond



Highbanks Enterprise Road Pond



Rainfall Totals for TS Fay - NOAA Data

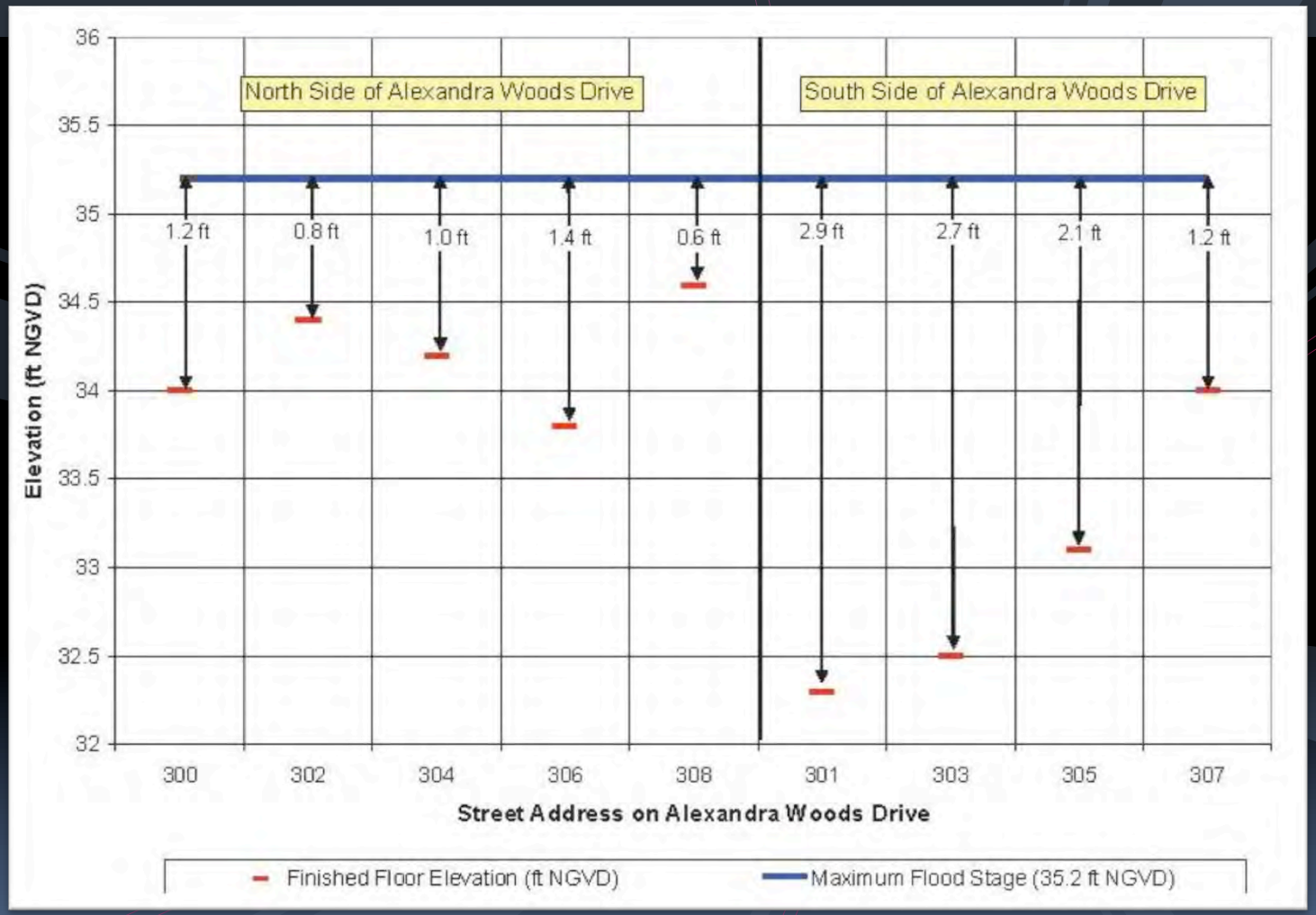
Highbanks Enterprise Road Pond

James Pond (9 structures flooded)

Highbanks Enterprise Road Pond

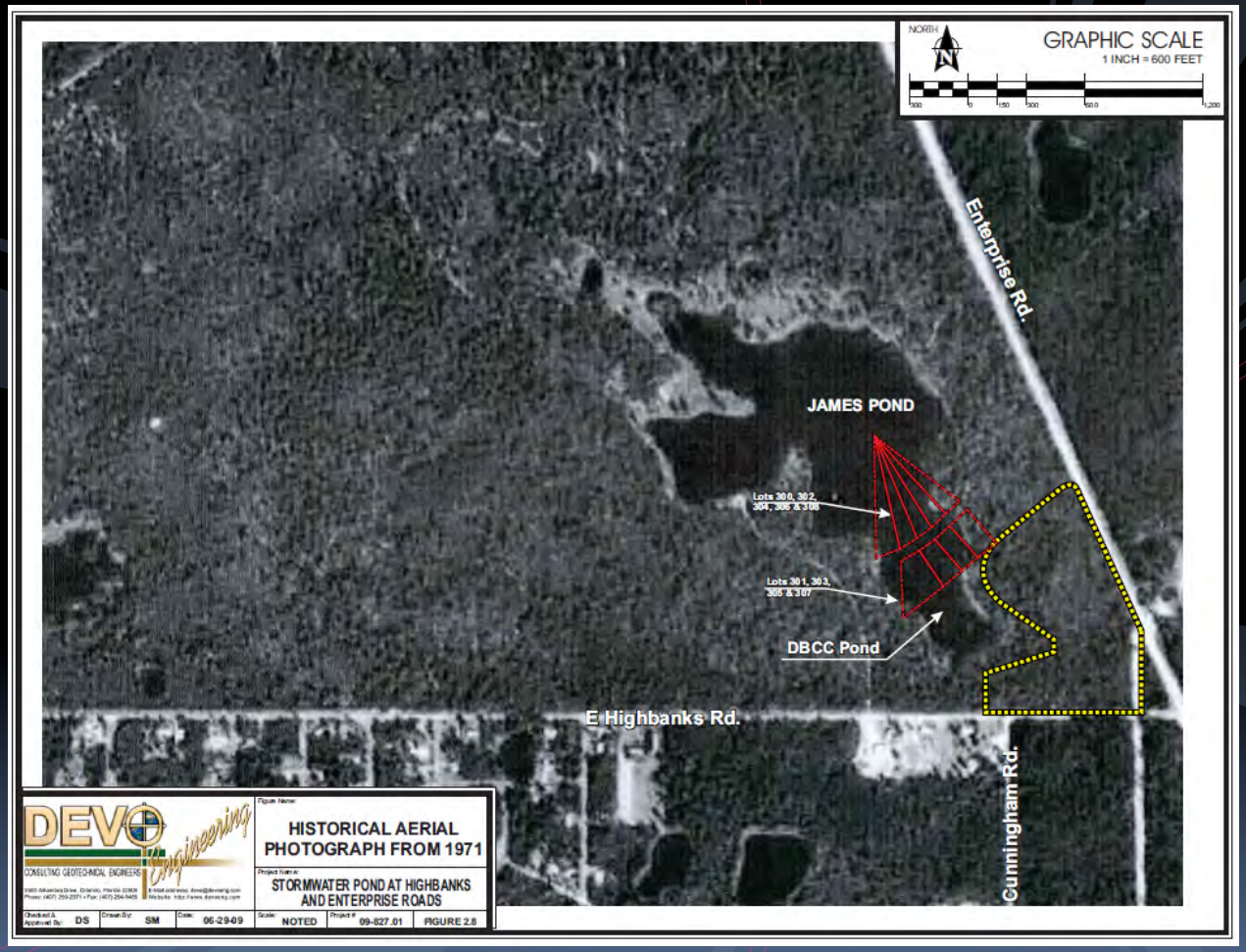
James Pond (9 structures flooded)

Highbanks Enterprise Road Pond



James Pond (9 structures flooded)

Highbanks Enterprise Road Pond



1971

Comparison of Peak Flood Stage in James Pond, with and without roadway widening

Table 15. Comparison of Predicted Flood Stages for "Predevelopment" Conditions		
Pond	Predicted Pond Stage (ft NGVD)	
	Devo Model 2 (with road widening)	Devo Model 3 (no road widening)
Gasline Lake	44.68	45.12
Enterprise Road Pond	44.47	N.A.
DBCC Pond	35.20	35.58
James Pond	35.20	35.58

Note:

1. The stages listed in the table above for Devo Model 2 assume an initial stage in Enterprise Road of +40 ft NGVD, i.e., no standing water in Enterprise Road Pond at the beginning of Tropical Storm Fay.

Note that the flood stage in James Pond would have been higher if the Enterprise Road Pond had not been constructed

Topic 3.2

Seepage Through Pond Berms

FDOT Saxon Pond

Photo date: 2002

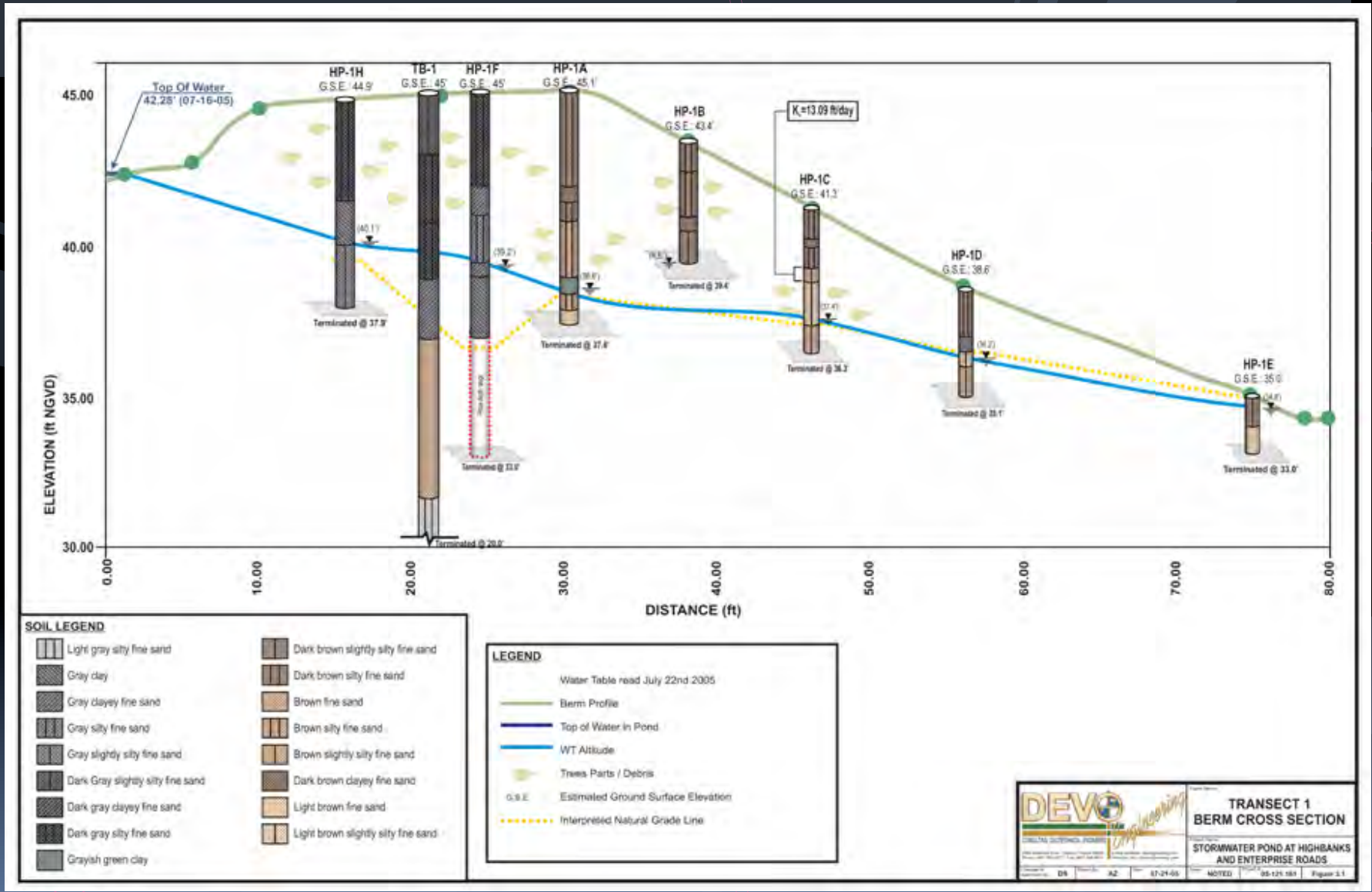
FDOT Saxon Pond

Photo date: 2003

Highbanks and Enterprise Pond

Photo date: 2005

Highbanks and Enterprise Pond



Highbanks and Enterprise Pond

Photo date: 2005

The Overlook at Lake Louisa

Photo date: 2004

The Overlook at Lake Louisa

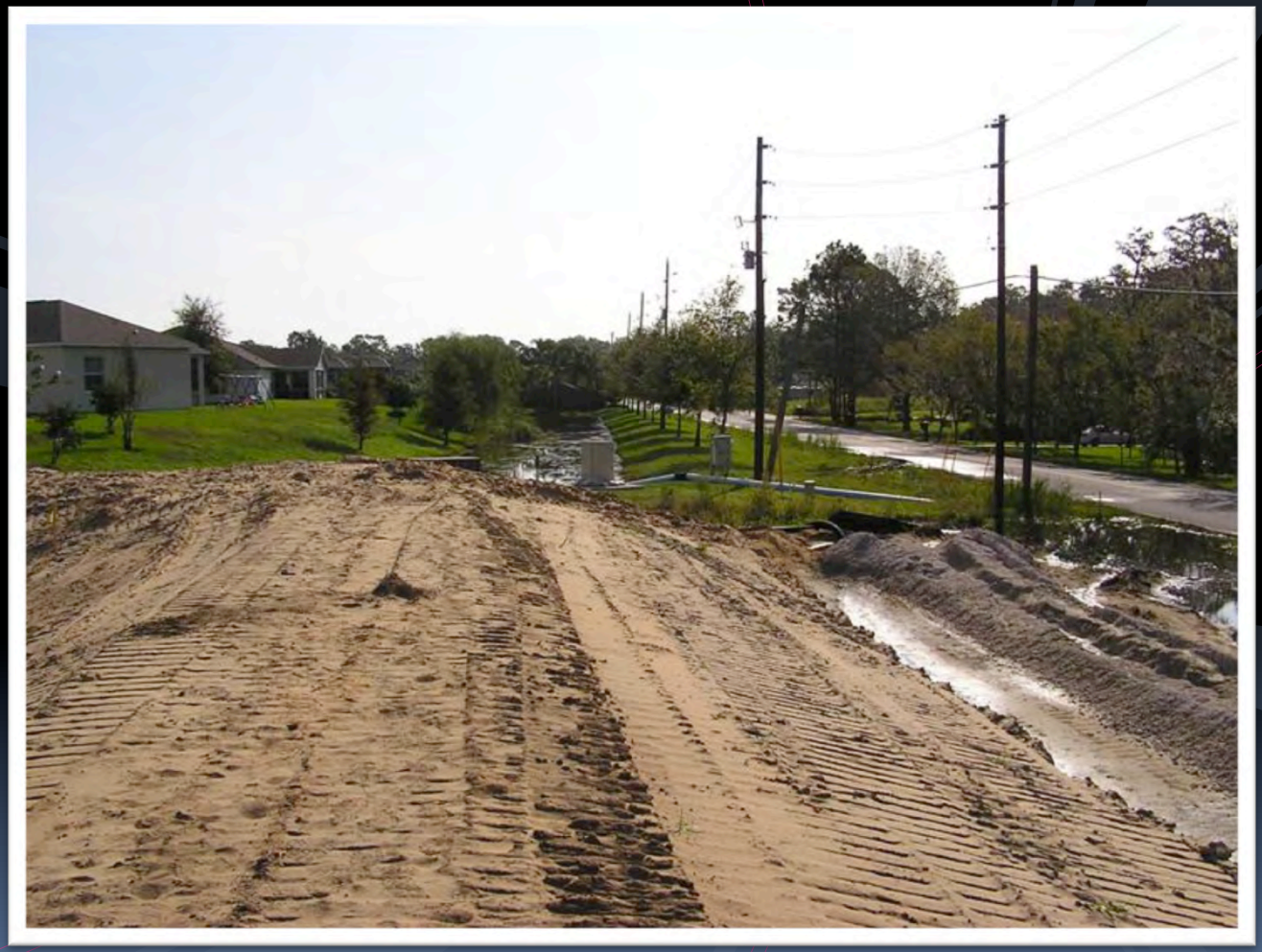


Photo date: 2004

The Overlook at Lake Louisa

Photo date: 2004

The Overlook at Lake Louisa

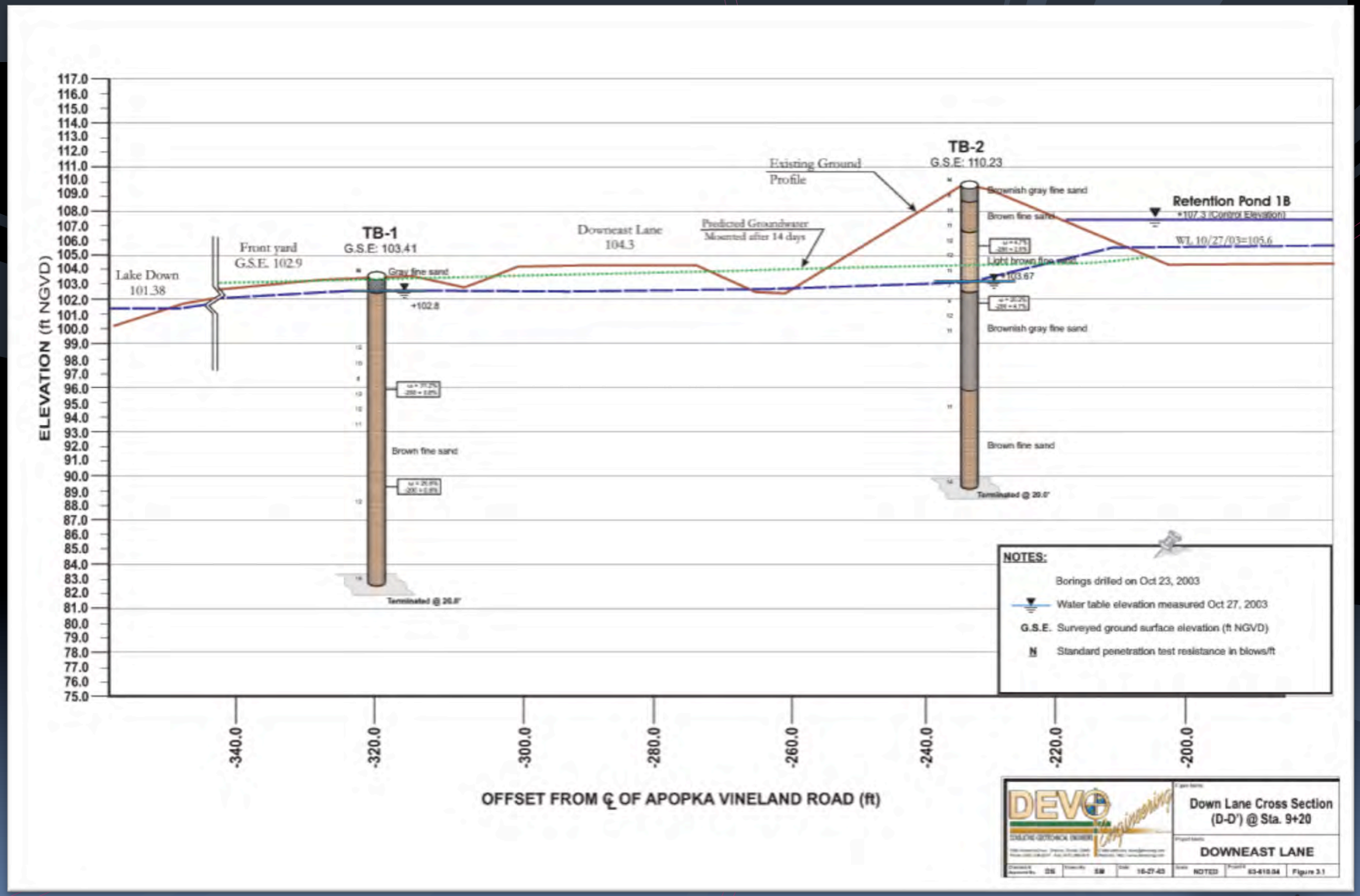
Photo date: 2004

Topic 3.3

Water Table Mounding from Ponds Affecting Roads & Offsite Property

Downeast Lane

Downeast Lane



Downeast Lane

Photo date: 2004

Downeast Lane

Photo date: 2004

Downeast Lane

Photo date: 2004

Topic 3.4

Pipe Joint Opening Due to Muck Subgrade

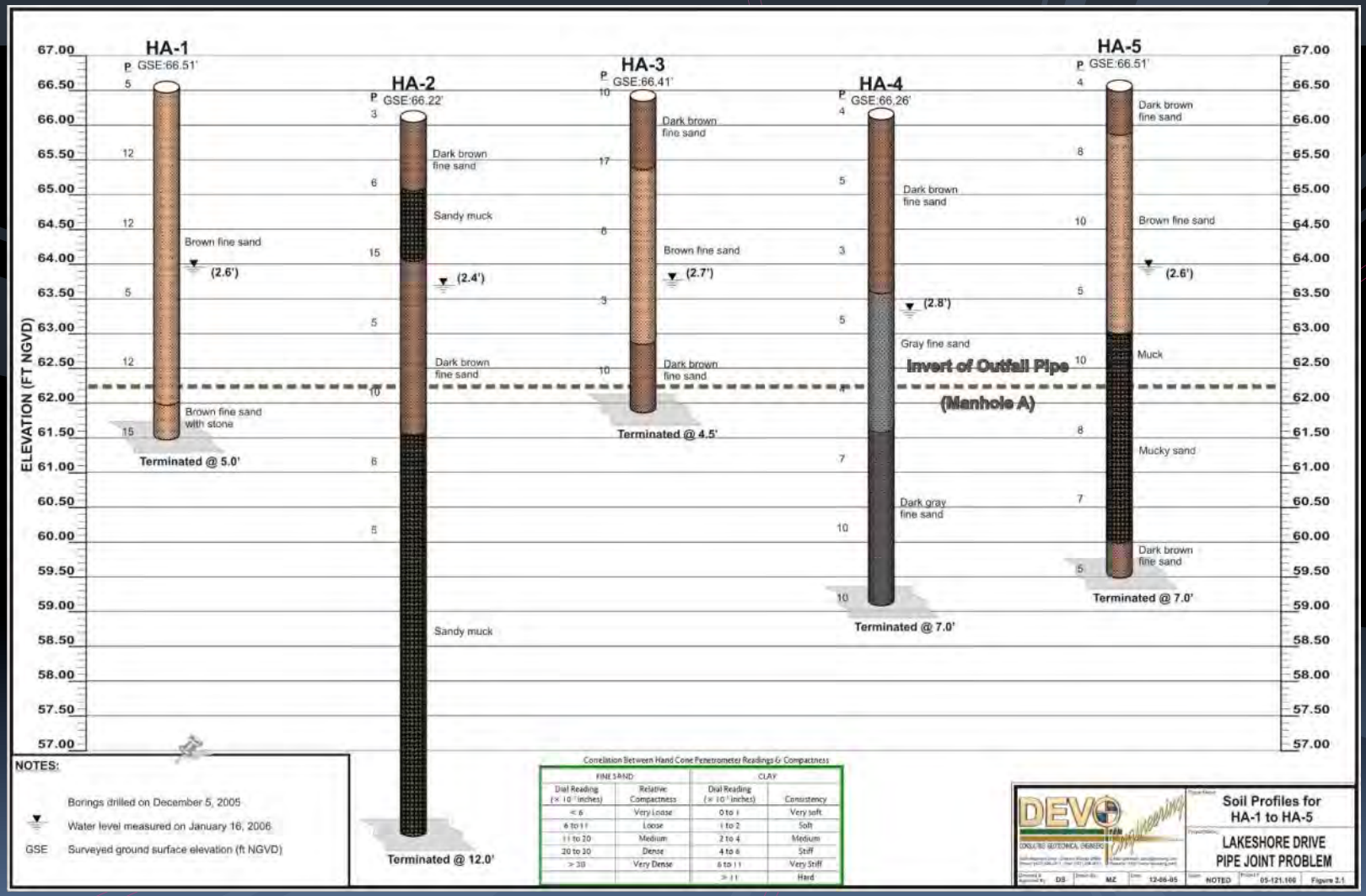
Pipe joint opening due to muck subgrade

Loss of soil & settlement distress at pipe crossing

Pipe joint opening due to muck subgrade

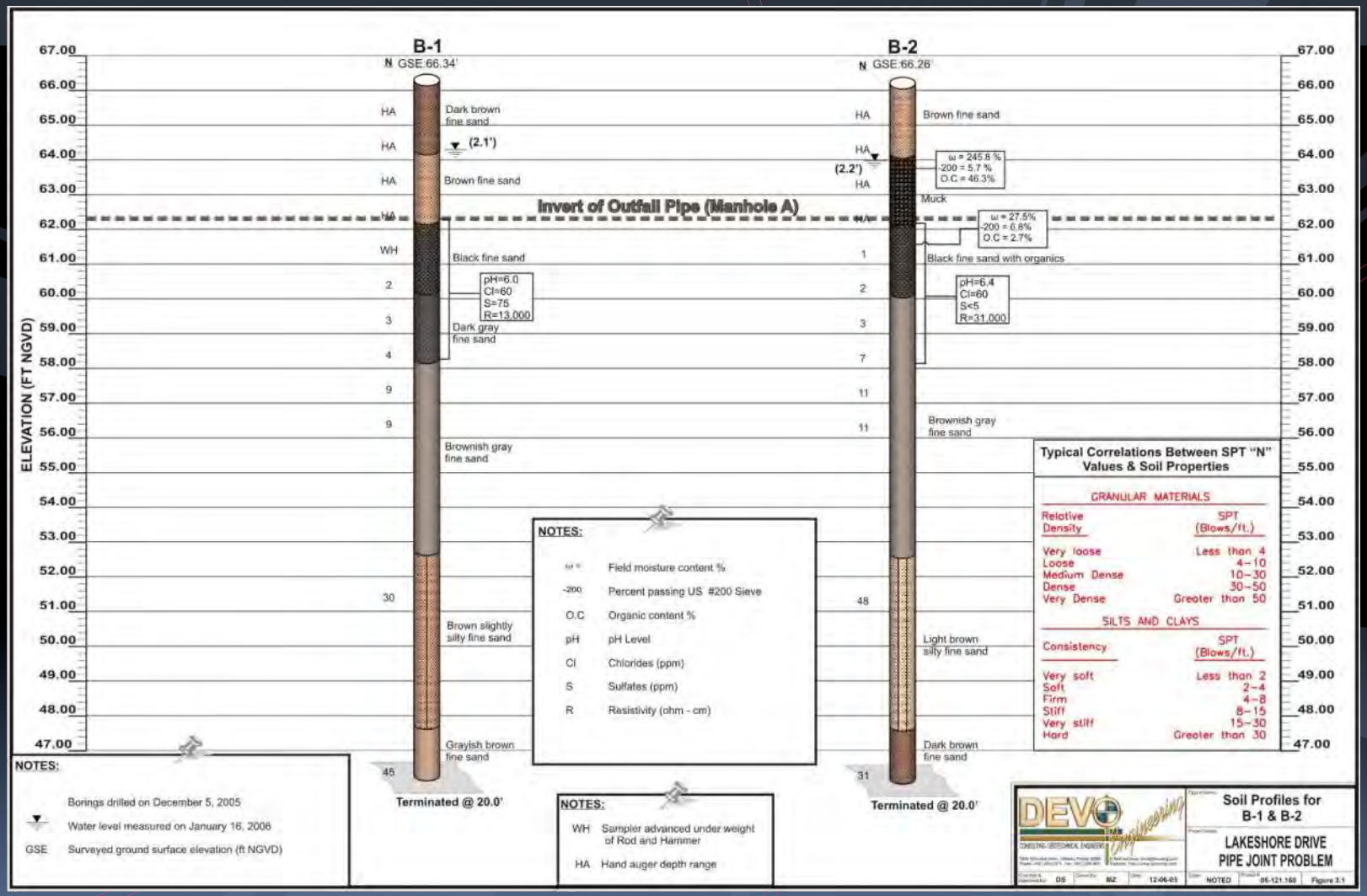
Pavement reinstated after settlement

Pipe joint opening due to muck subgrade



Pipe joints separated due to differential settlement

Pipe joint opening due to muck subgrade



Pipe invert on muck

Topic 4.1

Relic Horizontal Sock Drain Causing "Inexplicable Spring"

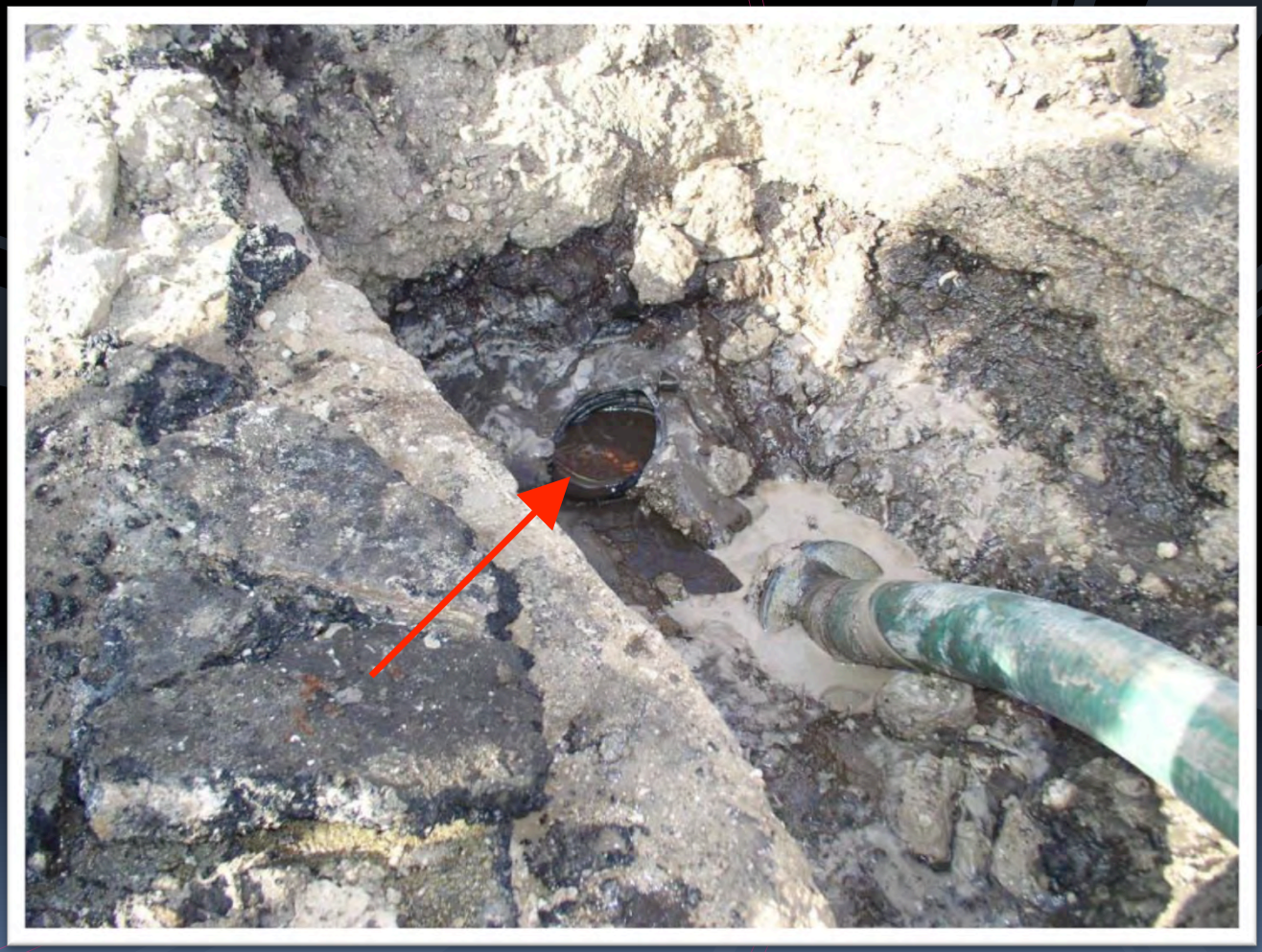
Tully Wood Court

Upward Seepage Beneath Pavement

Tully Wood Court

Field Investigation and Excavation

Tully Wood Court



Relic Sock Drain

Topic 4.2

Strong Seepage Across Road Causing Subgrade Movement Due to Barrier Caused by Large Diameter Pipe

McCulloch Rd Undermining

Project Location

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McCulloch Rd Undermining

Project Location

McCulloch Rd Undermining

Project Location

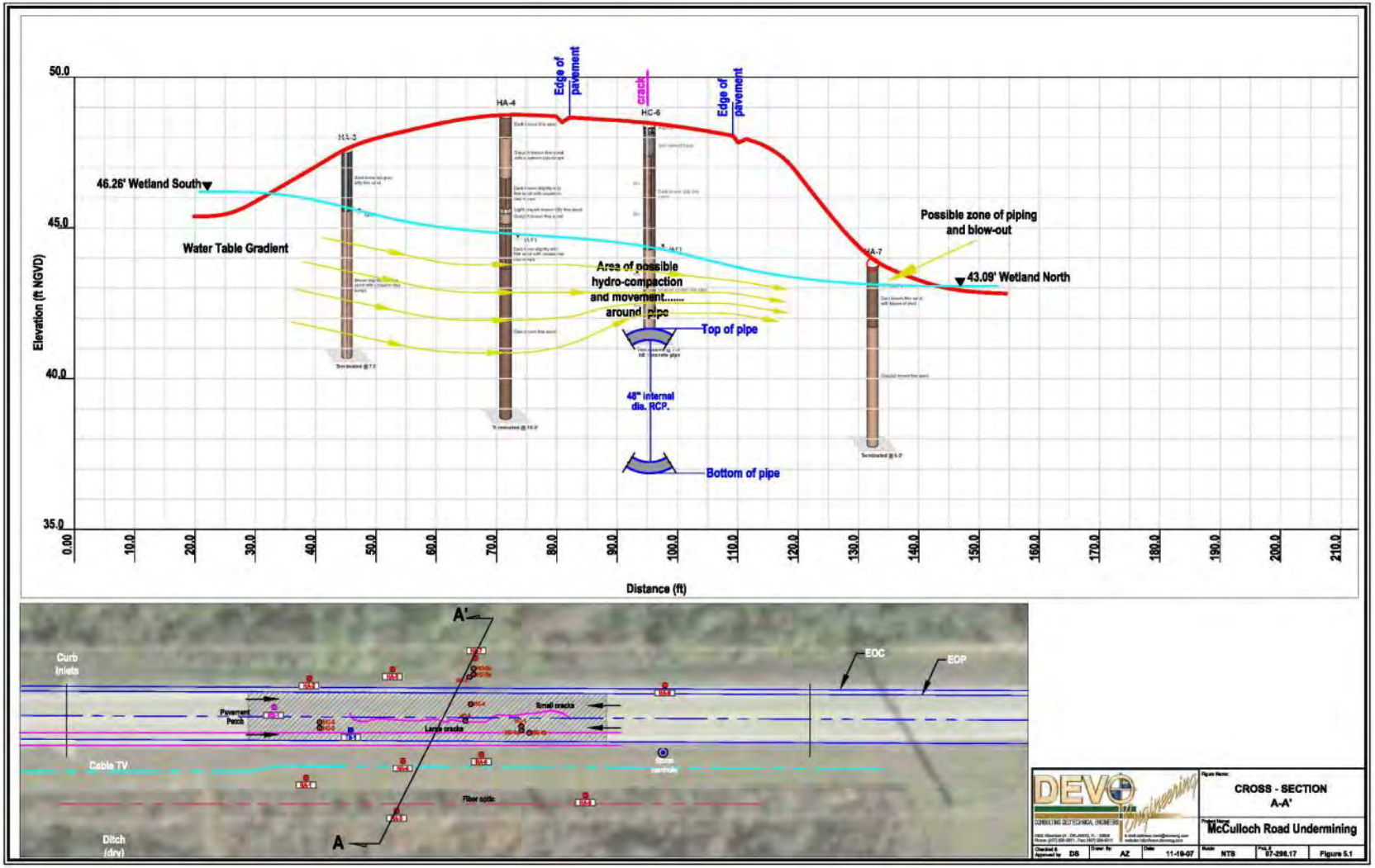
McCulloch Rd Undermining

Photos of Distress

McCulloch Rd Undermining

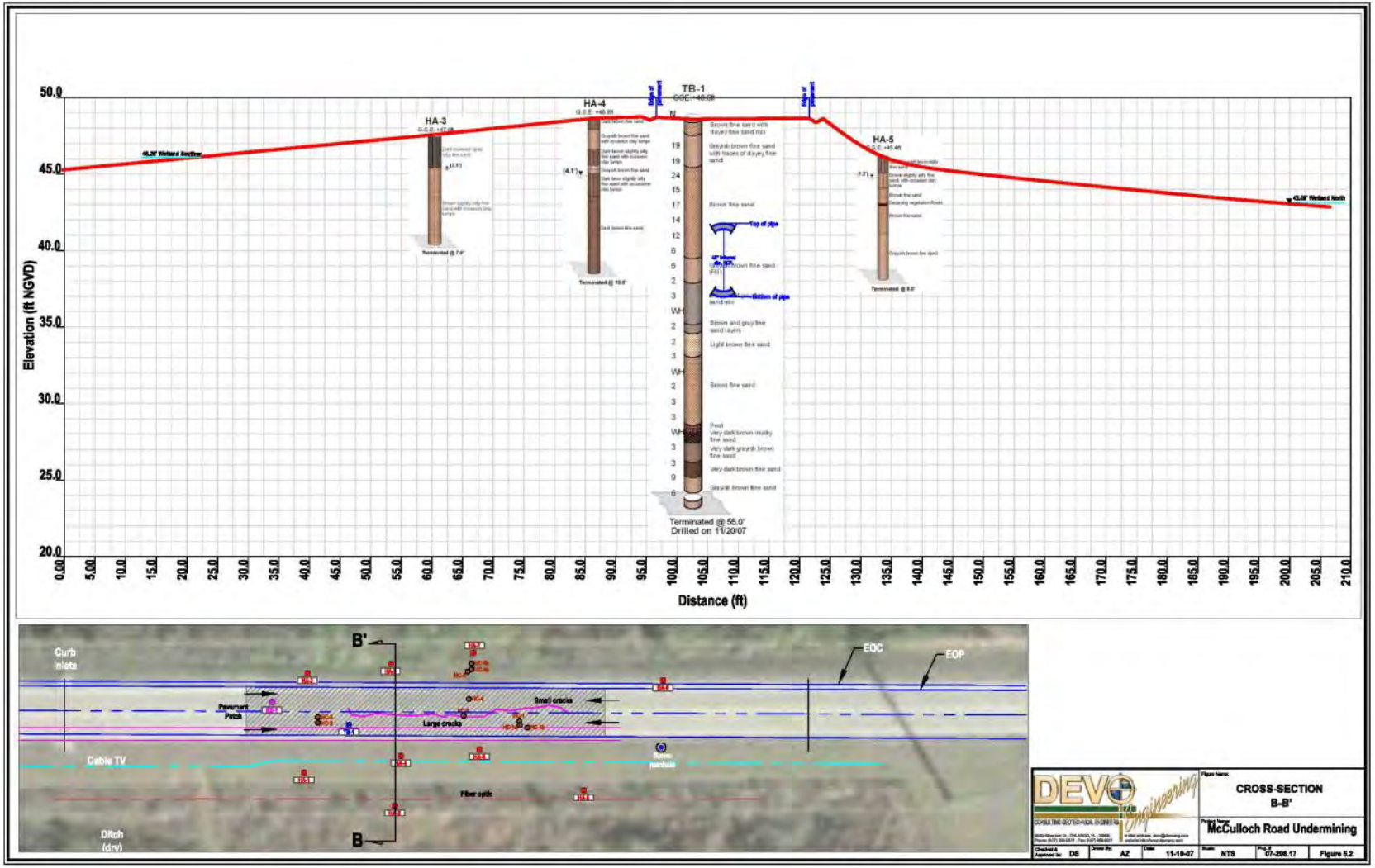
Photos of Distress

McCulloch Rd Undermining



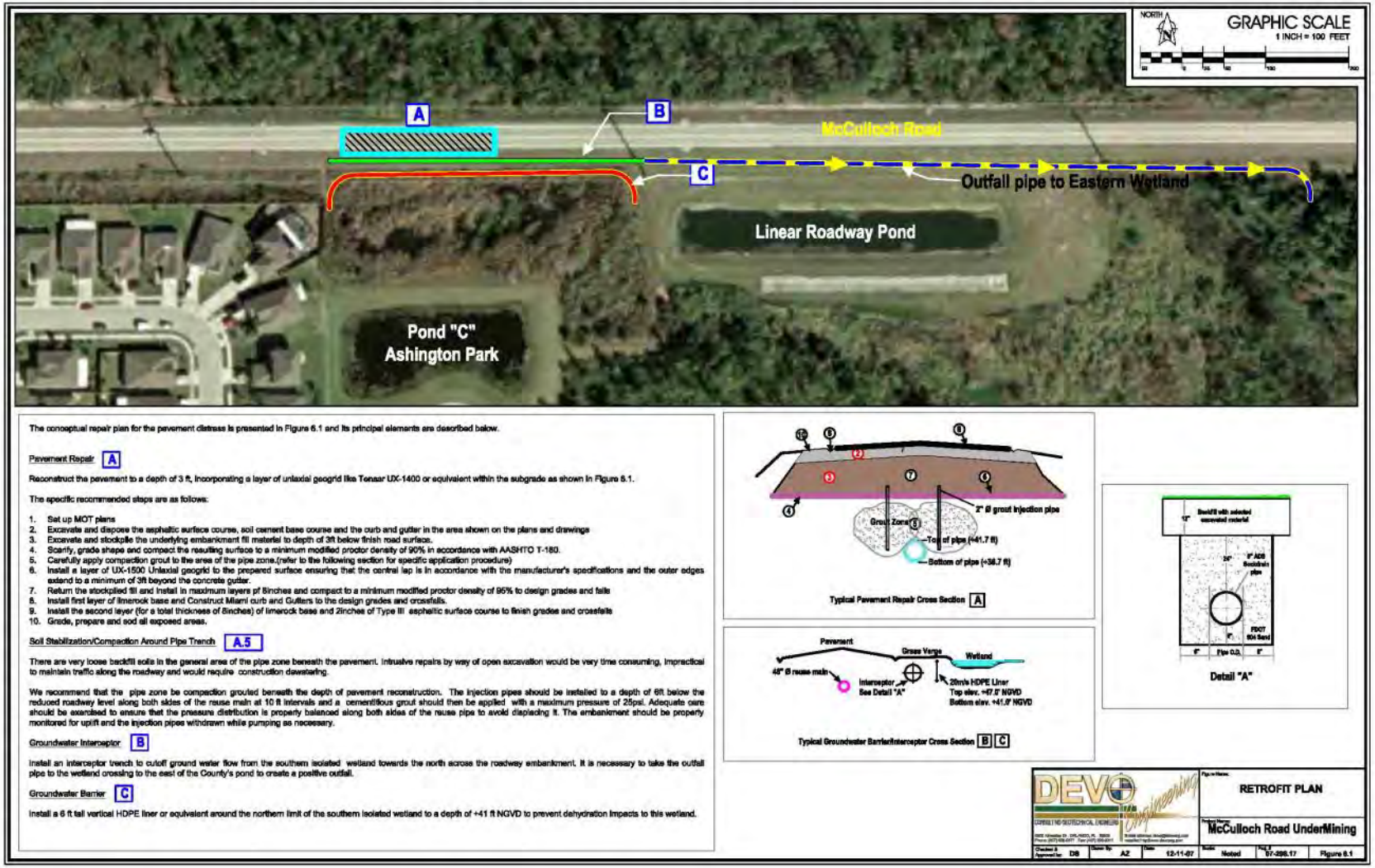
Subsurface Mechanism

McCulloch Rd Undermining



Subsurface Mechanism

McCulloch Rd Undermining



Retrofit Plan

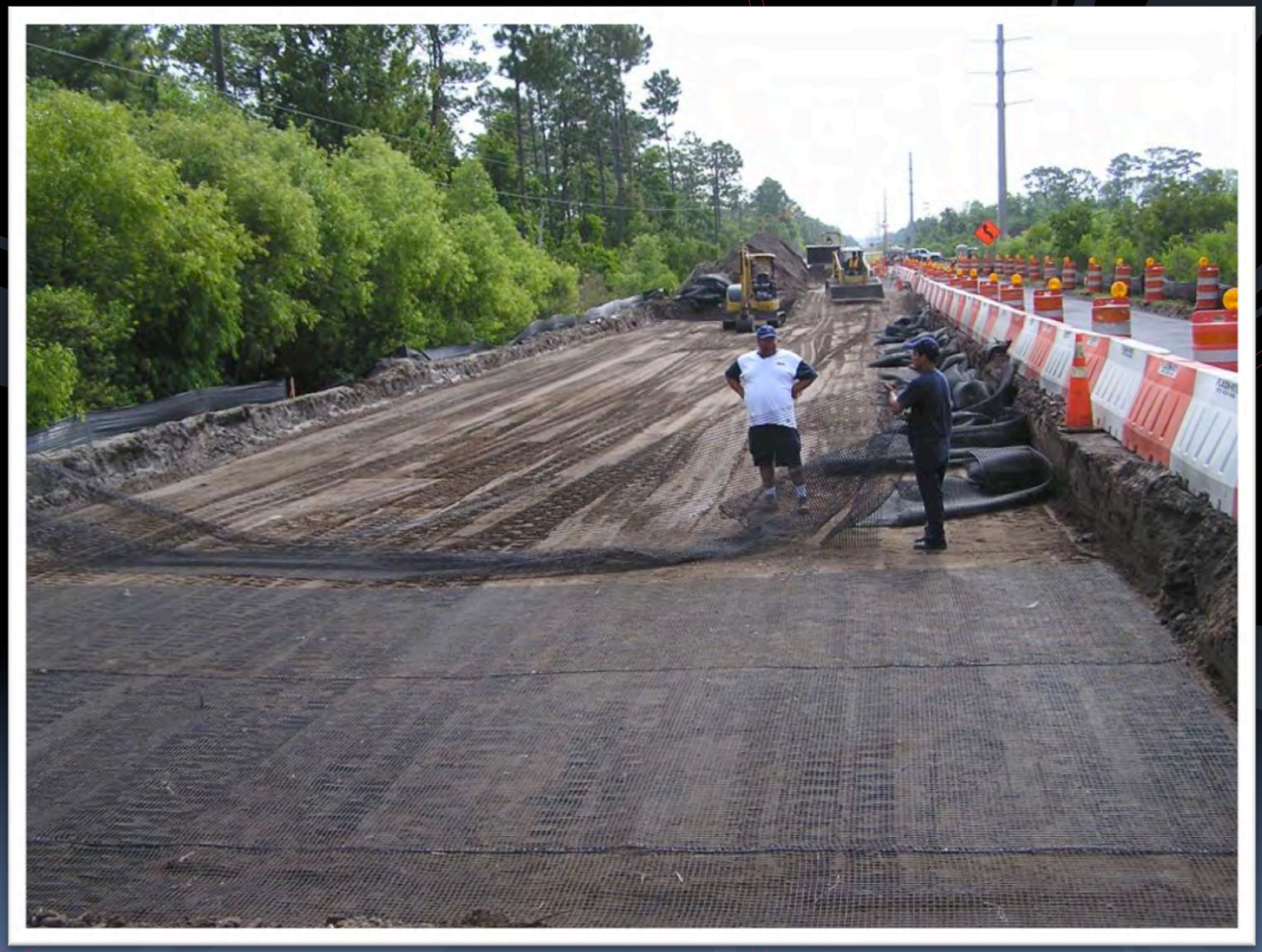
Photos of Fix

Grout injection on April 24, 2008

Photos of Fix

Another grout injection on April 24, 2008

Photos of Fix



Laying geogrid

Photos of Fix

Backfilled Road

Photos of Fix

Final Product

Topic 4.3

Perched Water Table Due to Low Permeability Fill

Site in Windermere

Photo date: 2005

Site in Windermere

Photo date: 2005

Site in Windermere

Photo date: 2005

Topic 5.1

Sinkholes on roadways

Fox Lake Drive

Fox Lake Drive

Fox Lake Drive

Fox Lake Drive

Fox Lake Drive

Cable concrete being placed into position (Sep 23)

Fox Lake Drive

Panel being positioned by county staff (Sep 23)

Fox Lake Drive

Another panel being placed (Sep 23)

Fox Lake Drive

Cable concrete being guided into position (Sep 23)

Pine Hills Road and North Lane

Pine Hills Road and North Lane

Swann Avenue

Swann Avenue

Swann Avenue

Swann Avenue

Topic 5.2

Sinkholes in ponds

Failure of clay liner in wet pond - FSU Regional Stormwater Pond

RSF sinkhole 1

Failure of clay liner in wet pond - FSU Regional Stormwater Pond

RSF sinkhole 1

Failure of clay liner in wet pond - FSU Regional Stormwater Pond

RSF sinkhole 1

Sinkholes in ponds - Spring Vista Drive in Debary

North Pond

Sinkholes in ponds - Spring Vista Drive in Debary

North Pond

Topic 6.1

Soil-loss in Manholes

Loss of soil around manholes - Lakeview Preserve

Sand flowing into leaking manhole leading to loss of soil and "sinkhole"

Loss of soil around manholes - Lakeview Preserve

Close-up view of "sinkhole"

Loss of soil around manholes - Lakeview Preserve

Close-up view of "sinkhole"

Topic 6.2

Dumping loose fill around the sediment removal structure & hydroconsolidation of loosely placed sand backfill

View of settlement around buried structure

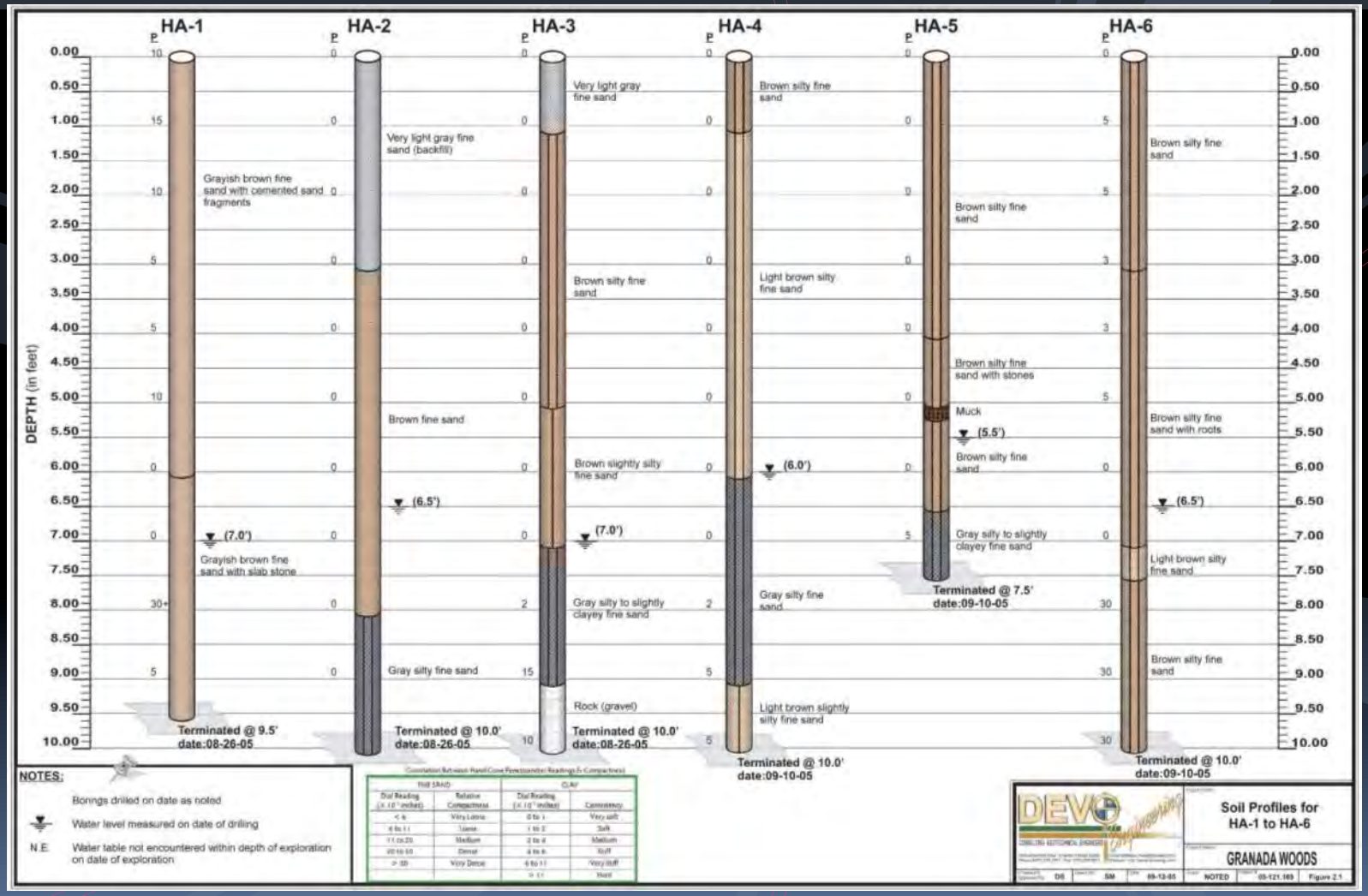
Settlement of Loose Sand Backfill Around Sediment Removal Structure

Installed structure in landscape strip

Settlement of Loose Sand Backfill Around Sediment Removal Structure

Settlement of soil around structure

Settlement of Loose Sand Backfill Around Sediment Removal Structure



Soil stratigraphy and compactness around structure

Settlement of Loose Sand Backfill Around Sediment Removal Structure

Photos of installation

Settlement of Loose Sand Backfill Around Sediment Removal Structure

Photos of installation