QUANTITATIVE ANALYSIS OF IMPACT OF ENTERPRISE ROAD POND ON TROPICAL STORM FAY'S FLOOD LEVEL IN THE DOWNGRADIENT JAMES POND/DBCC POND WATER BODY

ALEXANDRA WOODS DRIVE, GLEN ABBEY SUBDIVISION, CITY OF DEBARY, VOLUSIA COUNTY, FLORIDA, VOLUSIA COUNTY CIRCUIT COURT CASE NO: 2009 10578 CIDL

Prepared by Devo Seereeram, Ph.D., P.E.
On behalf of Volusia County, Florida

DEVO Engineering
CONSULTING GEOTECHNICAL ENGINEERS

Tuesday, February 8, 2011

PRESENTATION OUTLINE

1. Location of Alexandra Woods Drive Relative to Highbanks/Enterprise Pond

2. Tropical Storm Fay Rainfall Event

3. City-Wide Residential flooding in DeBary (T.S. Fay)

4. Photos of the Flooding at Alexandra Woods Drive (James Pond)

5. Original Damage Theory & Revised Damage Theories

6. Review Of Historic Aerials

7. Enterprise Road Widening project (completion date & stormwater flow regime)

8. Stormwater Modeling:

   a. The PEC FEMA model

   b. Devo Model 1 based on PEC model

   c. Devo Model 2 with field verified basin boundaries

   d. Simple Volumetric Comparison

   e. Devo Model 3 Pre-Enterprise Road Widening

9. Key Results of Devo Modeling – For Defendant

10. Defects with Marshall's Model – For Plaintiff

11. Rebuttal of Seidel's Model - For Plaintiff

PART 1

LOCATION OF ALEXANDRA WOODS DRIVE
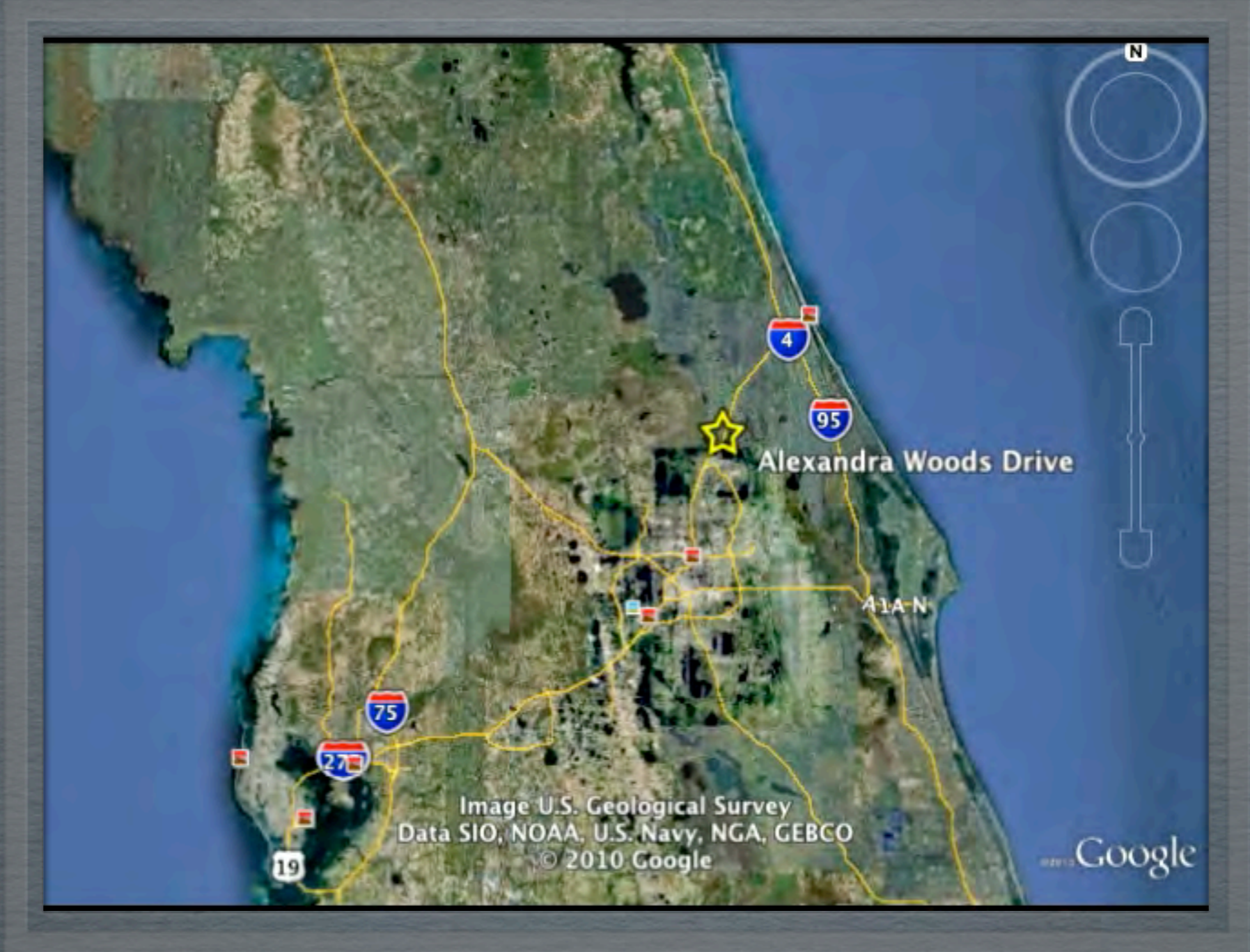## RELATIVE TO HIGHBANKS/ENTERPRISE POND

Presentation Outline

1. Location of Alexandra Woods Drive Relative to Highbanks/ Enterprise Pond

2. Tropical Storm Fay Rainfall Event

3. City-Wide Residential flooding in DeBary (T.S. Fay)

4. Photos of the Flooding at Alexandra Woods Drive (James Pond)

5. Original Damage Theory & Revised Damage Theories

6. Review Of Historic Aerials

7. Enterprise Road Widening project (completion date & stormwater flow regime)

8. Stormwater Modeling:
   a. The PEC FEMA model
   b. Devo Model 1 based on PEC model
   c. Devo Model 2 with field verified basin boundaries
   d. Simple Volumetric Comparison
   e. Devo Model 3 Pre-Enterprise Road Widening

9. Key Results of Devo Modeling – For Defendant

10. Defects with Marshall's Model – For Plaintiff

11. Rebuttal of Seidel's Model - For Plaintiff

Location

The nine residences which experienced flooding during Tropical Storm "Fay" are located on Alexandra Woods Drive in DeBary, Volusia County, Florida, at the following addresses:

- 300 Alexandra Woods Drive (not in buyout program or lawsuit)
- 301 Alexandra Woods Drive
- 302 Alexandra Woods Drive (not in lawsuit)
- 303 Alexandra Woods Drive
- 304 Alexandra Woods Drive
- 305 Alexandra Woods Drive
- 306 Alexandra Woods Drive (not in buyout program)
- 307 Alexandra Woods Drive
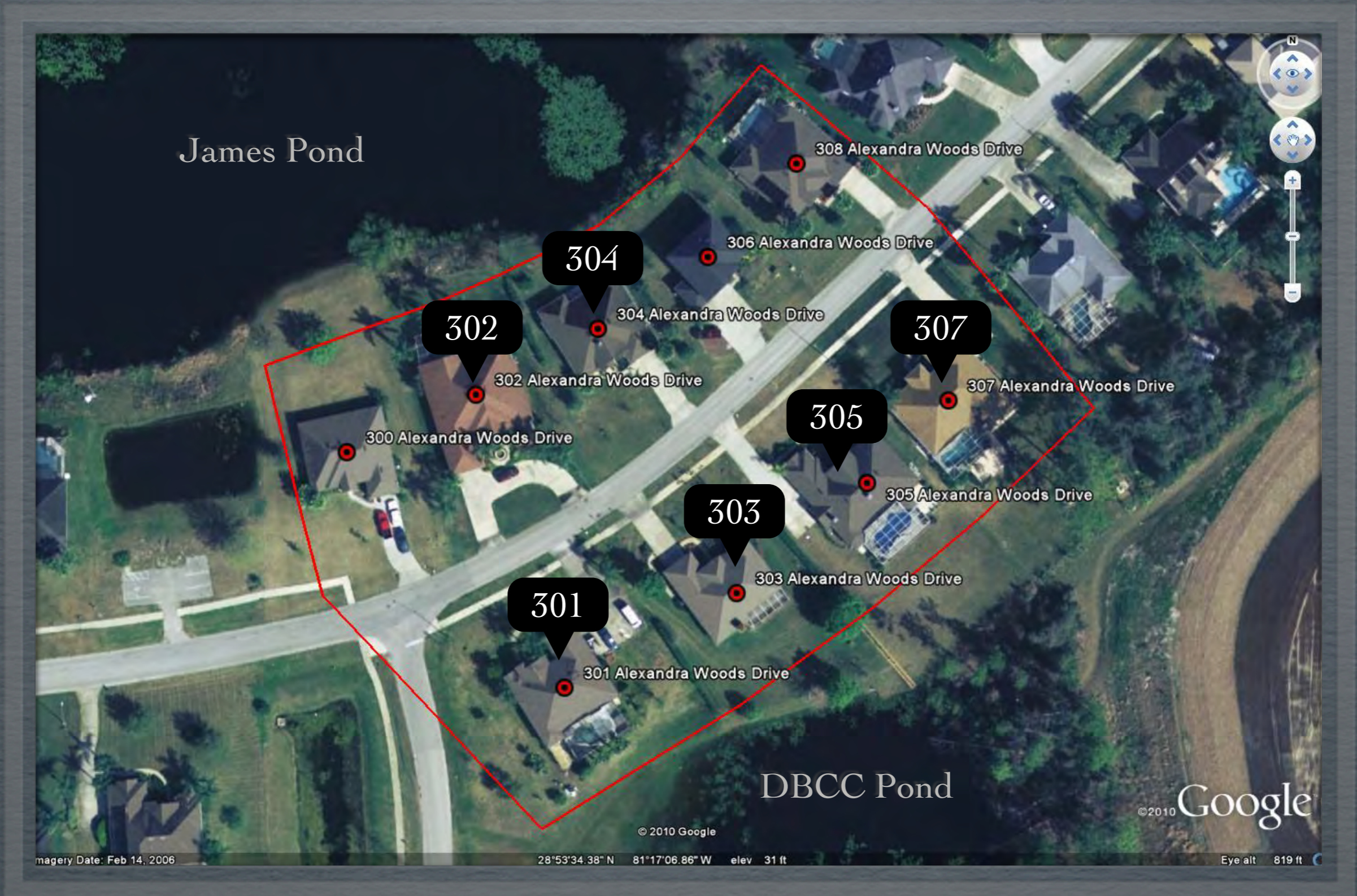- 308 Alexandra Woods Drive (not in buyout program)

LOCATION

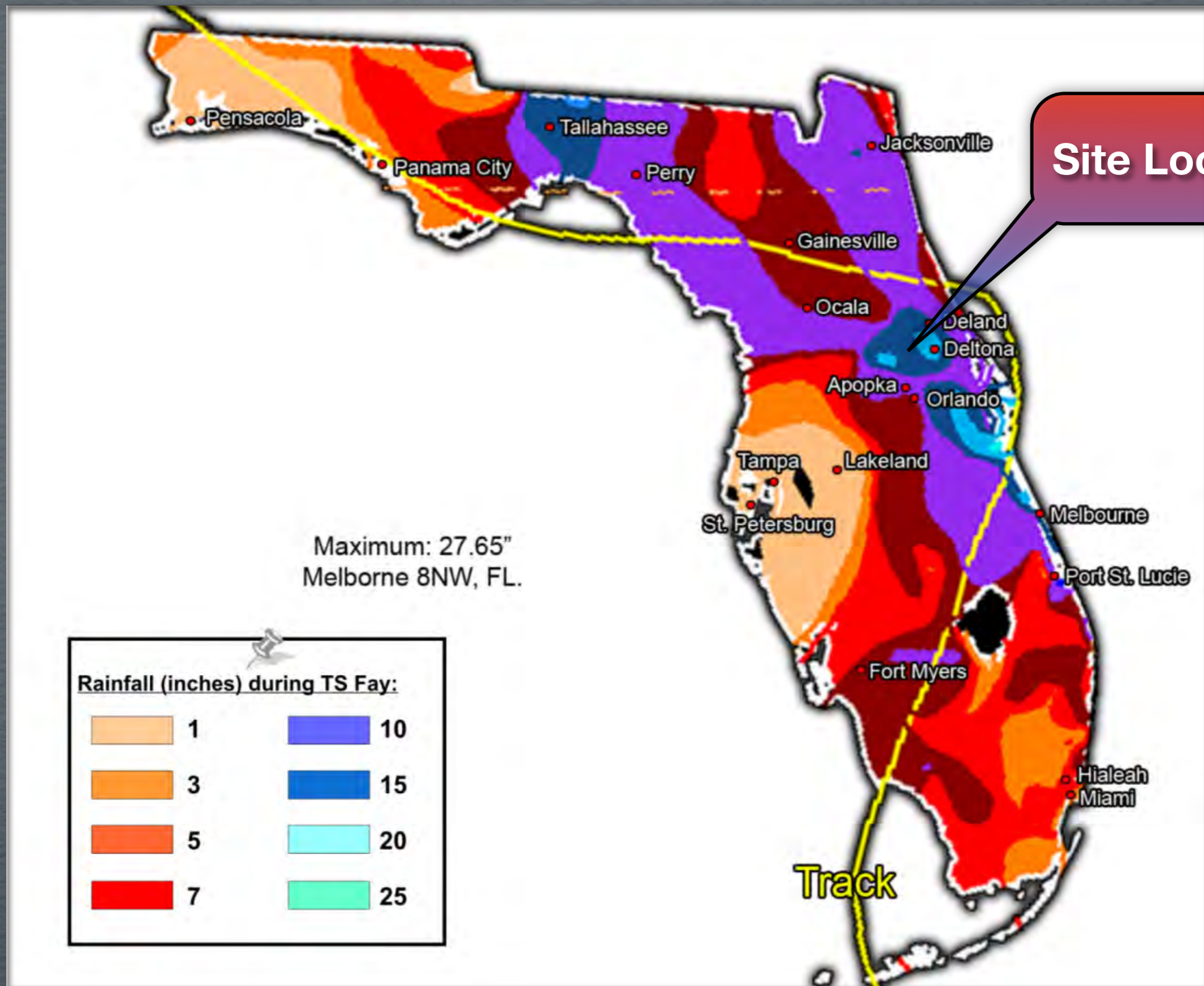# THE SUBJECT HOMES

THE SUBJECT HOMES

301 (Acquired & demolished)

Part 2

Tropical Storm Fay Rainfall Event

Presentation Outline

1. Location of Alexandra Woods Drive Relative to Highbanks/ Enterprise Pond

2. Tropical Storm Fay Rainfall Event

3. City-Wide Residential flooding in DeBary (T.S. Fay)

4. Photos of the Flooding at Alexandra Woods Drive (James Pond)

5. Original Damage Theory & Revised Damage Theories

6. Review Of Historic Aerials

7. Enterprise Road Widening project (completion date & stormwater flow regime)

8. Stormwater Modeling:

   a. The PEC FEMA model

   b. Devo Model 1 based on PEC model

   c. Devo Model 2 with field verified basin boundaries

   d. Simple Volumetric Comparison

   e. Devo Model 3 Pre-Enterprise Road Widening

9. Key Results of Devo Modeling – For Defendant

10. Defects with Marshall's Model – For Plaintiff

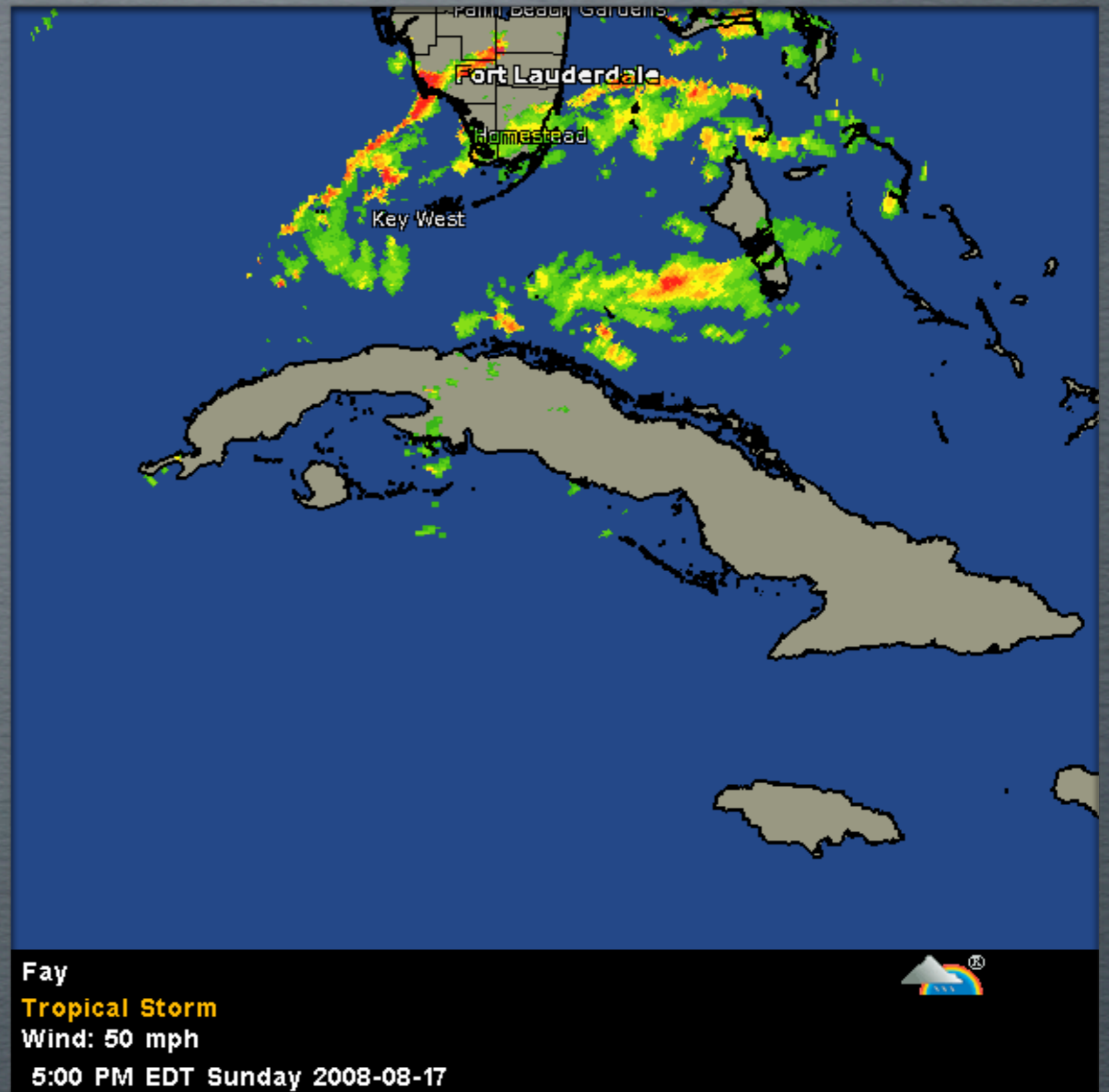11. Rebuttal of Seidel's Model - For Plaintiff

Rainfall Totals for TS Fay - NOAA Data

Storm Path For Tropical Storm Fay

Fay
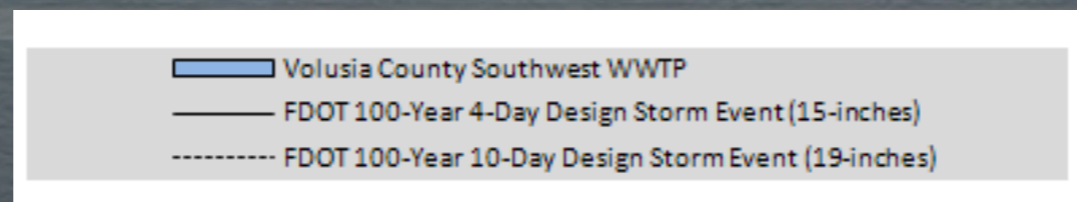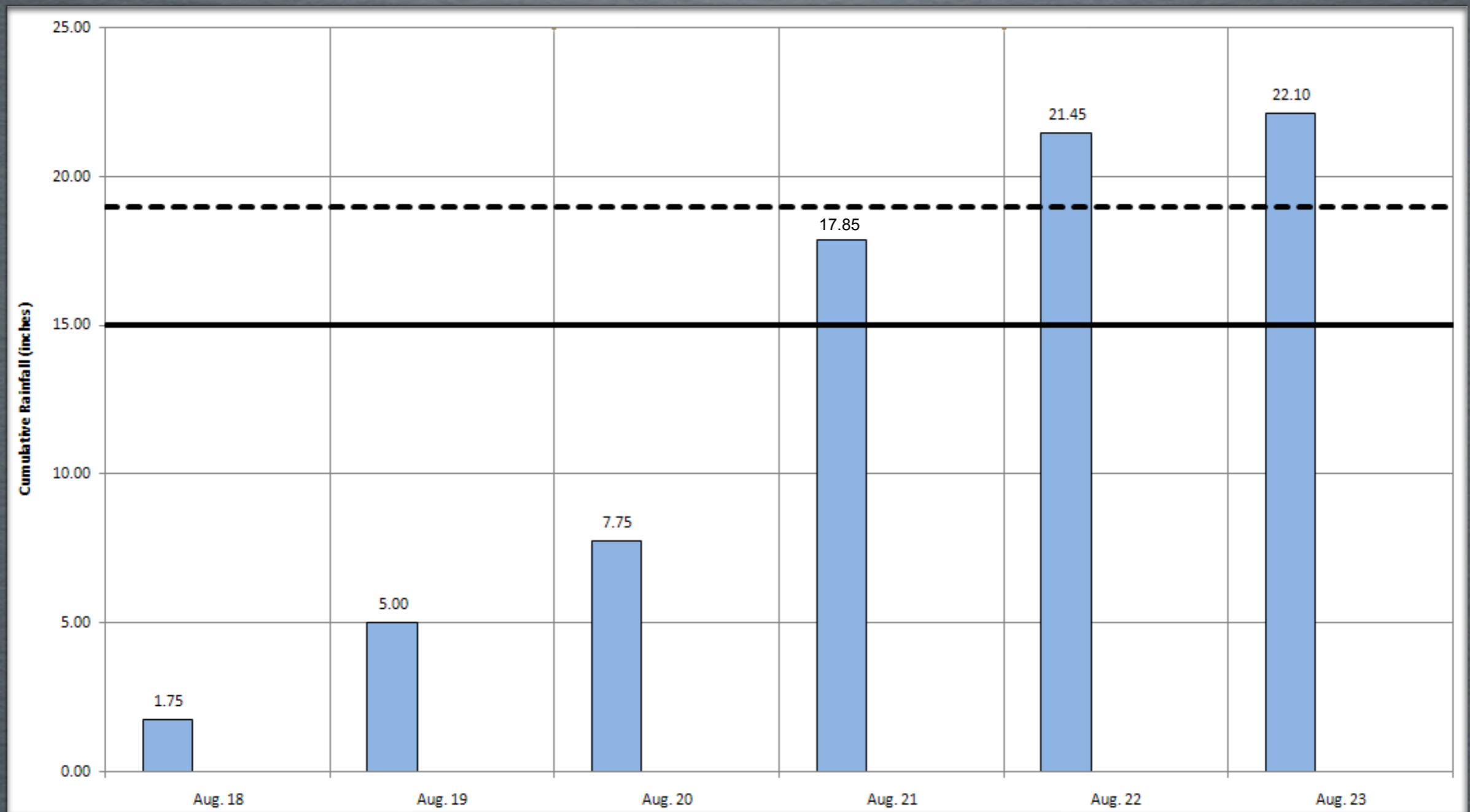Tropical Storm
Wind: 50 mph
5:00 PM EDT Sunday 2008-08-17

Bullet points about TS Fay

* The NOAA-published rainfall map shows that the Orange City locale (in Volusia County) received about 20 inches of rain during the multi-day storm and the distribution of rainfall was not uniform. Interestingly, the area in the Orange City-DeBary-Deltona triangle was within a zone of heaviest rainfall (20 to 25 inches) while nearby cities such as Deland, Lake Mary, Altamonte Springs, and Sanford were spared such excess rainfall.

* TS Fay rainfall measurements at several rain gages in the vicinity of DeBary/Orange City confirm that the magnitude of rainfall was generally between 21 and 22 inches during the storm (Aug 18-23, 2008). About 45 to 60% of this precipitation occurred on a single day: Thursday August 21st in this area. The spot measurements also confirm that the neighboring cities to the north and to the south did not receive the abnormally high rainfall totals.

Rain Gage Map
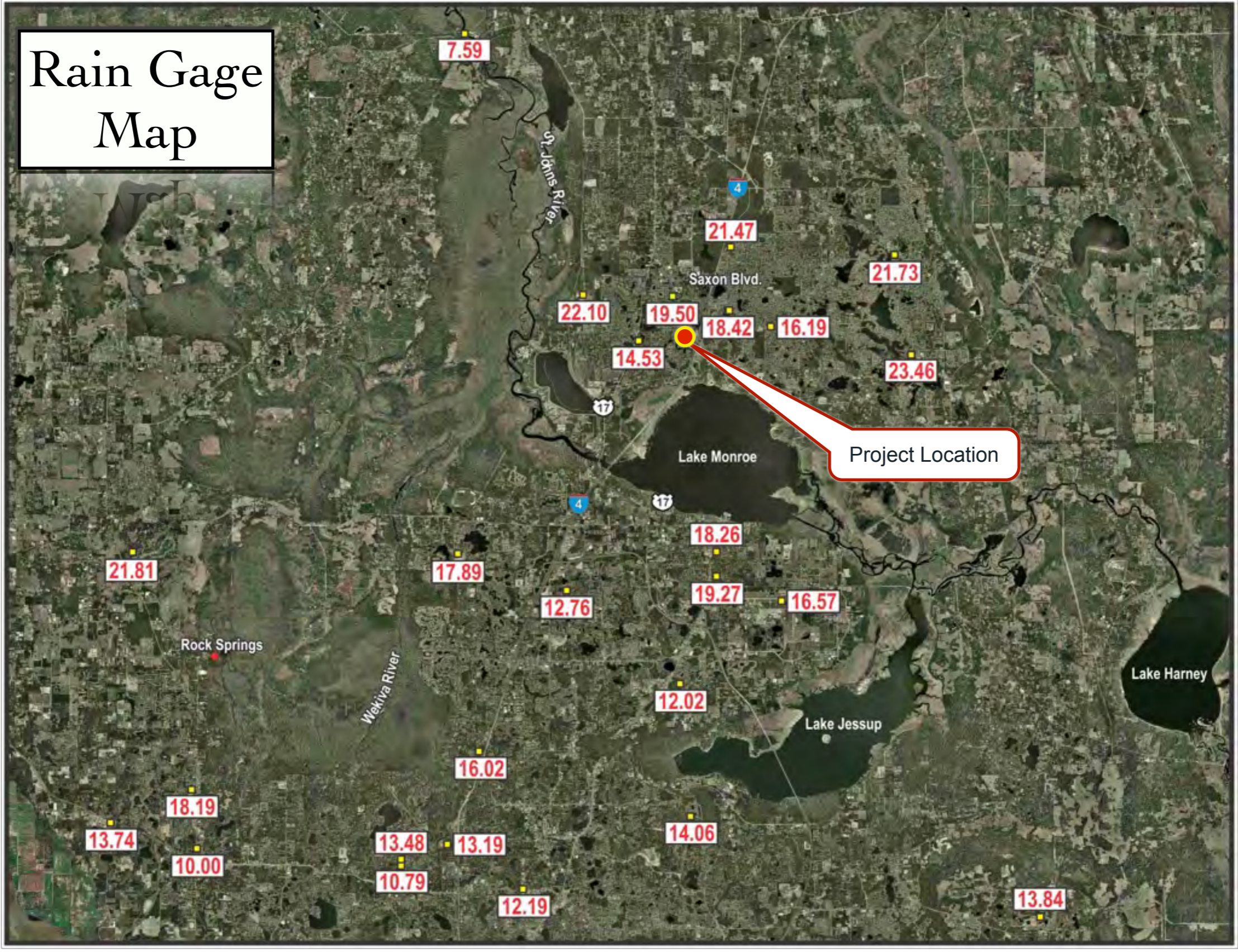
Comparison of Actual Rainfall to 100 year - 10 day storm

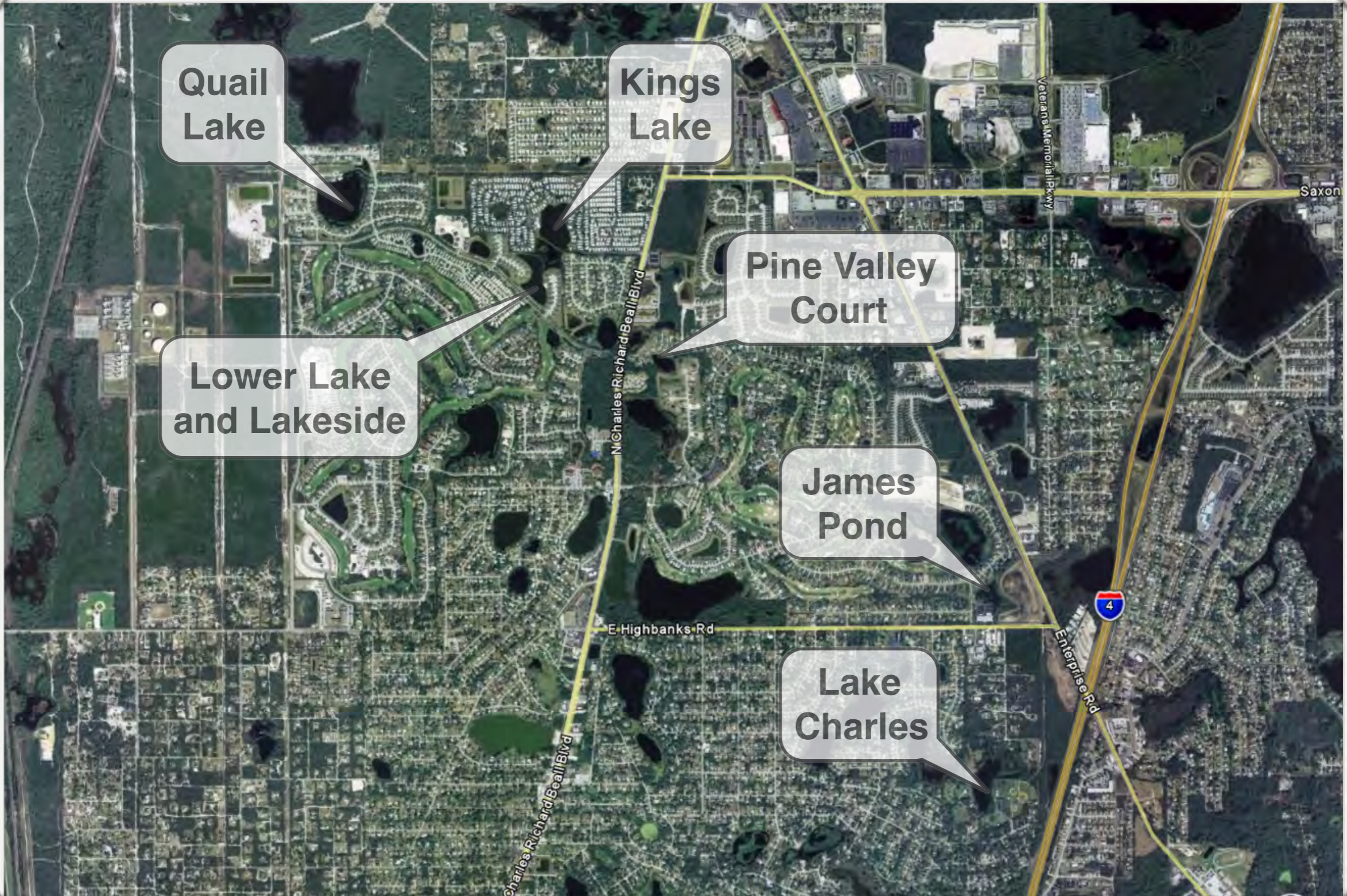# RAINFALL WEATHER STATION NEAR DEBARY, FL. TROPICAL STORM "FAY" (AUGUST 18-23, 2008)

Part 3

City-Wide Residential flooding in DeBary (T.S. Fay)

Presentation Outline

1. Location of Alexandra Woods Drive Relative to Highbanks/ Enterprise Pond

2. Tropical Storm Fay Rainfall Event

3. City-Wide Residential flooding in DeBary (T.S. Fay)

4. Photos of the Flooding at Alexandra Woods Drive (James Pond)

5. Original Damage Theory & Revised Damage Theories

6. Review Of Historic Aerials

7. Enterprise Road Widening project (completion date & stormwater flow regime)

8. Stormwater Modeling:

   a. The PEC FEMA model

   b. Devo Model 1 based on PEC model

   c. Devo Model 2 with field verified basin boundaries

   d. Simple Volumetric Comparison

   e. Devo Model 3 Pre-Enterprise Road Widening

9. Key Results of Devo Modeling – For Defendant

10. Defects with Marshall's Model – For Plaintiff

11. Rebuttal of Seidel's Model - For Plaintiff

RESIDENTIAL STRUCTURE FLOODING

DGCC LOWER LAKE AND LAKESIDE
(40 STRUCTURES FLOODED)

DGCC LOWER LAKE AND LAKESIDE
(40 STRUCTURES FLOODED)

DGCC LOWER LAKE AND LAKESIDE
(40 STRUCTURES FLOODED)

DGCC LOWER LAKE AND LAKESIDE
(40 STRUCTURES FLOODED)

DGCC LOWER LAKE AND LAKESIDE
(40 STRUCTURES FLOODED)

DEVO Engineering
CONSULTING GEOTECHNICAL ENGINEERS

KINGS LAKE (16 STRUCTURES FLOODED)

KINGS LAKE (16 STRUCTURES FLOODED)

Kings Lake (16 structures flooded)

DEVO Engineering
CONSULTING GEOTECHNICAL ENGINEERS

KINGS LAKE (16 STRUCTURES FLOODED)

LAKE SUSAN
(12 STRUCTURES FLOODED)

LAKE SUSAN (12 STRUCTURES FLOODED)

LAKE SUSAN (12 STRUCTURES FLOODED)

LAKE SUSAN (12 STRUCTURES FLOODED)

Project Location

PINE VALLEY COURT
(6 STRUCTURES FLOODED)

Pine Valley Court
(6 structures flooded)

PINE VALLEY COURT
(6 STRUCTURES FLOODED)

QUAIL LAKE (2 STRUCTURES FLOODED)

QUAIL LAKE (2 STRUCTURES FLOODED)

Quail Lake (2 structures flooded)

QUAIL LAKE (2 STRUCTURES FLOODED)

Lake Charles (1 structure flooded)

LAKE CHARLES (1 STRUCTURE FLOODED)

LAKE CHARLES (1 STRUCTURE FLOODED)

Part 4

Photos of the Flooding at Alexandra Woods Drive (James Pond)

DEVO Engineering
CONSULTING GEOTECHNICAL ENGINEERS

Presentation Outline

1. Location of Alexandra Woods Drive Relative to Highbanks/ Enterprise Pond

2. Tropical Storm Fay Rainfall Event

3. City-Wide Residential flooding in DeBary (T.S. Fay)

4. Photos of the Flooding at Alexandra Woods Drive (James Pond)

5. Original Damage Theory & Revised Damage Theories

6. Review Of Historic Aerials

7. Enterprise Road Widening project (completion date & stormwater flow regime)

8. Stormwater Modeling:

   a. The PEC FEMA model

   b. Devo Model 1 based on PEC model

   c. Devo Model 2 with field verified basin boundaries

   d. Simple Volumetric Comparison

   e. Devo Model 3 Pre-Enterprise Road Widening

9. Key Results of Devo Modeling – For Defendant

10. Defects with Marshall's Model – For Plaintiff

11. Rebuttal of Seidel's Model - For Plaintiff

James Pond (9 structures flooded)

James Pond (9 structures flooded)

JAMES POND (9 STRUCTURES FLOODED)

Labels on image: DBCC Pond, James Pond, Alexandra Woods Drive

James Pond (9 structures flooded)

James Pond Water Levels
Highest Recorded Stage = 35.2 ft, NGVD (08/30/08)
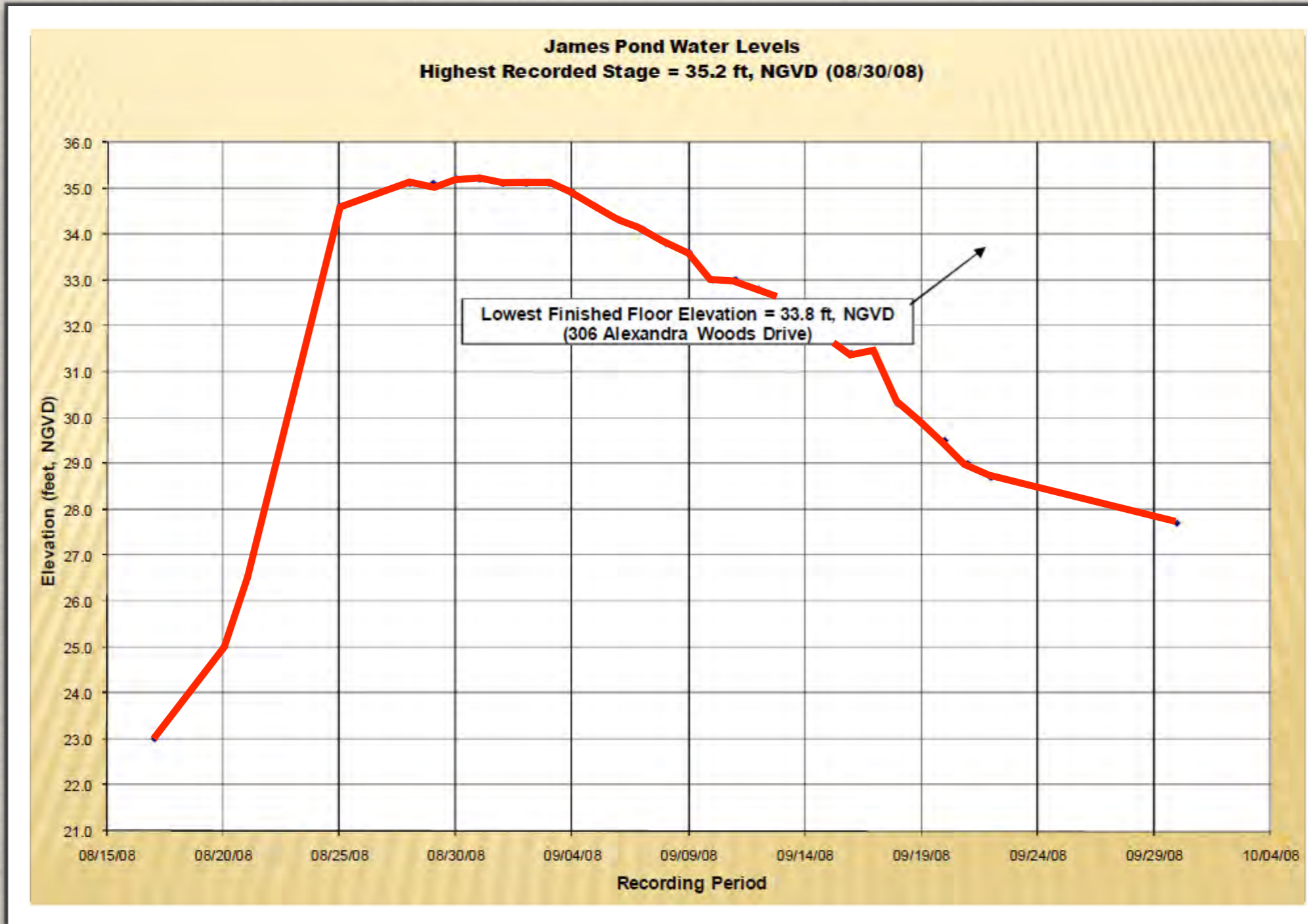
Lowest Finished Floor Elevation = 33.8 ft, NGVD
(306 Alexandra Woods Drive)

Table 1. Finished Floor Elevations of Flooded Homes

Alexandra Woods Dr. House Number	Flood Stage During Tropical Storm Fay (ft NGVD)	Finished Floor Elevation (ft NGVD)	Maximum Depth of Flooding (ft)
300	35.2	34.0	1.2
301	35.2	32.3	2.9
302	35.2	34.4	0.8
303	35.2	32.5	2.7
304	35.2	34.2	1.0
305	35.2	33.1	2.1
306	35.2	33.8	1.4
307	35.2	34.0	1.2
308	35.2	34.6	0.6
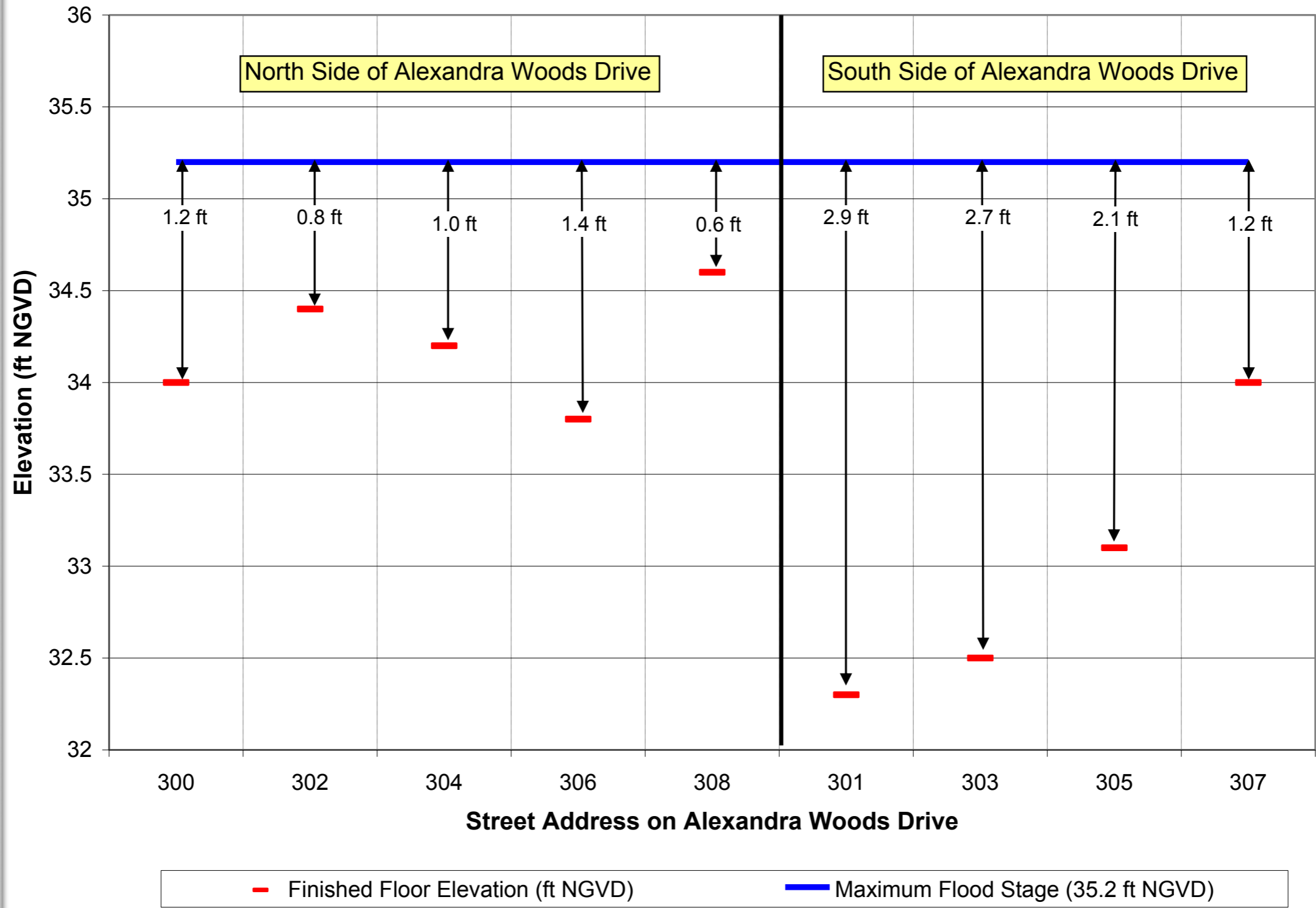
FINISHED FLOOR ELEVATIONS AND DEPTH OF FLOODING

Part 5

Original Damage Theory & Revised Damage Theories

Presentation Outline

1. Location of Alexandra Woods Drive Relative to Highbanks/ Enterprise Pond

2. Tropical Storm Fay Rainfall Event

3. City-Wide Residential flooding in DeBary (T.S. Fay)

4. Photos of the Flooding at Alexandra Woods Drive (James Pond)

5. Original Damage Theory & Revised Damage Theories

6. Review Of Historic Aerials

7. Enterprise Road Widening project (completion date & stormwater flow regime)

8. Stormwater Modeling:

   a. The PEC FEMA model

   b. Devo Model 1 based on PEC model

   c. Devo Model 2 with field verified basin boundaries

   d. Simple Volumetric Comparison

   e. Devo Model 3 Pre-Enterprise Road Widening

9. Key Results of Devo Modeling – For Defendant

10. Defects with Marshall's Model – For Plaintiff

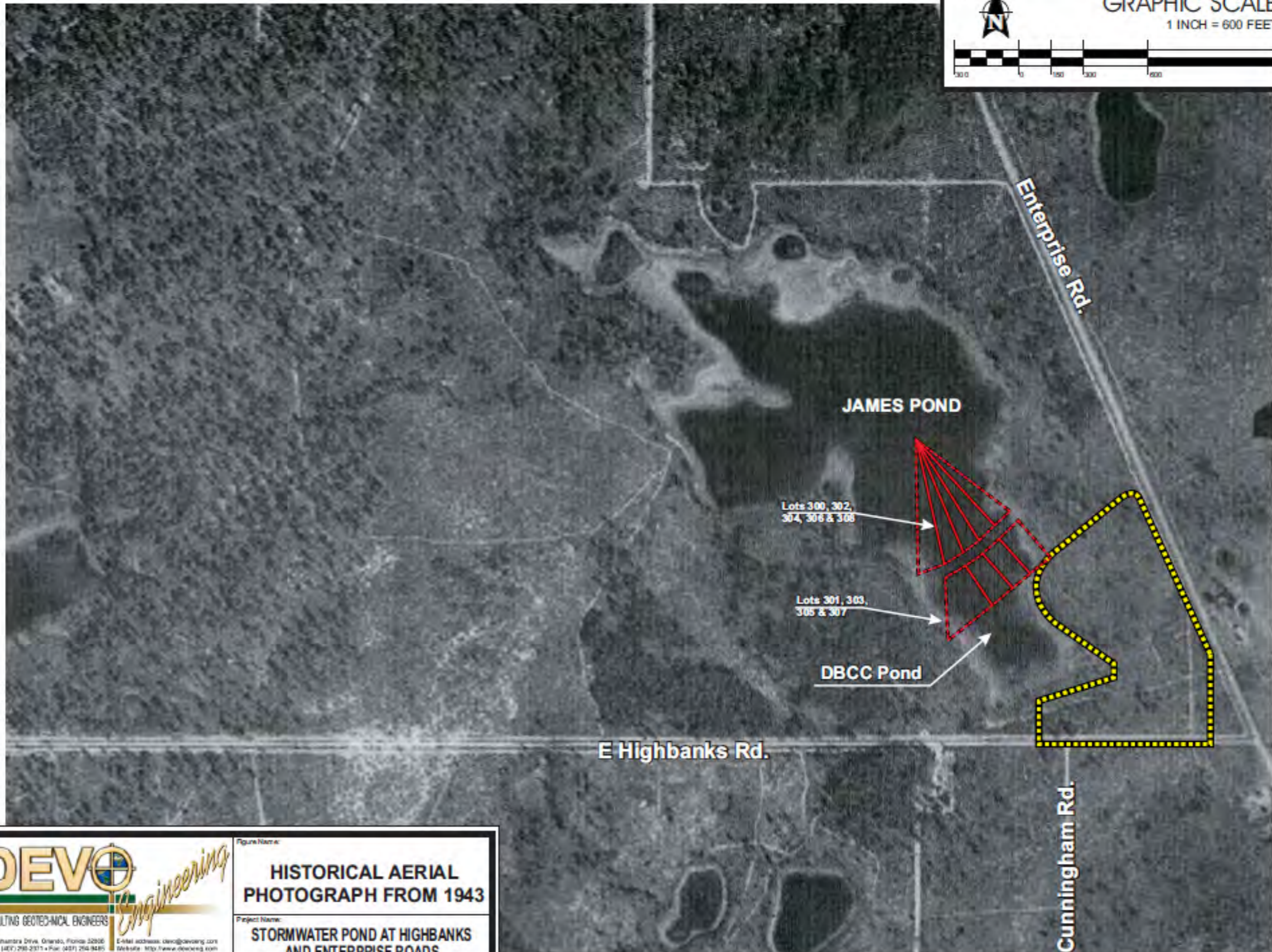11. Rebuttal of Seidel's Model - For Plaintiff

The Allegations

※ The original damage theory alleges that chronic wetness in the Enterprise Road Pond was a significant contributory factor to the flooding of the residences during Tropical Storm Fay.

※ The revised damage theory alleges that the widening of Enterprise Road and the construction of the Enterprise Road Pond resulted in an increase in runoff entering the James Pond basin and directly contributed to the flooding of the residences during Tropical Storm Fay.

※ The second revision of the damage theory now focuses on the Enterprise Road Pond base of aquifer elevation in the infiltration model described in the permit.

Part 6

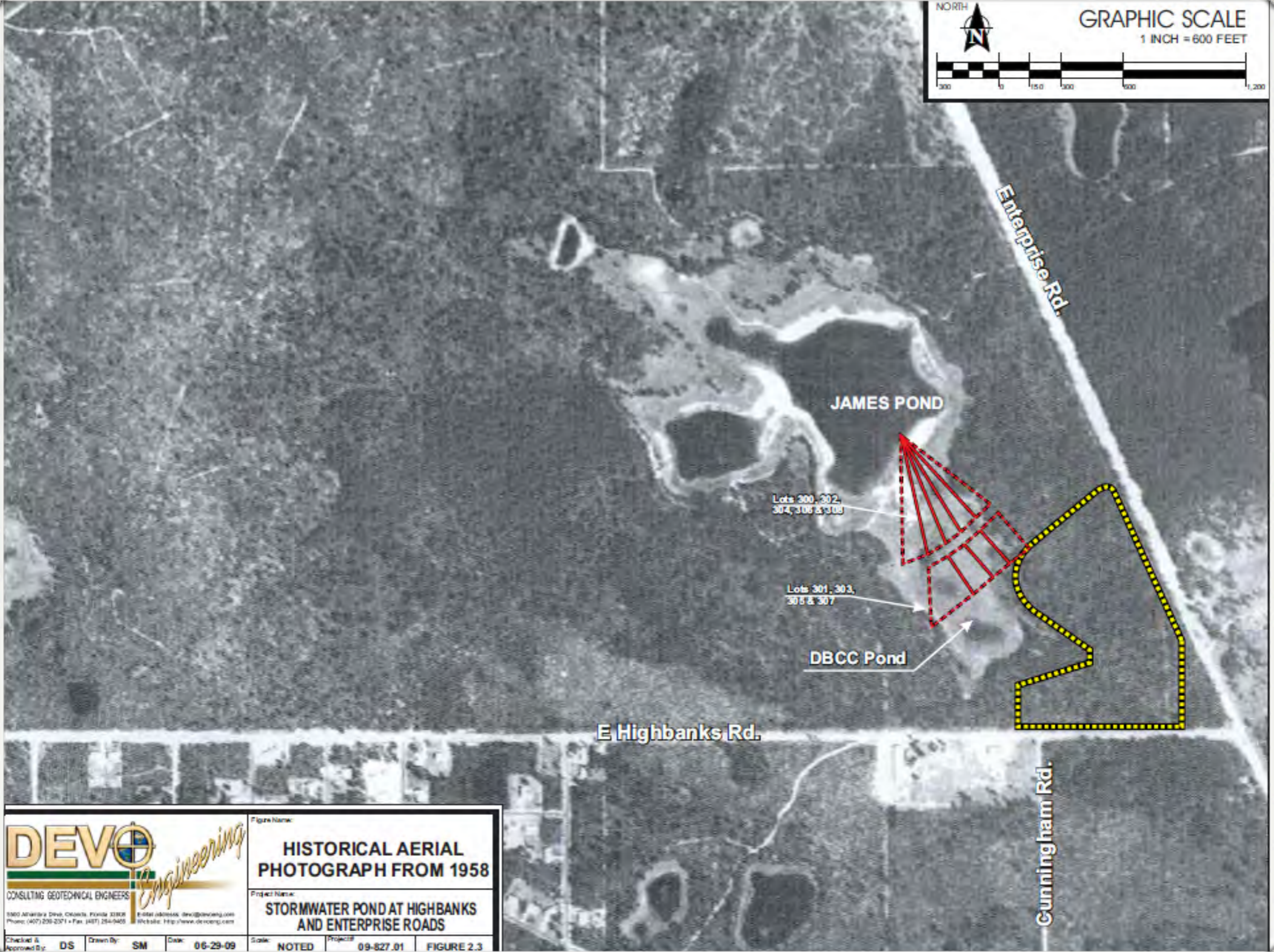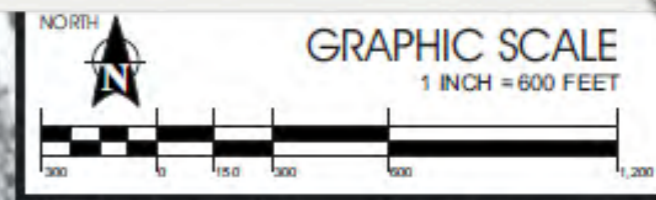## Review Of Historic Aerials

Presentation Outline

1. Location of Alexandra Woods Drive Relative to Highbanks/ Enterprise Pond

2. Tropical Storm Fay Rainfall Event

3. City-Wide Residential flooding in DeBary (T.S. Fay)

4. Photos of the Flooding at Alexandra Woods Drive (James Pond)

5. Original Damage Theory & Revised Damage Theories

6. Review Of Historic Aerials

7. Enterprise Road Widening project (completion date & stormwater flow regime)

8. Stormwater Modeling:

   a. The PEC FEMA model

   b. Devo Model 1 based on PEC model

   c. Devo Model 2 with field verified basin boundaries

   d. Simple Volumetric Comparison

   e. Devo Model 3 Pre-Enterprise Road Widening

9. Key Results of Devo Modeling – For Defendant

10. Defects with Marshall's Model – For Plaintiff

11. Rebuttal of Seidel's Model - For Plaintiff

1943

GRAPHIC SCALE
1 INCH = 600 FEET

NORTH

Enterprise Rd.

JAMES POND

Lots 300, 302, 304, 306 & 308

Lots 301, 303, 305 & 307

DBCC Pond

E Highbanks Rd.

Cunningham Rd.

DEVO Engineering
CONSULTING GEOTECHNICAL ENGINEERS

Figure Name:
HISTORICAL AERIAL
PHOTOGRAPH FROM 1958

Project Name:
STORMWATER POND AT HIGHBANKS
AND ENTERPRISE ROADS

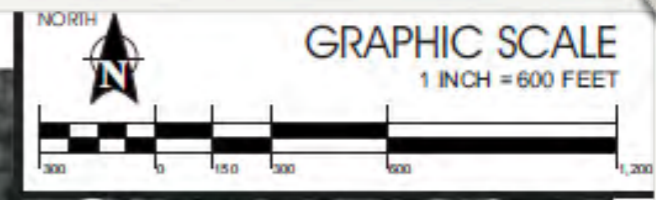| Checked & Approved By: DS | Drawn By: SM | Date: 06-29-09 | Scale: NOTED | Project#: 09-827.01 | FIGURE 2.3 |

1958

GRAPHIC SCALE
1 INCH = 600 FEET

JAMES POND

Lots 300, 302, 304, 306 & 308

Lots 301, 303, 305 & 307

DBCC Pond

E Highbanks Rd.

Enterprise Rd.

Cunningham Rd.

Figure Name:
HISTORICAL AERIAL PHOTOGRAPH FROM 1963

Project Name:
STORMWATER POND AT HIGHBANKS AND ENTERPRISE ROADS

Checked & Approved By: DS | Drawn By: SM | Date: 06-29-09 | Scale: NOTED | Project: 09-827.01 | FIGURE 2.4

1963

GRAPHIC SCALE
1 INCH = 400 FEET

JAMES POND

Lots 300, 302, 304, 306 & 308

Lots 301, 303, 305 & 307

DBCC Pond

Enterprise Rd.

Cunningham Rd.

E Highbanks Rd.

DEVO Engineering
CONSULTING GEOTECHNICAL ENGINEERS

Figure Name:
HISTORICAL AERIAL PHOTOGRAPH FROM 1964

Project Name:
STORMWATER POND AT HIGHBANKS AND ENTERPRISE ROADS

| Checked & Approved By: | DS | Drawn By: | SM | Date: | 06-29-09 | Scale: | NOTED | Project#: | 09-827.01 | FIGURE 2.5 |

1964

GRAPHIC SCALE

1 INCH = 600 FEET

Enterprise Rd.

JAMES POND

Lots 300, 302, 304, 306 & 308

Lots 301, 303, 305 & 307

DBCC Pond

E Highbanks Rd.

Cunningham Rd.

HISTORICAL AERIAL PHOTOGRAPH FROM 1967

Project Name: **STORMWATER POND AT HIGHBANKS AND ENTERPRISE ROADS**

Checked & Approved By: DS   Drawn By: SM   Date: 06-29-09   Scale: NOTED   Project #: 09-827.01   FIGURE 2.6
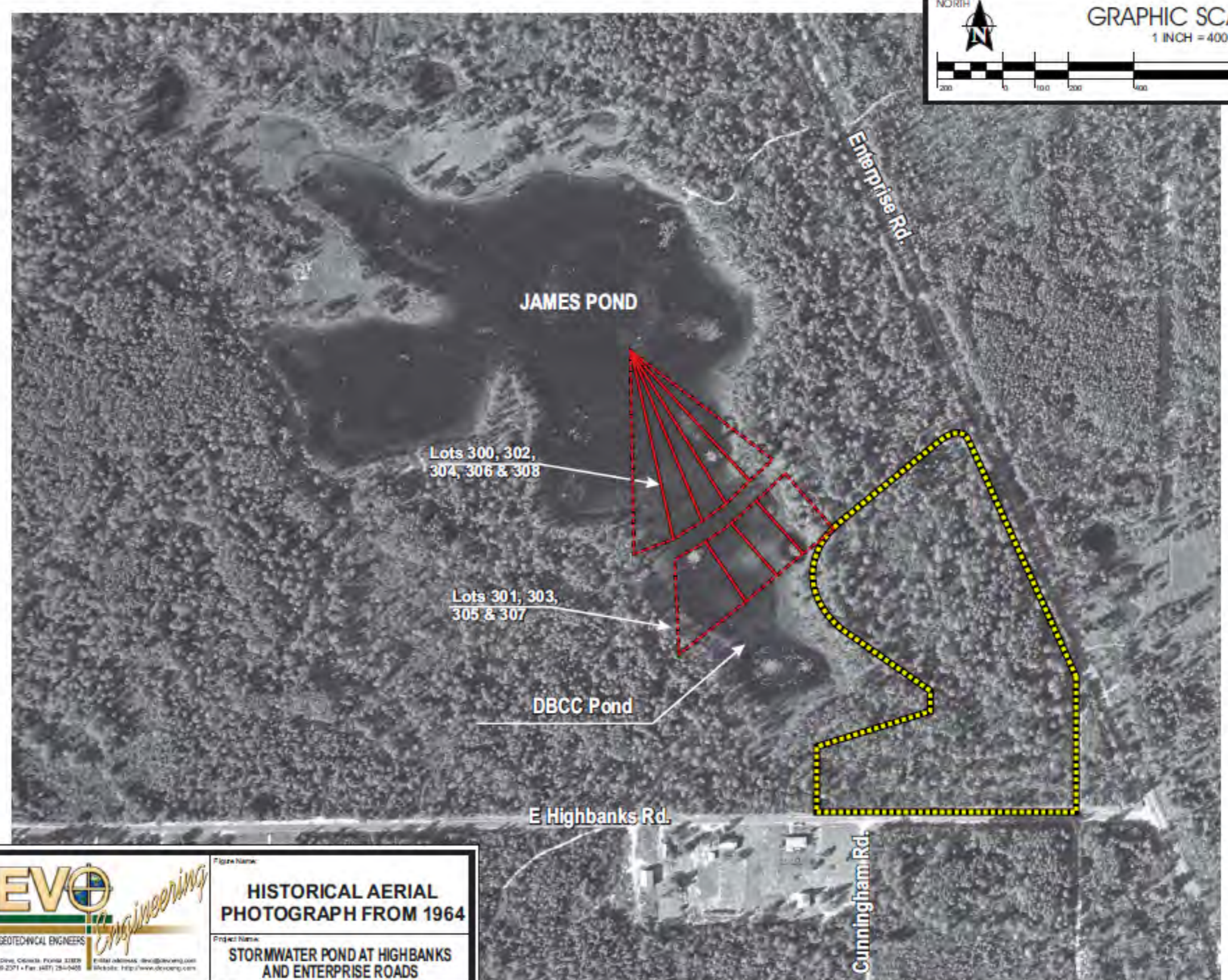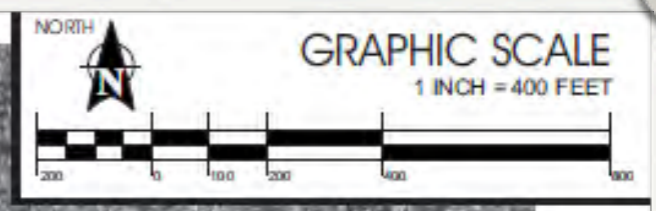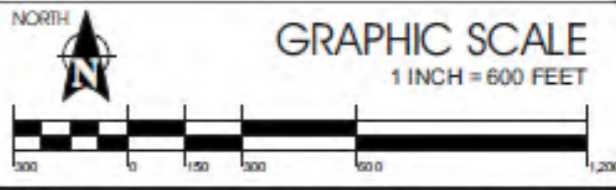
DEVO Engineering
CONSULTING GEOTECHNICAL ENGINEERS

1967

GRAPHIC SCALE
1 INCH = 400 FEET

JAMES POND

Lots 300, 302, 304, 306 & 308

Lots 301, 303, 305 & 307

DBCC Pond

Enterprise Rd.

Cunningham Rd.

E Highbanks Rd.

DEVO *Engineering*
CONSULTING GEOTECHNICAL ENGINEERS

HISTORICAL AERIAL PHOTOGRAPH FROM 1969

Project Name:
STORMWATER POND AT HIGHBANKS AND ENTERPRISE ROADS

| Checked & Approved By: | DS | Drawn By: | SM | Date: | 06-29-09 | Scale: | NOTED | Project # | 09-827.01 | FIGURE 2.7 |

1969

GRAPHIC SCALE
1 INCH = 600 FEET

NORTH

Enterprise Rd.

JAMES POND

Lots 300, 302, 304, 306 & 308

Lots 301, 303, 305 & 307

DBCC Pond

E Highbanks Rd.

Cunningham Rd.

DEVO Engineering
CONSULTING GEOTECHNICAL ENGINEERS

HISTORICAL AERIAL PHOTOGRAPH FROM 1971

Project Name:
STORMWATER POND AT HIGHBANKS AND ENTERPRISE ROADS

Checked & Approved By:	DS	Drawn By:	SM	Date:	06-29-09	Scale:	NOTED	Project #	09-827.01	FIGURE 2.8

1971

GRAPHIC SCALE
1 INCH = 600 FEET

Enterprise Rd.

JAMES POND

Lots 300, 302, 304, 306 & 308

Lots 301, 303, 305 & 307

DBCC Pond

E Highbanks Rd.

Cunningham Rd.

DEVO Engineering
CONSULTING GEOTECHNICAL ENGINEERS

Figure Name:
HISTORICAL AERIAL PHOTOGRAPH FROM 1973

Project Name:
STORMWATER POND AT HIGHBANKS AND ENTERPRISE ROADS

| Checked & Approved By: | DS | Drawn By: | SM | Date: | 06-29-09 |
| Scale: | NOTED | Project # | 09-827.01 | | FIGURE 2.9 |

1973

GRAPHIC SCALE
1 INCH = 400 FEET

JAMES POND

Enterprise Rd.

Lots 300, 302, 304, 306 & 308

Lots 301, 303, 305 & 307

DBCC Pond

E Highbanks Rd.

Cunningham Rd.

HISTORICAL AERIAL PHOTOGRAPH FROM 1974

Project Name:
STORMWATER POND AT HIGHBANKS AND ENTERPRISE ROADS

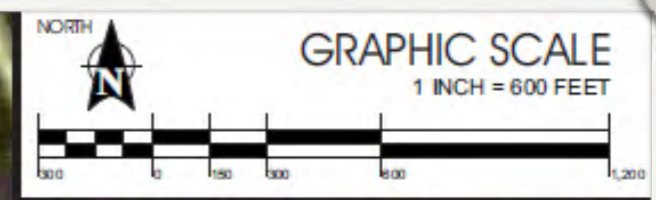Checked & Approved By: DS   Drawn By: SM   Date: 06-29-09   Scale: NOTED   Project #: 09-827.01   FIGURE 2.10

DEVO
CONSULTING GEOTECHNICAL ENGINEERS

1974

GRAPHIC SCALE
1 INCH = 400 FEET

JAMES POND

Lots 300, 302, 304, 306 & 308

Lots 301, 303, 305 & 307

DBCC Pond

Enterprise Rd.

E Highbanks Rd.

Cunningham Rd.

HISTORICAL AERIAL PHOTOGRAPH FROM 1976

Project Name:
STORMWATER POND AT HIGHBANKS AND ENTERPRISE ROADS

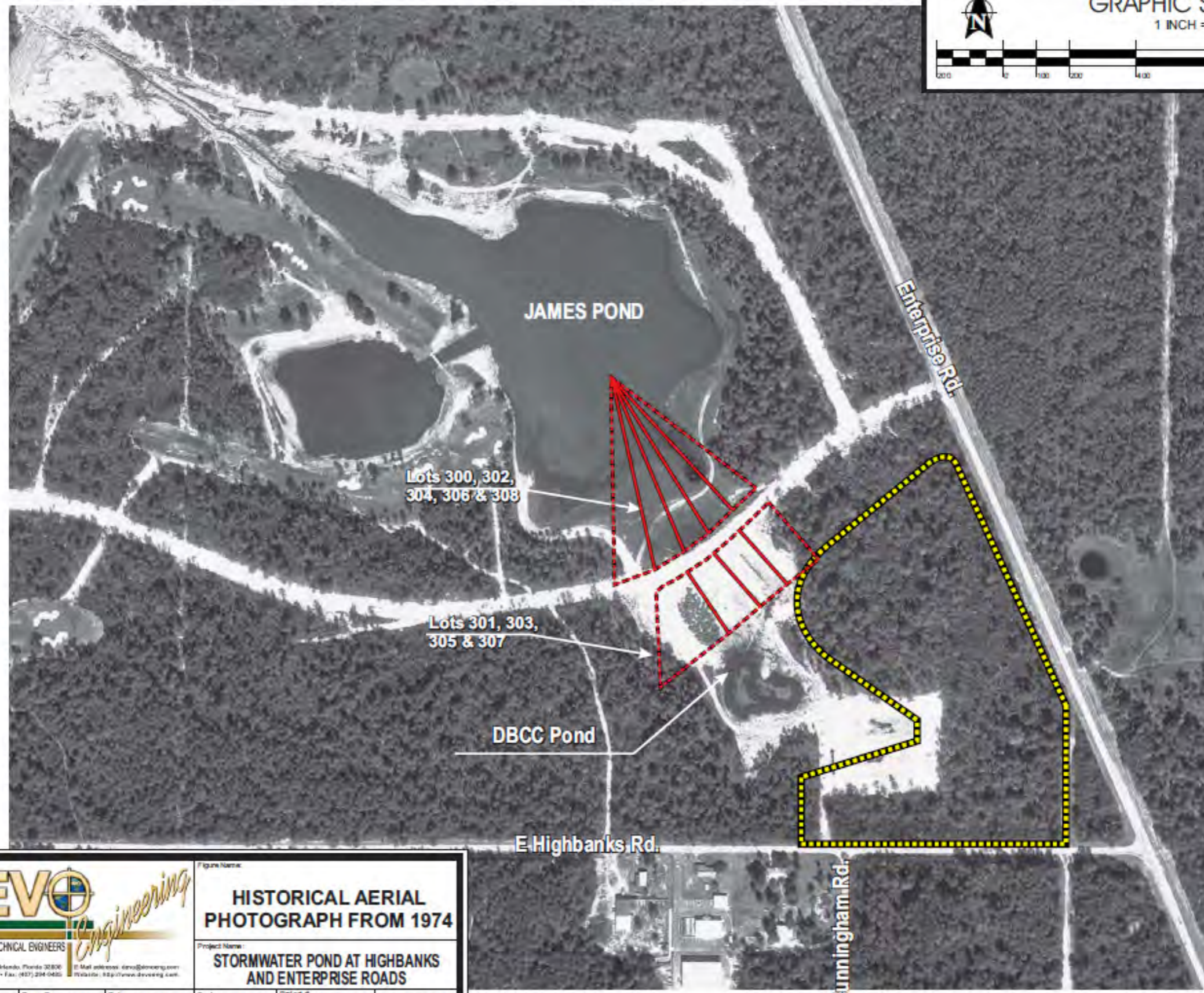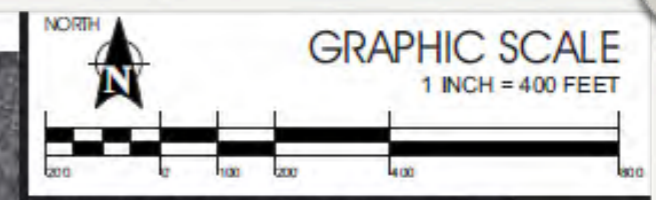Checked & Approved By: DS | Drawn By: SM | Date: 06-29-09 | Scale: NOTED | Project #: 09-827.01 | FIGURE 2.11

1976

GRAPHIC SCALE
1 INCH = 600 FEET

JAMES POND

Lots 300, 302, 304, 306 & 308

Lots 301, 303, 305 & 307

DBCC Pond

E Highbanks Rd.

Enterprise Rd.

Cunningham Rd.

DEVO Engineering
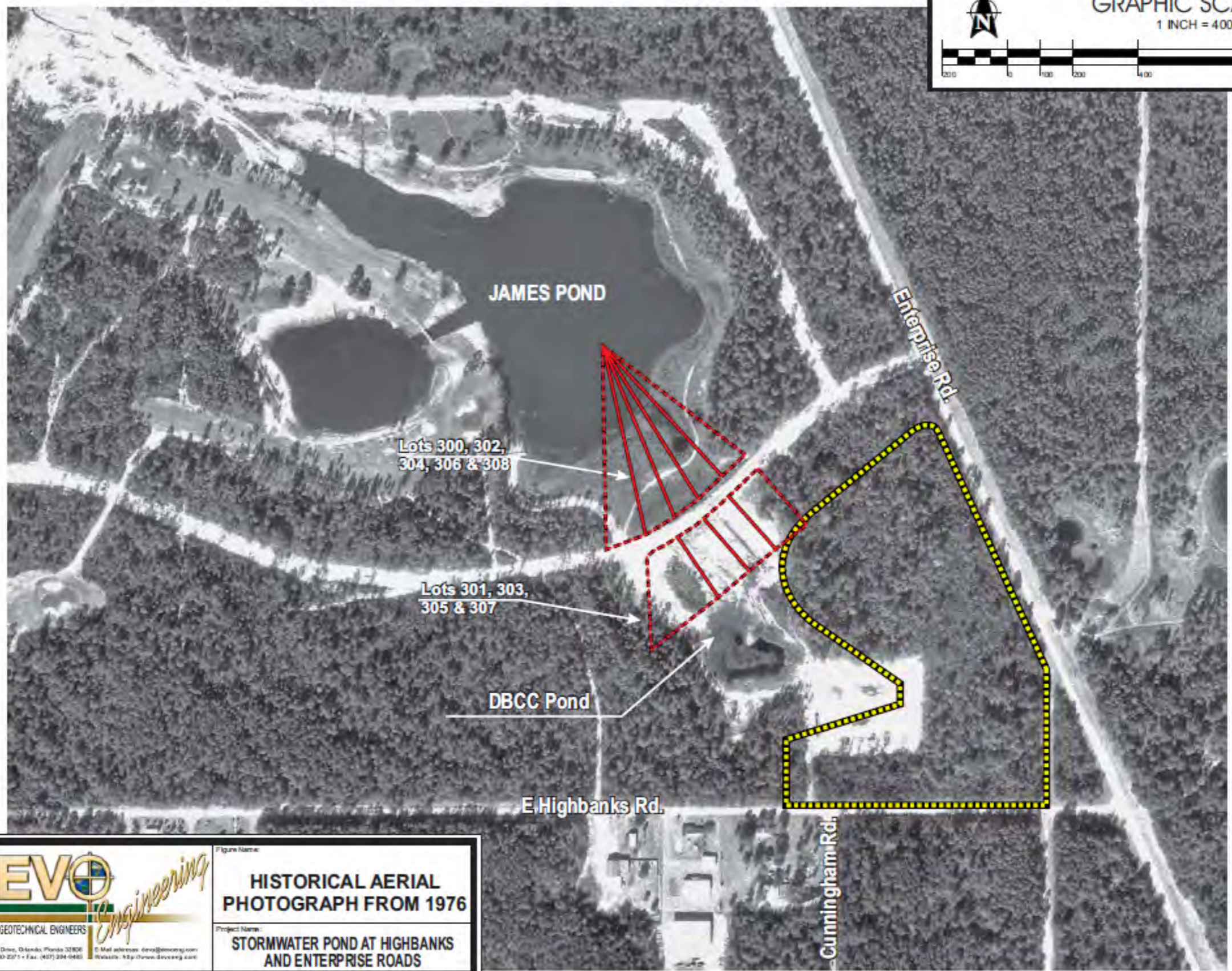CONSULTING GEOTECHNICAL ENGINEERS

HISTORICAL AERIAL
PHOTOGRAPH FROM 1986

Project Name:
STORMWATER POND AT HIGHBANKS
AND ENTERPRISE ROADS

| Checked & Approved By: | DS | Drawn By: | SM | Date: | 06-29-09 | Scale: | NOTED | Project #: | 09-827.01 | FIGURE 2.16 |

1986

GRAPHIC SCALE
1 INCH = 400 FEET

JAMES POND

Enterprise Rd.

Lots 300, 302, 304, 306 & 308

Lots 301, 303, 305 & 307

DBCC Pond

E Highbanks Rd.

Cunningham Rd.

DEVO Engineering
CONSULTING GEOTECHNICAL ENGINEERS

Figure Name:	**HISTORICAL AERIAL PHOTOGRAPH FROM 1992**
Project Name:	**STORMWATER POND AT HIGHBANKS AND ENTERPRISE ROADS**

| Checked & Approved By: DS | Drawn By: SM | Date: 06-29-09 | Scale: NOTED | Project #: 09-827.01 | FIGURE 2.19 |

1992

GRAPHIC SCALE
1 INCH = 600 FEET

JAMES POND

Lots 300, 302, 304, 306 & 308

Lots 301, 303, 305 & 307

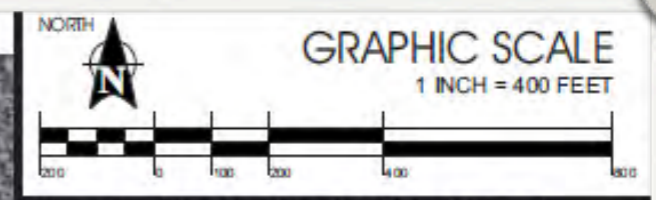DBCC Pond

E Highbanks Rd.

Enterprise Rd.

Cunningham Rd.

HISTORICAL AERIAL PHOTOGRAPH FROM 1993

Project Name:
STORMWATER POND AT HIGHBANKS AND ENTERPRISE ROADS

| Checked & Approved By: | DS | Drawn By: | SM | Date: | 06-29-09 | Scale: NOTED | Project # 09-827.01 | FIGURE 2.20 |

DEVO
Engineering
CONSULTING GEOTECHNICAL ENGINEERS

1993

GRAPHIC SCALE
1 INCH = 600 FEET

NORTH
N

JAMES POND

Lots 300, 302, 304, 306 & 308

Lots 301, 303, 305 & 307

DBCC Pond

Enterprise Rd.

E Highbanks Rd.

Cunningham Rd.

HISTORICAL AERIAL PHOTOGRAPH FROM 1999

STORMWATER POND AT HIGHBANKS AND ENTERPRISE ROADS

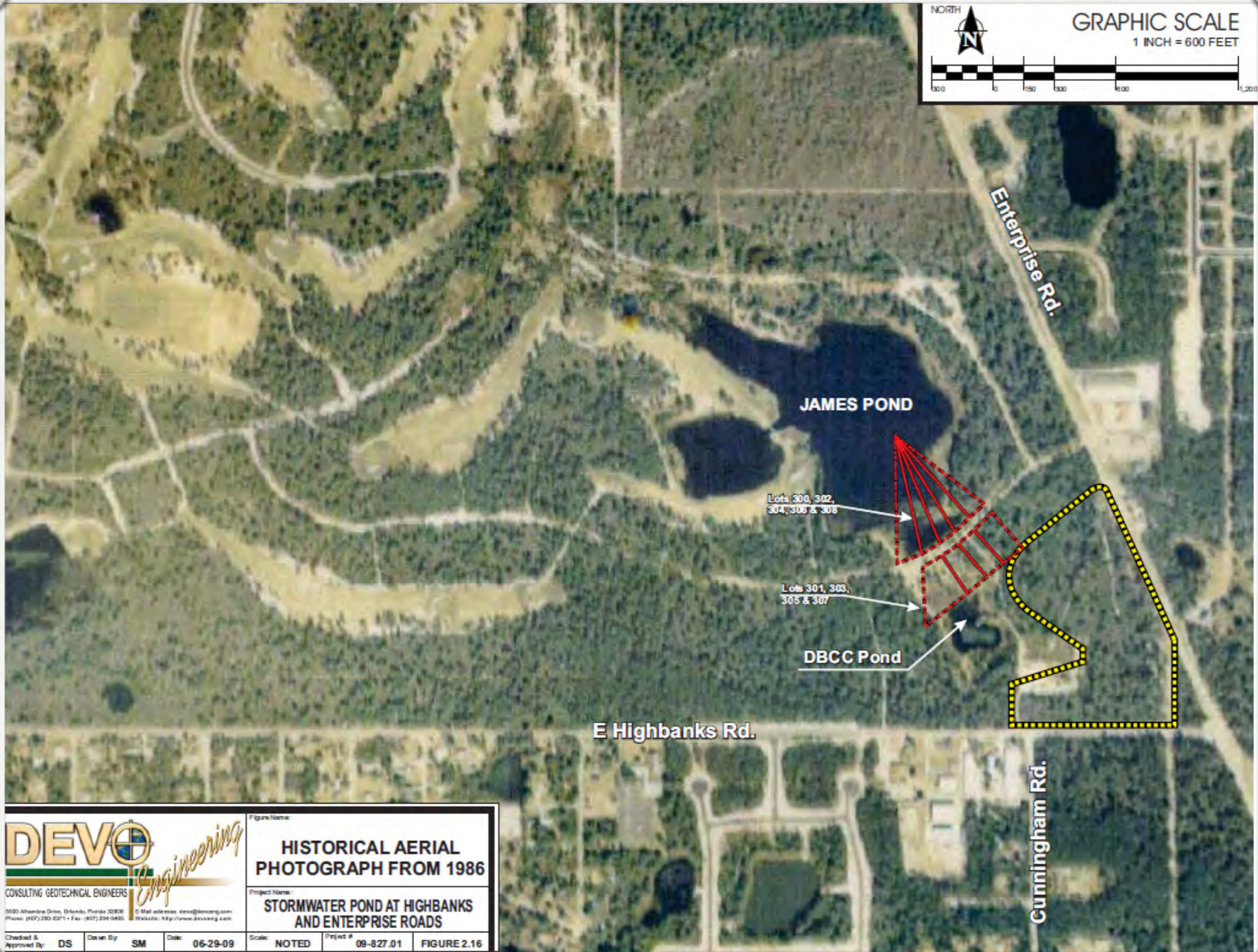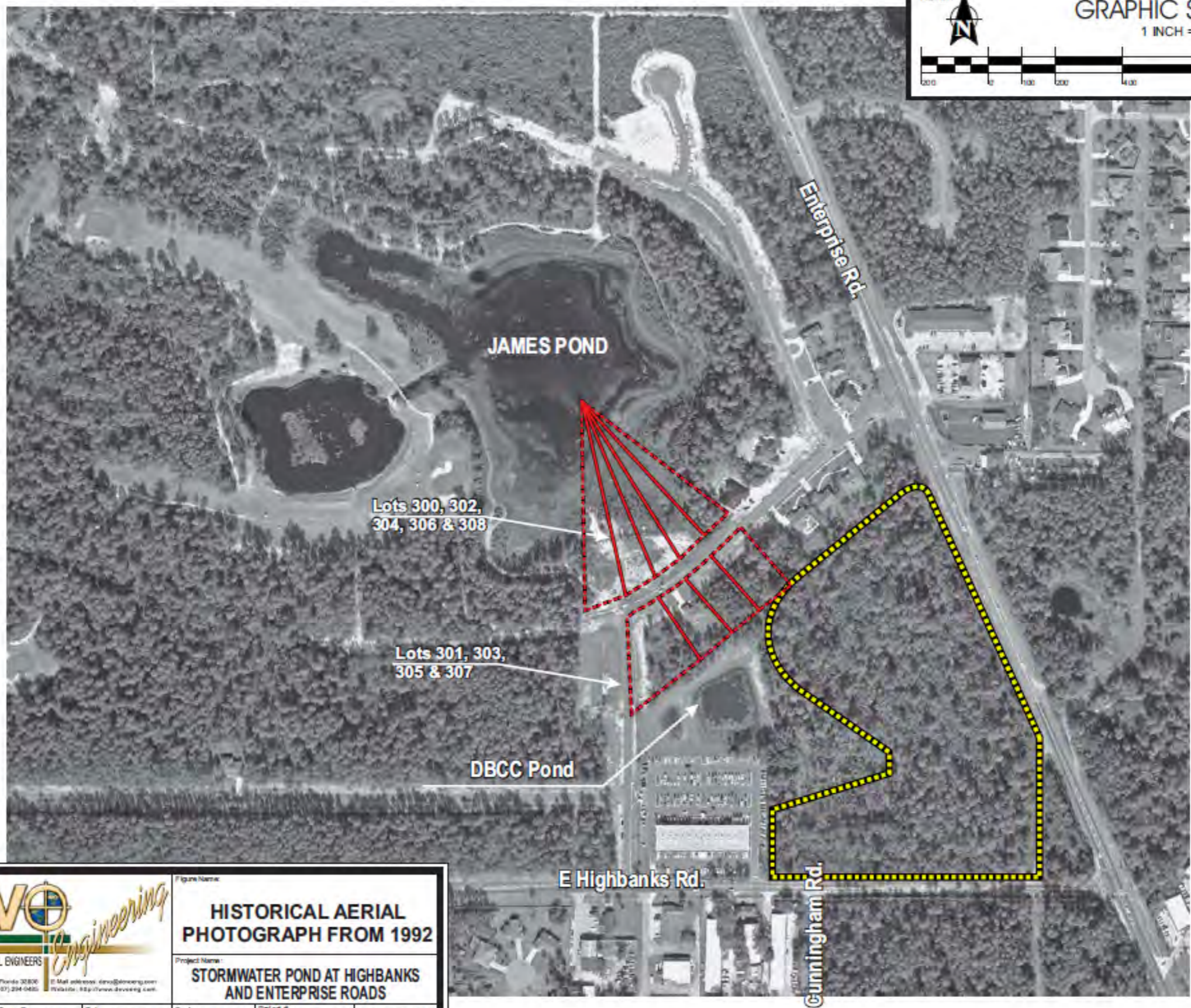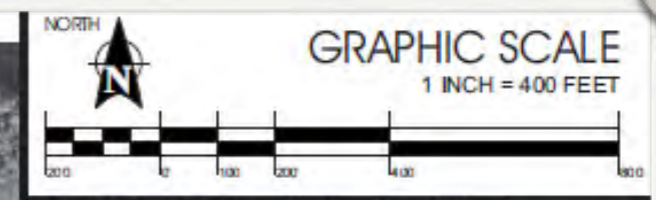Checked & Approved By: DS | Drawn By: SM | Date: 06-29-09 | Scale: NOTED | Project #: 09-827.01 | FIGURE 2.23

DEVO Engineering
CONSULTING GEOTECHNICAL ENGINEERS

1999

GRAPHIC SCALE
1 INCH = 600 FEET

JAMES POND

Lots 300, 302, 304, 306 & 308

Lots 301, 303, 305 & 307

DBCC Pond

Enterprise Rd.

E Highbanks Rd.

Cunningham Rd.

HISTORICAL AERIAL PHOTOGRAPH FROM 2003

Project Name:
STORMWATER POND AT HIGHBANKS AND ENTERPRISE ROADS

| Checked & Approved By: | DS | Drawn By: | SM | Date: | 06-29-09 | Scale: | NOTED | Project #: | 09-827.01 | FIGURE 2.24 |

DEVO Engineering
CONSULTING GEOTECHNICAL ENGINEERS

2003

HISTORICAL AERIAL PHOTOGRAPH FROM 2004

STORMWATER POND AT HIGHBANKS AND ENTERPRISE ROADS

2004

GRAPHIC SCALE
1 INCH = 600 FEET

JAMES POND

Lots 300, 302, 304, 306 & 308

Lots 301, 303, 305 & 307

DBCC Pond

E Highbanks Rd.

Enterprise Rd.

Cunningham Rd.

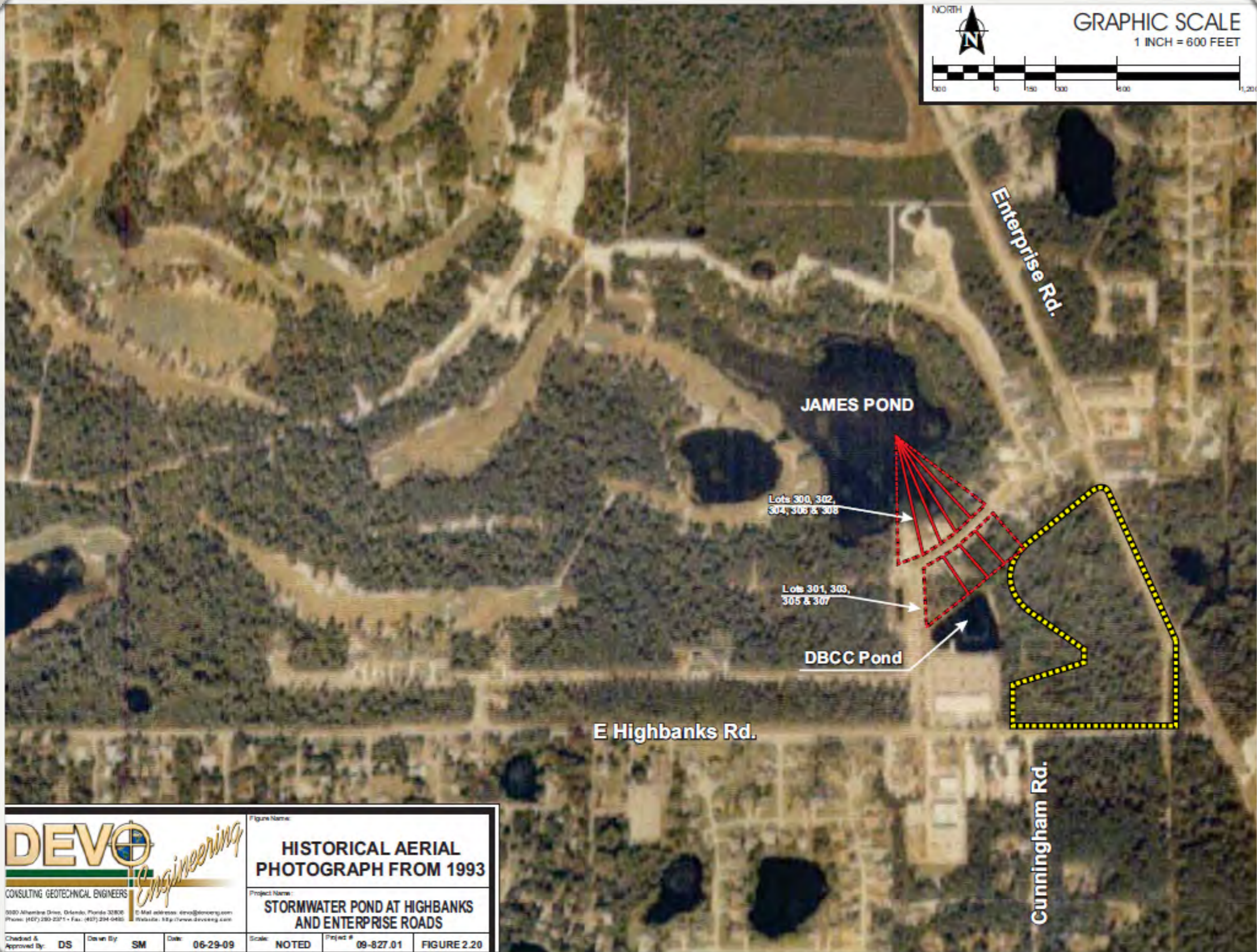**DEVO** Engineering
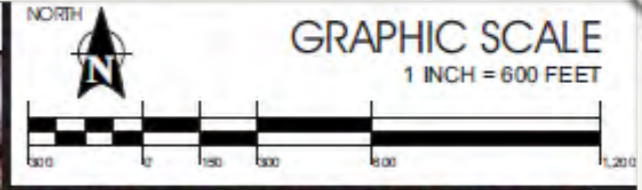CONSULTING GEOTECHNICAL ENGINEERS
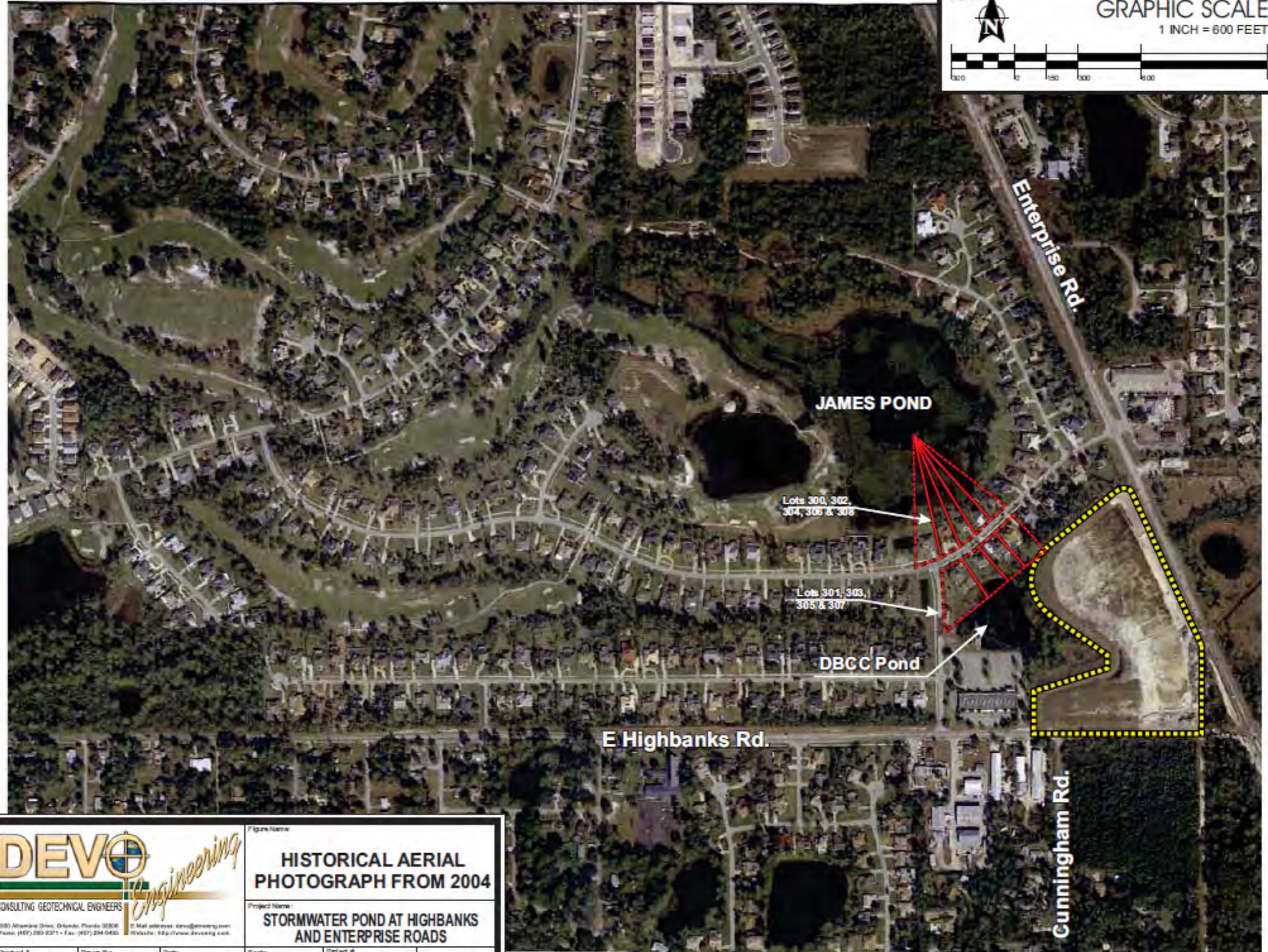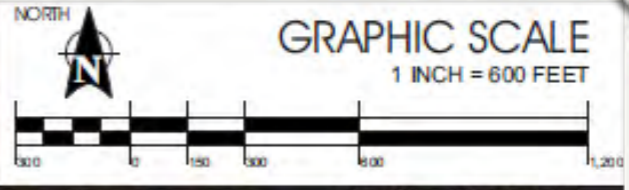
Figure Name:
HISTORICAL AERIAL PHOTOGRAPH FROM 2006

Project Name:
STORMWATER POND AT HIGHBANKS AND ENTERPRISE ROADS

| Checked & Approved By: DS | Drawn By: SM | Date: 06-29-09 | Scale: NOTED | Project #: 09-827.01 | FIGURE 2.26 |

2006

Part 7

Enterprise Road Widening project (completion date & stormwater flow regime)

DEVO Engineering
CONSULTING GEOTECHNICAL ENGINEERS

Presentation Outline

1. Location of Alexandra Woods Drive Relative to Highbanks/ Enterprise Pond

2. Tropical Storm Fay Rainfall Event

3. City-Wide Residential flooding in DeBary (T.S. Fay)

4. Photos of the Flooding at Alexandra Woods Drive (James Pond)

5. Original Damage Theory & Revised Damage Theories

6. Review Of Historic Aerials

7. Enterprise Road Widening project (completion date & stormwater flow regime)

8. Stormwater Modeling:

   a. The PEC FEMA model

   b. Devo Model 1 based on PEC model

   c. Devo Model 2 with field verified basin boundaries

   d. Simple Volumetric Comparison

   e. Devo Model 3 Pre-Enterprise Road Widening

9. Key Results of Devo Modeling – For Defendant

10. Defects with Marshall's Model – For Plaintiff

11. Rebuttal of Seidel's Model - For Plaintiff

DEVO Engineering
CONSULTING GEOTECHNICAL ENGINEERS

Timing Of Construction

- Early planning discussions for the widening of Enterprise Road began sometime in the late 1980s.

- First construction documents prepared in 1997.

- First drawings and stormwater calculations submitted to SJRWMD in June 1998.

- Environmental Resource Permit issued by SJRWMD on November 25, 1998.

- Pond construction started in 2002 and completed in Nov 2003

- Construction on road widening started in May 2004 and was complete in December 2005.

DEV *Engineering*
CONSULTING GEOTECHNICAL ENGINEERS

FLOW REGIME BEFORE ROADWAY WIDENING

- AREAS SHADED IN BLUE DRAIN DIRECTLY TO GASLINE LAKE. NOTE THAT THIS AREA INCLUDES ENTERPRISE ROAD AND SOME BASINS CONTIGUOUS TO ENTERPRISE ROAD.

- AREAS SHADED IN YELLOW DRAIN DIRECTLY TO DBCC POND. NOTE THAT THIS INCLUDES THE AREA WHICH IS NOW ENTERPRISE ROAD POND.

- AREAS SHADED IN GREEN DRAIN DIRECTLY TO JAMES POND

- GASLINE LAKE CAN DISCHARGE TO DBCC POND

- DBCC POND DISCHARGES TO JAMES POND

Flow Regime After Roadway Widening

- Areas shaded in blue drain directly to Gasline Lake.

- Areas shaded in pink drain directly to Enterprise Road Pond

- Areas shaded in yellow drain directly to DBCC pond.

- Areas shaded in green drain directly to James Pond

- Gasline Lake can discharge to Enterprise Road Pond

- Enterprise Road Pond can discharge to DBCC Pond

- DBCC Pond discharges to James Pond

COMPARISON OF BASIN AREAS BEFORE AND AFTER ROAD WIDENING

Basin / Pond	Before Road Widening 2 (acres)	After Road Widening 1 (acres)
Area draining to Gasline Lake	157.1	94
Area Draining to Enterprise Road Pond	0	81.2
Area Draining to DBCC Pond	29.7	13
Area Draining to James Pond	322.8	322.9
Total	**509.6**	**511.1**

Notes:
1. Area before road wideing represents areas in Devo Model 3.
2. Area after road widening represents basin areas in Devo Model 2.

Part 8

Stormwater Modeling

Part 8a

The PEC FEMA Model

PRESENTATION OUTLINE

1. Location of Alexandra Woods Drive Relative to Highbanks/ Enterprise Pond

2. Tropical Storm Fay Rainfall Event

3. City-Wide Residential flooding in DeBary (T.S. Fay)

4. Photos of the Flooding at Alexandra Woods Drive (James Pond)

5. Original Damage Theory & Revised Damage Theories

6. Review Of Historic Aerials

7. Enterprise Road Widening project (completion date & stormwater flow regime)

8. Stormwater Modeling:

    a. The PEC FEMA model

    b. Devo Model 1 based on PEC model

    c. Devo Model 2 with field verified basin boundaries

    d. Simple Volumetric Comparison

    e. Devo Model 3 Pre-Enterprise Road Widening

9. Key Results of Devo Modeling – For Defendant

10. Defects with Marshall's Model – For Plaintiff

11. Rebuttal of Seidel's Model - For Plaintiff

The PEC FEMA Model

※ Professional Engineering Consultants, Inc., (PEC) prepared a hydrologic and hydraulic analysis of the James Pond basin system for submission to the Federal Emergency Management Agency (FEMA) in support of an application for the acquisition and demolition of the affected nine (9) properties under the Hazard Mitigation Grant Program (HMGP). The PEC stormwater analysis was performed using the Advanced Interconnected Channel and Pond Routing Model (adICPR).

※ The PEC FEMA model was constructed to analyze several storm events in support of the benefit cost analysis

※ The PEC FEMA model was used as the basis for further modeling performed by Devo Engineering.

Basin Boundaries in PEC Model

Part 8b

Devo Model 1, Based On PEC Model

Presentation Outline

1. Location of Alexandra Woods Drive Relative to Highbanks/Enterprise Pond

2. Tropical Storm Fay Rainfall Event

3. City-Wide Residential flooding in DeBary (T.S. Fay)

4. Photos of the Flooding at Alexandra Woods Drive (James Pond)

5. Original Damage Theory & Revised Damage Theories

6. Review Of Historic Aerials

7. Enterprise Road Widening project (completion date & stormwater flow regime)

8. Stormwater Modeling:

   a. The PEC FEMA model

   b. Devo Model 1 based on PEC model

   c. Devo Model 2 with field verified basin boundaries

   d. Simple Volumetric Comparison

   e. Devo Model 3 Pre-Enterprise Road Widening

9. Key Results of Devo Modeling – For Defendant

10. Defects with Marshall's Model – For Plaintiff

11. Rebuttal of Seidel's Model - For Plaintiff

DEVO
Engineering
CONSULTING GEOTECHNICAL ENGINEERS

Devo Model 1

Devo Model 1 is based on the PEC FEMA model, with the following changes applicable to conditions during Tropical Storm Fay:

* Initial water levels in all ponds (except Enterprise Road Pond) were set to their normal water level.

* The rainfall distribution represents Tropical Storm Fay.

* Initially, Enterprise Road Pond is assumed to be dry, and the rainfall depth is calibrated to produce the measured flood stage in James Pond.

* The starting water level in Enterprise Road Pond was then varied to represent different degrees of standing water at the beginning of the storm event.

* The flood stage in James Pond was calculated for different degrees of standing water in Enterprise Road Pond

Basin Boundaries in Devo Model 1 (same as PEC FEMA model)

Storm Event and Rainfall Calibration

* The original PEC model was constructed to represent the 100 year/ 24 hour design storm event: 11.25 inches of rainfall falling over a period of 24 hours.

* Devo Model 1 uses a customized storm event based on the measured rainfall distribution from the nearby Glenn Abbey rainfall station.

* The depth of rainfall was calibrated so that the predicted flood stage matches the measured flood stage during Tropical Storm Fay.

* Based on the model calibration, a rainfall depth of 16.84 inches was required, falling over a duration of 6 days.

* Note that the rainfall which occurred during Tropical Storm Fay is greater than the 100 year design storm rainfall depth.
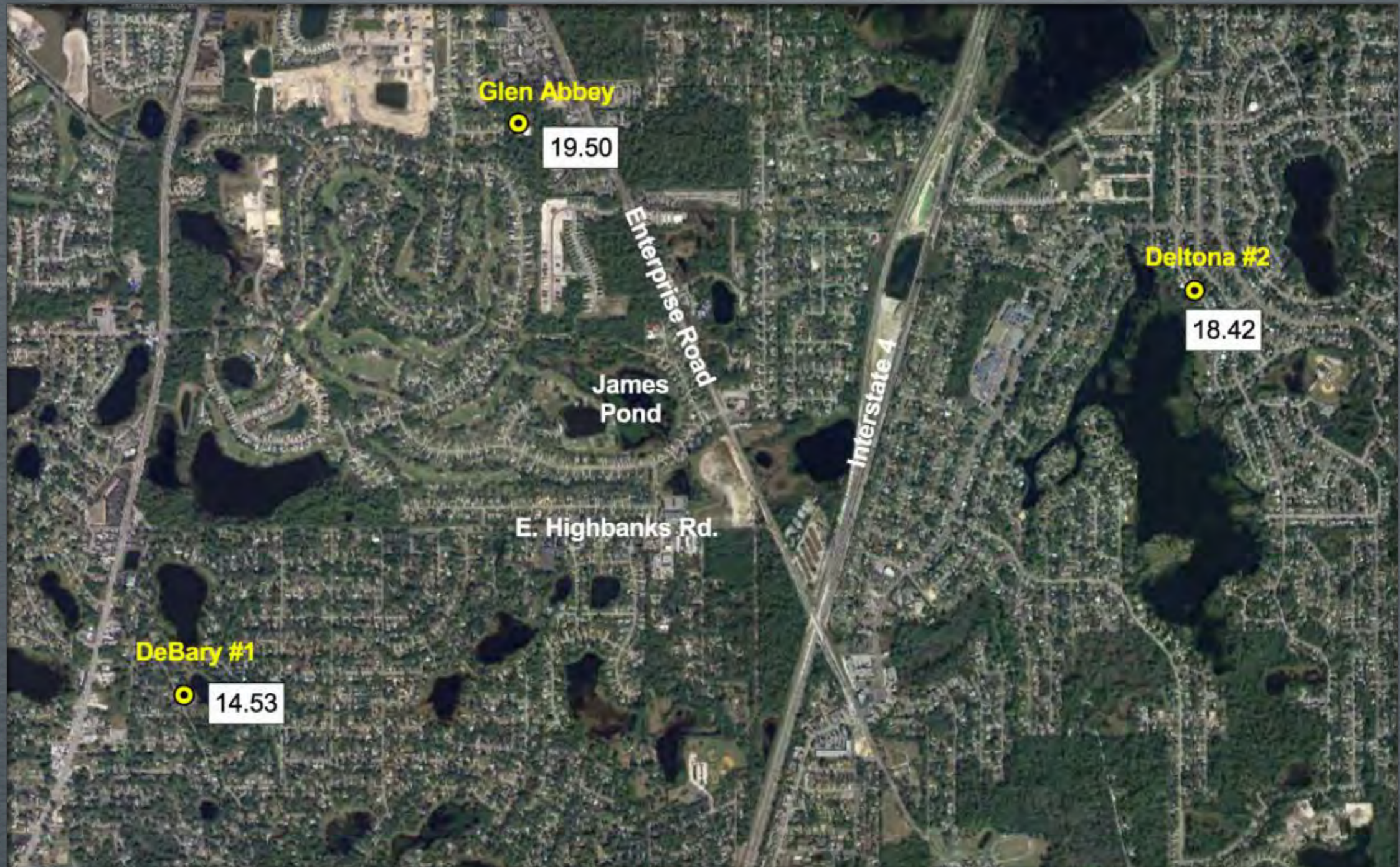
NEARBY RAINFALL STATIONS
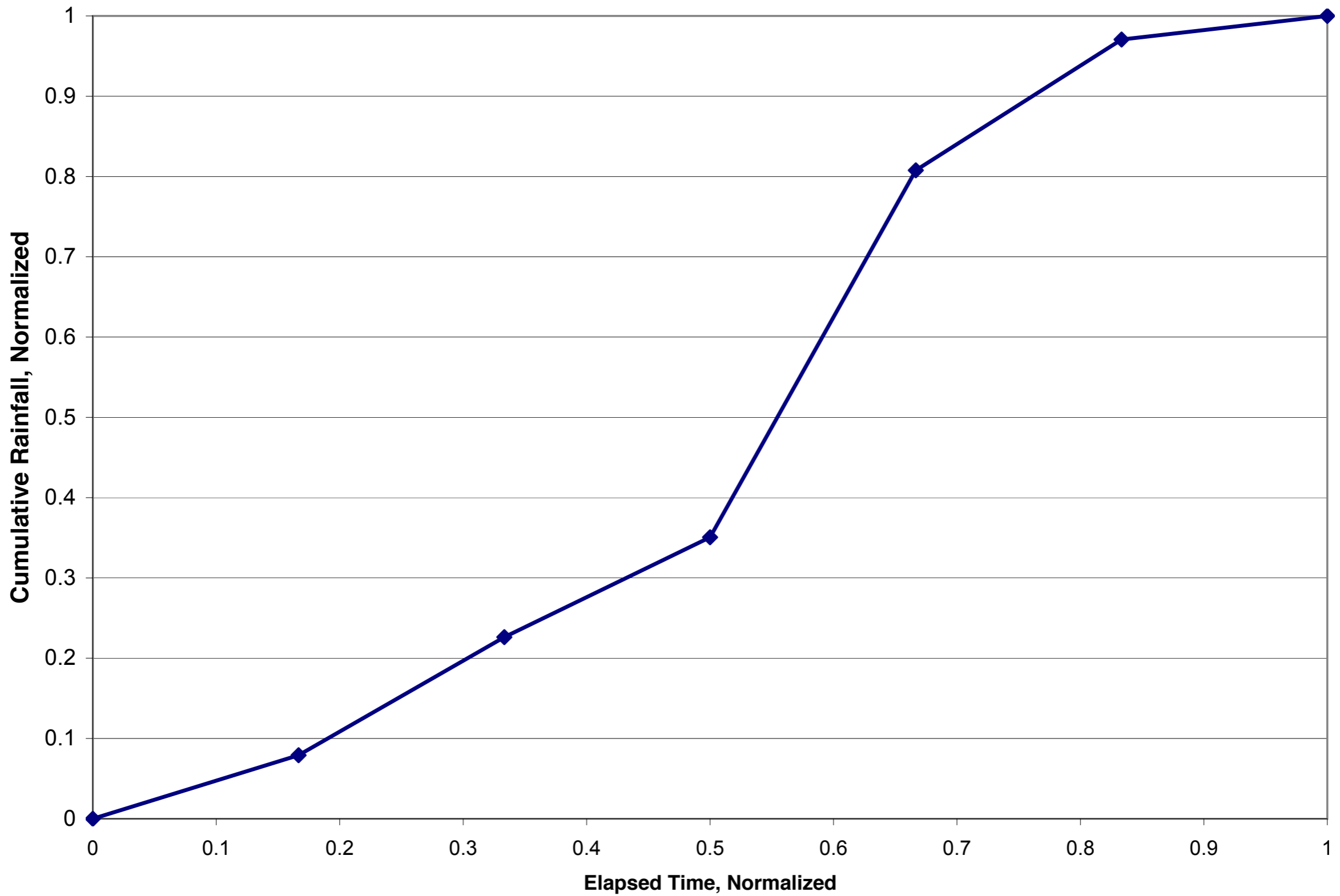
Rainfall Distribution for Tropical Storm Fay

PREDICTIVE SIMULATIONS FOR DEVO MODEL 1

* The rainfall calibration was performed assuming that there was no water in Enterprise Road Pond at the beginning of Tropical Storm Fay.

* Once a calibration was achieved, additional model simulations were performed assuming that there were varying depths of water in Enterprise Road pond at the beginning of Tropical Storm Fay. Model scenarios were run assuming 6 inches, 12 inches, and 18 inches of standing water in Enterprise Road Pond.

* These model scenarios were performed in order to determine if the flooding of the residences which occurred during Tropical Storm Fay was the result of a loss in pond capacity in Enterprise Road Pond due to chronic wetness, as has been alleged.

Part 8c

Devo Model 2
With Field Verified Basin Boundaries

Presentation Outline

1. Location of Alexandra Woods Drive Relative to Highbanks/ Enterprise Pond

2. Tropical Storm Fay Rainfall Event

3. City-Wide Residential flooding in DeBary (T.S. Fay)

4. Photos of the Flooding at Alexandra Woods Drive (James Pond)

5. Original Damage Theory & Revised Damage Theories

6. Review Of Historic Aerials

7. Enterprise Road Widening project (completion date & stormwater flow regime)

8. Stormwater Modeling:

   a. The PEC FEMA model

   b. Devo Model 1 based on PEC model

   c. Devo Model 2 with field verified basin boundaries

   d. Simple Volumetric Comparison

   e. Devo Model 3 Pre-Enterprise Road Widening

9. Key Results of Devo Modeling – For Defendant

10. Defects with Marshall's Model – For Plaintiff

11. Rebuttal of Seidel's Model - For Plaintiff

DEVO
Engineering
CONSULTING GEOTECHNICAL ENGINEERS

Devo Model 2 With Field Verified Basin Boundaries

- ⁕ Devo Engineering field verified the basin boundaries, as well as the connections between the ponds, and modified the original PEC FEMA model to reflect these field verified conditions.

- ⁕ The rainfall depth was recalibrated in order to match the measured flood stage in James Pond during Tropical Storm Fay. This calibration resulted in a rainfall depth of 16.89 inches falling over a period of 6 days.

- ⁕ The model was then run with varying amounts of standing water in the Enterprise Road Pond in order to determine the impact on the flood stage in James Pond during Tropical Storm Fay.

BASIN BOUNDARIES IN DEVO MODEL 2

- AREAS SHADED IN BLUE DRAIN DIRECTLY TO GASLINE LAKE.

- AREAS SHADED IN PINK DRAIN DIRECTLY TO ENTERPRISE ROAD POND

- AREAS SHADED IN YELLOW DRAIN DIRECTLY TO DBCC POND.

- AREAS SHADED IN GREEN DRAIN DIRECTLY TO JAMES POND

- GASLINE LAKE CAN DISCHARGE TO ENTERPRISE ROAD POND

- ENTERPRISE ROAD POND CAN DISCHARGE TO DBCC POND

- DBCC POND DISCHARGES TO JAMES POND

Basin Map For Devo Model 2

FIELD VERIFIED CONNECTION DETAILS BETWEEN DBCC POND AND JAMES POND

Field Verified Connection Details between DBCC Pond and James Pond

Field Verified Connection Details between Gasline Lake and Enterprise Road Pond

Part 8d

Simple Volumetric Comparison

Presentation Outline

1. Location of Alexandra Woods Drive Relative to Highbanks/ Enterprise Pond

2. Tropical Storm Fay Rainfall Event

3. City-Wide Residential flooding in DeBary (T.S. Fay)

4. Photos of the Flooding at Alexandra Woods Drive (James Pond)

5. Original Damage Theory & Revised Damage Theories

6. Review Of Historic Aerials

7. Enterprise Road Widening project (completion date & stormwater flow regime)

8. Stormwater Modeling:

    a. The PEC FEMA model

    b. Devo Model 1 based on PEC model

    c. Devo Model 2 with field verified basin boundaries

    d. Simple Volumetric Comparison

    e. Devo Model 3 Pre-Enterprise Road Widening

9. Key Results of Devo Modeling – For Defendant

10. Defects with Marshall's Model – For Plaintiff

11. Rebuttal of Seidel's Model - For Plaintiff

DEVO Engineering
CONSULTING GEOTECHNICAL ENGINEERS

Simple Volumetric Comparison

⁕ If there is standing water in Enterprise Road Pond at the beginning of Tropical Storm Fay, then that standing water represents a loss of storage available during the storm. An equivalent amount of water will consequently be discharged downgradient to James Pond/DBCC pond during the storm event.

⁕ A simple volumetric comparison can be performed based on the stage-area-volume relationship of Enterprise Road Pond versus James Pond/DBCC Pond.

DEVO
CONSULTING GEOTECHNICAL ENGINEERS
Engineering

Simple Volumetric Comparison

12 inches of water

equals

1.8 inches of water

Enterprise road pond
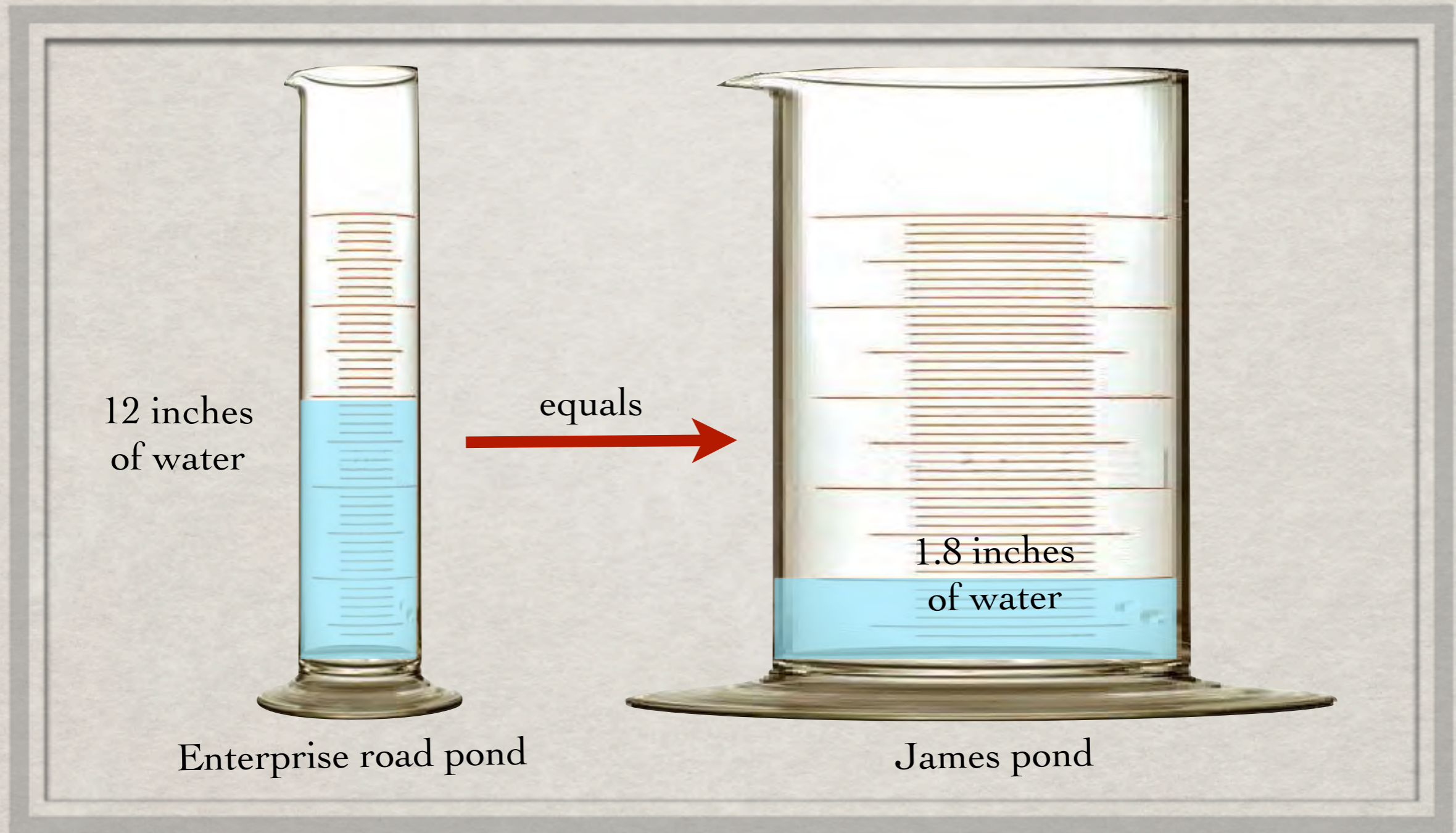
James pond

What is the impact on the flood stage in James Pond if there is water in Enterprise Road Pond at the beginning of the storm event?
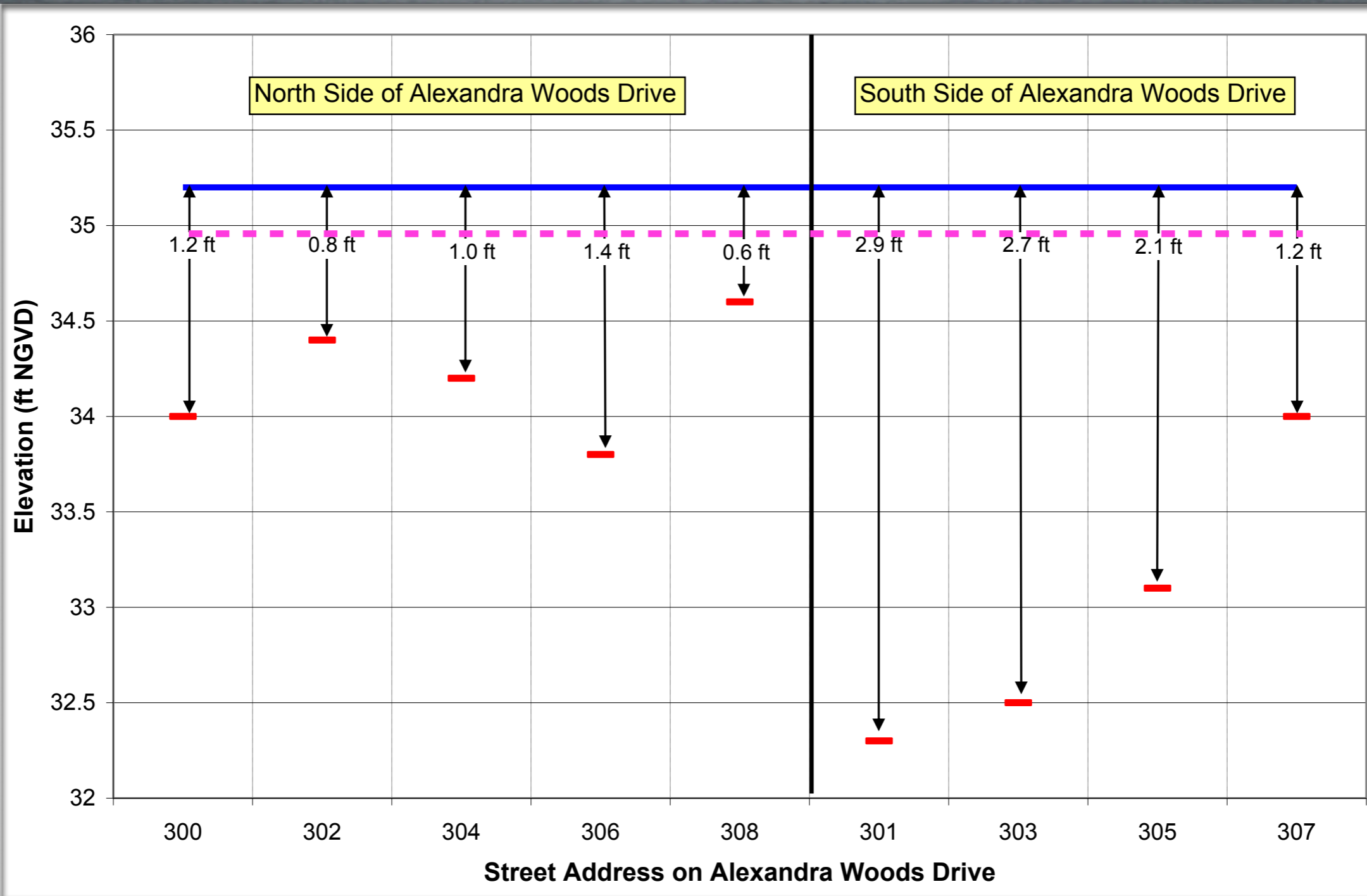
Finished Floor Elevations and Depth of Flooding

Part 8e

Devo Model 3 Predevelopment

Presentation Outline

1. Location of Alexandra Woods Drive Relative to Highbanks/ Enterprise Pond

2. Tropical Storm Fay Rainfall Event

3. City-Wide Residential flooding in DeBary (T.S. Fay)

4. Photos of the Flooding at Alexandra Woods Drive (James Pond)

5. Original Damage Theory & Revised Damage Theories

6. Review Of Historic Aerials

7. Enterprise Road Widening project (completion date & stormwater flow regime)

8. Stormwater Modeling:

   a. The PEC FEMA model

   b. Devo Model 1 based on PEC model

   c. Devo Model 2 with field verified basin boundaries

   d. Simple Volumetric Comparison

   e. Devo Model 3 Pre-Enterprise Road Widening

9. Key Results of Devo Modeling – For Defendant

10. Defects with Marshall's Model – For Plaintiff

11. Rebuttal of Seidel's Model - For Plaintiff

FLOW REGIME BEFORE ROADWAY WIDENING

- Devo Model 3 was constructed to determine whether the widening of Enterprise Road and the construction of the Enterprise Road Pond resulted in more runoff entering the James Pond basin during Tropical Storm Fay than would have occurred if the widening had not taken place.

- Devo Model 3 represents the "predevelopment" conditions, before roadway widening occurred.

Significant Differences in Pre vs post-widening Conditions

* Before the roadway widening, runoff from Enterprise Road flowed southward, and then to Gasline Lake. After the roadway widening, runoff from Enterprise Road flows southward to the Enterprise Road Pond.

* Before the roadway widening, the portion of Enterprise Road between Stations 163+50 to 176+70 flowed northward towards Saxon Boulevard (i.e., outside of the James Pond basin). After roadway widening, the runoff from this portion of Enterprise Road was routed southward to the Enterprise Road Pond.

* Before the roadway widening, runoff which reached Enterprise Road from adjacent properties to the west of Enterprise Road (basins ER-2 through ER-5 in Devo Model 2) flowed southward along Enterprise Road to Gasline Lake. After roadway widening, this runoff was routed to the Enterprise Road pond.

* Before the roadway widening, the portion of basin ER-1 (Devo Model 2) on which the Enterprise Road pond is situated flowed towards the DBCC pond. After the roadway widening, this area includes the Enterprise Road pond with some adjacent area which flows to the Enterprise Road Pond.

* Before the roadway widening, discharge from Gasline Lake flowed to the DBCC pond, with a historical discharge elevation from Gasline Lake of +44.2 ft NGVD. After roadway widening, discharge from Gasline Lake flows to the Enterprise Road pond, which in turn discharges to the DBCC pond based on a control structure elevation of 44.2 ft, NGVD.
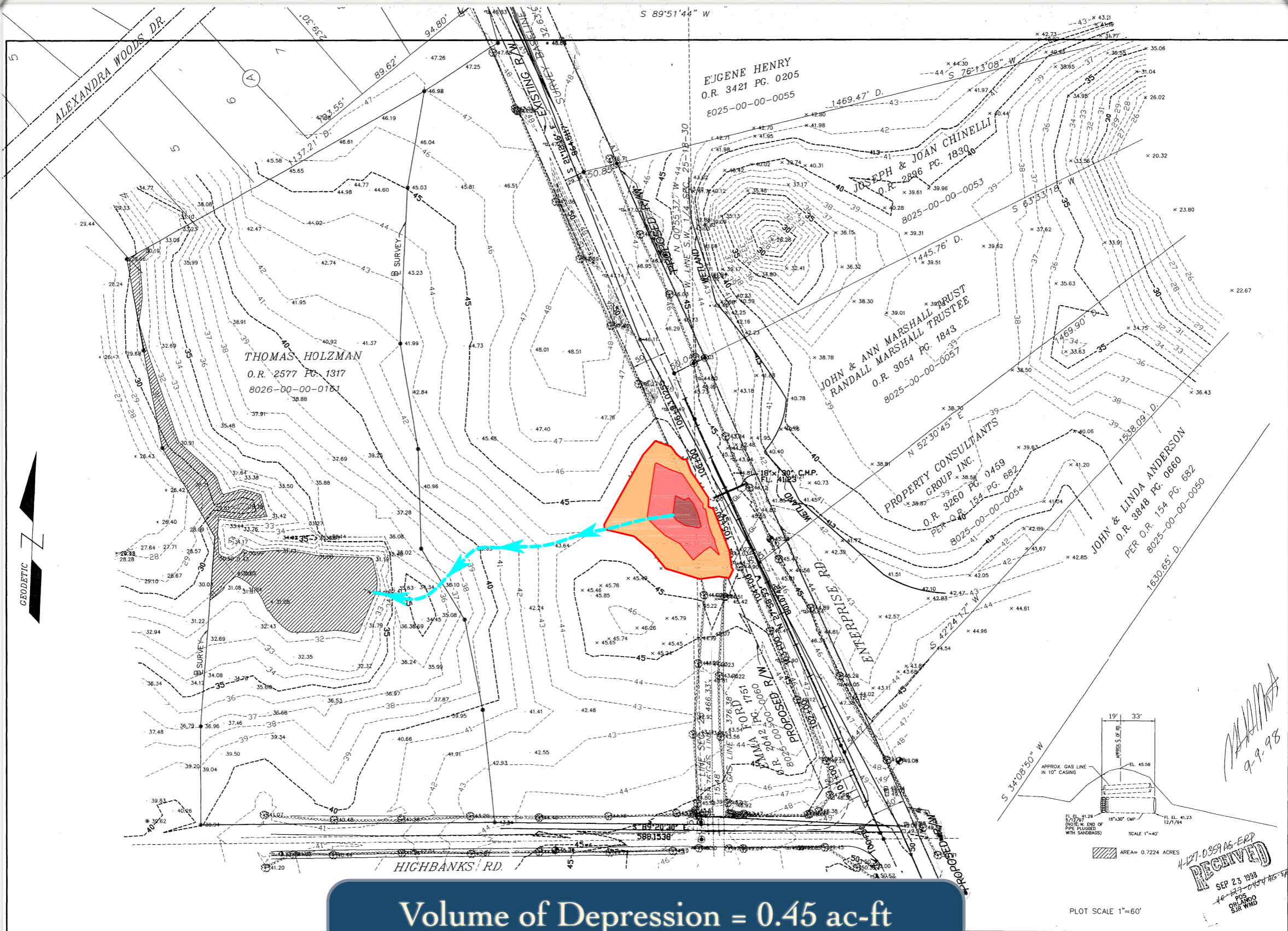
Volume of Depression = 0.45 ac-ft
Discharge from Gasline Lake = 82.1 ac-ft

ORIGINAL GROUND SURFACE CONTOURS

Flow Regime Before Roadway Widening

- Areas shaded in blue drain directly to Gasline Lake. Note that this area includes Enterprise Road and some basins contiguous to Enterprise Road.

- Areas shaded in yellow drain directly to DBCC pond. Note that this includes the area which is now Enterprise Road Pond.

- Areas shaded in green drain directly to James Pond

- Gasline Lake can discharge to DBCC pond

- DBCC Pond discharges to James Pond

PART 9

KEY RESULTS OF DEVO MODELING

FOR DEFENDANT

DEVO Engineering
CONSULTING GEOTECHNICAL ENGINEERS

Presentation Outline

1. Location of Alexandra Woods Drive Relative to Highbanks/ Enterprise Pond

2. Tropical Storm Fay Rainfall Event

3. City-Wide Residential flooding in DeBary (T.S. Fay)

4. Photos of the Flooding at Alexandra Woods Drive (James Pond)

5. Original Damage Theory & Revised Damage Theories

6. Review Of Historic Aerials

7. Enterprise Road Widening project (completion date & stormwater flow regime)

8. Stormwater Modeling:

    a. The PEC FEMA model

    b. Devo Model 1 based on PEC model

    c. Devo Model 2 with field verified basin boundaries

    d. Simple Volumetric Comparison

    e. Devo Model 3 Pre-Enterprise Road Widening

9. Key Results of Devo Modeling – For Defendant

10. Defects with Marshall's Model – For Plaintiff

11. Rebuttal of Seidel's Model - For Plaintiff

Table 8. Predicted Change In James Pond Flood Stage

Starting Water Level in Enterprise Road Pond	Height of Water Above Pond Bottom In Enterprise Road Pond	Model 1			Model 2		
		Peak Stage in James Pond	Increase in Flood Stage in James Pond [1]		Peak Stage in James Pond	Increase in Flood Stage in James Pond [1]	
(ft NGVD)	(inches)	(ft NGVD)	(ft)	(inches)	(ft NGVD)	(ft)	(inches)
40.0	--	35.20	--	--	35.20	--	--
40.5	6	35.27	0.07	0.8	35.27	0.07	0.8
41.0	12	35.35	0.15	1.8	35.35	0.15	1.8
41.5	18	35.44	0.24	2.9	35.44	0.24	2.9

Notes
1. The increase in flood stage for James Pond is measured relative to the case of Enterprise Road Pond being initially dry.

PREDICTED CHANGE IN JAMES POND FLOOD STAGE DUE TO STANDING WATER IN ENTERPRISE ROAD POND

DEVO Engineering
CONSULTING GEOTECHNICAL ENGINEERS

SIMPLE VOLUMETRIC COMPARISON

Starting Water Level in Enterprise Road Pond (ft NGVD)	Height of Water Above Pond Bottom In Enterprise Road Pond (inches)	Change In James Pond Flood Stage Due to Loss of Storage Volume in Enterprise Road Pond (inches)		
		Model 1	Model 2	Simple Volumetric Comparison
40.0	0	--	--	--
40.5	6	0.8	0.8	0.9
41.0	12	1.8	1.8	1.8
41.5	18	2.9	2.9	3.0

Table 13. Summary Of Predicted Change In James Pond Flood Stage

NOTE THAT THE FLOOD STAGE IN JAMES POND WOULD HAVE BEEN HIGHER IF THE ENTERPRISE ROAD POND HAD NOT BEEN CONSTRUCTED

DEVO Engineering
CONSULTING GEOTECHNICAL ENGINEERS

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

DEVO Engineering
CONSULTING GEOTECHNICAL ENGINEERS

Part 10

Defects with Marshall's Model
For Plaintiff

Presentation Outline

1. Location of Alexandra Woods Drive Relative to Highbanks/ Enterprise Pond

2. Tropical Storm Fay Rainfall Event

3. City-Wide Residential flooding in DeBary (T.S. Fay)

4. Photos of the Flooding at Alexandra Woods Drive (James Pond)

5. Original Damage Theory & Revised Damage Theories

6. Review Of Historic Aerials

7. Enterprise Road Widening project (completion date & stormwater flow regime)

8. Stormwater Modeling:

   a. The PEC FEMA model

   b. Devo Model 1 based on PEC model

   c. Devo Model 2 with field verified basin boundaries

   d. Simple Volumetric Comparison

   e. Devo Model 3 Pre-Enterprise Road Widening

9. Key Results of Devo Modeling – For Defendant

10. Defects with Marshall's Model – For Plaintiff

11. Rebuttal of Seidel's Model - For Plaintiff

Major Concerns With Model Developed by Plaintiff's Expert

1. Major Reduction of basin size: to make his model replicate the real-world flood elevation in James Pond/DBCC Pond, Mr. Marshall omitted 188 acres of the James Pond drainage basin and assumed that portion did not ultimately contribute to runoff into James Pond. While this may be true for small storm events, it is not a reasonable assumption for such an extreme event as experienced during Tropical Storm Fay. He reduced the drainage area to 163 acres from the 351 acres identified by PEC. This is not appropriate and will be obvious even to lay people that the model is likely not well posed.

2. Rainfall Total: in this T.S. Fay calibration, Frank Marshall used the rainfall data for Deland which totaled 20.51 inches. Why was a rainfall station closer to the study area not selected? The rainfall totals near the study area are less than 20 inches, by almost 5 inches at some stations.

Major Concerns With Model Developed by Plaintiff's Expert

3. Initial water levels for James Pond and DBCC Pond: the starting water level before the storm is set to +26.11 ft in both James Pond and DBCC pond prior to T.S. Fay; however, this is not consistent with the records in the PEC presentation to the City of DeBary (which was based on "measured" elevation). James Pond is closer to +23 ft in elevation. In the Devo Model we set DBCC pond to +26.99 ft which corresponds to its outfall elevation. Marshall mis-read a piezometer as the lake level.

4. Calibration targets: In addition, to make his model calibrate, he varied the initial water levels in the water bodies (Gasline Lake, County Pond) which seems to be subject to significant user judgement. This was in addition to reducing the contributory basin size.

5. Never presents a pre-post analysis: Why did the modeler not do a pre-Enterprise Rd widening simulation to show what the change in T.S. Fay flood elevation would have been without the county's Enterprise Road widening project?

6. In his addenda report dated July 28, 2010, Marshall now disingenuously appears to attribute different damage contribution to the flood water from James Pond versus that from DBCC Pond? What difference does it make if the floodwater came up from James Pond versus DBCC Pond? Are these ponds not interconnected at a much lower level? Is his expert testimony to represent only the residents along the shoreline of DBCC Pond and not those along the shoreline of James Pond?

7. In his addendum report, Marshall now takes the tact that the ultimate flood level is not the crux of the complaint. He has shifted the basis of the complaint to evacuation timing without any supporting data to show that there was a time differential of consequence or there was in fact even a time differential because he has no observations from residents on the James Pond shoreline.

8. Unexplained discrepancies in his computer printouts.

Part 11

Rebuttal of Seidel's Model
For Plaintiff

DEVO Engineering
CONSULTING GEOTECHNICAL ENGINEERS

PRESENTATION OUTLINE

1. Location of Alexandra Woods Drive Relative to Highbanks/ Enterprise Pond

2. Tropical Storm Fay Rainfall Event

3. City-Wide Residential flooding in DeBary (T.S. Fay)

4. Photos of the Flooding at Alexandra Woods Drive (James Pond)

5. Original Damage Theory & Revised Damage Theories

6. Review Of Historic Aerials

7. Enterprise Road Widening project (completion date & stormwater flow regime)

8. Stormwater Modeling:

   a. The PEC FEMA model

   b. Devo Model 1 based on PEC model

   c. Devo Model 2 with field verified basin boundaries

   d. Simple Volumetric Comparison

   e. Devo Model 3 Pre-Enterprise Road Widening

9. Key Results of Devo Modeling – For Defendant

10. Defects with Marshall's Model – For Plaintiff

11. Rebuttal of Seidel's Model - For Plaintiff

DEV○ Engineering
CONSULTING GEOTECHNICAL ENGINEERS

THESE ARE THE MAJOR CONCERNS EXPRESSED BY BALMORAL REGARDING THE DEVO MODEL 2:

- The Devo July 2010 study did not quantify the impact of the infiltration occurring in the existing stormwater management facilities on the runoff produced by the basins as predicted in the original permit. Balmoral claims that this could have a significant impact on the timing of the flooding and calibrating a runoff model used to analyze the different flooding scenarios.

- Devo Model 2 does not utilize the initial stage witnessed by the residents in the Enterprise Road Pond by not developing reasonable initial stages. By not utilizing the higher initial stages in the calibrated model, Balmoral claims that the model will overestimate the runoff contribution from the James Pond Basins and underestimate the impact of the Enterprise Road Pond.

Balmoral's Analyses

✦ Balmoral ran 2 modified versions of Devo Model 2 (which we call herein Devo Model 2a and Devo Model 2b) and took the difference between those runs and came up with a 10 inch differential in predicted flood elevation.

✦ Devo Model 2a ➪ Balmoral simply added 18 inches of standing water to the Enterprise Road Pond and then re-ran our model (without infiltration) to get a peak stage of +35.41 ft NGVD in James Pond/DBCC Pond. This was the only modification made to the model.

✦ Devo Model 2b ➪ Balmoral added the permitted infiltration rates for Enterprise Road pond and Gasline Lake, leaving the initial stages unchanged from Devo Model 2 (i.e., no standing water in Enterprise Road Pond). This produced a stage in James Pond/DBCC Pond of 34.54 ft NGVD.

✦ Balmoral then takes the difference between these runs and claims that the Devo predictions on flood stage can be off by up to 10 inches.

Faults With Balmoral's Analyses

- Balmoral failed to recognize that they needed to re-calibrate Devo Model 2a when they added 18 inches of standing water at the start of TS Fay. By them adding 18 inches of water in Enterprise Road pond, they increased the flood stage in James Pond/DBCC Pond to +35.41 ft from its known peak of +35.2 ft.

- Balmoral then extracted infiltration to Enterprise Road pond and assumed that the infiltrated water disappeared from the basin. A drainage professional will recognize that this is not appropriate for this pond since the infiltrated water will eventually discharge into DBCC pond (through subsurface flow) due to its proximity.

- The tabulated results on the following slides show the corrected results for Balmoral's assumptions and these results show that the infiltration assumption does not affect the main conclusion that the post-Enterprise Road widening flood level is LOWER than the corresponding pre-Enterprise Road widening flood level. In other words, the base of aquifer assumption does not have a significant impact on the flood levels.

COMPARISON OF PEAK FLOOD STAGE IN JAMES POND, WITH AND WITHOUT ROADWAY WIDENING

Table 1a. Pre vs Post Flood Stage in James Pond With No Infiltration			
Initial Water Depth in Enterprise Road Pond For Calibration	Calibrated Rainfall Depth (inches)	Peak Stage In James Pond (ft NGVD)	
		Postdevelopment (Devo Model 2)	Predevelopment (Devo Model 3)
18 inches	16.53	35.2	35.35
12 inches	16.67	35.2	35.44
6 inches	16.79	35.2	35.51
0 inches	16.90	35.2	35.58

Notes:
1.   No infiltration in Enterprise Road Pond.
2.   No infiltration in Gasline Lake.

DEVO Engineering
CONSULTING GEOTECHNICAL ENGINEERS

COMPARISON OF PEAK FLOOD STAGE IN JAMES POND, WITH AND WITHOUT ROADWAY WIDENING

Table 1b. Pre vs Post Flood Stage in James Pond With Infiltration Rates in Permit			
Initial Water Depth in Enterprise Road Pond For Calibration	Calibrated Rainfall Depth (inches)	Peak Stage In James Pond (ft NGVD)	
		Postdevelopment (Devo Model 2)	Predevelopment (Devo Model 3)
18 inches	17.64	35.2	35.53
12 inches	17.75	35.2	35.60
6 inches	17.85	35.2	35.66
0 inches	17.93	35.2	35.71

Notes:
1.   Base of aquifer was assumed to be at elevation 0 ft NGVD. Infiltration rating curve taken from Balmoral report for this scenario.
2.   Infiltration in Gasline Lake per Balmoral report (pre and post).

DEVO Engineering
CONSULTING GEOTECHNICAL ENGINEERS

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

Table 1c. Pre vs Post Flood Stage in James Pond With Balmoral's Revised Infiltration Rates			
Initial Water Depth in Enterprise Road Pond For Calibration	Calibrated Rainfall Depth (inches)	Peak Stage In James Pond (ft NGVD)	
		Postdevelopment (Devo Model 2)	Predevelopment (Devo Model 3)
18 inches	17.29	35.2	35.31
12 inches	17.42	35.2	35.39
6 inches	17.54	35.2	35.47
0 inches	17.65	35.2	35.54

Notes:
1.   Base of aquifer was assumed to be at elevation 28.5 ft NGVD. Infiltration rating curve taken from Balmoral report for this scenario.
2.   Infiltration in Gasline Lake per Balmoral report (pre and post).

Conclusions

⁕ During Tropical Storm Fay, the nine subject homes experienced flooding of between 0.6 feet and 2.9 ft above finished floor elevations.

⁕ If the Enterprise Road Pond held 12 inches of standing water at the beginning of Tropical Storm Fay, then this would result in an increase in the flood stage of James Pond of approximately 0.15 feet. This increase in flood stage is less than the depth of flooding experienced. Therefore, these nine residences would have still flooded regardless of the conditions in Enterprise Road Pond at the beginning of Tropical Storm Fay. Chronic wetness in Enterprise Road Pond is not the cause of the flooding.

⁕ If the Enterprise Road Pond had not been constructed, the flooding would have actually been worse. The predicted flood stage in James Pond would have been 0.38 ft higher if the retention pond had not been constructed. The construction of the pond did not increase the flood stage, but in fact lowered it by adding additional storage volume to the basin.

DEV☉
CONSULTING GEOTECHNICAL ENGINEERS
Engineering

Conclusions

* During Tropical Storm Fay, the nine subject homes experienced flooding of between 0.6 feet and 2.9 ft above finished floor elevations.

* If the Enterprise Road Pond held 12 inches of standing water at the beginning of Tropical Storm Fay, then this would result in an increase in the flood stage of James Pond of approximately 0.15 feet. This increase in flood stage is less than the depth of flooding experienced. Therefore, these nine residences would have still flooded regardless of the conditions in Enterprise Road Pond at the beginning of Tropical Storm Fay. Chronic wetness in Enterprise Road Pond is not the cause of the flooding.

* If the Enterprise Road Pond had not been constructed, the flooding would have actually been worse. The predicted flood stage in James Pond would have been 0.38 ft higher if the retention pond had not been constructed. The construction of the pond did not increase the flood stage, but in fact lowered it by adding additional storage volume to the basin.