WETLAND CLASSIFICATION & BASIN CHARACTER STUDY

Preliminary Results

NTB LTPRG Meeting
March 12, 2009

Southwest Florida Water Management District

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WETLAND CLASSIFICATION & BASIN CHARACTER STUDY

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Tasks

– Re-Evaluate Hydric/Non-Hydric Interface Location (119 sites)
– Soil Characterization at 46 District Sites
– Wetland Hydrologic Analysis
– Develop a Wetland Classification System

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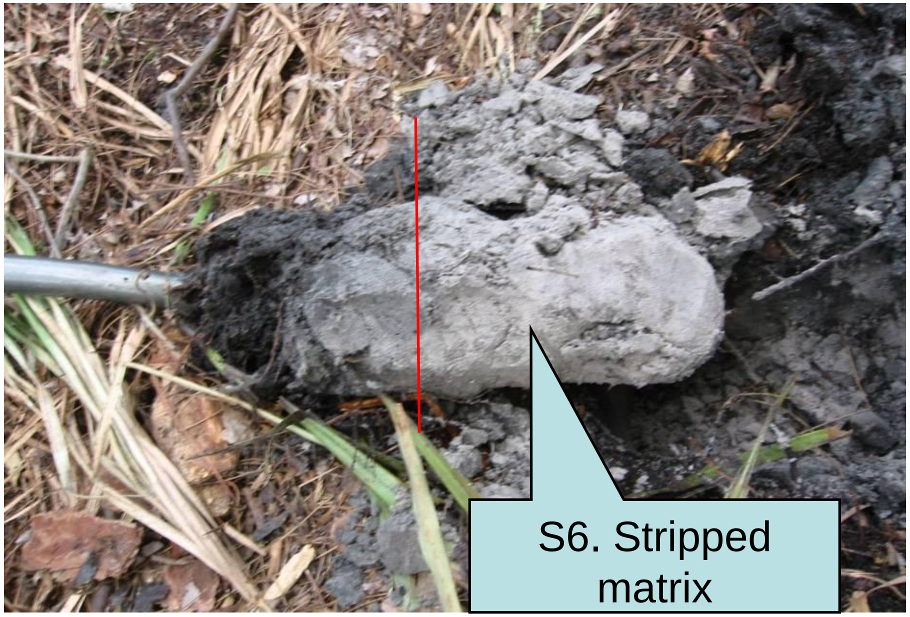
HYDRIC/NON-HYDRIC RE-EVALUATION

- Background
  - Soils consist of natural bodies that occur on a landform within a landscape and have properties that result from the integrated effects of climate and living organisms, acting on parent material, as conditioned by relief, over a period of time.
  - Soil physical characteristics are specifically tied to the location where they form and conditions that they form under.

HYDRIC/NON-HYDRIC RE-EVALUATION

- Hydric Soils
  - Definition
    - Saturated, flooded, or ponded (5% -18.25 days/year)
  - Types:
    - S6. Stripped matrix,
    - S7. Dark surface,
    - A6. Organic bodies,
    - A7. Mucky mineral,
    - A8. Muck presence,
    - S5. Sandy Redox



HYDRIC/NON-HYDRIC RE-EVALUATION

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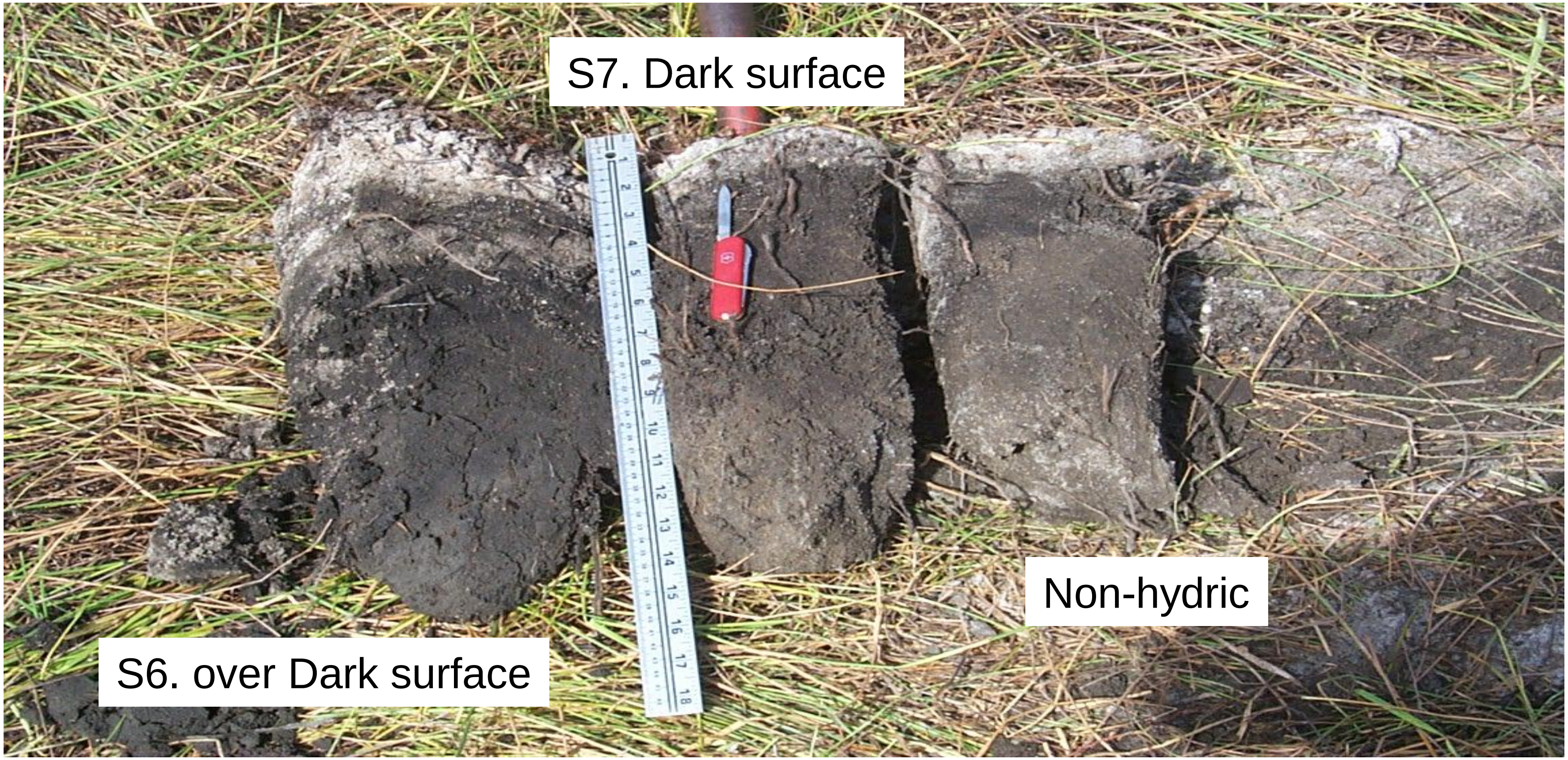

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HYDRIC/NON-HYDRIC RE-EVALUATION

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A6. Organic bodies

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HYDRIC/NON-HYDRIC RE-EVALUATION

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S5. Sandy Redox

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HYDRIC/NON-HYDRIC RE-EVALUATION

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HYDRIC/NON-HYDRIC REFERENCES

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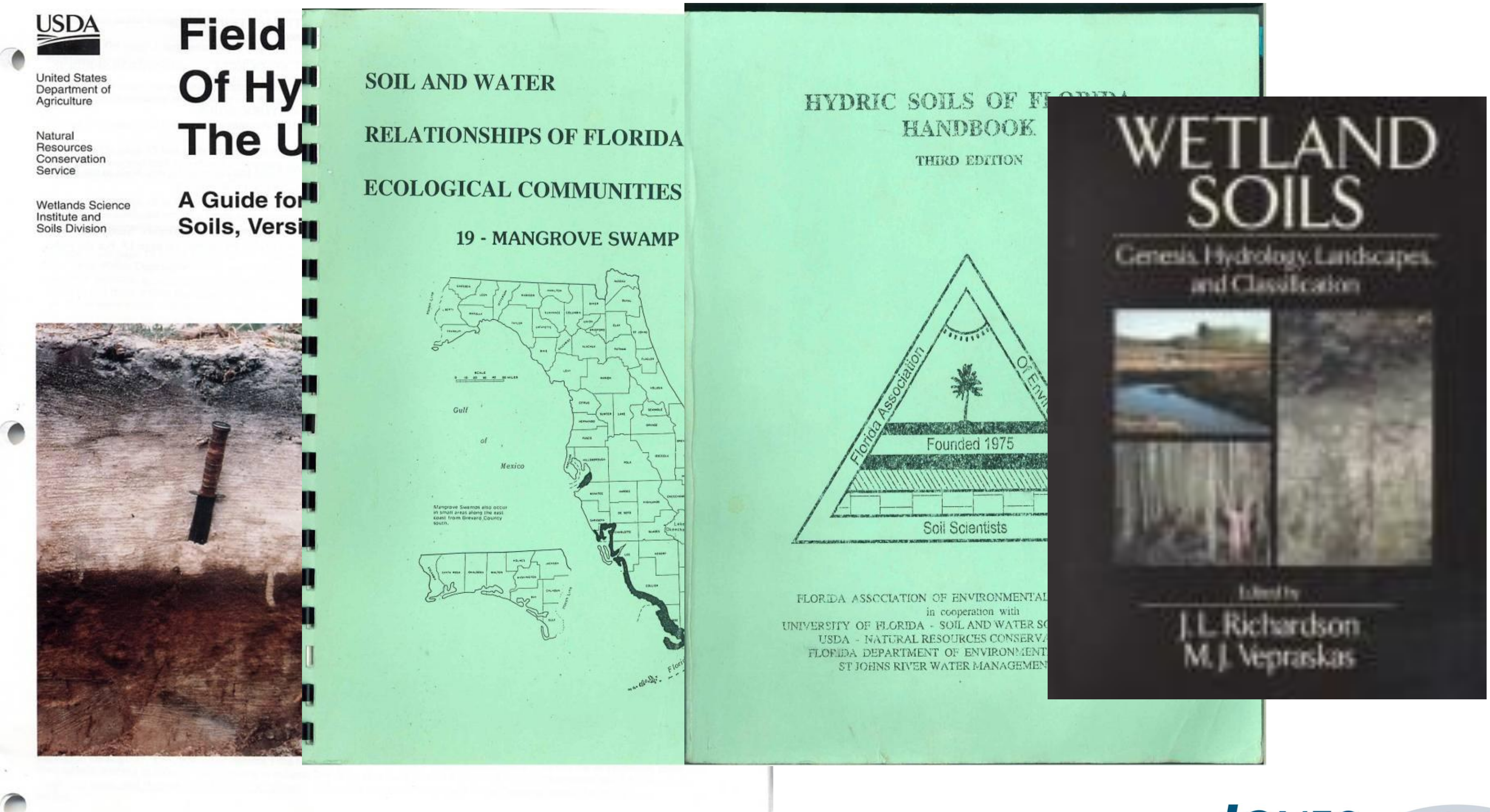

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HYDRIC/NON-HYDRIC RE-EVALUATION

- 2003 Wade Hurt of UF
  - Conducted the hydric/non-hydric soil (H/NH) evaluation at 119 wetlands to determine if that interface was within the wetland boundary, near the wetland boundary (palmetto fringe), or outside the wetland boundary.
- In 2008 and 2009
  - Repeating 2003 Hurt work
    - Compare elevation and horizontal results
    - Results can provide insight into re-hydration or dehydration of previously impacted wetlands

HYDRIC/NON-HYDRIC RE-EVALUATION

- Methods
  - Evaluating 119 wetlands,
  - 3 to 8 pits per wetland
  - Characterize H/NH interface location to 12-16”
  - H/NH marked in field with PVC pole
    - Location recorded with GPS
    - Elevation determined from District bench mark
  - H/NH location measured from/to the wetland edge (saw palmetto fringe) and to previous evaluation
  - Compare all results to control wetland

HYDRIC/NON-HYDRIC RE-EVALUATION

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- Preliminary Results
  - Reference wetlands (Green Swamp)
    - H/NH at or above the palmetto fringe
  - Well field wetlands (no confining layer)
    - H/NH interface inside the wet prairie, marsh, or cypress communities versus in the saw palmetto community
    - Some no longer have hydric soil indicator within 6 or 12 inches
    - Many H/NH interfaces have moved toward the palmetto fringe compared to 5 years ago

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HYDRIC/NON-HYDRIC RE-EVALUATION

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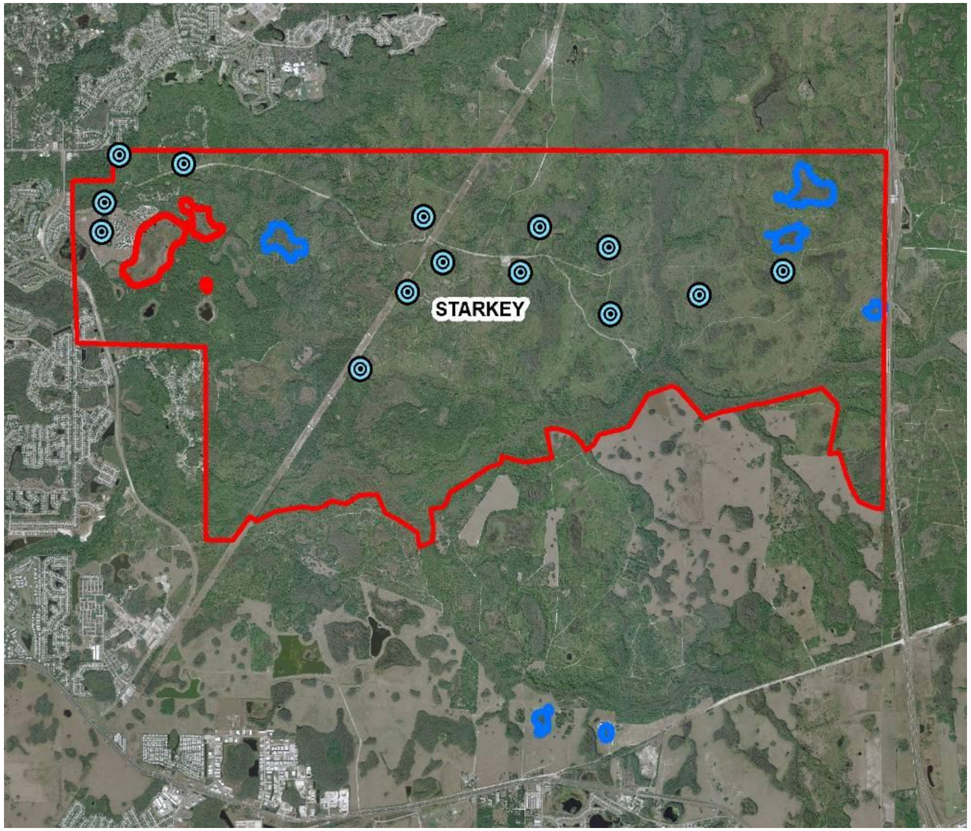
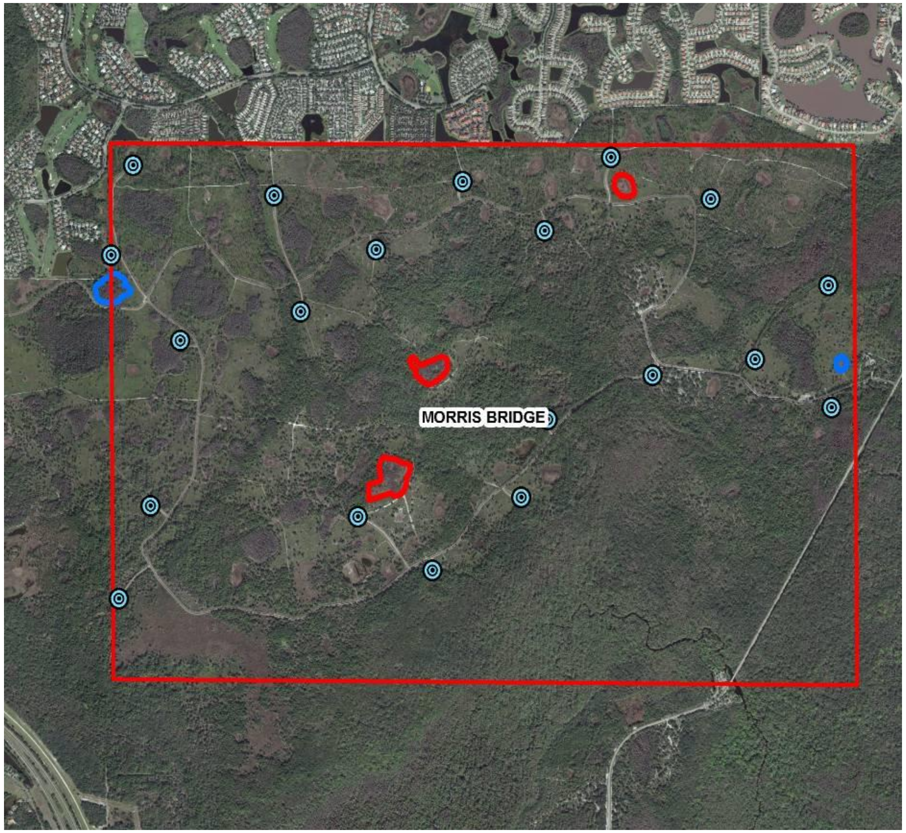
- Preliminary Results (red H/NH moved down the hill and blue H/NH moved up the hill)





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DETAILED SOIL EVALUATION

- Overview
  - Soil assessments should provide additional insight into the historic and current hydroperiod of wetlands
  - Detailed soil characteristics within each vegetative community of 46 wetlands. Three pits per community:
    - One pit to a depth of 6 feet below grade or to a confining layer
    - Two pits to a depth 10” and 16” inches

DETAILED SOIL EVALUATION

- Methods
  - Soil transects paralleled WAP transects or were adjacent to the Wade Hurt evaluation transects
  - Open face soil auger and a soil spade
  - Evaluation points located with sub-meter GPS
  - Generated cross-section graphs of soil transects

DETAILED SOIL EVALUATION

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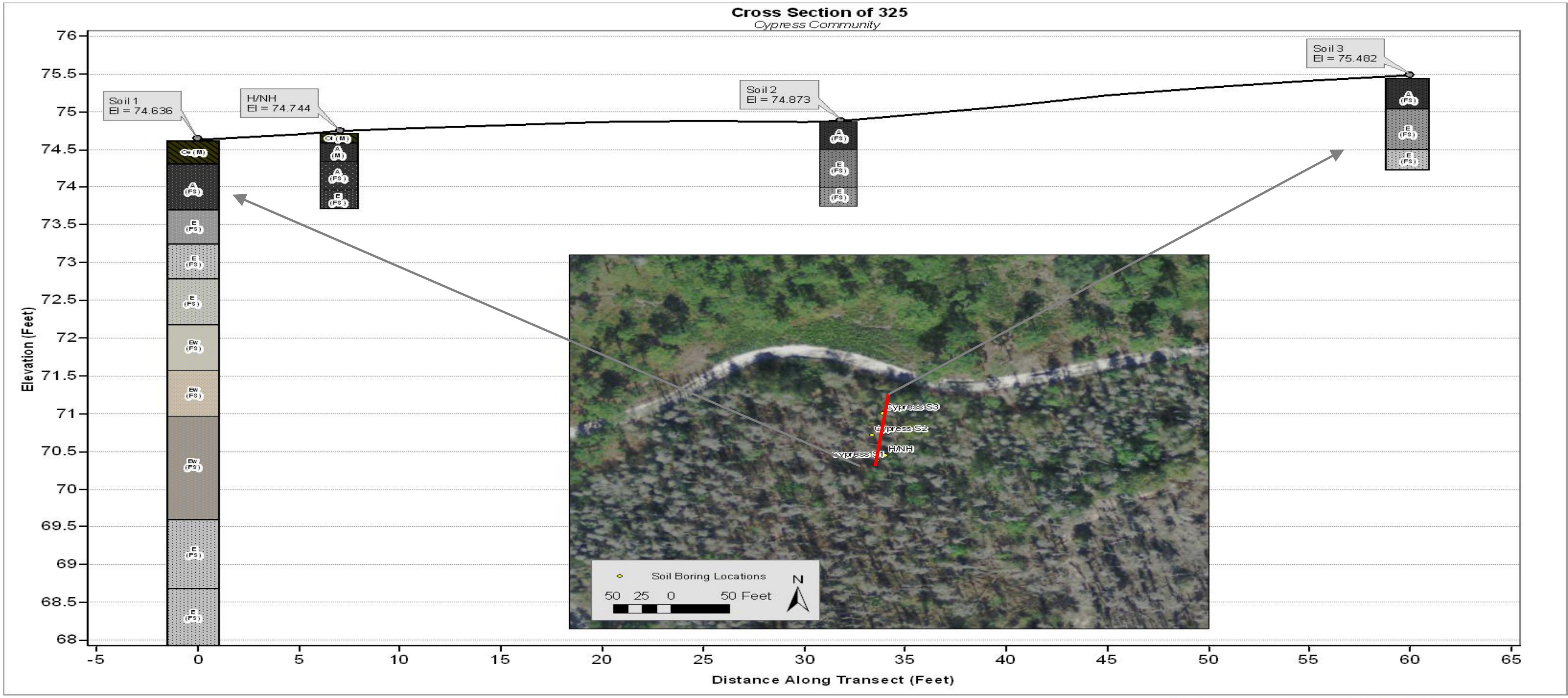
- Preliminary Results (Upper Hillsborough FDA)



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DETAILED SOIL EVALUATION

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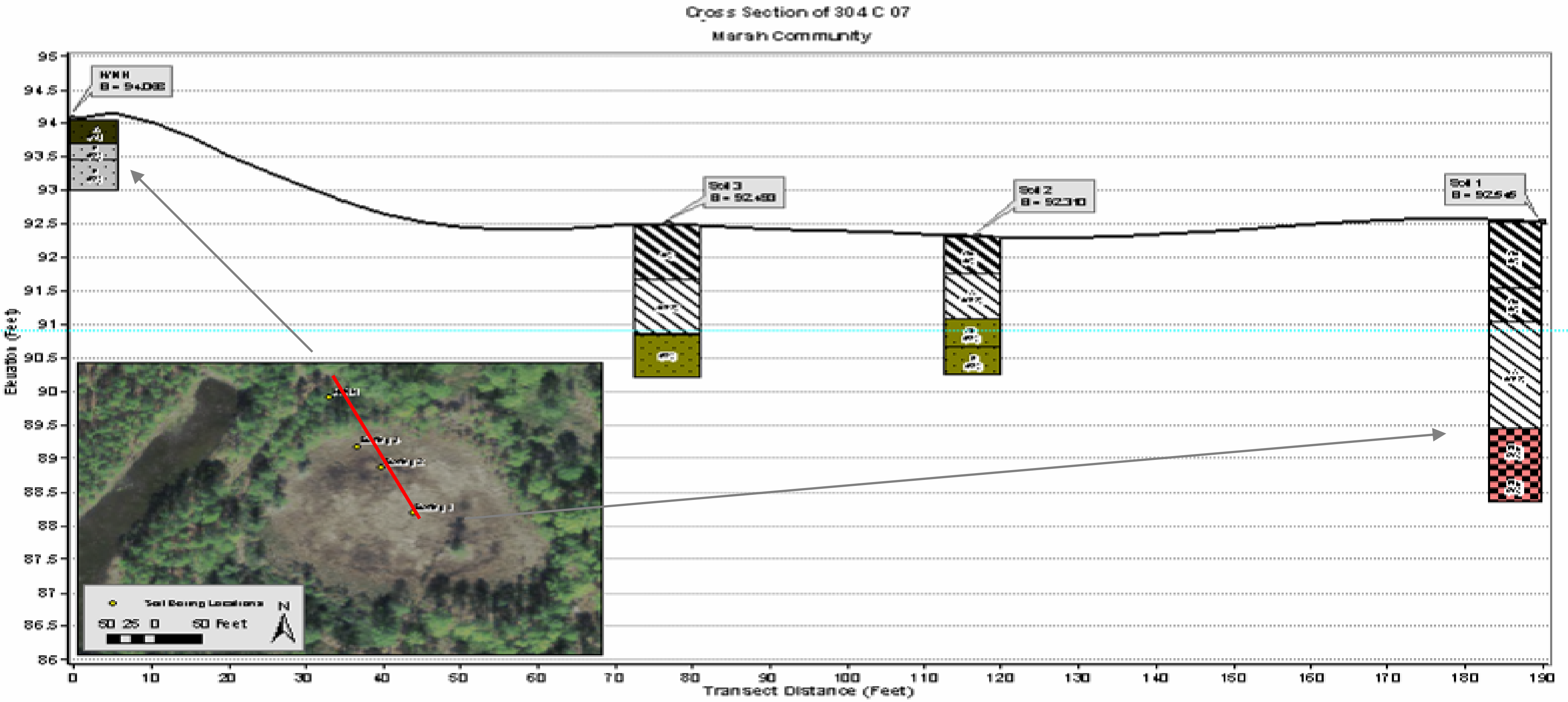
- Preliminary Results (Reference Site (Green Swamp))



DETAILED SOIL EVALUATION
Dehydrated Soils

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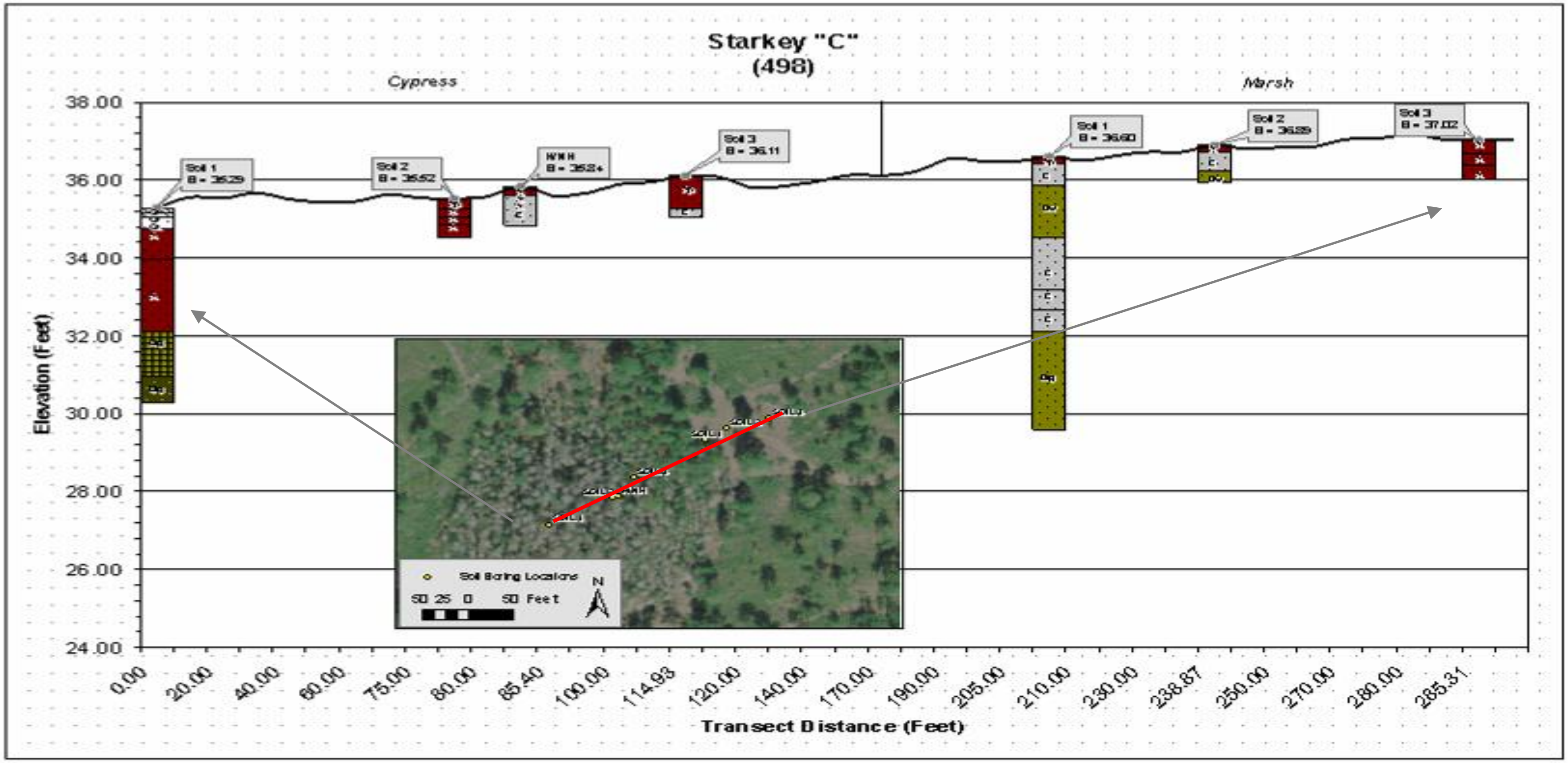
- Preliminary Results (Starkey C (Dehydrated Soils))



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DETAILED SOIL EVALUATION

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- Future Analysis
  - Further characterize wetlands susceptible to drawdown
  - Use results to develop wetland classification system that incorporates vulnerability
  - Incorporate hydrologic data (historic normal pool and annual average water levels)
  - Apply annual, seasonal, and long term average water levels can be applied to graphs
    - Compare soil characteristics to water levels
    - Compare water levels year by year

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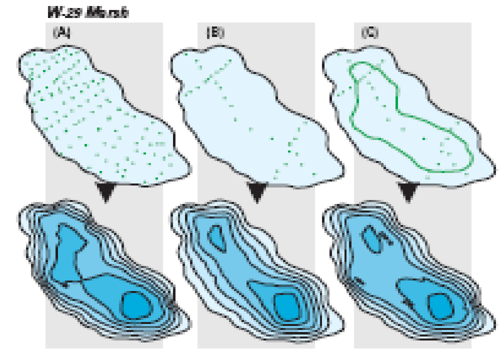
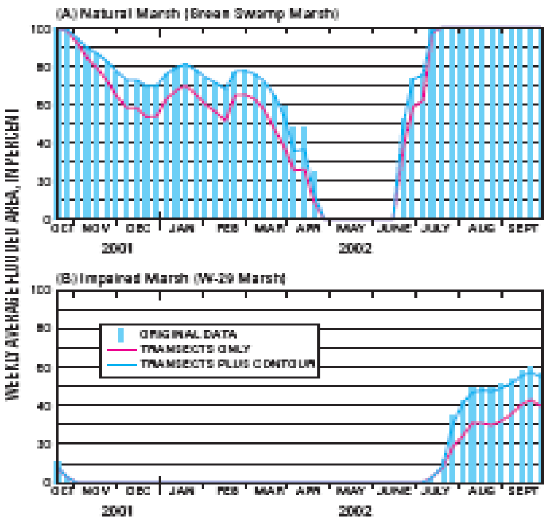
WETLAND HYDROLOGIC ANALYSIS

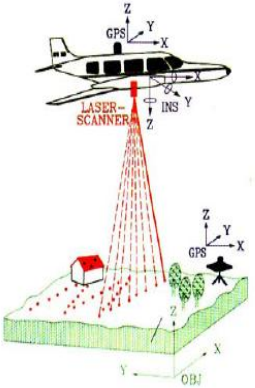
- Background
  - 2000-2004 USGS Study (Haag 2005)
    - Wetland bathymetry-10 District wetlands
      - Survey intensity (3 approaches)
      - Stage area/stage volume relationships
    - Installed water level recorders for 2 years
      - Generated flood frequency distributions
      - Compared natural & impaired marsh marsh
      - Flood frequency distributions- valuable data for District managers
    - Valuable monitoring tool for water resource managers

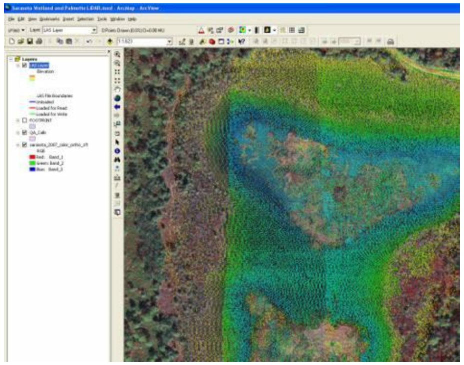


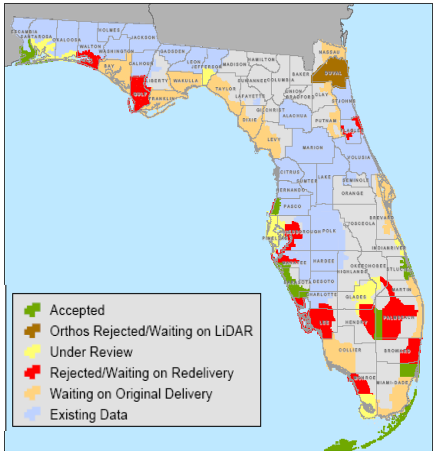


WETLAND HYDROLOGIC ANALYSIS

- What about LiDAR?
  - Widely available
    - District projects
    - FDEM project
    - Cities/Counties
  - Used extensively for SWFWMD WMP work
  - District monitors ALOT of wetlands…400
    - Extremely cost effective
    - Data currently available in many areas







WETLAND HYDROLOGIC ANALYSIS

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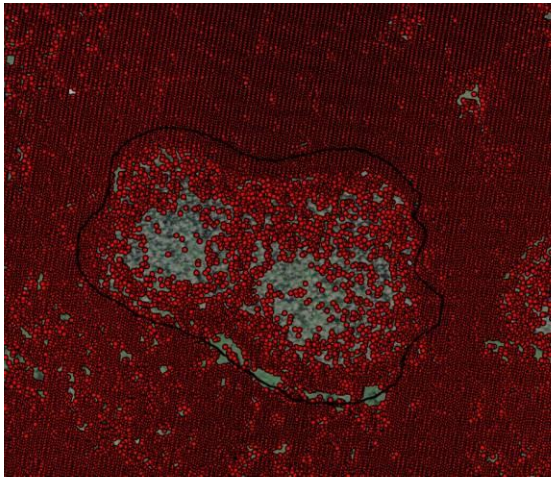
- Project Purpose
  - Evaluate LiDAR’s effectiveness in wetlands
  - Conduct pilot project:
    - Compare LiDAR vs. traditional surveying data (USGS)
    - Stage Area/Stage Volume relationships
    - Flood Area Frequencies



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WETLAND HYDROLOGIC ANALYSIS

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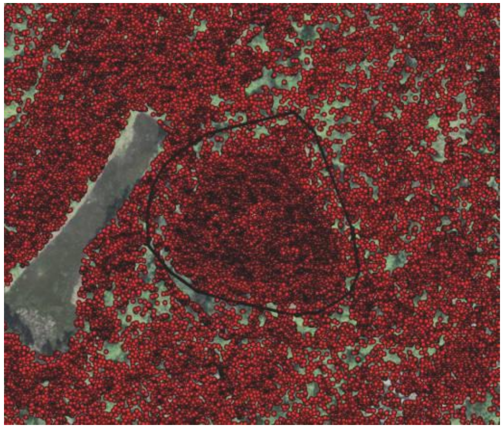
- Sites
  - 4 District wetlands from USGS study
    - 2 reference sites (302 and 304 in Green Swamp)
    - 2 impacted sites (439/S-063 and 443/S-068 in Starkey Well Field)
- Data Sources
  - USGS survey data
  - LiDAR data (bare earth)
    - 2004 Pasco
    - 2006 North District (L470 and L471)



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WETLAND HYDROLOGIC ANALYSIS

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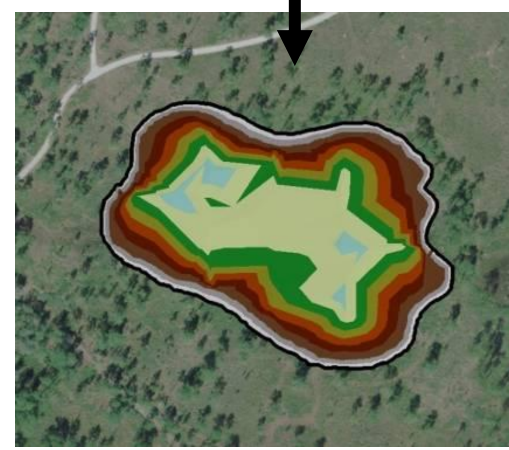
- Methods
  - – USGS data prep
    - Obtained data in EXCEL
    - Converted from NGVD29 to NAVD88
      - – -0.83 to 0.87 ft decrease
    - Generated TIN



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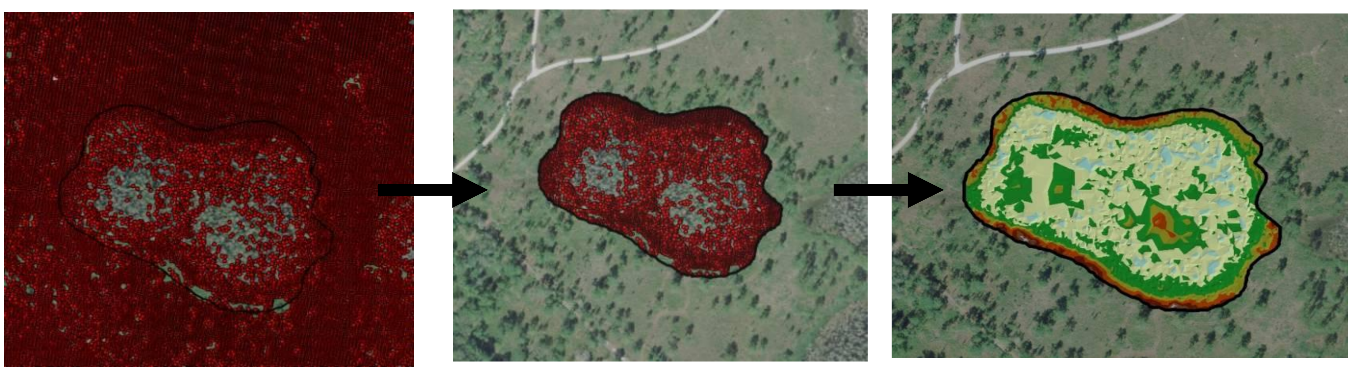
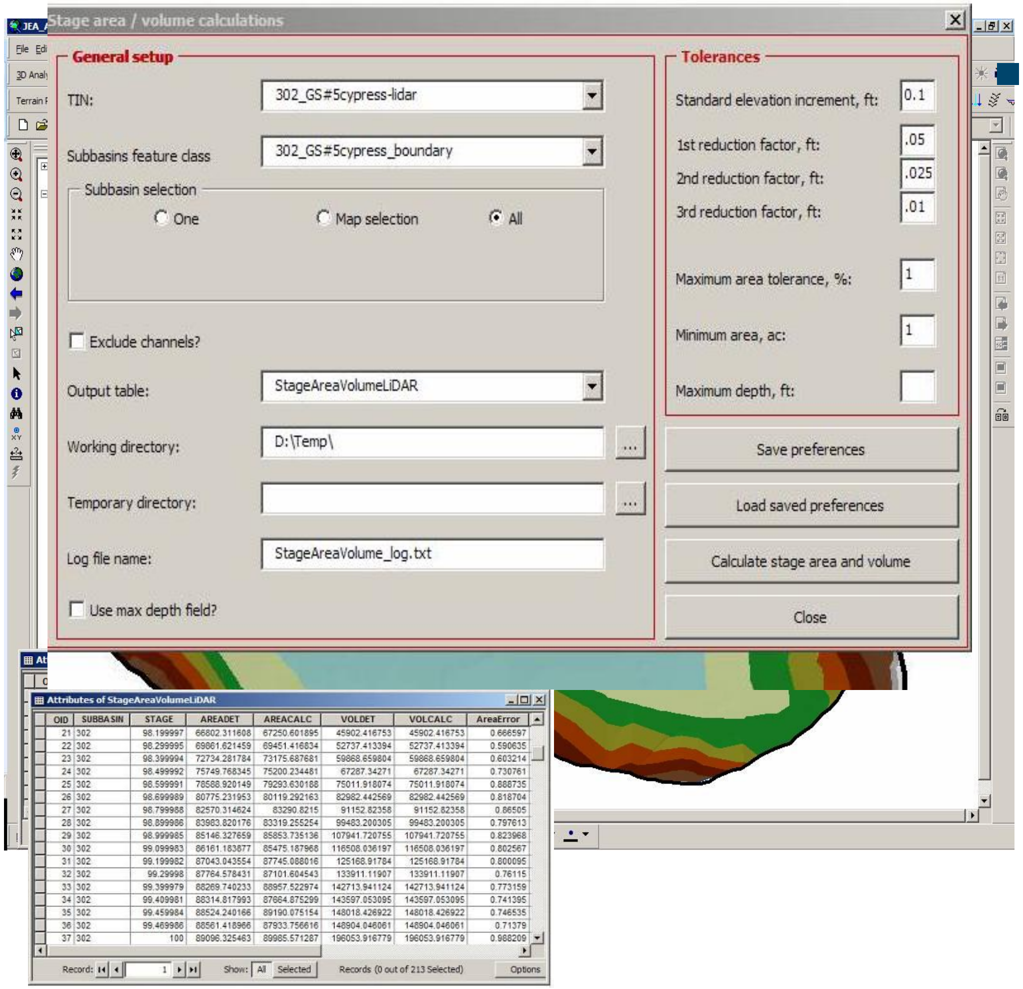
WETLAND HYDROLOGIC ANALYSIS

- Methods
  - LiDAR data prep
    - Clipped to USGS wetland line (palmetto edge)
    - Reviewed outliers (> 0.5 ft) in field
      - Often logs and hummocks
      - Removal had minimal affect on RMSE
    - Generated TIN
  - Calculated RMSE b/w LiDAR and USGS
    - Extracted elevation from USGS TIN



WETLAND HYDROLOGIC ANALYSIS

INTEGRITY | KNOWLEDGE | SERVICE℠



OID	SUBBASIN	STAGE	AREADET	AREACALC	VOLDET	VOLCALC	AreaError
21	302	98.199997	66802.311608	67250.601895	45902.416753	45902.416753	0.666597
22	302	98.299995	69861.621459	69451.416834	52737.413394	52737.413394	0.590635
23	302	98.399994	72734.281784	73175.687681	59868.659804	59868.659804	0.603214
24	302	98.499992	75749.768345	75200.234481	67287.34271	67287.34271	0.730761
25	302	98.599991	78588.920149	79293.630188	75011.918074	75011.918074	0.888735
26	302	98.699989	80775.231953	80119.292163	82982.442569	82982.442569	0.818704
27	302	98.799988	82570.314624	83290.8215	91152.82358	91152.82358	0.86505
28	302	98.899986	83983.820176	83319.255254	99483.200305	99483.200305	0.797613
29	302	98.999985	85146.327659	85853.735136	107941.720755	107941.720755	0.823968
30	302	99.099983	86161.183877	85475.187968	116508.036197	116508.036197	0.802567
31	302	99.199982	87043.043554	87745.088016	125168.91784	125168.91784	0.800095
32	302	99.29998	87764.578431	87101.604543	133911.11907	133911.11907	0.76115
33	302	99.399979	88269.740233	88957.522974	142713.941124	142713.941124	0.773159
34	302	99.409981	88314.817993	87664.875299	143597.053095	143597.053095	0.741395
35	302	99.459984	88524.240166	89190.075154	148018.426922	148018.426922	0.746535
36	302	99.469986	88561.418966	87933.756616	148904.046061	148904.046061	0.71379
37	302	100	89096.325463	89985.571287	196053.916779	196053.916779	0.988209

Methods

- Stage Area/Stage Volume Analysis
  - Automated ArcMap tool
    - Average end/area method for calculating volume
    - Elevation extraction interval of 0.1 ft from TIN
    - Results written to a database

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WETLAND HYDROLOGIC ANALYSIS

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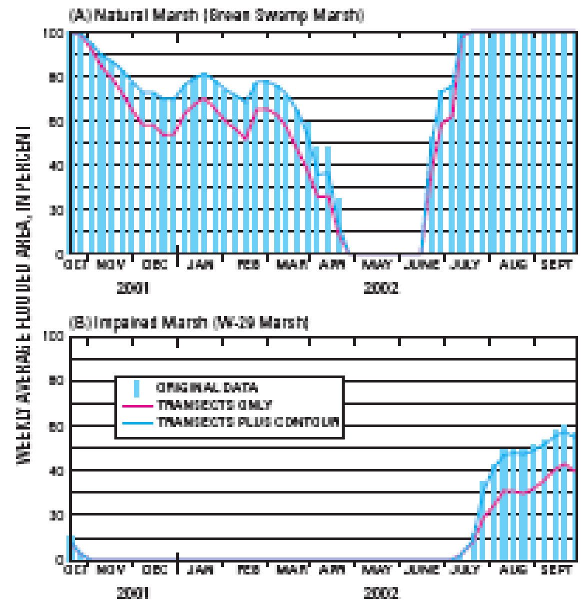
- Methods
  - Flood Frequency Analysis
    - WMIS site
      - Sampling frequency varied (hourly, daily, bi-monthly)
    - Generated Flood Frequency Distributions in EXCEL
      - POR
      - 2004 (Wet year)
      - 2007 (Dry year)



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WETLAND HYDROLOGIC ANALYSIS

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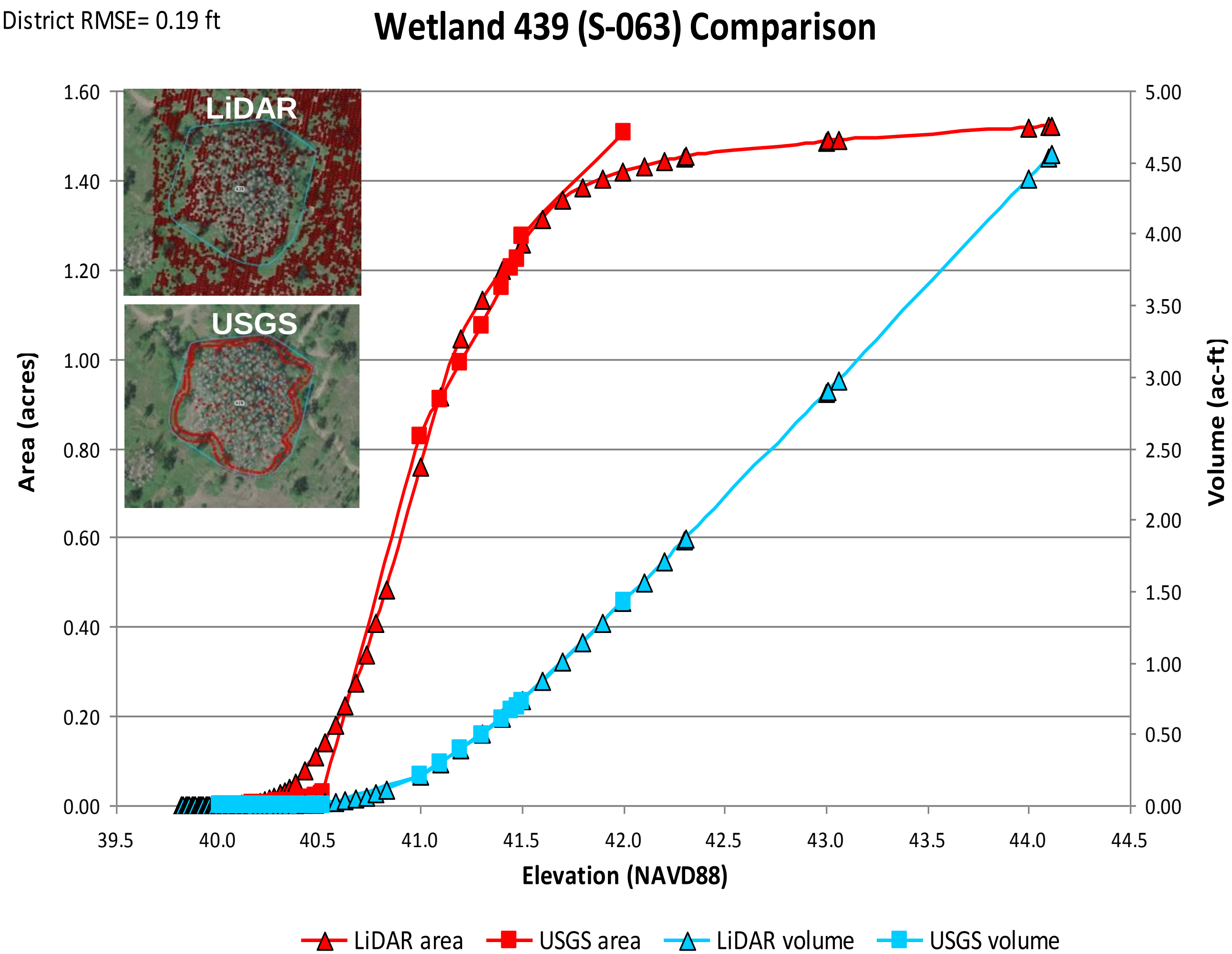
RMSE = 0.72 ft
RMSE W/Out Wetland Line = 0.39 ft
District RMSE= 0.19 ft



- Results
  - 523 pts/ac with LiDAR
  - 59 pts/ac with USGS
  - RMSE
  - Overall…very similar

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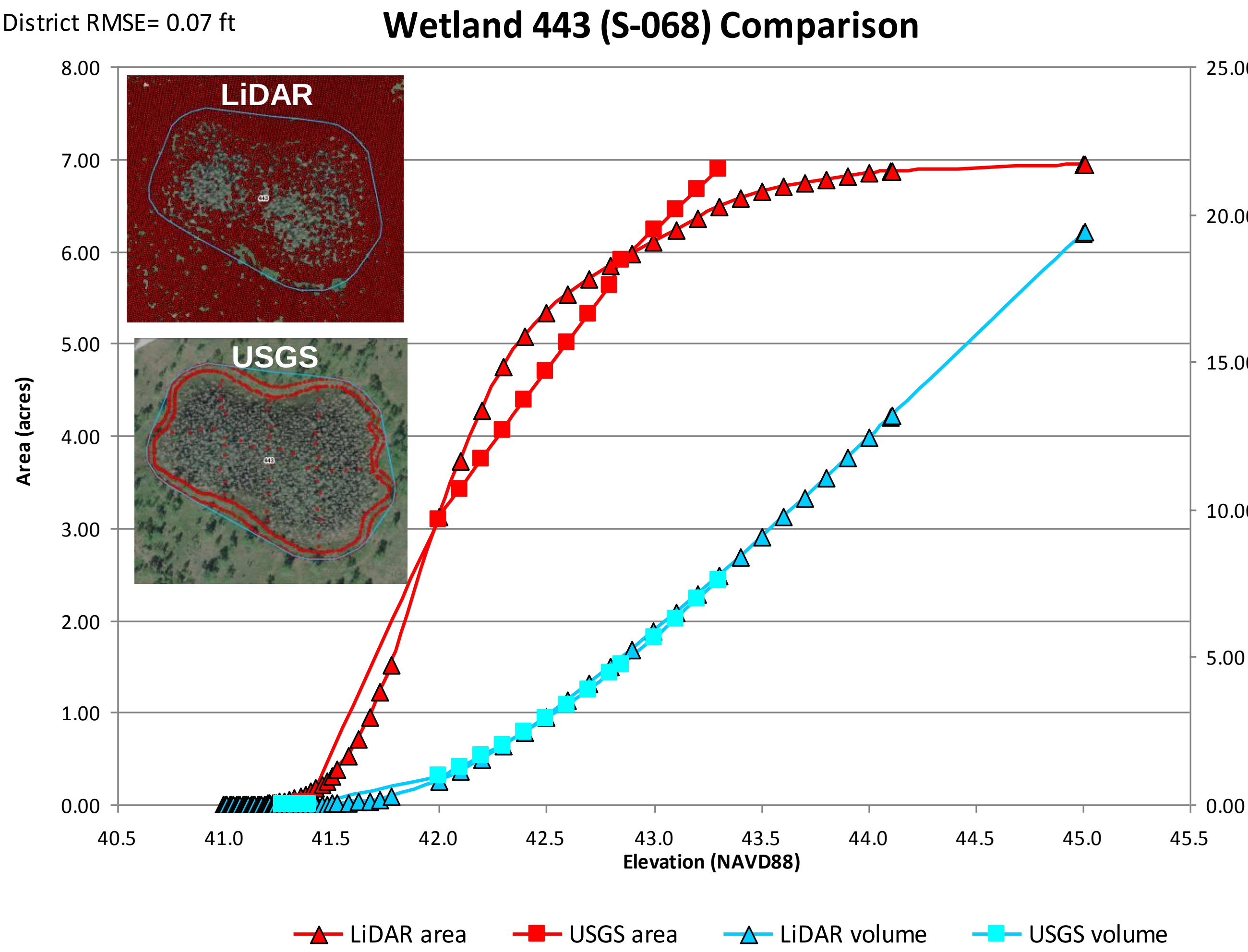
WETLAND HYDROLOGIC ANALYSIS

RMSE = 0.43 ft
RMSE W/Out Wetland Line = 0.47 ft
District RMSE= 0.07 ft



- Results
  - 648 pts/ac with LiDAR
  - 8 pts/ac with USGS
  - RMSE
  - Overall……. very similar

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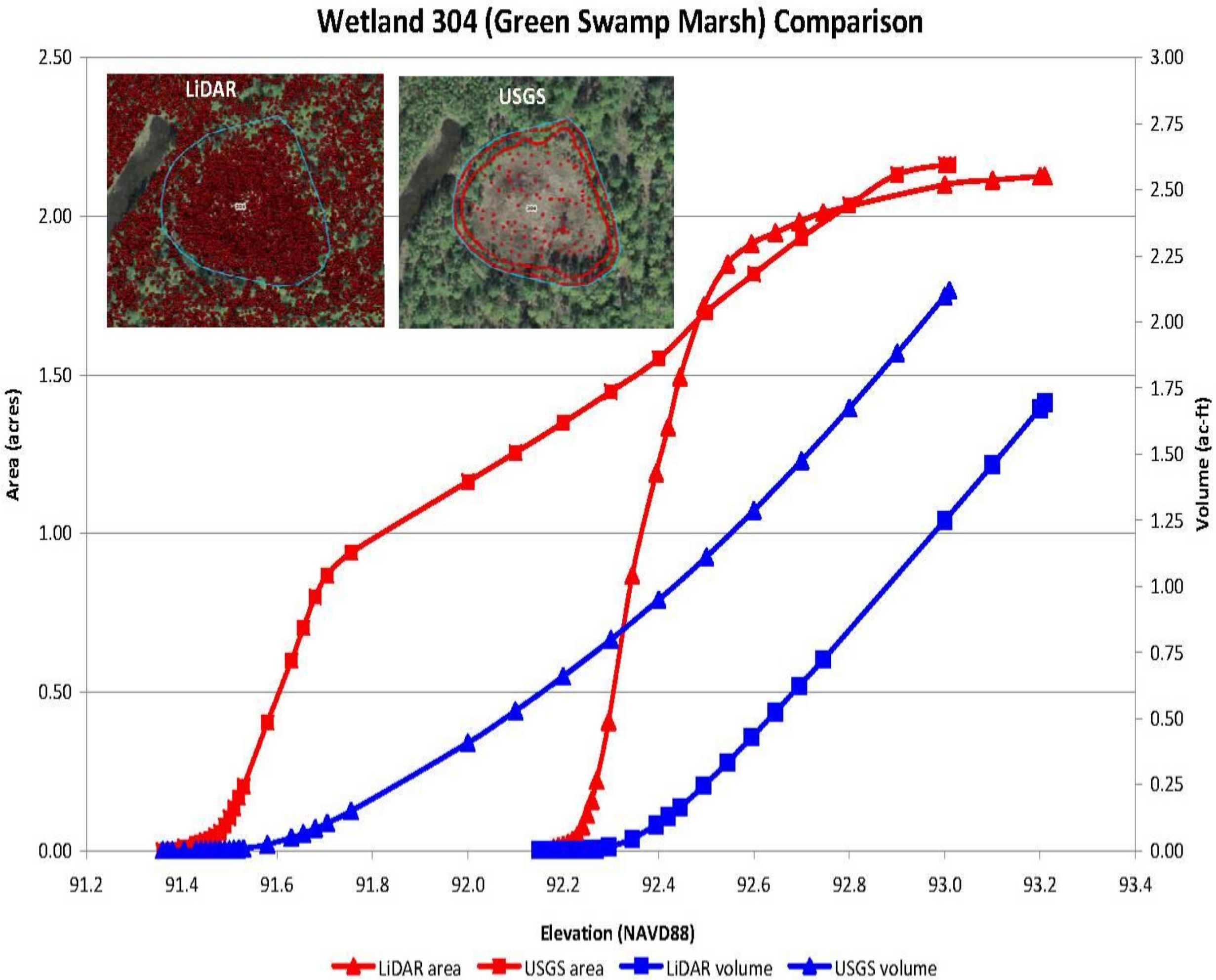
RMSE = 0.45 ft
RMSE W/Out Wetland Line = 0.71 ft
District RMSE= 0.68 ft



- Results
  - 2374 pts/ac with LiDAR
  - 18 pts/ac with USGS
  - RMSE low
  - Misclassification… bare earth may be top of veg
  - No Class 11 points
  - TIN could be adjusted

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WETLAND HYDROLOGIC ANALYSIS

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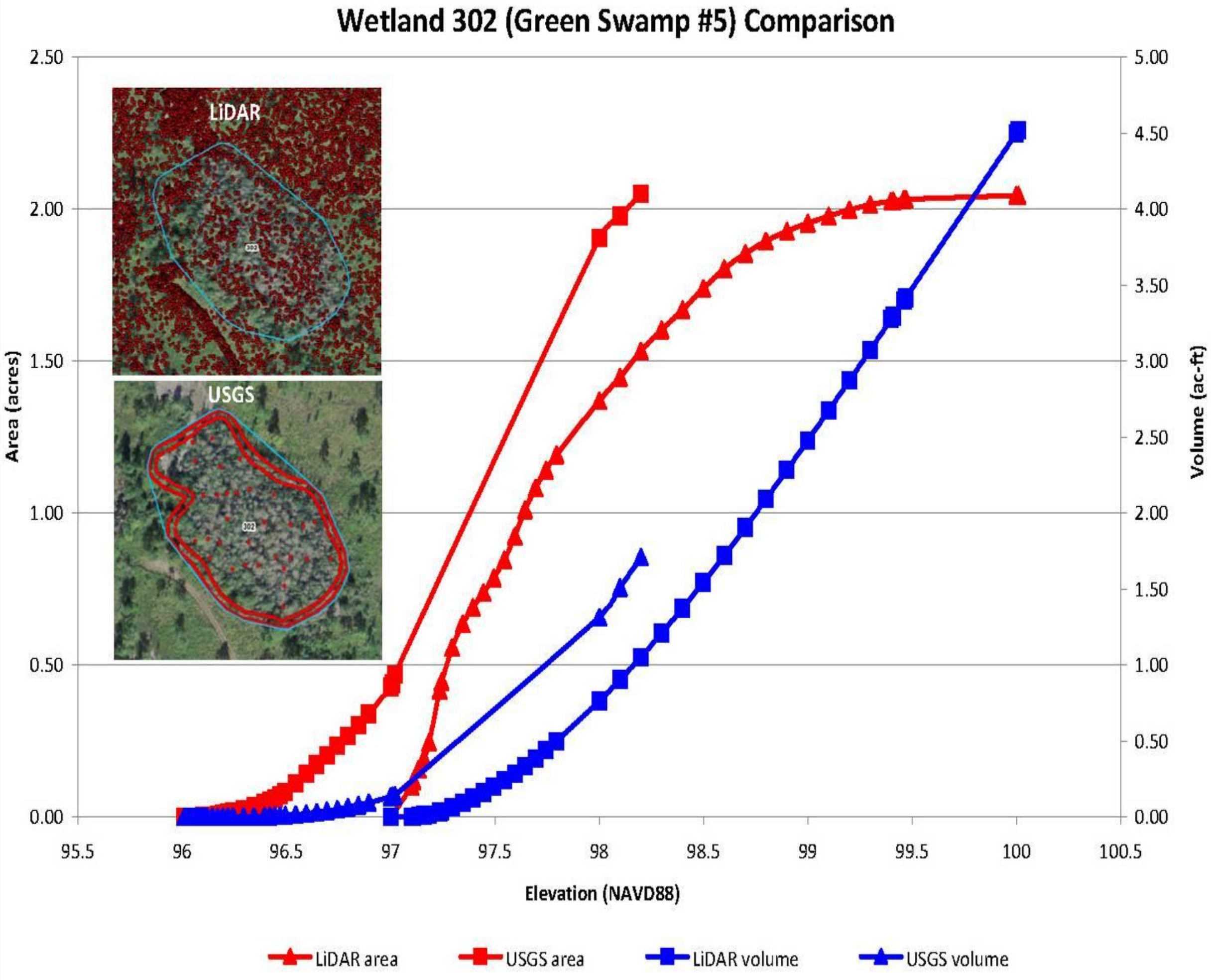
RMSE = 0.80 ft
RMSE W/Out Wetland Line = 0.47 ft
District RMSE= 0.65 ft



- Results
  - 523 pts/ac with LiDAR
  - 18 pts/ac with USGS
  - RMSE…a little high
  - Misclassification…. bare earth may be top of veg
  - No Class 11 points
  - TIN could be adjusted

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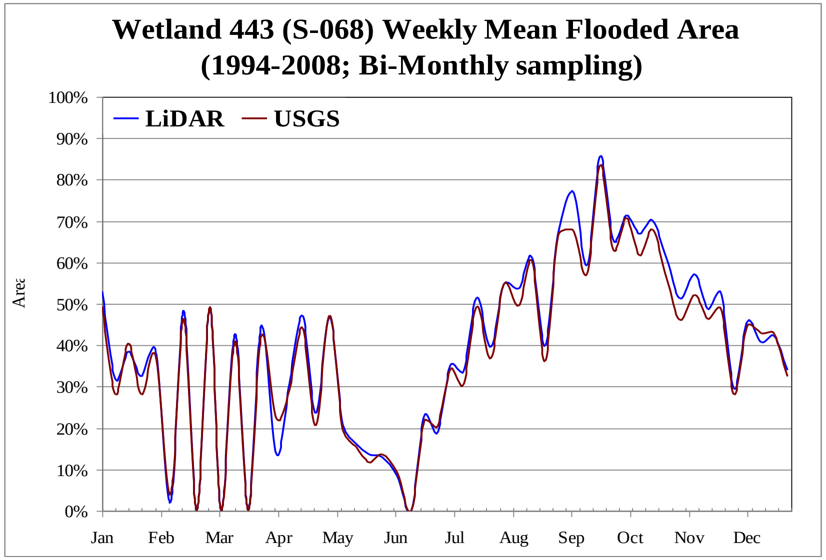
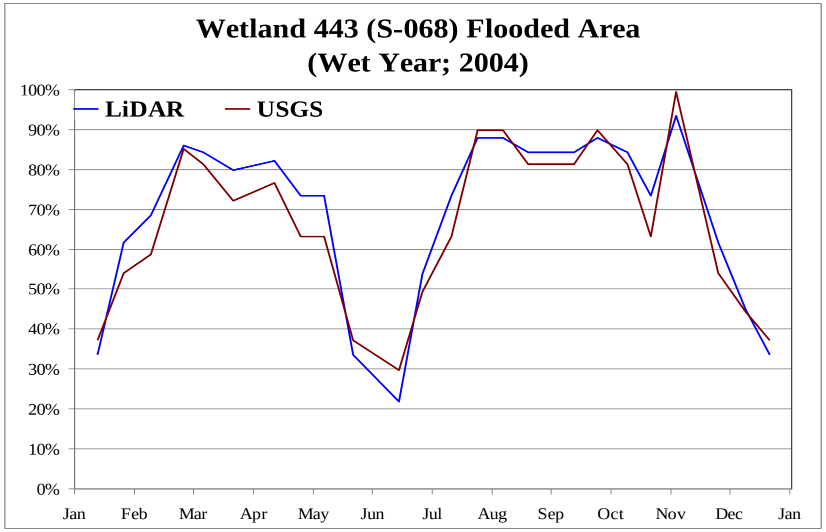
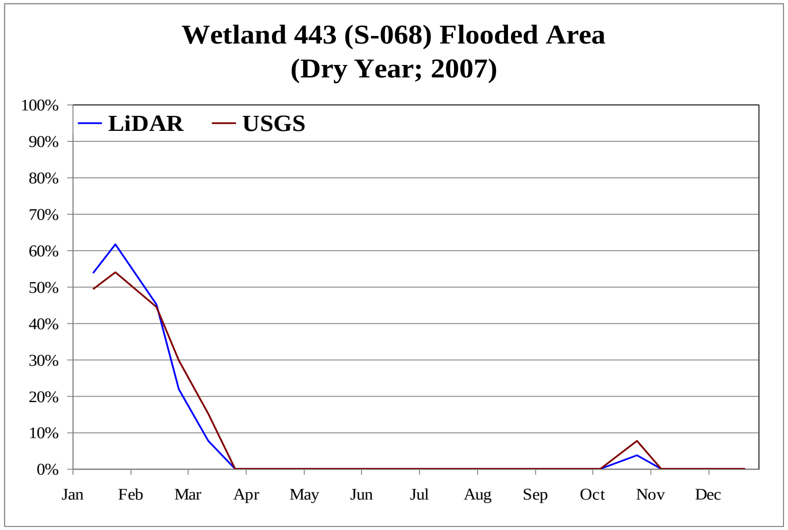




- Results
  - Wetland 443 (S-068)
    - POR
    - Wet Year; 2004
    - Dry Year; 2007



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WETLAND HYDROLOGIC ANALYSIS

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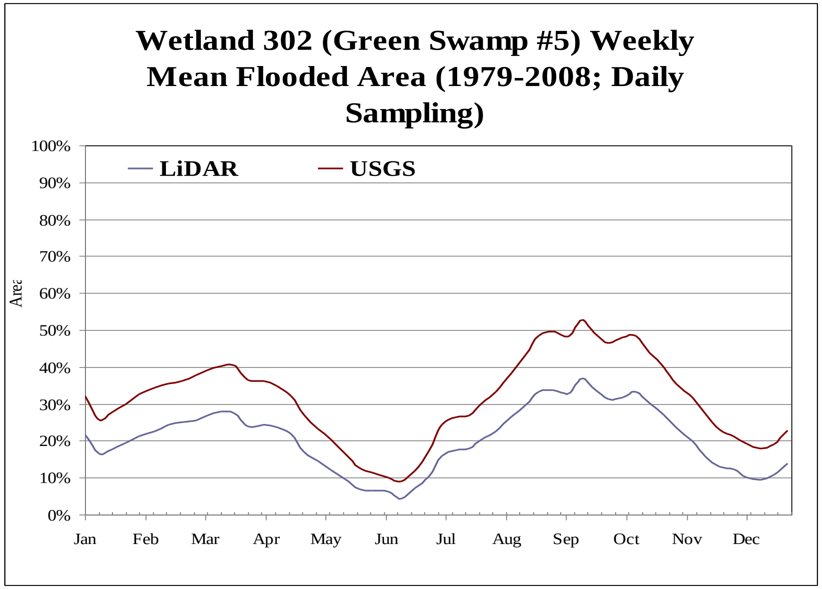
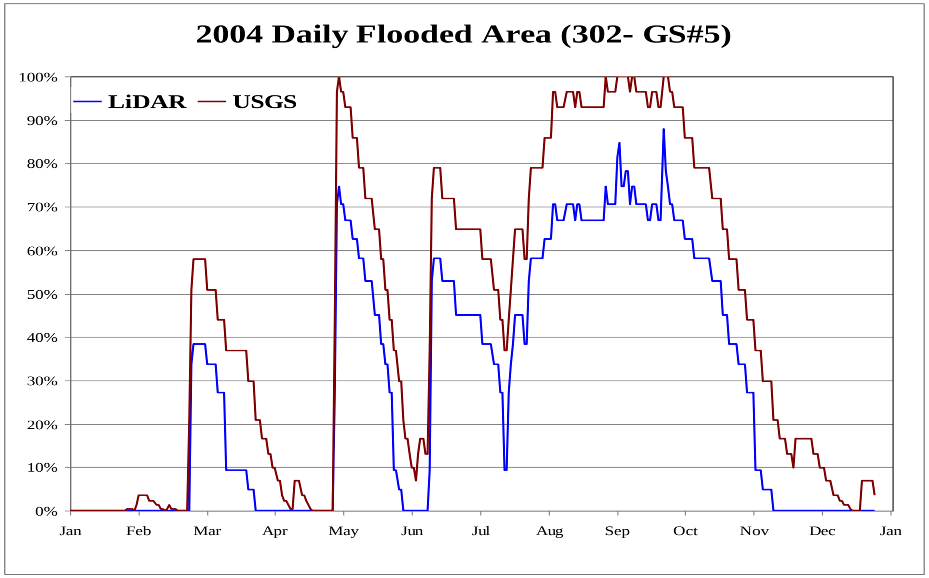
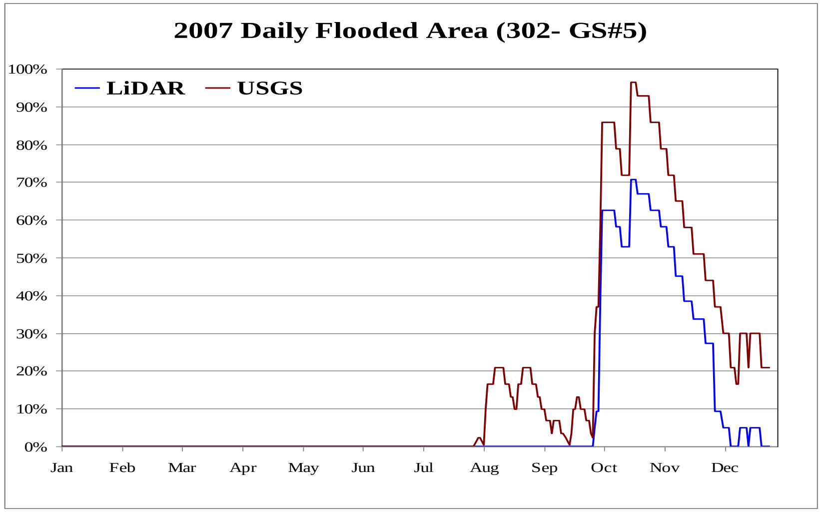
- Results
  - Wetland 302 – GS#5
    - POR
    - Wet year; 2004
    - Dry year; 2007



Wetland 302 (Green Swamp #5) Weekly Mean Flooded Area (1979-2008; Daily Sampling)



2004 Daily Flooded Area (302- GS#5)



2007 Daily Flooded Area (302- GS#5)

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WETLAND HYDROLOGIC ANALYSIS

- In Summary
  - Results are promising
  - Powerful wetland hydrology (health) monitoring tool
    - Cost effective…cheap
    - Can conduct assessment at various intervals
      - Annually
      - For POR
      - For only wet season/dry season
  - Future LiDAR flights could generate acceptable data for wetland sites where currently unacceptable
- Moving Forward
  - SOP for evaluating LiDAR suitability
    - Need to develop thresholds or screening process
    - TIN adjustment based on known elevations at wetland (benchr well, staff gauge, WAP transects)
  - Conduct analysis on 42 remaining wetlands