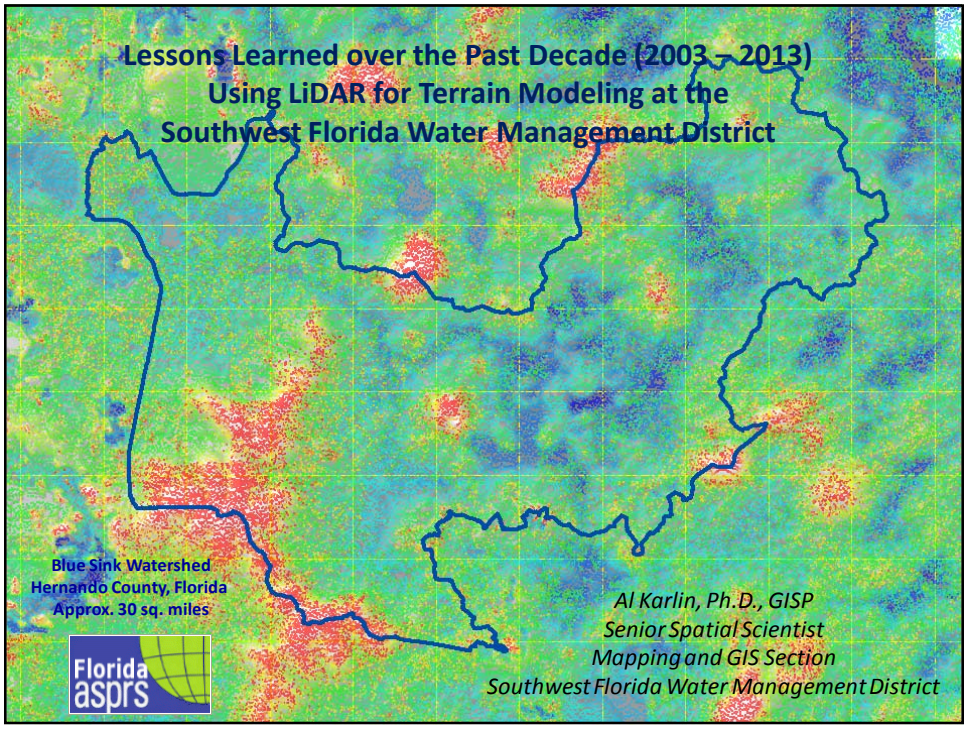
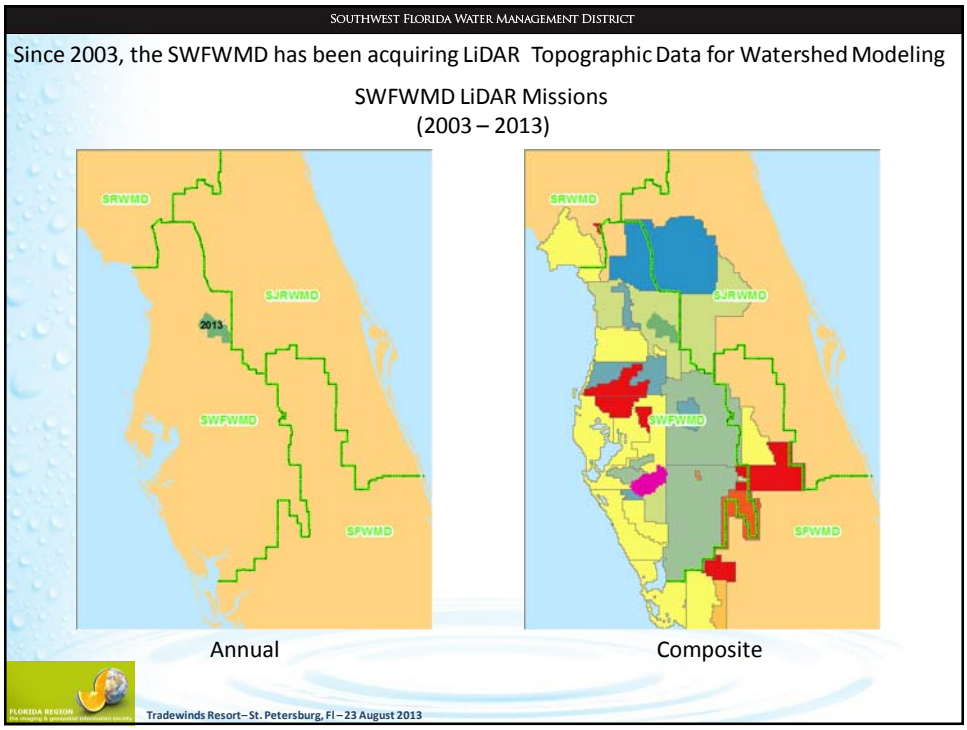
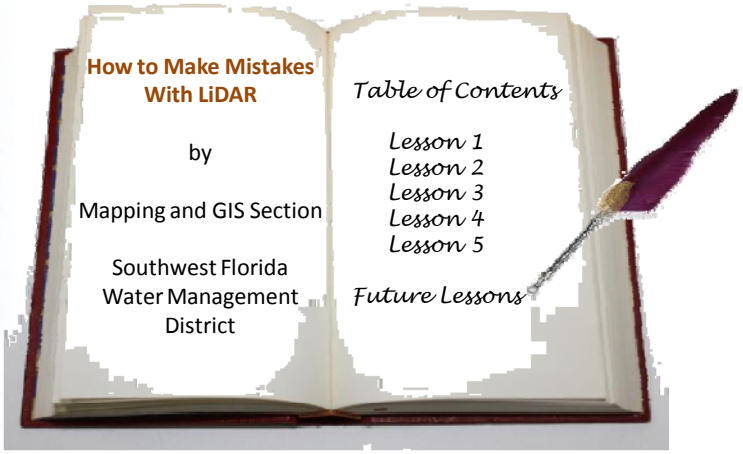

Lessons Learned over the Past Decade (2003 – 2013)
Using LiDAR for Terrain Modeling at the
Southwest Florida Water Management District
Blue Sink Watershed
Hernando County, Florida
Approx. 30 sq. miles
Florida asprs
Al Karlin, Ph.D., GISP
Senior Spatial Scientist
Mapping and GIS Section
Southwest Florida Water Management District


Southwest Florida Water Management District
Since 2003, the SWFWMD has been acquiring LiDAR Topographic Data for Watershed Modeling
SWFWMD LiDAR Missions
(2003 – 2013)
SRWMD
SJRWMD
2013
SWFWMD
SFWMD
Annual
SRWMD
SJRWMD
SWFWMD
SFWMD
Composite
Tradewinds Resort– St. Petersburg, Fl – 23 August 2013

And since 2003, the SWFWMD has been writing the book …



… and learning lessons regarding LiDAR for Watershed Modeling.

Lesson 1 - Decide on a LiDAR format and stick with it!

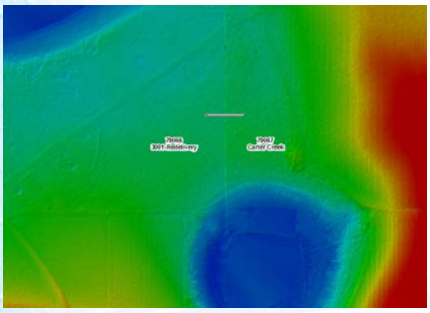
2003 – Marion County – ASCII format - ground only
2004 – Manatee (partial), Pasco and Sarasota Counties –
EBN proprietary format
Unclassified Point Cloud
Ground-only
2005 – South District – ASPRS LAS 1.1
Classes 1, 2, 9, 10 (low confidence), 11 (photogrammetric)
2006 – North District – LAS 1.2
Classes 1, 2, 9, 10 (photogrammetric), 11 (low confidence)
Lake County – gridded LiDAR: Classes 2, 9
2007 – Florida Coastal – LAS 1.2
Classes 1, 2, 7 (noise), 9, and 12 (overlap)
Hernando County – LAS1.2
Classes 1, 2, 9, 10 and 11
2011 – Pasco and Hillsborough County reflights – LAS 1.3
Classes 1, 2, 6, 9, 11, 12, and 23 (overpasses)
2012 – Lake Manatee Watershed – LAS 1.3
2012 – Jumper Creek/Bushnell – LAS 1.3

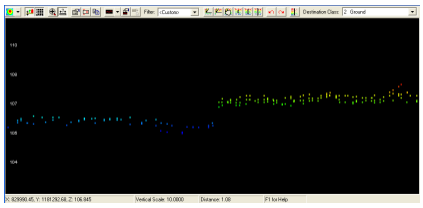
SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT

Lesson 2 - "Tie edges" between missions NEVER work out right

4.0 - The Consultant will tie the data collected under this work order to that collected by previous projects so as to minimize differences in surface elevations at the intersecting seams of the project areas. The vertical difference along a tie-edge will not exceed the FVA in consolidated terrains or the SVA in specific vegetation types.

SWFWMD LiDAR Specification 4.31 (Feb 2012)





Elevation difference within specification, but 1' waterfalls do not occur in Florida!

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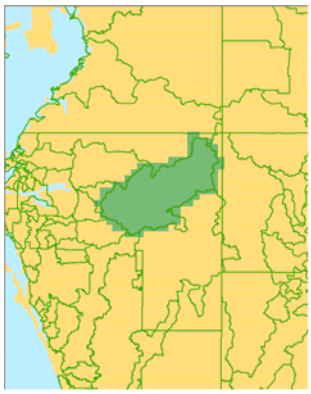
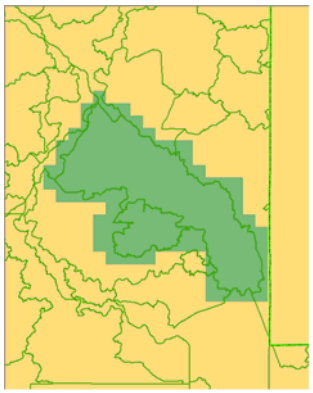
Lesson 2 - Solution/Remedy Learned - no quick fix!

2011 – 10 Watersheds
~500 sq. miles

2012 – 1 Watershed
~ 180 sq. miles



2013 – 2 Watersheds
~ 165 sq. miles



This brings us to Lesson 3…

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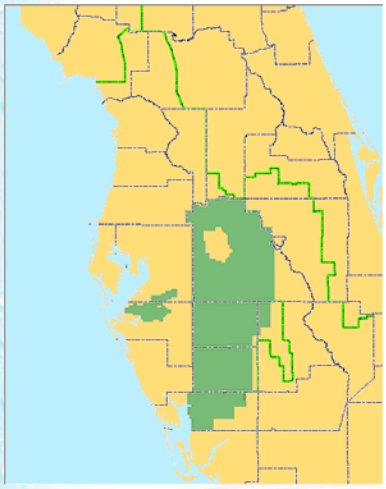
Lesson 3 - Don't bite off more than you can chew (or QA)



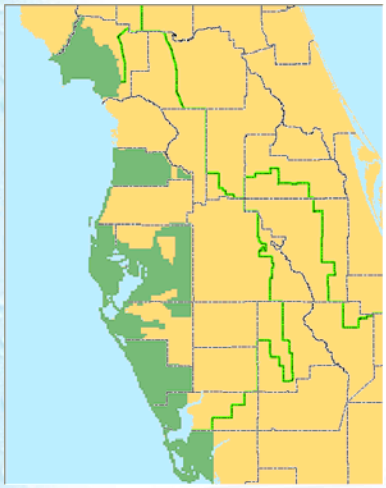
In 2005, the District had an opportunity to collect over 3500 sq. miles of LiDAR terrain data covering all or parts of 6 counties! At the time, the ONLY software that the District used to review the data was ArcGIS 9.0. The QA routine involved:

1- converting the LiDAR to multipoint
2- constructing an Esri-Terrain data set
3- extracting a DEM
4- examining the DEM

As a result of the extended processing time, the District was able to review less than 10 % of the delivered data AND even that required three (3) GIS Analysts and over 6 months.

SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT

Lesson 3 - Don't bite off more than you can chew (or QA)



Two years later (2007) the District cooperated with the Florida Division of Emergency Management to collect another 3895 sq. miles of LiDAR terrain data! (When will we ever learn?)

This time, however,

1) several consulting firms were hired to conduct independent QA on some of the data, and

2) additional software was available to assist with in-house QA. Data were processed and visualized much more rapidly using MARS (Merrick & Co.), LP360 (QCoherent/GeoCue Inc.) and Global Mapper (BlueMarble Geographics)

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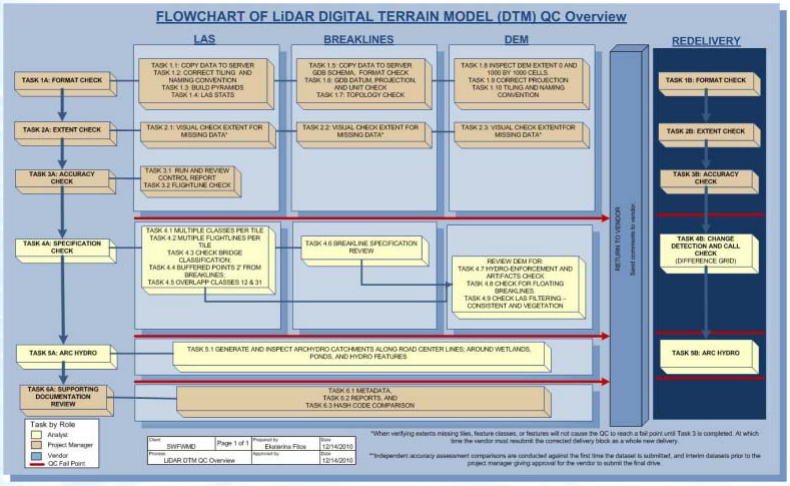
Lesson 3 - Solution/Remedy Learned - have a good QA plan

The right software, training and a QA plan really facilitate the process and insure that the products received meet the specifications of the mission

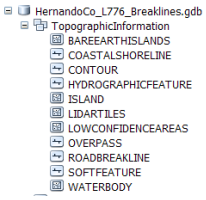


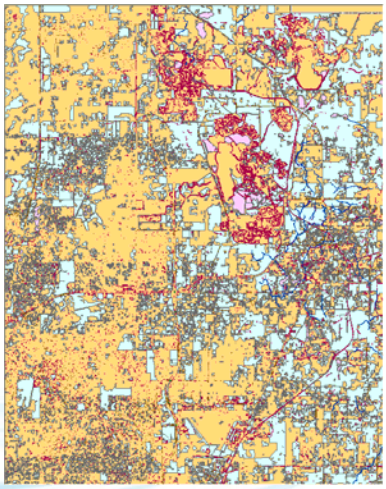
Lesson 4 - Do we really need breaklines?

Breaklines (prior to 2010)

9 Feature Types

- BareEarthIslands
- CoastalShoreline
- HydrographicFeature
- Island
- LowConfidenceAreas
- OverPass
- Roads
- Soft Breaklines
- Waterbody





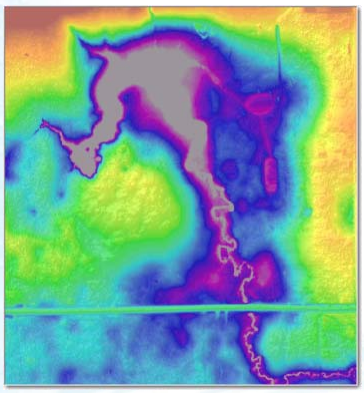
Interpretation of "Soft Breaklines"…

so…

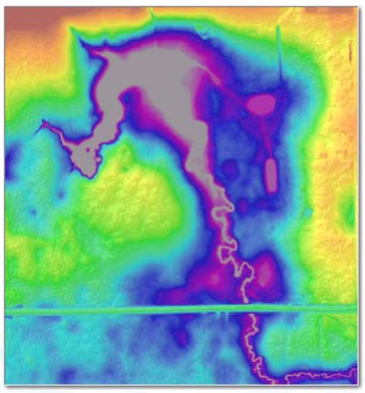
Lesson 4 – So, if you don't need Breaklines, why bother???

In 2009, to evaluate the effect of breaklines in our environment on surface water modeling, we reprocessed a watershed (Peck Sink), that had been previously breaklined, by removing the breaklines (except hydroflattening) and re-introducing the buffer points (~250,000/tile) that had been removed because of breaklining.

No Breaklines



Breaklines



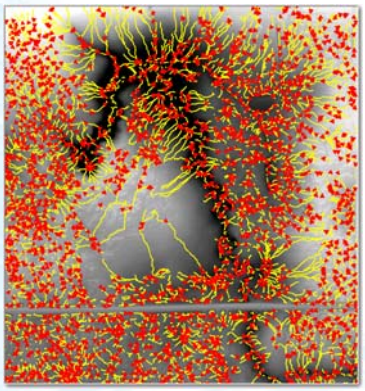
Scale= 1:6000

Lesson 4 - The problem with breaklines is…

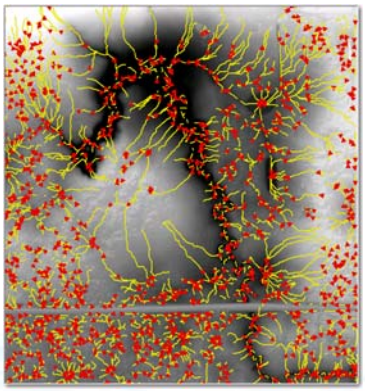
The DEMs look quite similar, but metrics tell a different story…

	No Breaklines	Breaklines
Drainage Points/Catchments	5075	5075
Preferential Links (flow paths)	10959	5216

No Breaklines



Breaklines

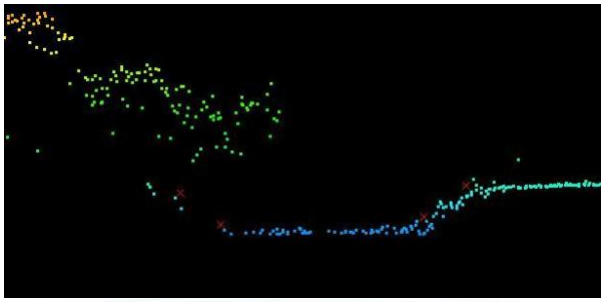


Scale= 1:6000

Lesson 4 - The Solution/Remedy… careful definitions, and do not use breaklines to replace planimetric mapping!

1- Road breaklines **are not needed** when the laser points define the crown, but road breaklines **are needed** in obscured areas where laser points to not reach the ground.

2- Hydrofeature breaklines **are not needed** when the laser points define the top of bank and toe of slope, but **are needed** when the feature is obscured.



3- Do not breakline extractive (Mining) areas!

SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT

Lesson 5 - Who to trust with your data (no one!)

Standard "Deliverables" may include:

LAS files (tiled)
DEMs (Grid/FLT, etc.)
Breaklines
Contours
Imagery
Survey Reports
Accuracy Statements, etc.

BUT… data can be lost, destroyed or altered!

ATTACHMENT A – DELIVERABLE SUMMARY TABLE

Copies	Description	Format
	LiDAR	
1	Project Pilot Area	Multiple
1	LiDAR Laser points	LAS 1.2 or 1.3
1	RAW LiDAR Instrument\ IMU\GPS Data	Proprietary
1	Digital Topographic Feature Database Dataset	ArcGIS file-based Geodatabase
1	Imagery Dataset Used in Breakline Compilation	GeoTIFF
1	Contours	ArcGIS file-based Geodatabase
1	Flight Plan	ArcGIS file-based Geodatabase
1	Actual Flight Lines	ArcGIS file-based Geodatabase
1	Apparent Seamline	ArcGIS file-based Geodatabase
1	Set of DEM tiles	ESRI Grid
2	Survey Report	Hardcopy
1	Survey Report	PDF
2	Tie Edge Report	Hardcopy
1	Tie Edge Report	PDF
1	Tie Edge Difference Grid	ESRI Grid
2	LiDAR Processing Report	Hardcopy
1	LiDAR Processing Report	PDF
2	Horizontal Accuracy Report	Hardcopy
1	Horizontal Accuracy Report	PDF
2	Vertical Accuracy Report	Hardcopy
1	Vertical Accuracy Report	PDF
1	Vertical and Horizontal Accuracy Points	ArcGIS file-based Geodatabase
1	Ground Control Points	ArcGIS file-based Geodatabase
1	ArcHydro Generated Sinks and Catchments	ArcGIS file-based Geodatabase
1	Metadata file	ArcGIS XML
1	Hash Code file	Excel and ASCII (.CSV)

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Future Lesson 1 -

Updating terrain with Flash LiDAR, UAV/UAS, etc.

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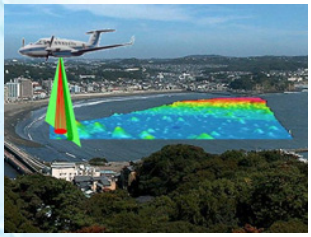
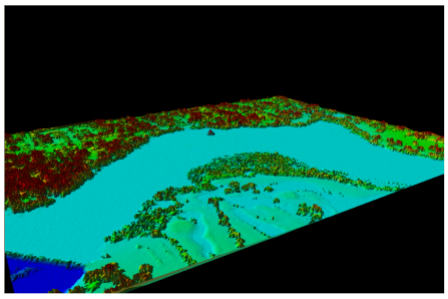
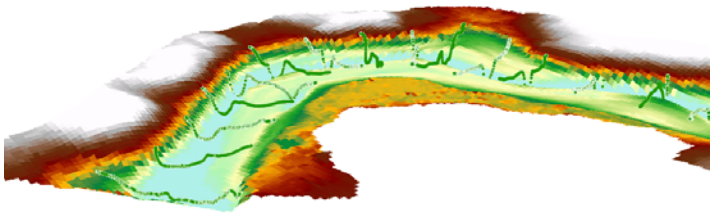
Future Lesson 2 -

Airborne Bathymetric LiDAR (BathyLiDAR)??

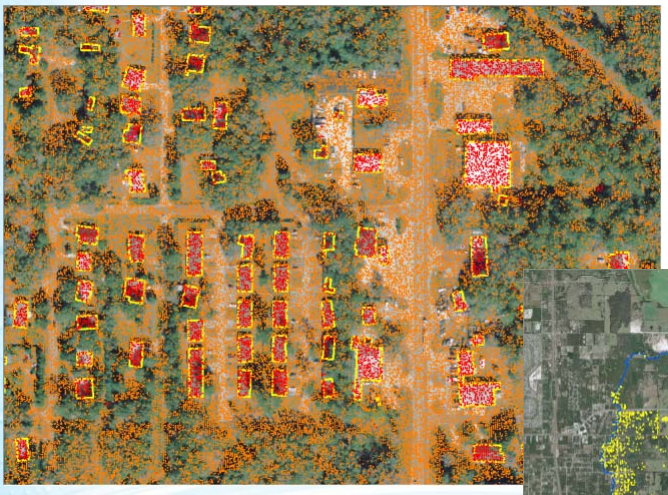


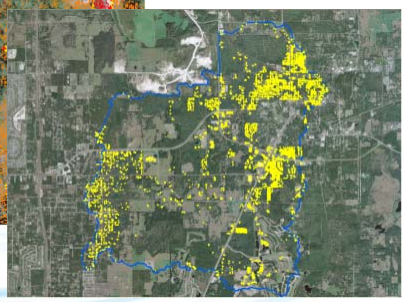




Future Lesson 3 -

Feature Extraction for Level of Service Analysis





SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT

Brooksville, FL Headquarters of the Southwest Florida Water Management District
LiDAR – Image Data Fusion

http://ftp.swfwmd.state.fl.us/GWIS
Al.Karlin@SWFWMD.State.FL.US

Thank you for your attention…

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