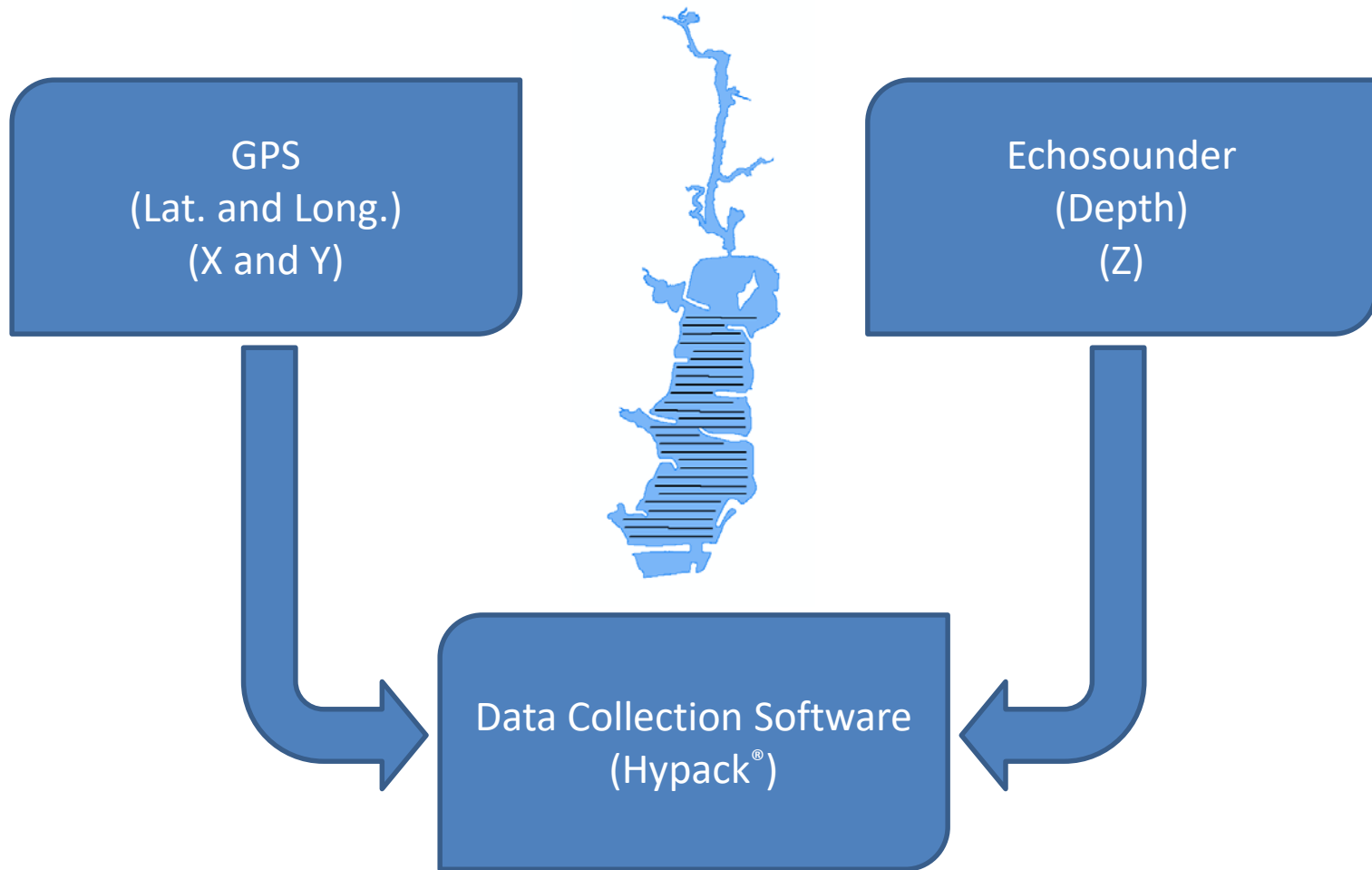# The Role of Reservoir Geomorphology in Determining Coverage Densities for Bathymetric Surveys in Oklahoma Water Supply Reservoirs – OCLWA 2019

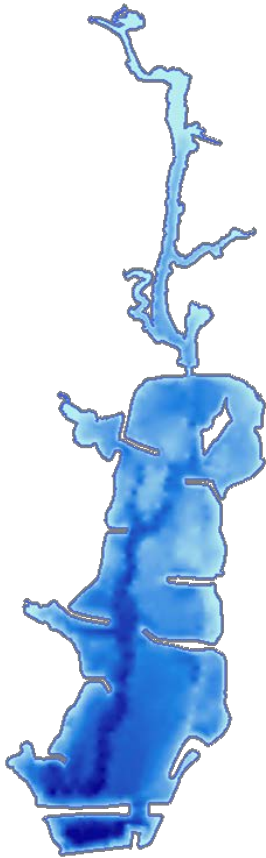James Decker, Scott Roberson, Chris Adams, and Paul Koenig

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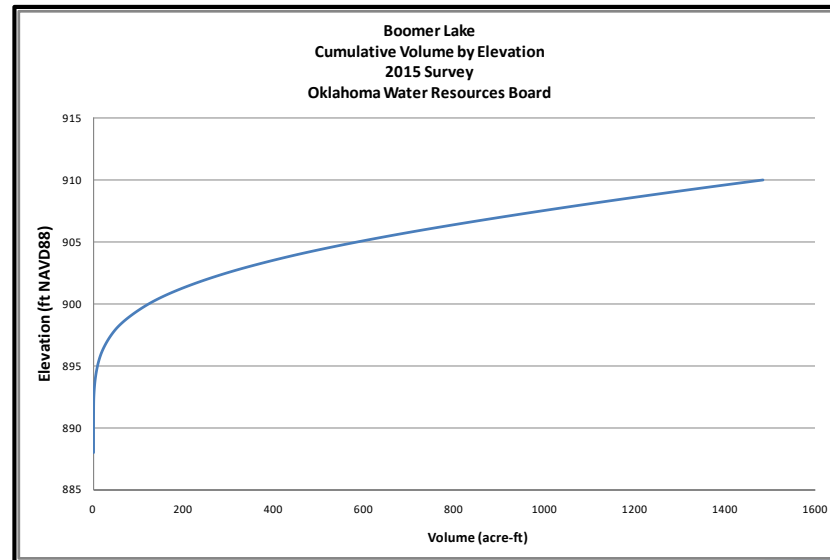the water agency

Bathymetric Surveying

Bathymetry Products

Shaded Relief

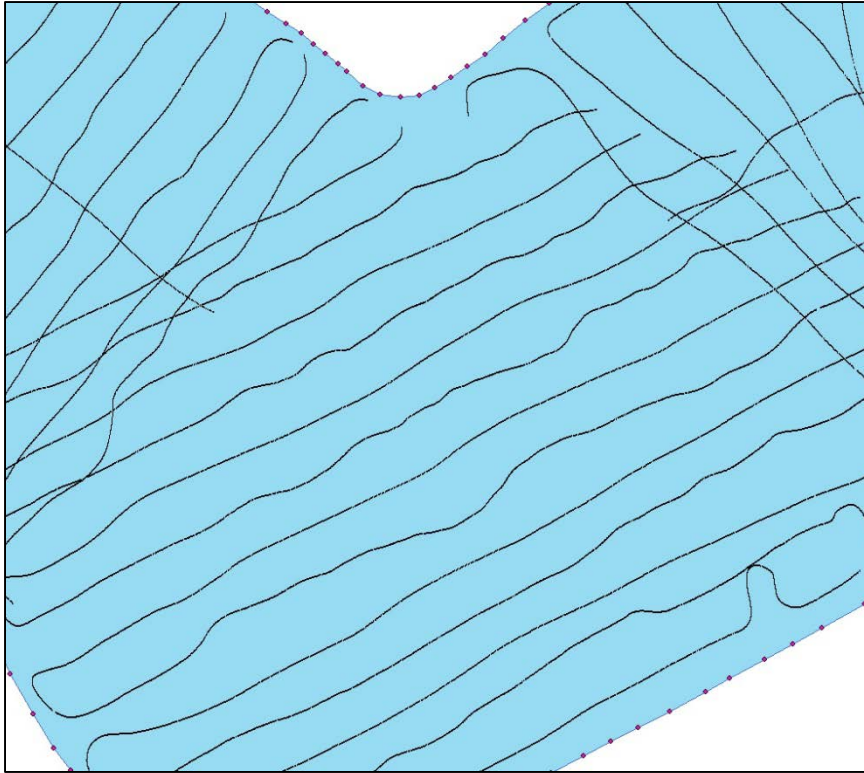- 3-dimensional data sets allow visualization of information in several ways
  - Maps
  - Tables and Graphs
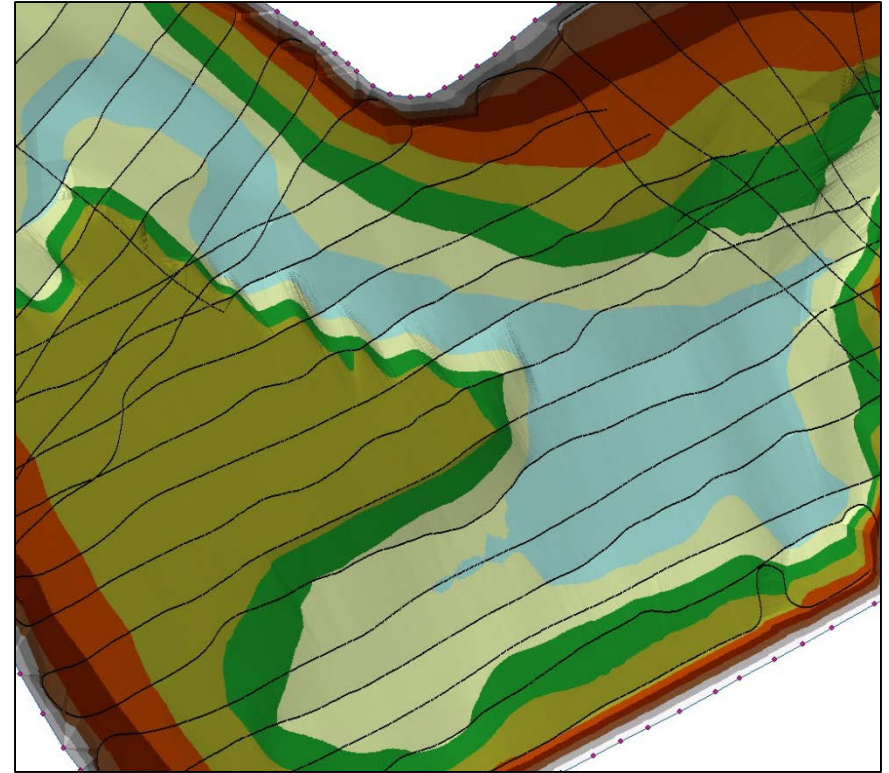

Boomer Lake
Cumulative Volume by Elevation
2015 Survey
Oklahoma Water Resources Board

2 ft Contours

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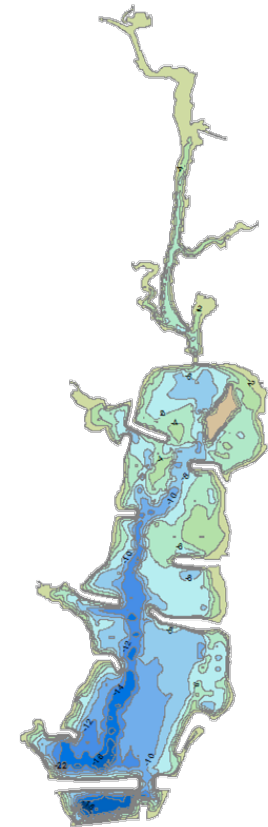
Data Interpolation

Collected Data Points

TIN (Triangulated Irregular Network)

Project Questions

- Is overall accuracy dependent on data density?
  - At what point does data density begin to effect accuracy
  - Transect density vs point density
- What affect does lake geomorphology have on this?
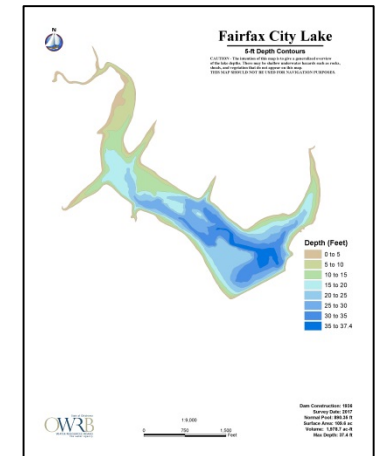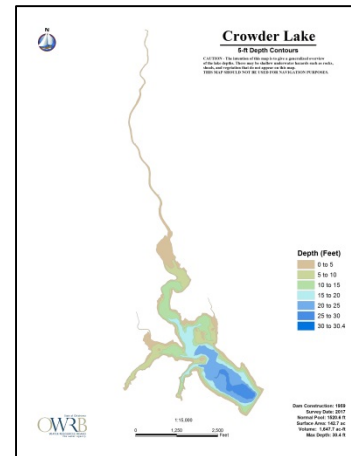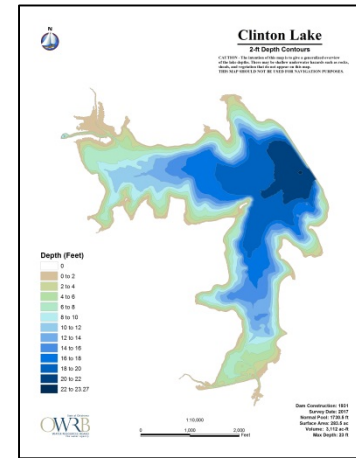 - Simple vs Complex

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Why is this important?

- Data Users
  - Federal and State Agencies
  - Municipalities
  - Universities
  - Lake and fisheries managers
  - Citizens

- Data Uses
  - Assessments
  - Management
  - Research
  - Modeling
  - Recreation

- Improve scope and budgeting of future bathymetric projects
- Provide the best product possible

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Data Assessment

- Existing bathymetric datasets (2017)
- Three small municipal lakes with varying morphological complexity
  - Clinton
  - Crowder
  - Fairfax

Waterbody	Surface Area (Acre)	Mean Depth (ft)	Maximum Depth (ft)
Clinton Lake	280.34	11.2	23.0
Crowder Lake	142.74	11.54	30.4
Fairfax City Lake	106.63	18.05	37.4

- Channel lines and boundary did not change
- Transect spacing
  - 75, 150, 300, and 600 ft
- Data point density
  - 0.5, 1, 5, and 10 ft sorting radii
- Recalculate volume/area for each dataset

Transect Spacing

75 ft	150 ft	300 ft	600 ft

Clinton Lake Transect Spacing with 0.5 ft sorting

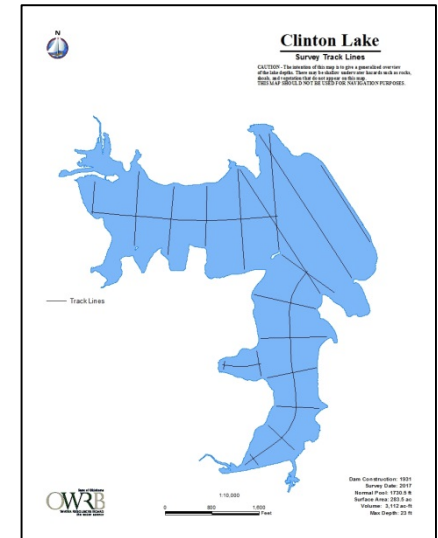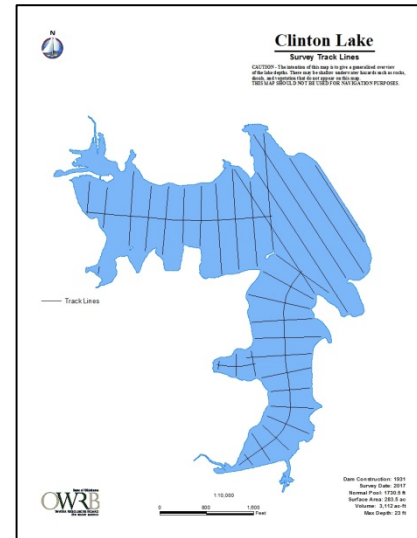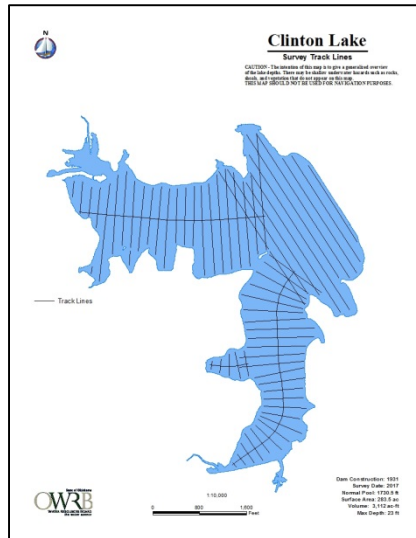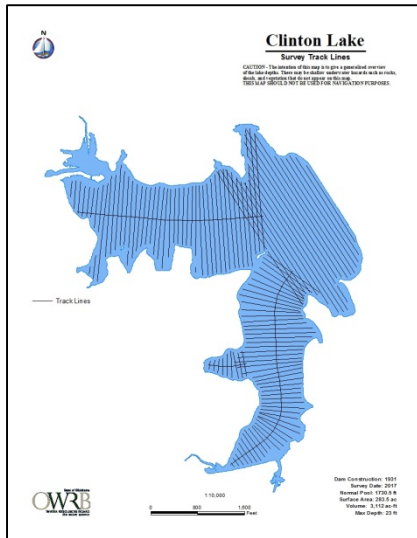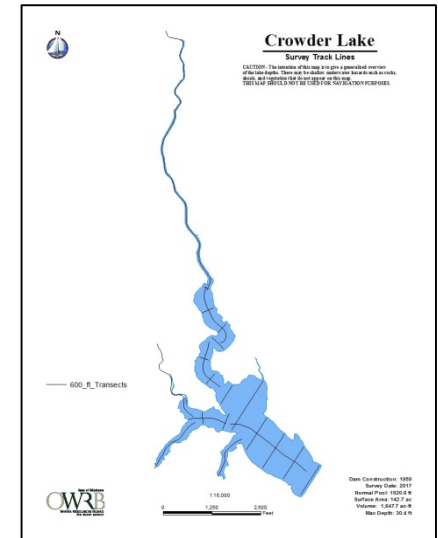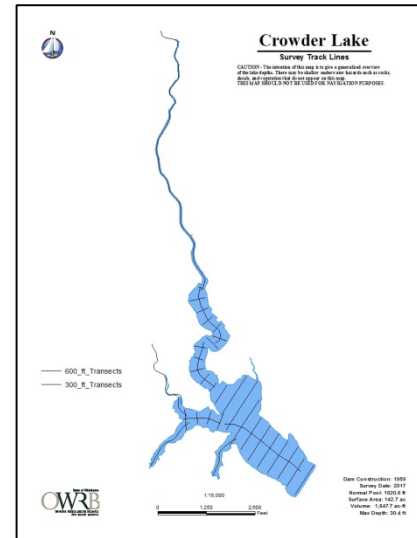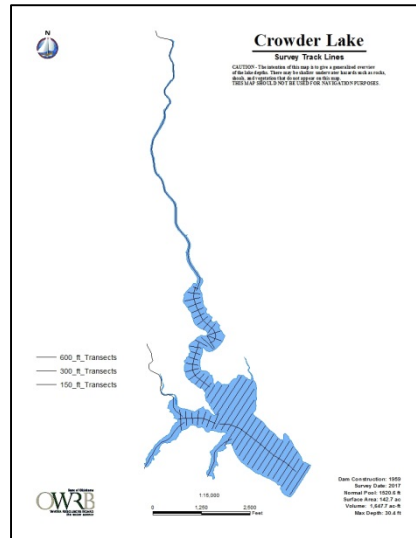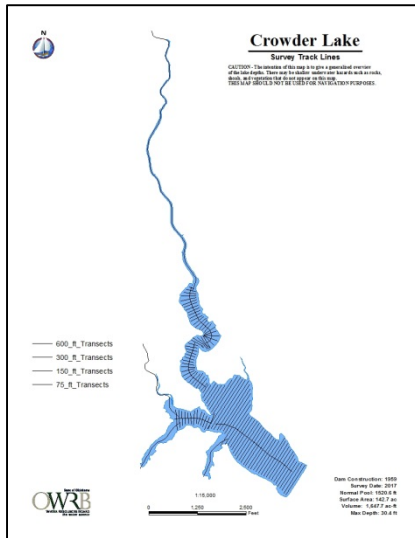# Transect Spacing

75 ft   150 ft   300 ft   600 ft
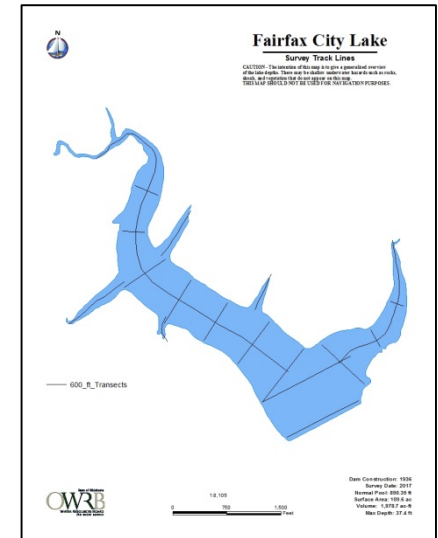

Crowder Lake Transect Spacing with 0.5 ft sorting
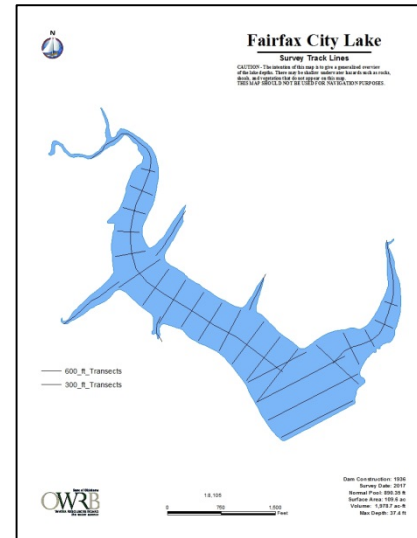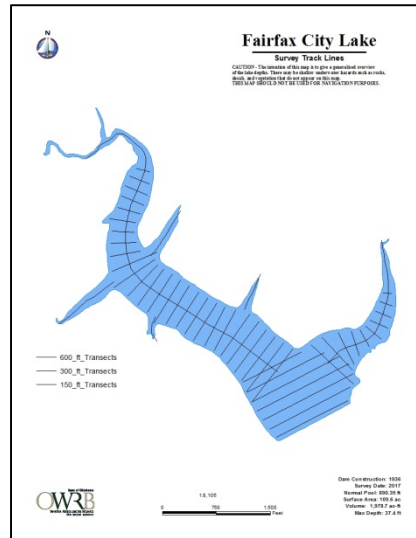
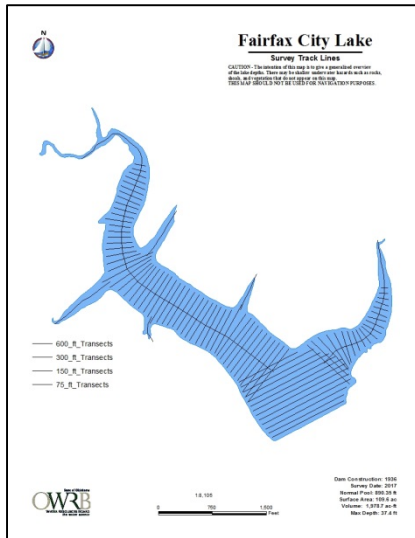# Transect Spacing

75 ft   150 ft   300 ft   600 ft

Fairfax Lake Transect Spacing with 0.5 ft sorting

Data Point Spacing

10 ft Sort

5 ft Sort

1 ft Sort

0.5 ft Sort
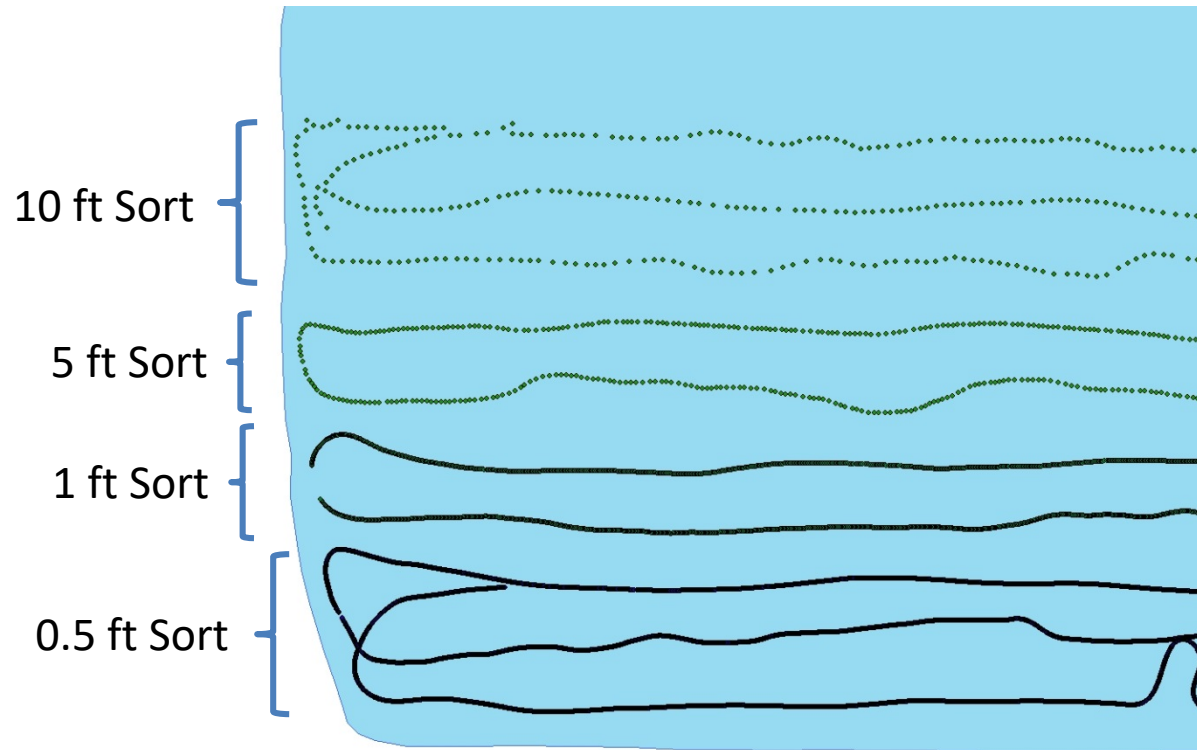
- Sorting ignores data points within select radii
- More manageable file sizes

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Clinton Results

Transect Spacing
Results
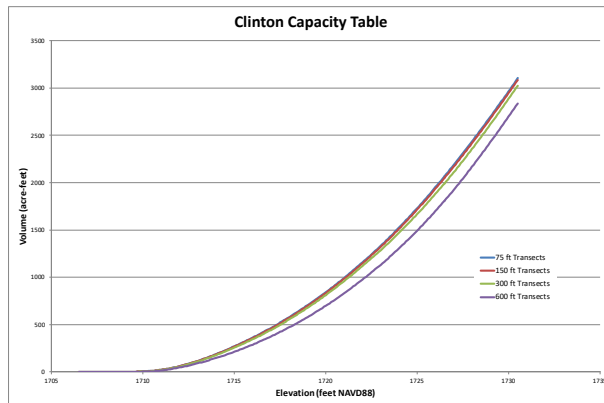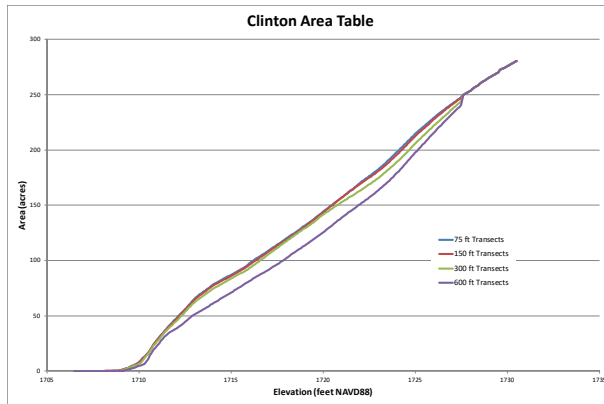
	Clinton Lake			
Transect Spacing	75 ft	150 ft	300 ft	600 ft
# of Transects	134	64	33	18
Volume (acre-ft)	3104.7	3086.5	3024.2	2836.4
Volume Reduction (%)		0.6	2.6	8.6
Area Average Reduction (%)		0.9	4.0	13.9

- Least morphologically complex reservoir
- Greatest volume reduction at 600 ft
- Only 2.6% loss at 300 ft
- Did see an affect on area throughout the water column

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Clinton Results

Clinton Area Table

Clinton Capacity Table

Data Point Sorting
Results

- Data sorting had little to no effect on volume and area

- We do not sort with a radius greater than 10 ft

- Expect there to be a change if a larger sorting radius were used

Crowder Results

Crowder Area Table

Crowder Capacity Table

Transect Spacing
Results
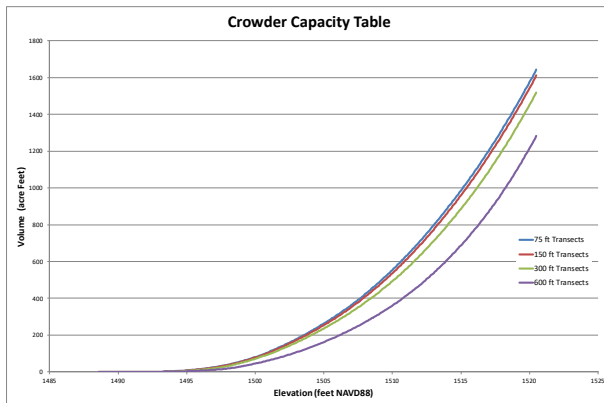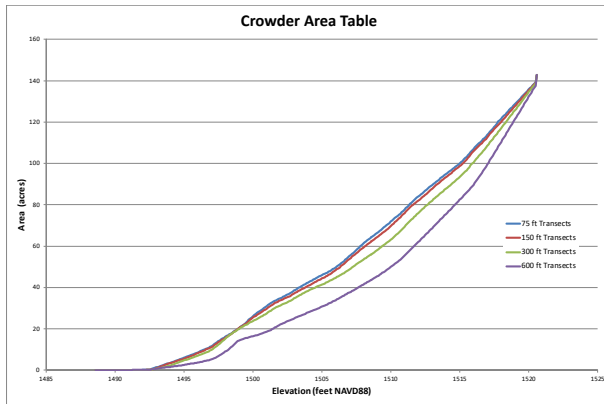
Crowder Lake				
Transect Spacing	75 ft	150 ft	300 ft	600 ft
# of Transects	104	51	36	13
Volume (acre-ft)	1643.6	1610.9	1519.7	1283.1
Volume Reduction (%)		1.99	7.5	21.9
Area Average Reduction (%)		3.5	11.8	31.4

- Most morphologically complex reservoir
- Notable losses at 300 and 600 ft spacing
- Area was also greatly impacted

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Crowder Results

Crowder Area Table

Crowder Capacity Table

Data Point Sorting
Results

- Again, little to no change

Fairfax Results

Fairfax Area Table

Fairfax Capacity Table

Transect Spacing
Results

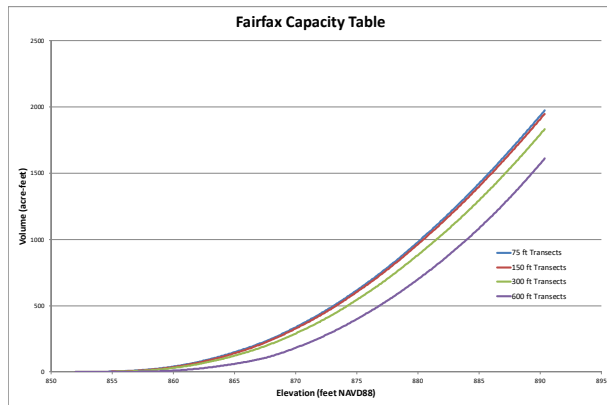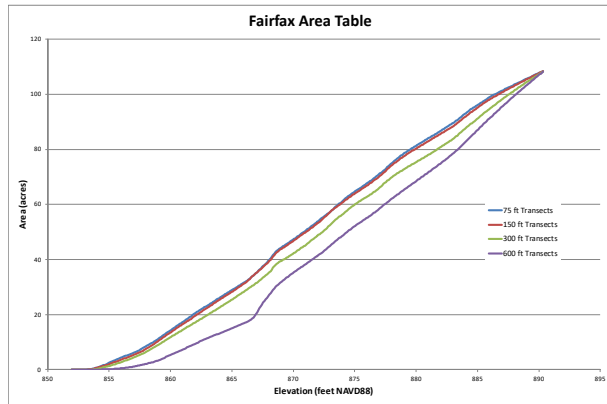| Fairfax City Lake				
Transect Spacing	75 ft	150 ft	300 ft	600 ft
# of Transects	93	44	23	12
Volume (acre-ft)	1973.7	1948.8	1833.5	1610.3
Volume Reduction (%)		1.3	7.1	18.4
Area Average Reduction (%)		4.8	15.0	36.2

- Morphologically complex reservoir
- Greatest change in lake depth
- Notable losses at both 300 and 600 ft spacing
- Area was also greatly impacted

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Fairfax Results

Fairfax Area Table

Fairfax Capacity Table

Data Point Sorting
Results

- Again, little to no change
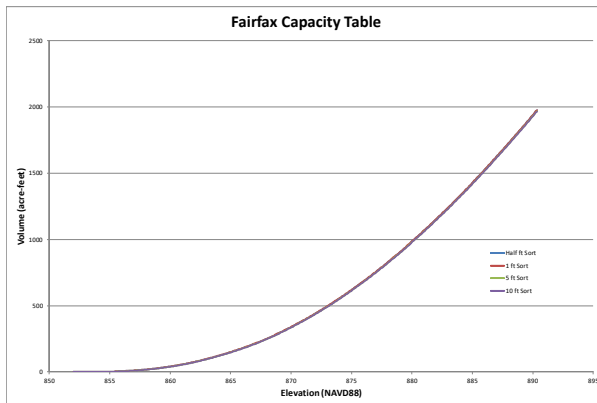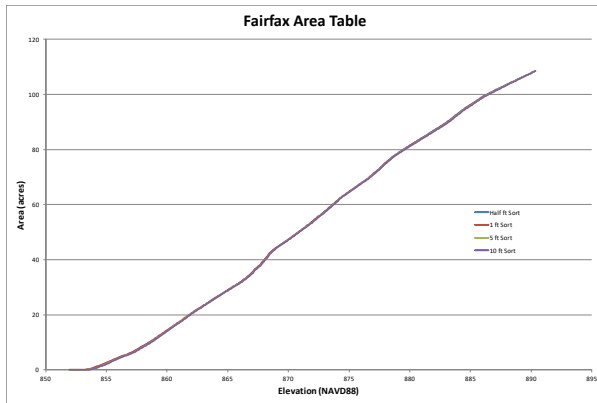
Takeaways

- Disclaimer - Assumption of volume accuracy

- Data point spacing does not seem to matter, at least up to 10 ft sorting

- Less complex reservoirs can be surveyed at a lower transect density with minimal impact

- More complex reservoirs need closer transect spacing

- Importance of consistency between surveys

- Improve our ability to scope and budget future projects

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Future Questions

- Do these results carry to larger reservoirs or does it compound?

- Can we assign spacing based on Geomorphological indices?

- Should spacing vary, depending on segment of reservoir?

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Acknowledgements/Questions

Questions?

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