MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
Fisheries TWC Meeting

December 19, 2013

Final KDM 1-24-14

ATTENDEES:

Bill Marshall (SCDNR)
Milton Quattlebaum (SCANA)
Steve Summer (SCANA)
Shane Boring (Kleinschmidt)
Dick Christie (SCDNR)
Kelly Miller (Kleinschmidt)
Byron Hamstead (USFWS)
Sam Stokes (SCDNR)
Bill Argentieri (SCE&G)
Ron Ahle (SCDNR)
Randy Mahan (SCANA)
Henry Mealing (Kleinschmidt)
Fritz Rohde (NOAA)
Dan Dieter (Kleinschmidt)
Scott Lamprecht (SCDNR)

These notes serve as a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Henry opened the meeting with introductions and then briefly discussed the agenda with the group.

Fisheries Baseline Report
Shane then reviewed the edits made to the Fisheries Baseline Report. He mentioned that there was only a small amount of fisheries information available for the Recreation Lake and asked that if anyone had more information to send it to him and he would include it in the report. Additional data will be accepted until August 2014 for inclusion in the PAD. Shane also told the group that an addendum was added to the report, summarizing the American Eel and American Shad data collected by SCDNR as part of the Santee River Basin Accord (Accord). SCDNR reviewed the summary before it was finalized and added to the Fisheries Baseline Report.

Robust Redhorse Spawning Areas
The group then discussed the potential Robust Redhorse spawning areas that were identified during the Mesohabitat Assessment. Shane said the search for spawning sites wasn't quantitative however the group had published habitat requirements (Freeman and Freeman 2002) in mind during the survey and identified a few potential sites as they moved downriver. Shane showed the group a few pictures of the two areas that were identified as potential spawning areas for Robust Redhorse. This information is included at the end of these notes. Scott noted that he believed these to also be the two sites where he had tracked his limited number of telemetered fish. Shane noted that Scott and Milton are planning to go out on the river again to search for more potential spawning sites. The group agreed that the best way to document all of this information is for Shane to develop a memo that will be added as an appendix to the IFIM Report, as well as be included in the PAD.

Reservoir Fluctuations

Next the group focused on the fluctuations of Parr and Monticello Reservoirs, and discussed what would be the best way to study these fluctuations and determine possible effects. At an earlier meeting, the group discussed the possibility of using existing LiDAR data to measure the fluctuation zone of each reservoir. Dan analyzed the existing LiDAR data and determined it was unreliable for analyzing the fluctuation zone for a variety of reasons. Since the LiDAR data collected was for land and not water, it was full of errors, most notably related to data not being available for the full range of reservoir fluctuations. Also, Monticello Reservoir was at full pool when the LiDAR was collected, so no shoreline was visible below 425 ft msl. Dan's PowerPoint presentation which summarizes his findings is included at the end of these notes.

Bill A. then presented information on the fluctuations of the two reservoirs, collected by SCE&G and USGS. For both reservoirs, the greatest amount of fluctuation occurs in August and the least amount occurs in February. The average fluctuation for Parr Reservoir over the course of a year is approximately 4.69 ft and the average fluctuation for Monticello Reservoir is approximately 2.46 ft. Henry explained to the group that since reservoir fluctuation occurs every day, fish are not likely to use the habitat that is subject to the daily fluctuations. Ron added that fish don't have to spawn every year, such as during dry years when spawning habitats may not be available. Ron also mentioned that flow control and pool management were potential mitigation options. Henry asked the group to brainstorm other ways that the spawning areas could be enhanced besides flow control. Installation of spawning benches, bamboo bundles, and artificial reefs below the fluctuation zone in Monticello Reservoir can all create artificial spawning habitat for various fish species. Because of the flowing nature of Parr Reservoir, it may be more difficult to permanently install some of these natural or artificial habitats. The group discussed the need to go on site at Parr Reservoir and document the fluctuation effects. Information can be collected at a few select sites, including taking pictures during a drawdown and gathering slope and distance of exposed littoral zones. Milton suggested installing some enhancement measures in areas such as Cannon's Creek, where they are less likely to be washed away. Scott said that in his experience, the best enhancements are of natural materials, such as cedar trees. If cedar trees are submerged when they are still green with the root wads attached, they are very effective and last for a long time. Scott also said that gravel beds are effective at attracting Centrarchids, although it is unknown as to whether they actually use these areas for spawning. Scott also suggested building a small dyke to create a littoral impoundment within Parr Reservoir which would retain water between fluctuations. This would be another way to create spawning habitat. Henry said that all of these ideas can be evaluated in the future as PM&E measures. In the meantime, the group agreed to go out to representative locations within the two reservoirs and document the exposed areas during fluctuations to create a baseline. Steve also suggested that the group could consider the total surface area of Parr Reservoir before and after the 9 ft crest gates were built. This area accounts for 9 of the 10 feet of fluctuation zone in Parr Reservoir. SCE&G and Kleinschmidt will develop a study plan to include existing information on the fluctuations with Parr and Monticello Reservoirs, an action plan for gathering more information at select sites within the reservoirs, and possible options for PM&E measures.

Waterfowl Study

Shane then discussed the changes that were made to the Waterfowl Study Plan. At the request of SCDNR, three additional monitoring dates per study year were added to the existing six monitoring dates per study year, for a total of 18 monitoring dates, or nine per year. Everyone agreed to these changes, so this study plan will be finalized for inclusion in the PAD.

American Eel Abundance Study

The group then discussed the American Eel Study Plan. There was initial concern over the frequency in which the American eel trap was to be checked. Traps were originally to be checked weekly, but after further discussion, the study plan was amended to specify that traps would be checked every Monday, Wednesday, and Friday during the study period. Henry then explained that SCE&G and Kleinschmidt are investigating the use of a "wireless camera" to aid in monitoring. This way, traps could be remotely monitored on a daily basis. Since technology is constantly changing, the group agreed to amend the study plan explaining that the eel trap would be monitored remotely via on-site camera or on-site every Monday, Wednesday and Friday. Fritz expressed concern that one trap may not be enough to thoroughly monitor the area for eels, and showed the group images of traps from an American eel study that was performed at Roanoke Rapids in North Carolina. Henry reminded the group that previous eel studies at the Columbia Dam, located downstream of Parr Shoals Dam, collected less than 10 eels over several years of study. Based on that information the group decided that one trap should be satisfactory for the study. Henry added that electrofishing efforts would also be utilized to ensure the study area is thoroughly examined for American eels. Fritz agreed that one trap would be fine, as long as it is properly placed. Kleinschmidt will edit the study plan to reflect the changes discussed and Bill A. will submit the final plan to the Accord members for approval.

Entrainment/Impingement Study

The group discussed the draft Entrainment/Impingement Study Plan. Prior to the meeting, Byron submitted comments and questions regarding this study plan, which were addressed as the group worked through the document. Henry explained to the group how a desktop entrainment study is prepared and some history on how these desktop studies began in the 1990's. He explained that factors such as bar rack spacing, entrainment velocities, location of intakes, reservoir stratification, species composition, and turbine size and type are all considered, among others, during a desktop study. There was some general discussion regarding collecting hydroacoustic information as part of the study. Dick explained that hydroacoustic data was collected at the Keowee-Toxaway Project, and data collected showed that operational changes at one of the units resulted in a reduction in entrainment. Field work was performed at that Project because fish populations were a concern however this is not the case at the Parr/Fairfield Project. There was general consensus that a desktop Entrainment/Impingement Study was an acceptable method to address this issue. The group discussed the need for hold points to occur during the study. The group will meet to discuss the progress of the study after each of the following parts of the study is complete: Step 1 - Develop an entrainment and turbine mortality database that can be applied to the Parr and Monticello developments; Step 3 - Characterize the species composition of potential fish entrainment; Step 5 - Estimate the total annual entrainment for the Project based on normal operation; and Step 7 - Estimate impingement mortality for fish elimination from entrainment estimates. A draft report will then be issued. Bill M. asked if any information was available on fish distribution in the forebay area. Very little is currently available, so the group agreed to have Milton conduct some additional electrofishing surveys in the forebay in Monticello Reservoir and the tailrace canal in Parr Reservoir when he collects fish for the VC Summer Nuclear Plan studies in the spring and fall of 2014 and 2015. This information will also be used in the Entrainment study. Kleinschmidt will revise the study plan to reflect the changes discussed and send out a revised draft to the TWC for approval. The study plan will then be finalized and included in the PAD.

Diadromous Fish Passage

The group then talked about the need for a Diadromous Fish Passage Alternatives Evaluation, an issue that was originally raised by Gerrit Jobsis and Karla Reece at one of the initial RCG meetings. Byron noted in an email prior to the meeting that the USFWS thought that this issue would be addressed as part of the Accord. Bill A. explained for the group that the Accord has identified triggers for a fish passage alternatives analysis. Henry said that information on the Accord, along with information on the Santee-Cooper Basin Diadromous Fish Passage Restoration Plan, will be included in the PAD however moving forward with a fish passage alternatives plan is premature at this point. Fritz noted that there has been internal discussion within the NOAA Protected Resources Group about becoming more involved in the Parr/Fairfield Relicensing and the Accord. The group agreed that this is an appropriate way to handle the issue at this point and in the meantime, SCE&G and Kleinschmidt will reach out to Gerrit and Karla to discuss any further concerns they may have.

After discussion of the fish passage issue, Henry closed the meeting. Action items identified during the meeting are included below.

ACTION ITEMS:

- Ron will send his photos of the two sites identified for Robust Redhorse spawning to Kelly.
- SCE&G will develop graphs depicting the fluctuations during wet versus dry years at Parr and Monticello Reservoir.
- SCE&G will find information on the reservoir surface areas before and after the crest gates were built, to be included in the Fluctuation Study Plan.
- Kleinschmidt will develop a Fluctuation Study Plan and submit to the TWC for review.
- Kleinschmidt will finalize the Waterfowl Study Plan and distribute to the TWC.
- Kleinschmidt will amend and finalize the American Eel Study Plan as discussed at the meeting and distribute to the TWC. Bill A. will submit this study plan to the Accord members for approval.
- Kleinschmidt will revise the Entrainment/Impingement Study Plan and resubmit the draft to the TWC for review.

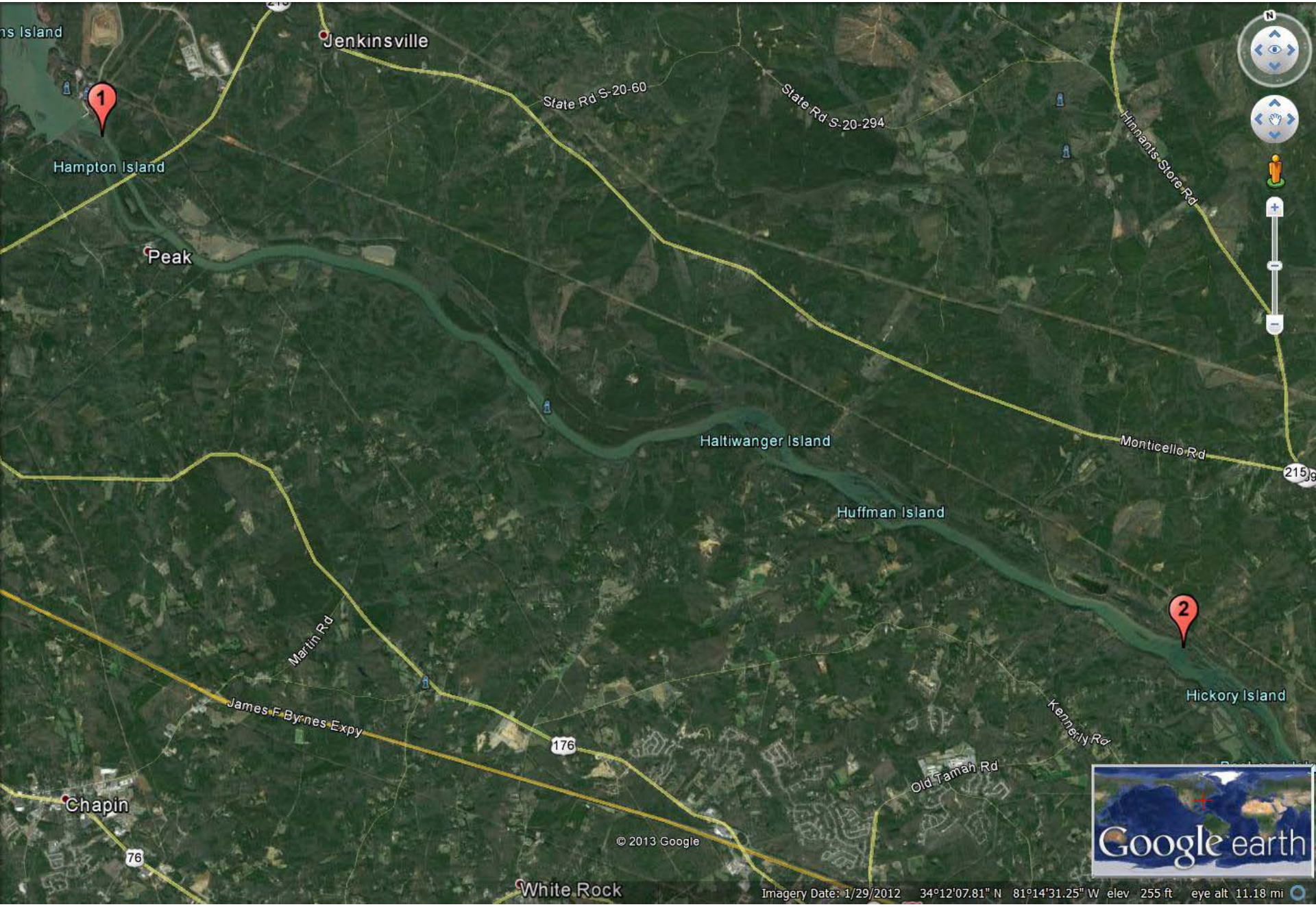
Potential Robust Redhorse Sites

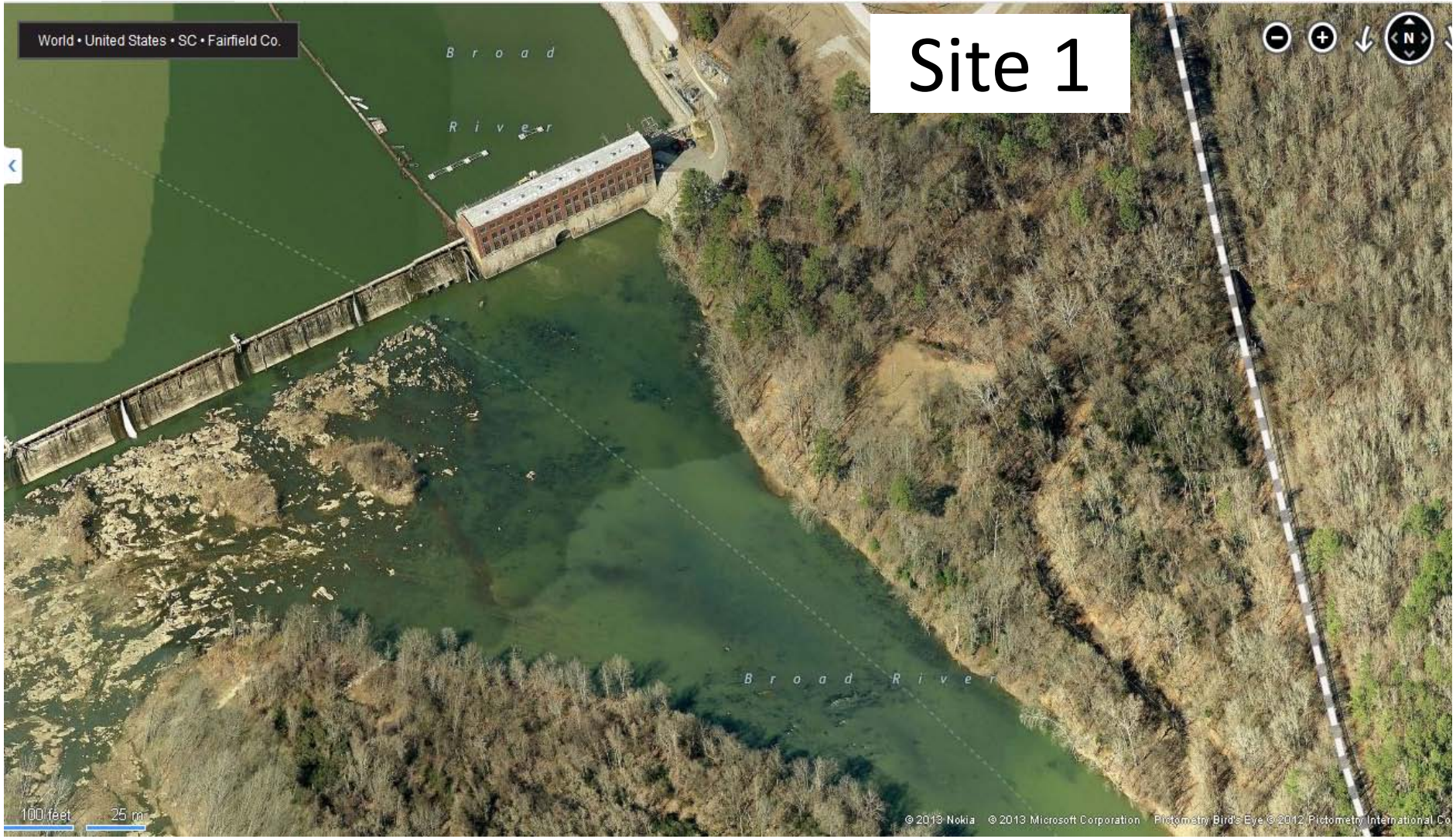
Robust Redhorse Spawning Habitat (Freeman and Freeman, 2001)

- Mid-channel gravel bars
- Dominated by medium - coarse gravel, 12-50 mm (0.5 – 2.0 in)
- < 30 % sand and minimal fine particles
- “small enough to be moved and allow egg deposition….yet large enough to provide interstitial space for eggs and larvae”

Robust Redhorse Spawning Habitat (Freeman and Freeman, 2001)

- Suitable water depth: 0.29 - 1.1 m (1 – 3.6 ft)
- Suitable average water column velocity: 0.26 - 0.67 m/s (0.85 – 2.20 ft/s)
- Interstitial flow thought to be very important, hence spawning in “heads of gravel-bottom riffle” (glides)


Jenkinsville
State Rd S-20-60
State Rd S-20-294
Hinnants Store Rd
1
Hampton Island
Peak
Haltiwanger Island
Monticello Rd
215
Huffman Island
2
Martin Rd
Hickory Island
James F Byrnes Expy
176
Kennerly Rd
Old Taman Rd
Chapin
76
© 2013 Google
White Rock
Google earth
Imagery Date: 1/29/2012 34°12'07.81" N 81°14'31.25" W elev 255 ft eye alt 11.18 mi

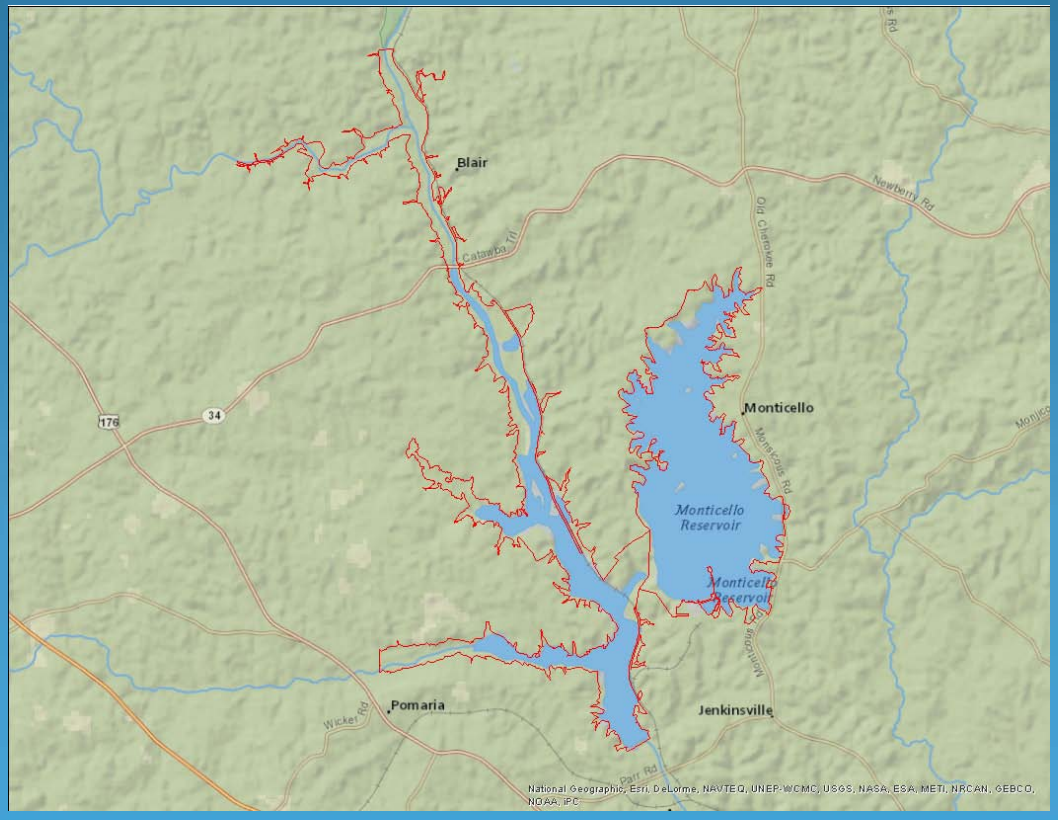

World • United States • SC • Fairfield Co.
Broad River
Broad River
Site 1
100 feet
25 m
© 2013 Nokia © 2013 Microsoft Corporation Pictometry Bird's Eye © 2012 Pictometry International Co


World • United States • SC • Richland Co. • North Area
Site 2
B r o a d R i v e r
25 feet
10 m
© 2013 Microsoft Corporation © 2012 Pictometry International Corp


10/24/2013


10/24/2013

Reservoir Fluctuation at Parr and Monticello Reservoirs



Introduction

- Minimum reservoir pools create some dynamic riparian areas

- Public LiDAR data was studied to determine the surface area exposure resulting from reservoir fluctuation within the project boundary

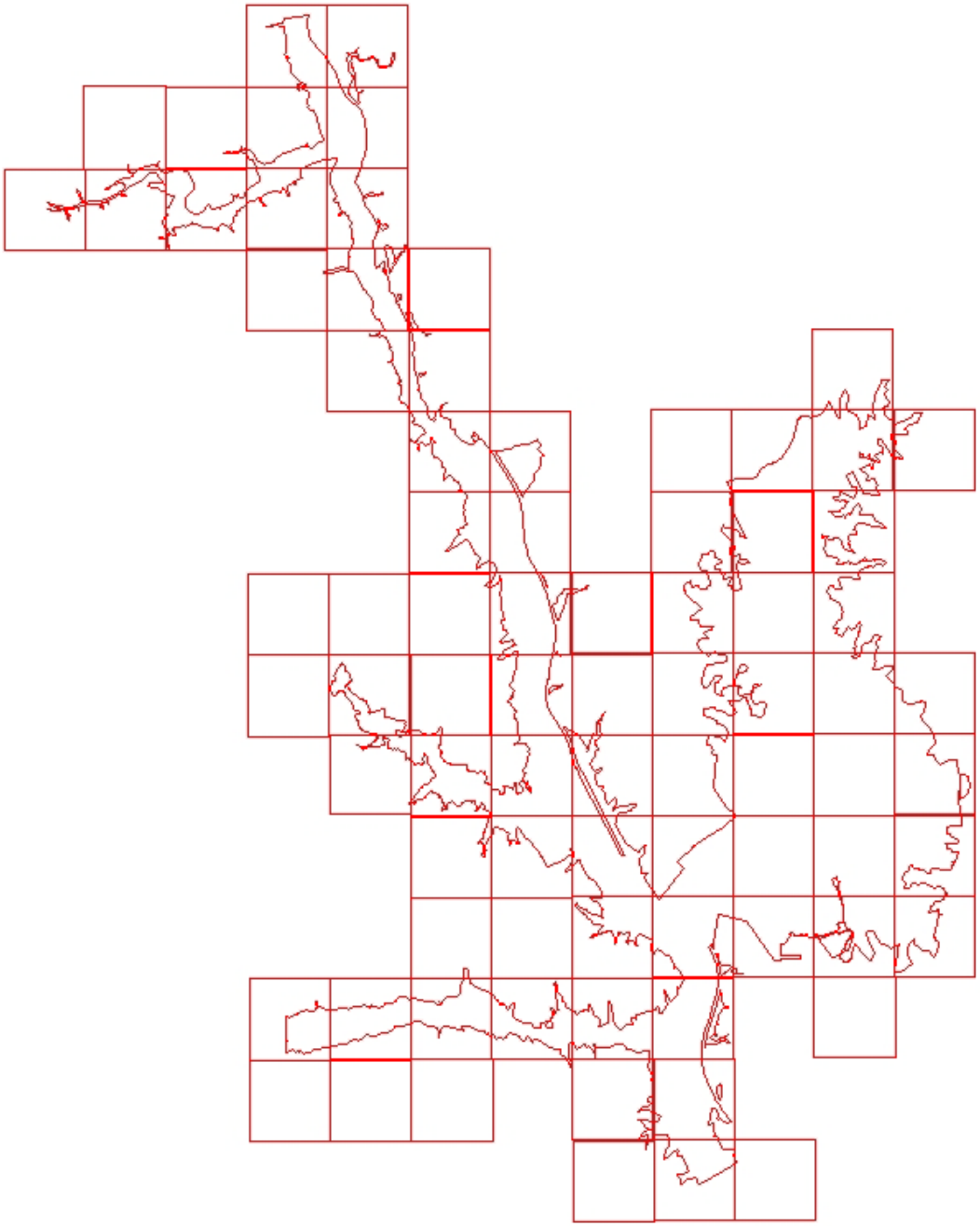
Background

- Parr Reservoir water surface elevations resulting from the Fairfield Pump Storage System
  - Maximum pool elevation 266 ft
  - Minimum pool elevation 256 ft

- Surface Area of Parr Reservoir – 4,400 acres
- Surface Area of Monticello Reservoir – 6,800 acres
- Total Surface Area of Both Reservoirs – 11,200 acres

Methods

- LiDAR point cloud data (.las) collected and verified for USGS by contractor Dewberry and subcontractor Fugro EarthData
- Collected from January, 15 2008 to February 10, 2008
- <2% error in dataset



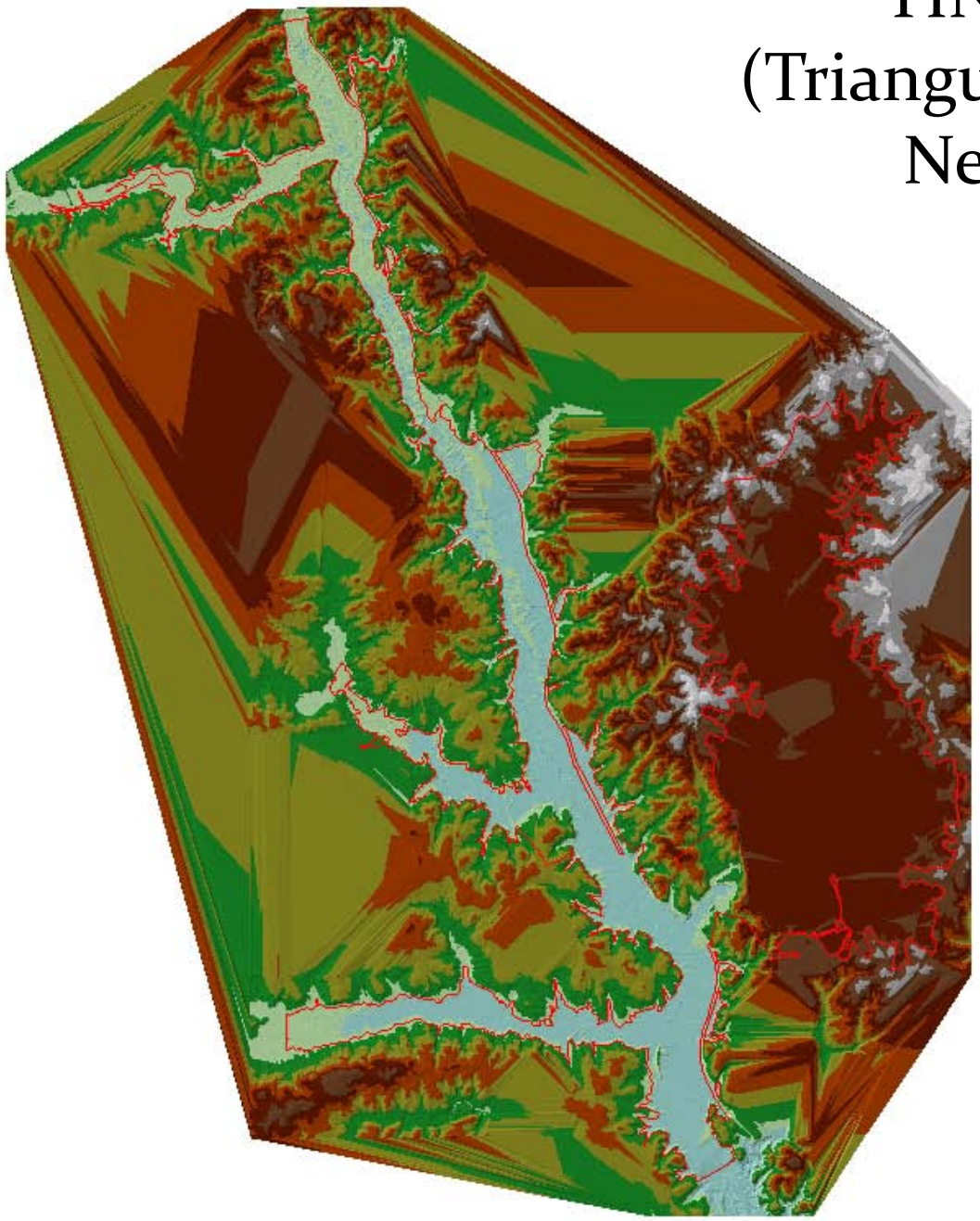
Methods (cont'd)

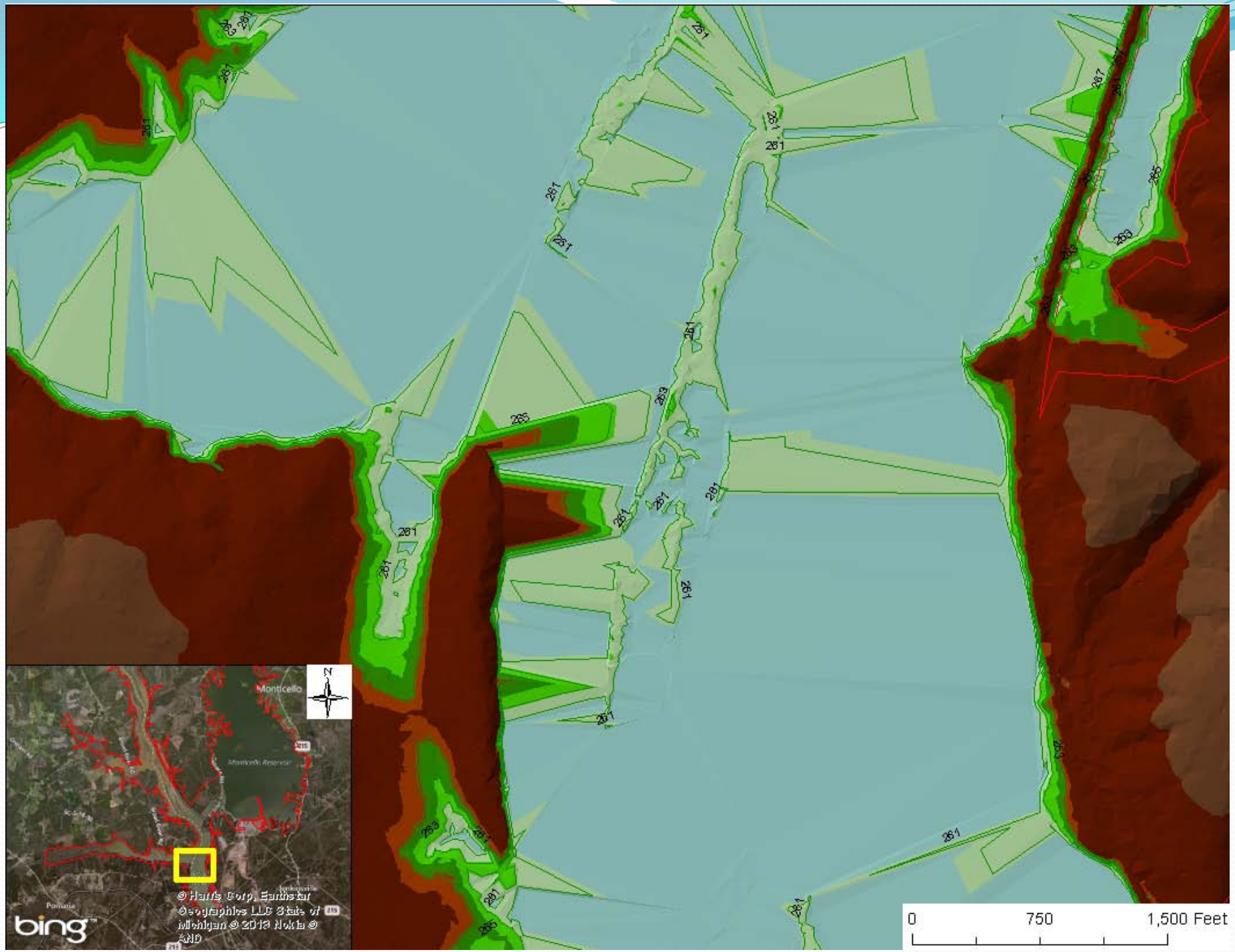
- Las Dataset created in ArcMap 10.1 with project boundary as a surface constraint
- Data conversion from Las to TIN
  - Surface Volume Functional tool to calculate surface area
- TIN to Contours
  - Contours illustrate 2ft topographical elevations

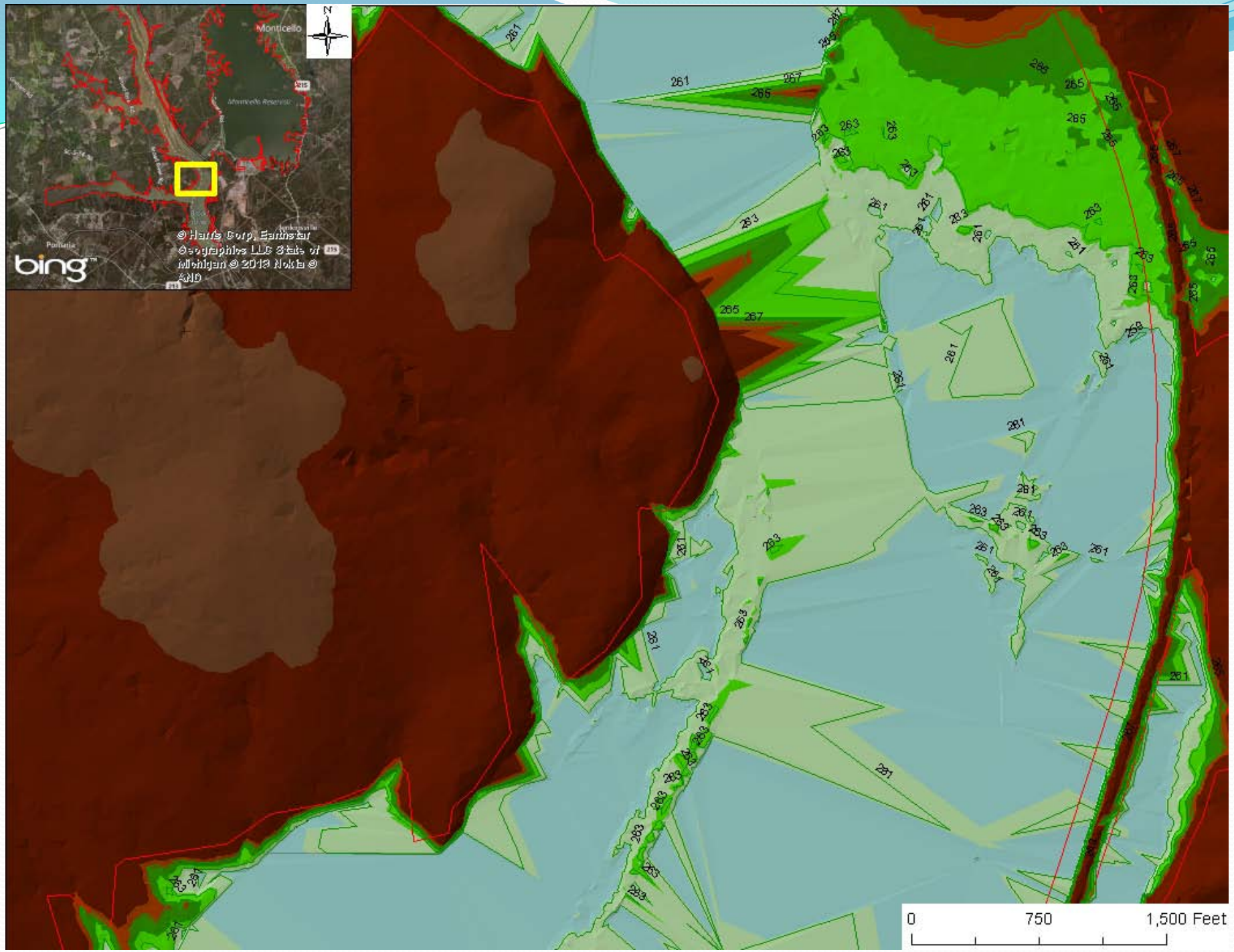
Methods (cont'd)

- Areas of exposure were measured in 2ft increments of total acreage within the project boundary at Parr Reservoir
  - 267-265
  - 265-263
  - 263-261
  - 261-259
  - 267-259 (total)

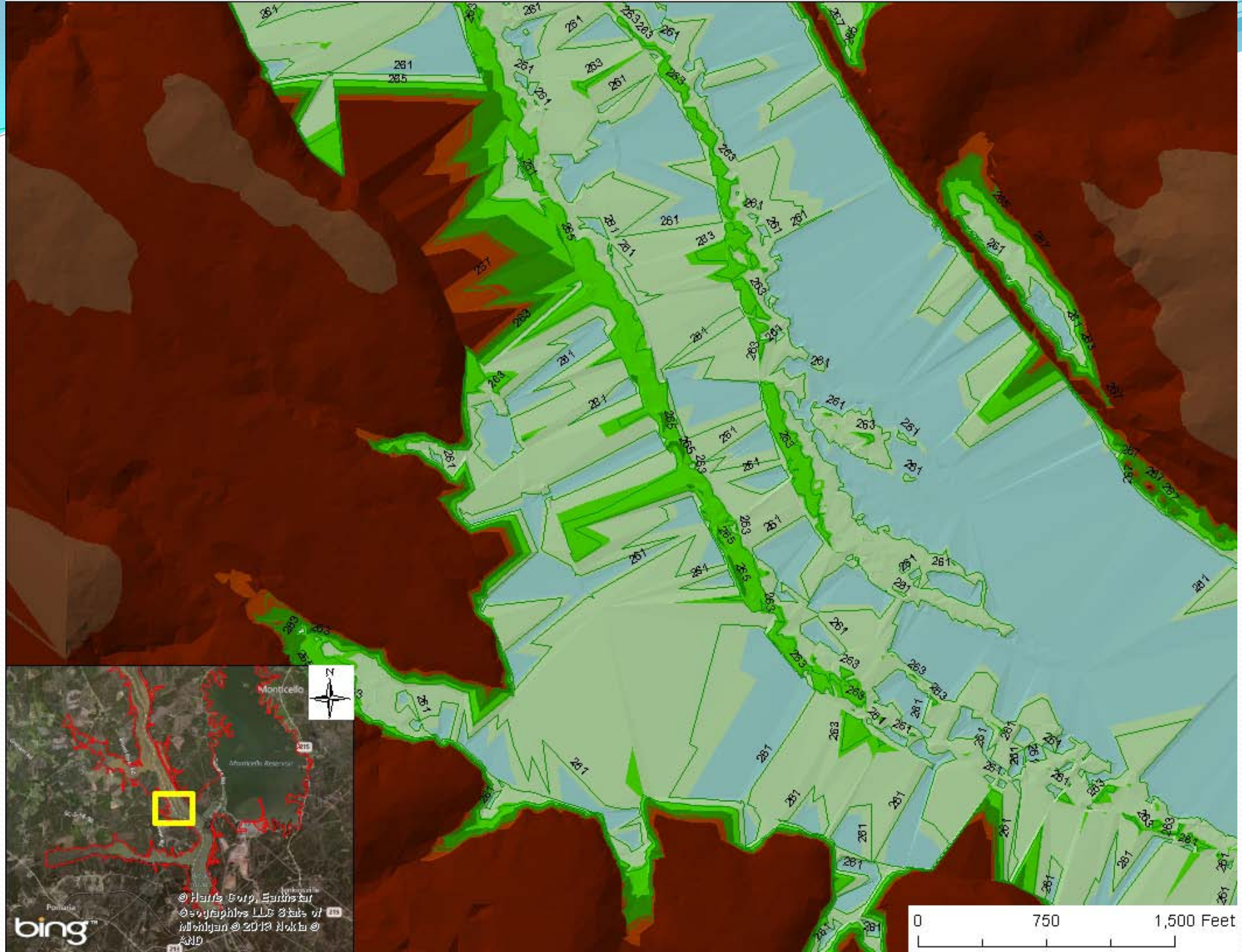
TIN Model (Triangular Irregular Network)




261
263
265
N
Monticello
0
750
1,500 Feet
bing

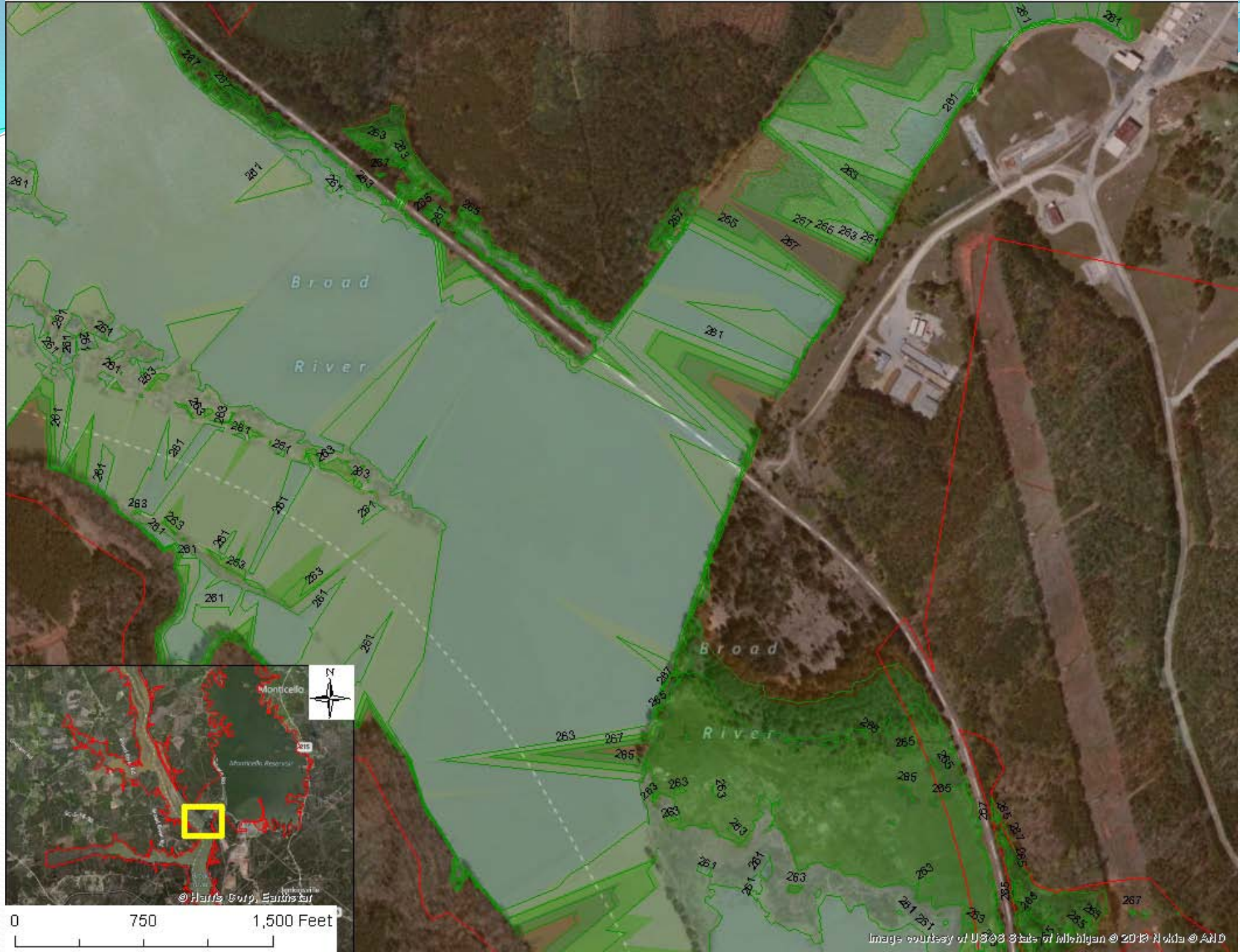

N
Monticello
bing
0
750
1,500 Feet


N
Monticello
bing
0
750
1,500 Feet

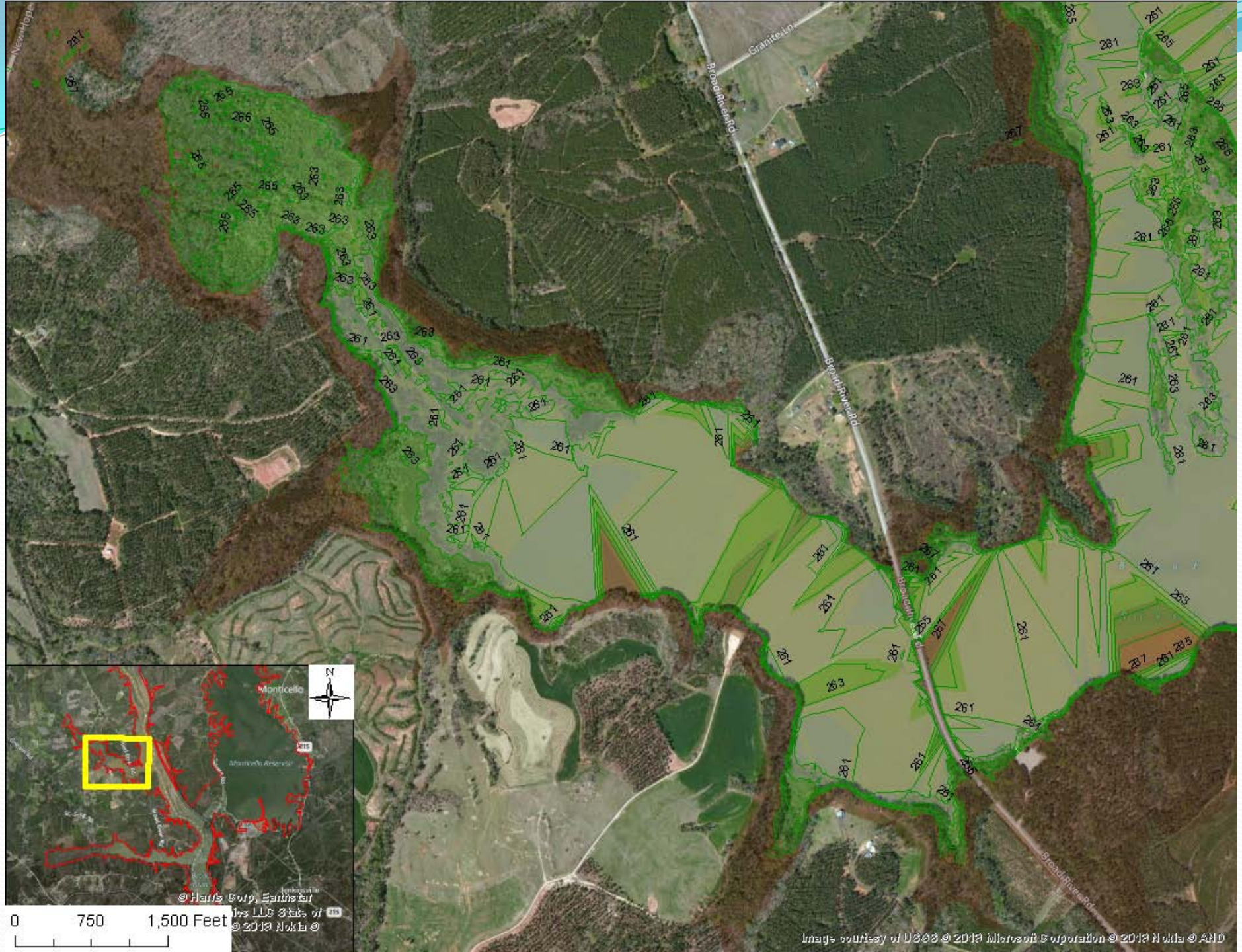

N
Monticello
Pontiac
© Harris Corp, Earthstar Geographics LLC State of Michigan © 2013 Nokia © AND
bing
0
750
1,500 Feet

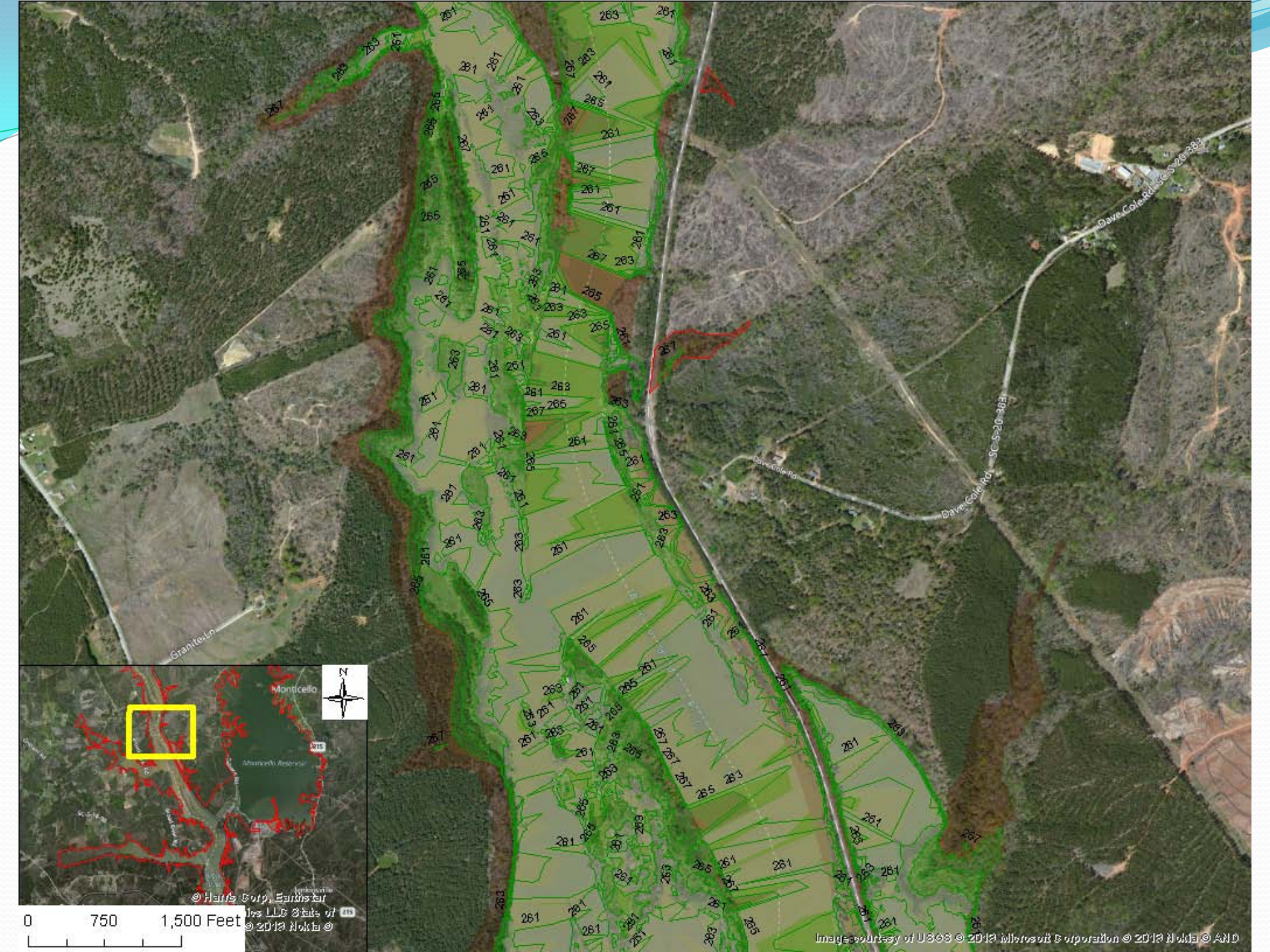

Broad River
Broad River
N
Monticello
Pomaria
bing
© Harris Corp, Earthstar Geographics LLC State of Michigan © 2013 Nokia © AND
0
750
1,500 Feet

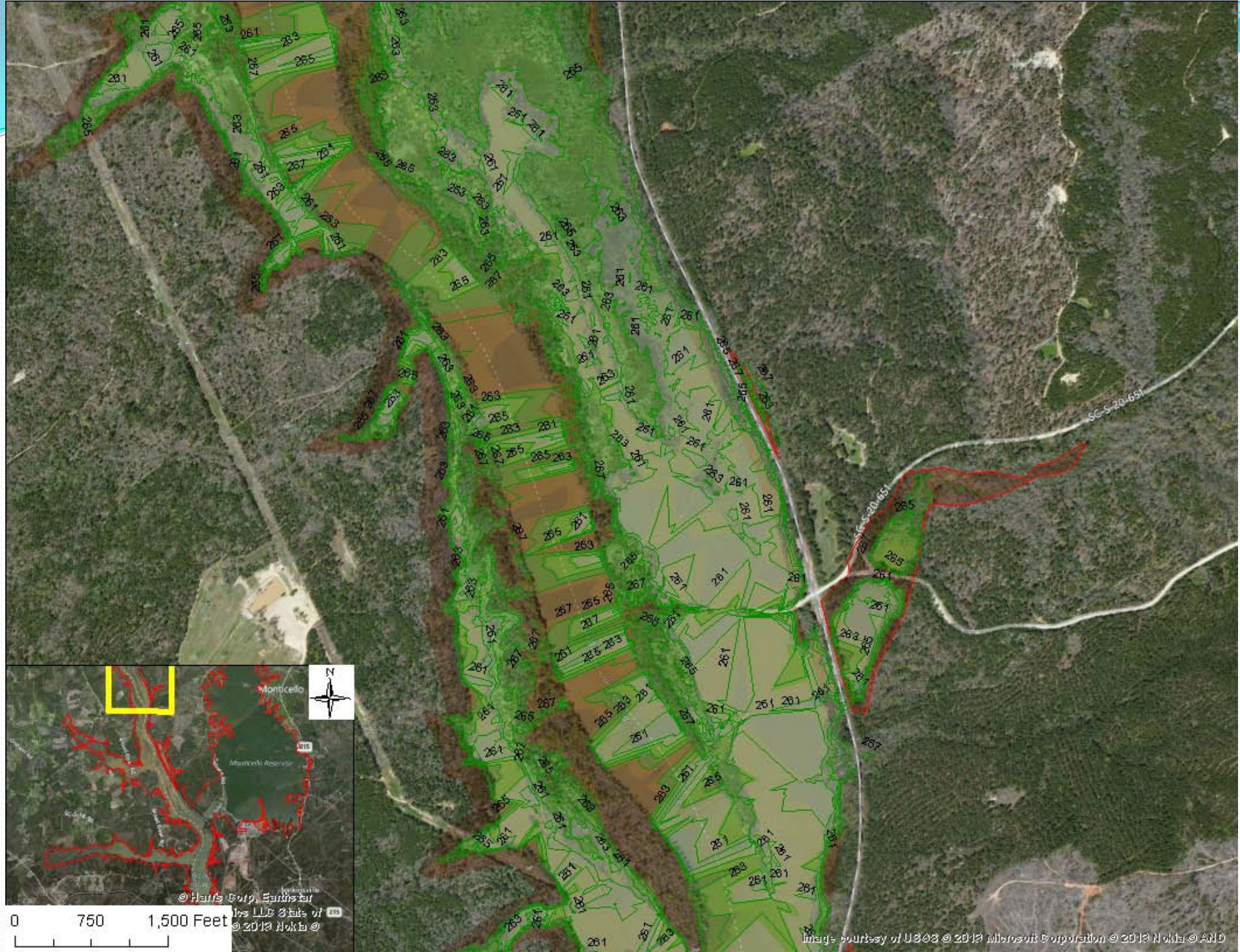

N
Monticello
Monticello Reservoir
Pontella
© Harris Corp, Earthstar Geographics LLC State of Michigan © 2013 Nokia © AND
bing
B r o a d
bing
0
750
1,500 Feet

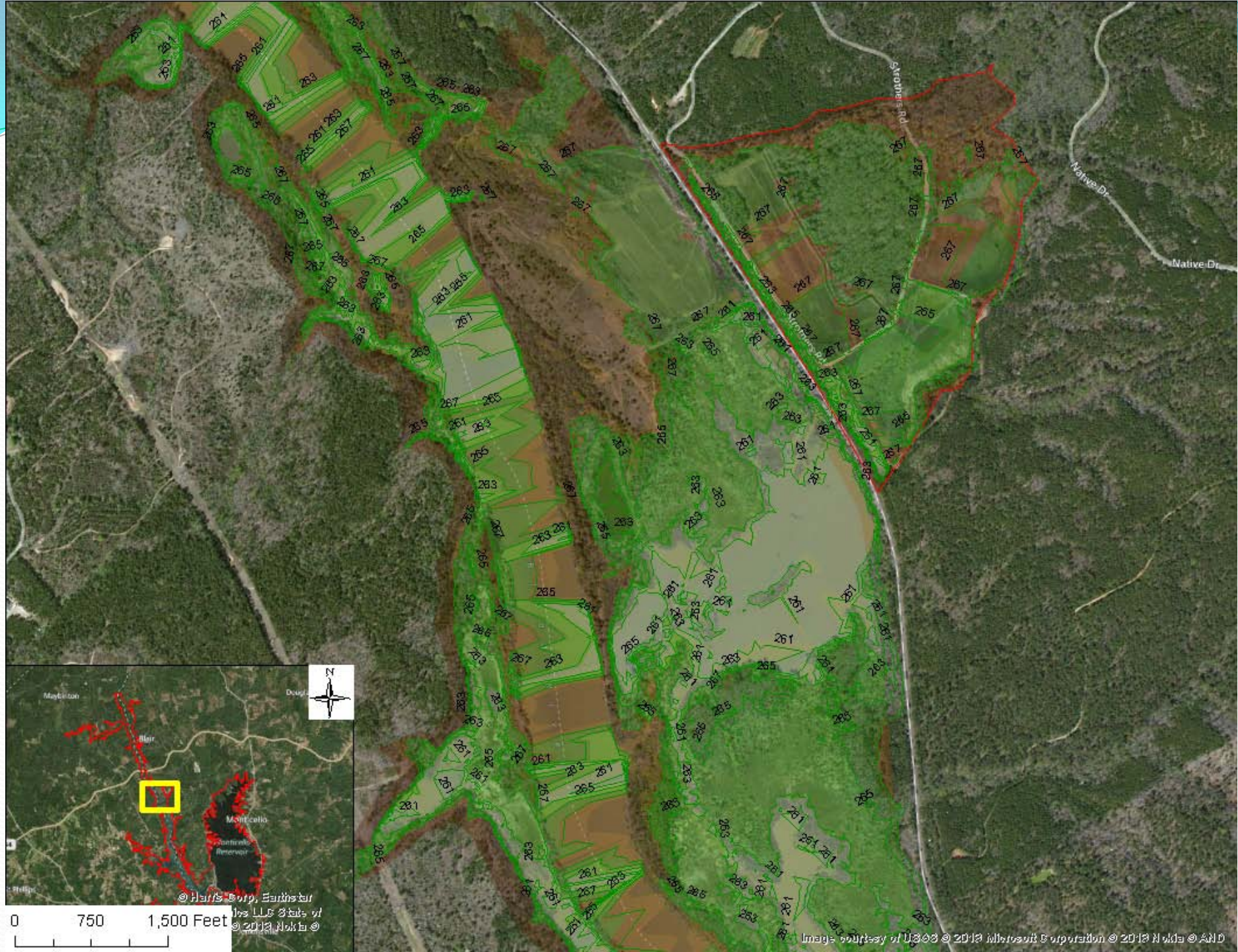

Broad
River
Broad
River
N
Monticello
© Harris Corp, Earthstar
0
750
1,500 Feet
Image courtesy of USGS State of Michigan © 2013 Nokia © AND

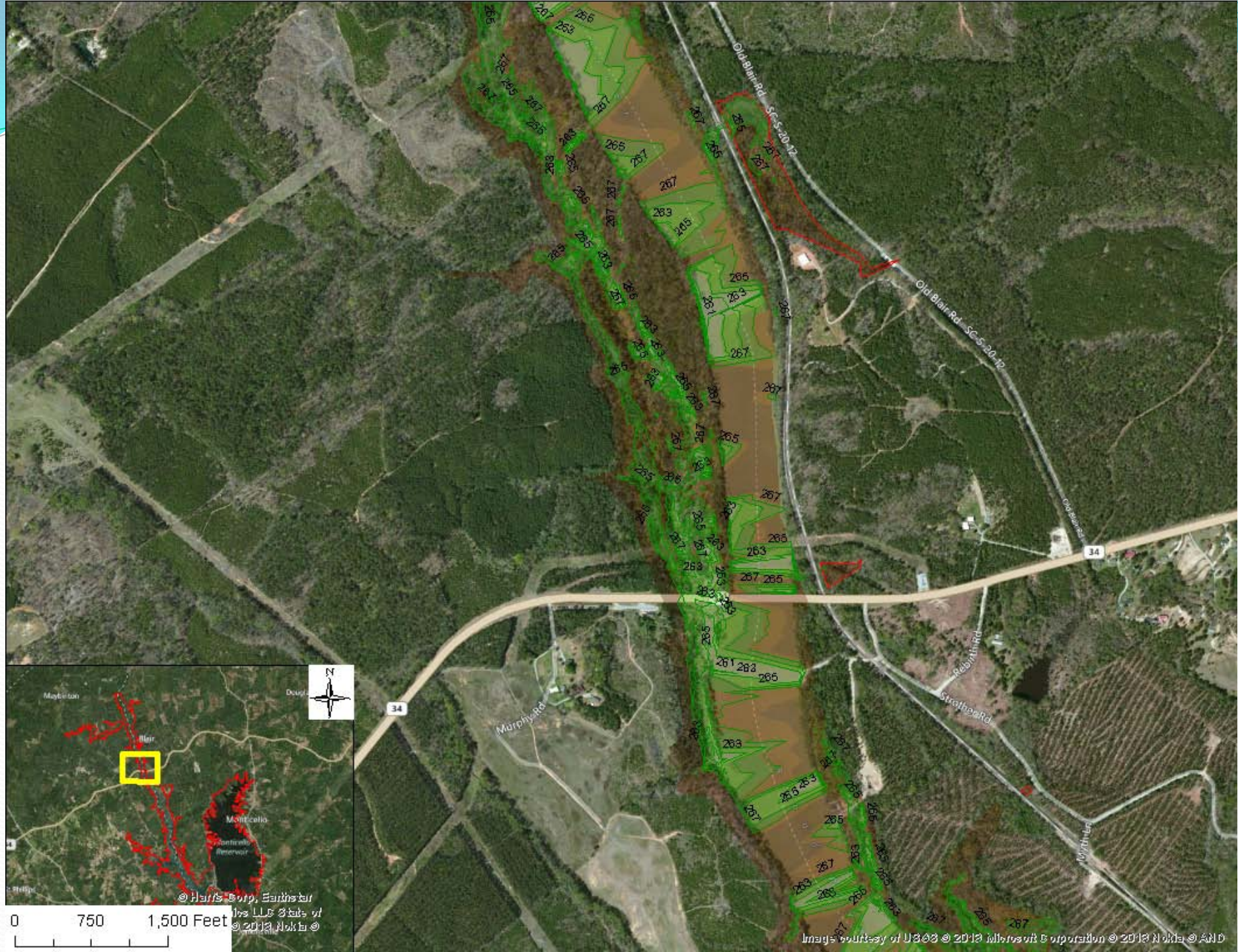

George Buck Rd
Monticello
N
0
750
1,500 Feet


Granite Ln
Broad River Rd
Broad River Rd
Broad River Rd
Monticello
N
0
750
1,500 Feet
Image courtesy of USGS © 2013 Microsoft Corporation © 2013 Nokia © AND


Granite Ln
Dave Cole Rd
Dave Cole Rd - SC-S-20-383
Monticello
N
0
750
1,500 Feet
© Harris Corp, Earthstar
© 2013 Nokia ©
Image courtesy of USGS © 2013 Microsoft Corporation © 2013 Nokia © AND


SC-5-20-451
SC-5-20-451
Monticello
N
0
750
1,500 Feet
Image courtesy of USGS © 2013 Microsoft Corporation © 2013 Nokia © AND


Brothers Rd
Native Dr
Native Dr
N
Blair
Monticello
Monticello Reservoir
© Harris Corp, Earthstar
© 2013 Nokia ©
0
750
1,500 Feet
Image courtesy of USDA © 2013 Microsoft Corporation © 2013 Nokia © AND


Old Blair Rd - SC-S-20-12
Old Blair Rd - SC-S-20-12
34
34
Murphy Rd
Rebirth Rd
Strother Rd
Myrtle
N
Blair
Monticello
Monticello Reservoir
0
750
1,500 Feet
© Harris Corp, Earthstar
© 2013 Nokia ©
Image courtesy of USGS © 2013 Microsoft Corporation © 2013 Nokia © AND


Henderson Ferry Rd E
Sumter National Forest
Old Blair Rd
Old Blair Rd
Old Blair Rd
N
Monticello
0
750
1,500 Feet
Image courtesy of USGS © 2013 Microsoft Corporation © 2013 Nokia © AND

Parr Reservoir Results

Area between contours :

267-265 = 686 Acres

265-263 = 798 Acres

263-261 = 1,387 Acres

261-259 = 1,273 Acres

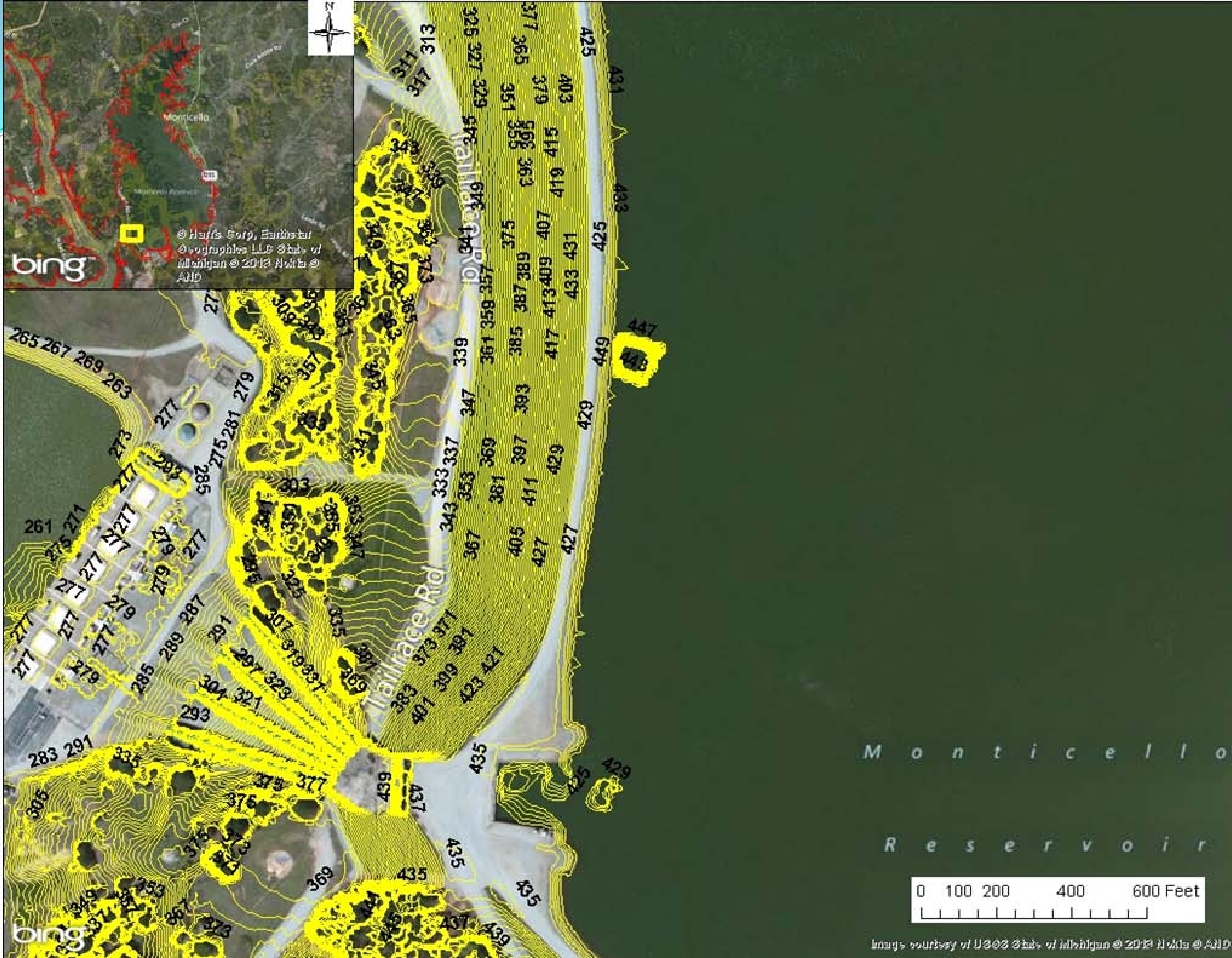
Total 267 - 259 = **4,143 Acres**

Percent of Parr Reservoir affected by Fluctuation

4,143/4,400 = **94.2%**

Results for Monticello Reservoir

- Elevations of the shoreline at 425 ft (full pool)



Monticello Reservoir
Tailrace Rd
Tailrace Rd
0 100 200 400 600 Feet
© Harris Corp, Earthstar Geographics LLC State of Michigan © 2013 Nokia © AND
Monticello
bing
bing
Image courtesy of USGS State of Michigan © 2013 Nokia © AND


N
Monticello
© Harris Corp, Earthstar Geographics LLC State of Michigan © 2013 Nokia © AND
bing
Tailrace Rd
M o n t i c e l l o
R e s e r v o i r
0 100 200 400 600 Feet
bing
Image courtesy of USGS State of Michigan © 2013 Nokia © AND

Summary

- LiDAR data does not accurately depict Parr Reservoir bottom elevations

- Monticello Reservoir LiDAR extents are limited to full pool

Parr & Monticello Reservoir Fluctuation

Parr Hydroelectric Project Relicensing

Fisheries Technical Working Committee

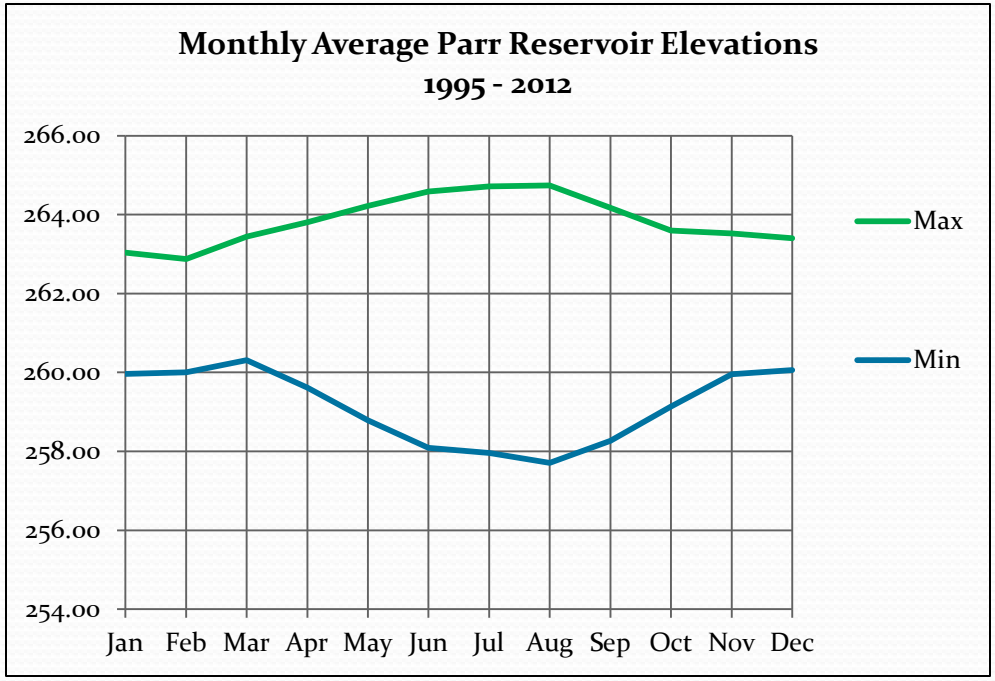
December 19,2013

Reservoir Data

- Daily minimum and maximum Parr Reservoir levels from USGS station 02160990, Parr Shoals Reservoir at Parr, SC; period of record 1995-2012.
- Daily minimum and maximum Monticello Reservoir levels from SCE&G data; period of record 2005-2012.

Parr Reservoir Monthly Data 1995-2012

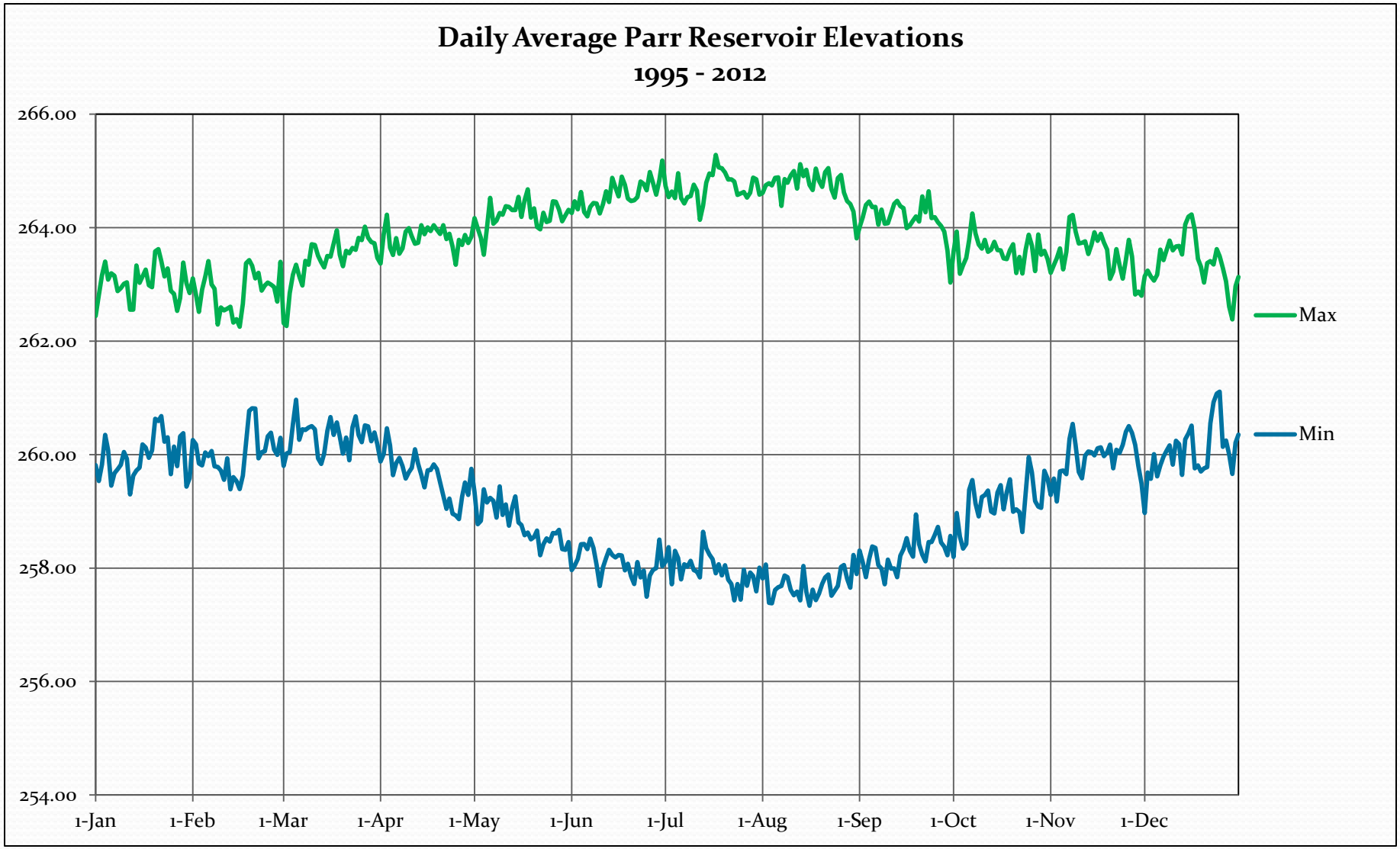
Monthly Average Res. Elev.			
	Max	**Min**	**Range**
Jan	263.04	259.96	3.08
Feb	262.88	260.01	2.87
Mar	263.44	260.32	3.13
Apr	263.81	259.61	4.20
May	264.22	258.79	5.43
Jun	264.59	258.09	6.49
Jul	264.72	257.96	6.75
Aug	264.74	257.71	7.03
Sep	264.17	258.27	5.90
Oct	263.60	259.14	4.46
Nov	263.53	259.96	3.57
Dec	263.41	260.06	3.34
Average	**263.84**	**259.16**	**4.69**



Parr Reservoir Average Daily Fluctuation 1995-2012

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	2.63	2.85	2.51	3.49	4.83	6.29	6.63	6.80	5.69	5.38	3.92	4.17
2	3.27	2.64	2.25	3.87	5.21	6.42	6.17	6.69	6.08	4.96	3.76	3.56
3	3.33	2.67	2.80	3.77	4.99	6.16	6.92	7.39	6.56	4.63	4.29	3.56
4	3.06	3.10	2.64	3.49	4.13	6.21	6.22	7.37	6.31	5.00	3.93	3.06
5	3.00	3.10	2.38	3.88	4.85	5.85	6.79	7.26	5.98	5.04	3.55	3.55
6	3.74	3.44	2.89	3.97	5.29	5.86	6.72	7.23	6.01	4.41	3.92	3.81
7	3.48	2.93	2.53	3.60	4.89	5.85	6.36	6.70	6.01	4.70	3.91	3.46
8	3.14	3.13	2.98	3.84	5.23	6.08	6.52	6.99	6.33	4.76	3.68	3.53
9	3.11	2.51	2.87	4.35	4.82	6.37	6.43	6.95	6.35	4.79	3.77	3.61
10	2.97	2.87	3.20	4.30	5.29	6.56	6.80	7.31	5.93	4.38	4.03	3.78
11	3.11	2.99	3.25	4.08	5.26	6.40	6.71	7.48	6.25	4.50	4.16	3.43
12	3.26	2.64	3.57	3.62	5.62	6.46	6.30	7.10	6.43	4.21	3.78	3.50
13	2.92	3.22	3.55	3.90	5.25	6.13	5.75	7.69	6.63	4.61	3.48	3.88
14	3.61	2.72	3.28	4.40	5.05	6.65	6.44	6.87	6.16	4.79	3.66	3.79
15	3.26	2.85	3.09	4.46	5.74	6.52	6.72	7.44	6.01	4.27	3.94	3.82
16	2.96	2.86	2.83	4.28	5.43	6.32	6.77	7.42	5.46	4.14	3.66	3.72
17	3.14	3.03	3.37	4.21	5.90	6.68	7.38	7.05	5.74	4.42	3.76	4.20
18	3.04	3.17	3.39	4.22	6.05	6.79	7.00	7.60	5.92	4.10	3.77	3.64
19	2.88	2.65	3.21	4.22	5.67	6.44	7.17	7.28	5.25	4.04	3.58	3.61
20	2.95	2.51	3.30	4.38	5.79	6.61	6.92	6.99	5.69	4.72	2.92	3.28
21	3.03	2.30	3.29	4.77	5.35	6.76	7.05	7.14	6.32	4.16	3.47	3.60
22	2.73	3.27	3.65	4.75	5.74	6.43	7.13	7.17	6.15	4.50	3.53	2.86
23	2.91	2.85	3.16	4.67	5.84	6.98	7.39	7.16	6.18	4.56	3.31	2.42
24	2.98	2.92	2.93	4.71	5.57	6.82	6.86	6.93	5.71	4.31	2.93	2.55
25	3.23	2.71	3.47	4.42	5.65	7.16	7.16	7.19	5.60	3.92	3.04	2.39
26	2.69	2.61	3.56	4.92	5.85	7.11	6.66	6.91	5.37	4.00	3.28	3.16
27	2.74	2.86	3.50	4.44	5.85	6.82	6.84	6.56	5.58	4.05	3.11	2.81
28	2.44	2.70	3.32	4.36	5.65	6.58	6.70	6.66	5.55	4.80	2.65	2.61
29	3.01	3.11	3.51	4.44	5.78	6.34	7.03	6.76	5.38	4.46	3.08	2.72
30	3.59		3.34	4.09	5.90	7.15	7.26	6.05	4.47	3.88	3.31	2.76
31	3.26		3.29		5.86		6.57	5.92		3.87		2.78
Average	**3.08**	**2.87**	**3.13**	**4.20**	**5.43**	**6.49**	**6.75**	**7.03**	**5.90**	**4.46**	**3.57**	**3.34**

Parr Reservoir Daily Data 1995-2012

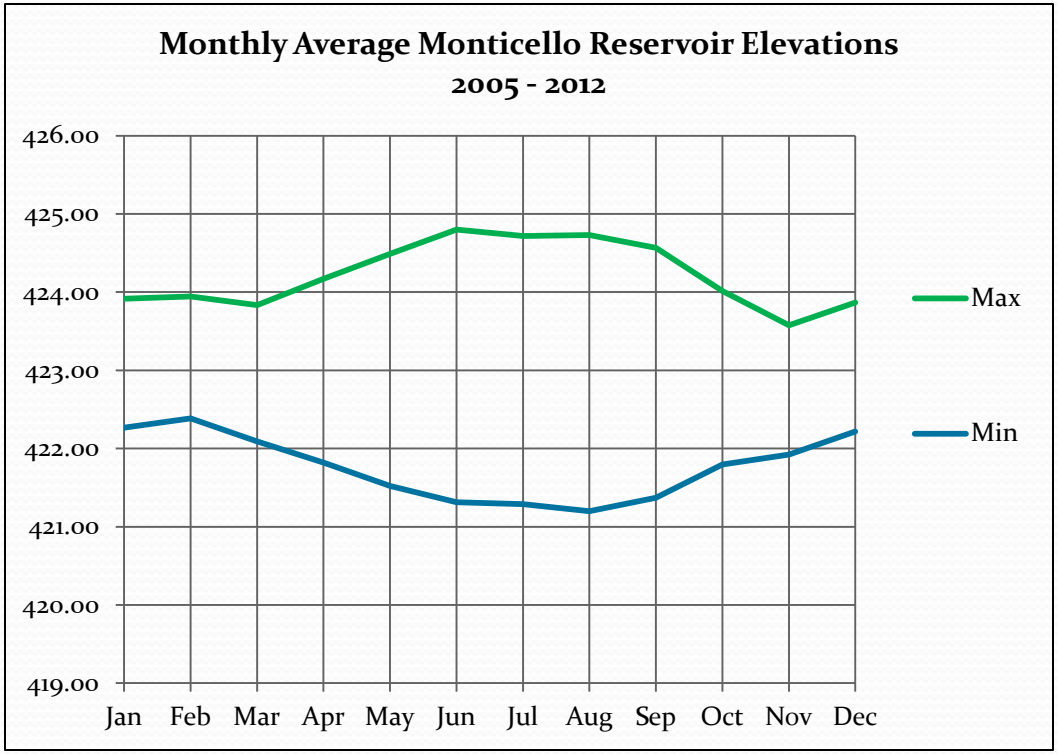


Parr Reservoir Summary

- February has smallest average fluctuation – 2.87 feet.
- August has largest average fluctuation – 7.03 feet.
- Average fluctuation for year is 4.69 feet.
- Average fluctuation March – May is 4.25 feet.
- Average fluctuation April – July is 5.72 feet.

Monticello Reservoir Monthly Data 2005-2012

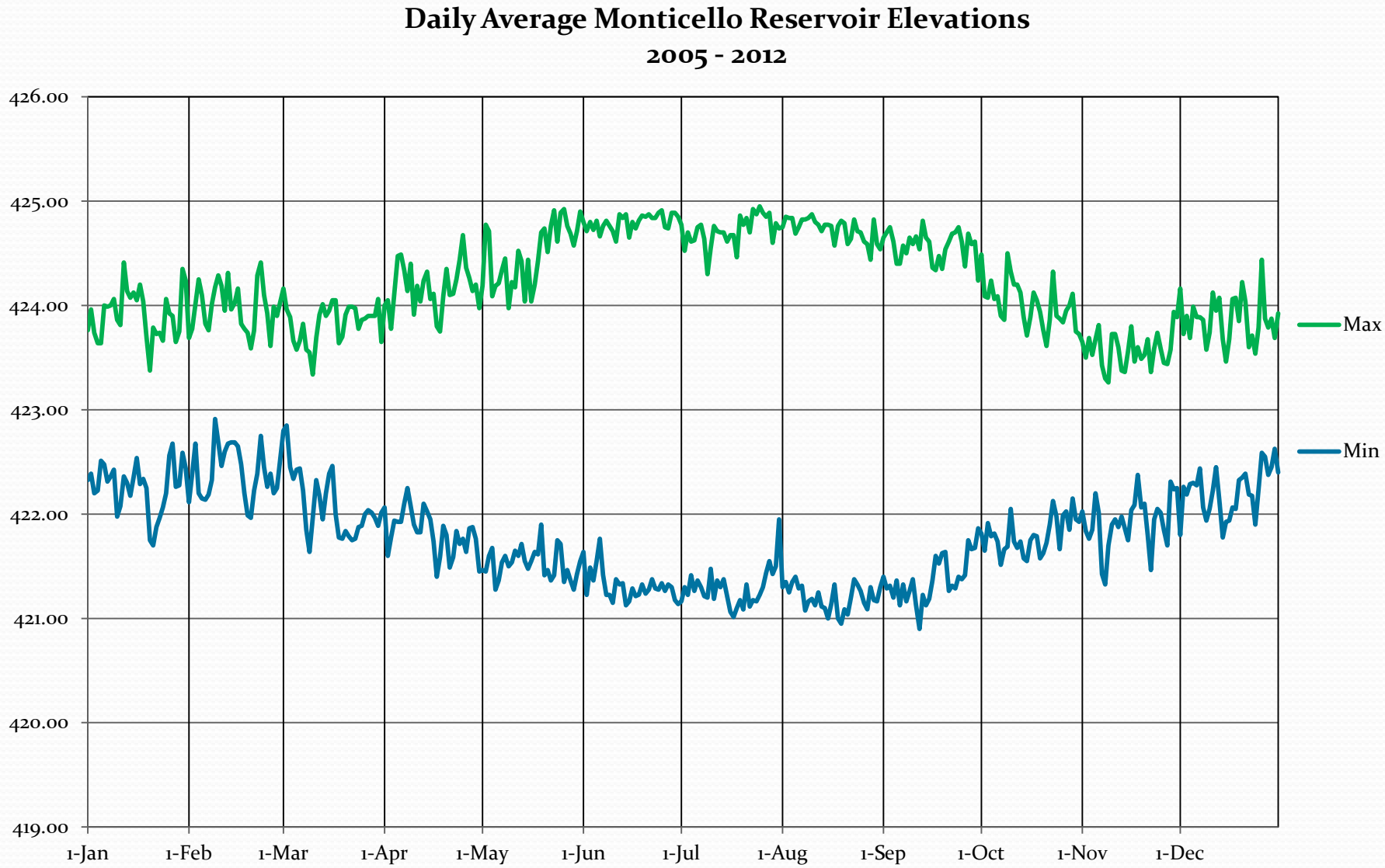
Monthly Average Res. Elev.			
	Max	**Min**	**Range**
Jan	423.91	422.27	1.65
Feb	423.94	422.39	1.58
Mar	423.84	422.09	1.74
Apr	424.17	421.82	2.35
May	424.49	421.52	2.96
Jun	424.80	421.31	3.48
Jul	424.72	421.29	3.43
Aug	424.73	421.20	3.53
Sep	424.57	421.37	3.20
Oct	424.01	421.80	2.22
Nov	423.58	421.92	1.65
Dec	423.87	422.22	1.65
Average	**424.22**	**421.77**	**2.45**



Monticello Reservoir Average Daily Fluctuation 2005-2012

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1.44	1.57	1.36	1.94	2.73	3.16	3.61	3.45	3.25	2.68	1.62	2.36
2	1.57	1.39	1.11	2.45	3.33	3.49	3.22	3.50	3.41	2.44	1.66	1.46
3	1.54	1.34	1.44	2.00	3.11	3.31	3.48	3.59	3.44	2.16	1.93	1.71
4	1.41	2.05	1.32	2.18	2.41	3.36	3.20	3.49	3.41	2.45	1.67	1.40
5	1.12	1.95	1.15	2.55	2.91	3.26	3.36	3.29	3.04	2.25	1.47	1.69
6	1.52	1.69	1.22	2.56	2.85	2.90	3.39	3.46	3.27	2.35	1.80	1.61
7	1.68	1.58	1.60	2.24	2.80	3.35	3.48	3.51	3.25	2.39	2.00	1.45
8	1.64	1.69	1.73	1.89	2.85	3.59	3.43	3.75	3.34	2.20	1.97	1.80
9	1.64	1.26	1.91	2.32	2.47	3.54	3.10	3.68	3.39	2.81	1.56	1.64
10	1.89	1.60	1.38	2.01	2.69	3.56	3.07	3.69	3.21	2.27	1.82	1.69
11	1.74	1.73	1.36	2.36	2.52	3.24	3.58	3.68	3.54	2.46	1.78	1.90
12	2.05	1.35	1.74	2.21	2.92	3.55	3.35	3.52	3.64	2.52	1.73	1.50
13	1.84	1.64	2.06	2.14	2.71	3.50	3.40	3.60	3.59	2.39	1.40	1.94
14	1.90	1.27	1.70	2.30	2.49	3.75	3.33	3.67	3.52	2.31	1.50	1.90
15	1.78	1.34	1.56	2.11	2.96	3.49	3.40	3.78	3.43	2.16	1.81	1.54
16	1.51	1.51	1.59	2.38	2.49	3.51	3.61	3.63	3.00	2.14	1.76	1.74
17	1.91	1.35	2.05	2.40	2.56	3.53	3.66	3.25	2.74	2.32	1.38	2.00
18	1.70	1.57	1.86	2.16	2.81	3.59	3.36	3.76	2.95	2.26	1.22	2.03
19	1.45	1.75	1.94	2.20	2.80	3.54	3.69	3.86	2.73	2.36	1.42	1.53
20	1.63	1.62	2.07	2.55	3.32	3.61	3.69	3.70	2.90	2.14	1.43	1.87
21	2.09	1.54	2.20	2.61	3.05	3.60	3.51	3.55	3.35	1.89	1.87	1.65
22	1.85	1.90	2.24	2.53	3.40	3.46	3.59	3.44	3.38	1.96	1.90	1.41
23	1.78	1.66	2.21	2.41	3.50	3.55	3.75	3.45	3.41	2.20	1.64	1.54
24	1.60	1.65	1.90	2.72	2.86	3.61	3.71	3.39	3.35	1.93	1.69	1.64
25	1.86	1.66	1.98	2.91	3.18	3.57	3.73	3.44	3.24	2.21	1.58	1.55
26	1.36	1.23	1.88	2.73	3.57	3.49	3.59	3.46	2.96	1.85	1.60	1.85
27	1.23	1.79	1.86	2.40	3.30	3.41	3.41	3.50	2.94	1.93	1.74	1.33
28	1.39	1.65	1.89	2.26	3.32	3.59	3.34	3.14	2.93	2.15	1.26	1.41
29	1.48		1.94	2.44	3.30	3.71	3.17	3.65	2.94	1.96	1.70	1.43
30	1.76		2.18	2.53	3.29	3.71	3.29	3.43	2.38	1.80	1.64	1.06
31	1.80		1.64		3.35		2.79	3.24		1.80		1.53
Average	**1.65**	**1.58**	**1.74**	**2.35**	**2.96**	**3.48**	**3.43**	**3.53**	**3.20**	**2.22**	**1.65**	**1.65**

Monticello Reservoir Daily Data 2005-2012



Monticello Reservoir Summary

- February has smallest average fluctuation – 1.58 feet.
- August has largest average fluctuation – 3.53 feet.
- Average fluctuation for year is 2.46 feet.
- Average fluctuation March – May is 2.35 feet.
- Average fluctuation April – July is 3.06 feet.

DRAFT
DESKTOP FISH ENTRAINMENT STUDY PLAN

PARR HYDROELECTRIC PROJECT
(FERC NO. 1894)

Prepared for:

South Carolina Electric & Gas Company
Cayce, South Carolina

Prepared by:

Kleinschmidt

Lexington, South Carolina
www.KleinschmidtUSA.com

October 2013

DRAFT

DESKTOP FISH ENTRAINMENT STUDY PLAN

PARR HYDROELECTRIC PROJECT
(FERC NO. 1894)

Prepared for:

South Carolina Electric & Gas Company
Cayce, South Carolina

Prepared by:

Kleinschmidt

Lexington, South Carolina
www.KleinschmidtUSA.com

October 2013

DRAFT DESKTOP FISH ENTRAINMENT STUDY PLAN

PARR HYDROELECTRIC PROJECT
(FERC NO. 1894)

SOUTH CAROLINA ELECTRIC & GAS COMPANY

TABLE OF CONTENTS

LIST OF TABLES

DRAFT DESKTOP FISH ENTRAINMENT STUDY PLAN

PARR HYDROELECTRIC PROJECT
(FERC NO. 1894)

SOUTH CAROLINA ELECTRIC & GAS COMPANY

1.0 INTRODUCTION

South Carolina Electric & Gas Company (SCE&G) is the Licensee of the Parr Hydroelectric Project (FERC No. 1894) (Project). The Project consists of the Parr Hydro Development and the Fairfield Pumped Storage Development. Both developments are located along the Broad River in Fairfield and Newberry Counties, South Carolina.

The Project is currently involved in a relicensing process which involves cooperation and collaboration between SCE&G, as licensee, and a variety of stakeholders including state and federal resource agencies, state and local government, non-governmental organizations (NGO), and interested individuals. Collaboration and cooperation is essential in the identification of and treatment of operational, economic, and environmental issues associated with a new operating license for the Project. SCE&G has established several Technical Working Committees (TWC's) comprised of interested stakeholders with the objective of achieving consensus regarding the identification and proper treatment of these issues in the context of a new license.

The TWC determined that a desktop fish entrainment and mortality study should be conducted to determine the likely effects of Project-induced entrainment and impingement based on the physical characteristics of the Project. This study plan outlines the process for a desktop analysis.

2.0 BACKGROUND AND EXISTING INFORMATION

As noted, the Project is comprised of two developments. The Parr Hydro Development forms Parr Reservoir along the Broad River. The Development consists of a 37-foot-high, 200-foot-long concrete gravity spillway dam with a powerhouse housing generating units with a combined licensed capacity of 14.9 MW. Parr Hydro operates in a modified run-of-river mode and normally operates continuously to pass Broad River flow. Current minimum flow license articles require that 1,000 cubic feet-per-second (cfs), or average daily natural inflow to Parr Reservoir[1], whichever is less, be provided downstream of Parr Dam from March through May. During the remainder of the year, 800 cfs daily average flow and 150 cfs minimum flow, or natural inflow, whichever is less, are required downstream of the Parr Dam. The 13-mile-long Parr Reservoir has a surface area of 4,400 acres at full pool and serves as the lower reservoir for pumped-storage operations at the Fairfield Pumped Storage Development.

The Fairfield Pumped Storage Development is located directly off of the Broad River. Four earthen dams form the 6,800-acre upper reservoir, Monticello Reservoir. As noted, Parr Reservoir serves as the lower reservoir for pumped storage operations. The Fairfield Development has a licensed capacity of 511.2 MW and is primarily used for peaking operations, reserve generation, and power usage.

The Project area supports warmwater fish communities typical of impounded river reaches in the Piedmont of South Carolina. Recent survey work within the Project area has documented 30 species of fish occurring in Parr Reservoir and 24 species in Monticello Reservoir (Table 1). Although some seasonal variations in community structure have been documented, the fish communities are generally similar between the two reservoirs, with gizzard shad, blue catfish, bluegill, channel catfish and white perch being the dominant species (Normandeau 2007, 2008, 2009; SCANA 2013). No state or federally listed threatened or endangered species have been documented in Monticello or Parr reservoirs, although robust redhorse, which is considered a

[1] Evaporative loss from Parr and Monticello Reservoirs is subtracted from average daily natural inflow to determine flows downstream of Parr Dam.

species of highest conservation concern by the SCDNR (2005), has been documented in limited[2] numbers in both reservoirs.

TABLE 1 FISH SPECIES DOCUMENTED AT PARR AND MONTICELLO RESERVOIRS (SOURCE: NORMANDEAU 2007, 2008, 2009; SCANA 2013)

COMMON NAME	SCIENTIFIC NAME	PARR	MONTICELLO
black crappie	*Pomoxis nigromaculatus*	x	x
blue catfish	*Ictalurus furcatus*	x	x
bluegill	*Lepomis macrochirus*	x	x
channel catfish	*Ictalurus punctatus*	x	x
flat bullhead	*Ameiurus platycephalus*	x	x
flathead catfish	*Pylodictis olivaris*	x	
gizzard shad	*Dorosoma cepedianum*	x	x
golden shiner	*Notemigonus chrysoleucas*	x	x
highfin carpsucker	*Carpiodes velifer*	x	
largemouth bass	*Micropterus salmoides*	x	x
longnose gar	*Lepisosteus osseus*	x	
northern hogsucker	*Hypentelium nigricans*	x	x
notchlip redhorse	*Moxostoma collapsum*	x	x
pumpkinseed	*Lepomis gibbosus*	x	x
quillback	*Carpiodes cyprinus*	x	x
redbreast sunfish	*Lepomis auritus*	x	x
redear sunfish	*Lepomis microlophus*	x	x
robust redhorse	*Moxostoma robustum*	x	x
sandbar shiner	*Notropis scepticus*	x	
shorthead redhorse	*Moxostoma macrolepidotum*	x	x
smallmouth bass	*Micropterus dolomieu*	x	x
snail bullhead	*Ameiurus brunneus*		x
spottail shiner	*Notropis hudsonius*	x	x
threadfin shad	*Dorosoma petenense*	x	x
warmouth	*Lepomis gulosus*	x	
white bass	*Morone chrysops*	x	
white catfish	*Ameiurus catus*	x	x
white perch	*Morone americana*	x	x
whitefin shiner	*Cyprinella nivea*	x	x
yellow bullhead	*Amierus natalis*	x	x
yellow perch	*Perca flavescens*	x	x

[2] To date, 2 robust redhorse have been documented in Monticello Reservoir and 3 robust redhorse have been documented in Parr Reservoir.

3.0 STUDY GOALS AND OBJECTIVES

The goal of the desktop fish entrainment and mortality study is to develop additional information necessary to estimate potential fish entrainment and impingement at the Project. This will provide a basis for understanding the effects of entrainment, impingement and turbine mortality on fisheries resources in the Project area. The study objective is to characterize and provide an order-of-magnitude estimate of entrainment at both developments using existing literature and site-specific information.

4.0 PROJECT NEXUS

Fish that reside in the Project area could be susceptible to impingement on the Project trashracks or entrainment through the Project turbines. Evaluation of the physical characteristics of each Project development along with an evaluation of expected fish behavior at the intake structures utilizing existing information will help in the understanding of the potential for continued Project operations to affect the fishery.

5.0 GEOGRAPHIC SCOPE

As this analysis is a desktop exercise, no field reconnaissance will be implemented. Fish species present within the Project vicinity that are determined to be potentially susceptible to impingement and/or entrainment through the Project will be analyzed in this study.

6.0 METHODOLOGY

Comment [b1]: Include write-up of electrofishing in tailrace and forebay of Fairfield Pumped Storage. Include fish distribution from Parr studies as a line item.

Fish impingement and entrainment at the Project may occur when fish that elect to enter into the project intake flow field during periods of operation may become impinged on the trashracks or entrained through the turbines. Fish that are small enough to pass through the projects trashracks will be considered susceptible to entrainment while those physically excluded due to size (i.e. length, width, and/or depth) will be considered as potential candidates for impingement. Not all fish species occurring in the Project reservoirs may be equally susceptible to entrainment or impingement because of their habitat use, behavior and swimming abilities relative to the project intake velocity. As noted, fish entrainment at the Project developments will be assessed through a desktop study. The primary inputs for this analysis will be as follows:

1. Develop an entrainment and turbine mortality database that can be applied to the Parr and Monticello developments. Hold Point
2. Calculate and estimate fish entrainment rates, seasonally if possible, at each Project development. Entrainment rates are defined as: number of Fish/volume of water entrained.
3. Characterize the species composition of potential fish entrainment. Hold Point
4. Apply any physical or biological filters that may influence entrainment.
5. Estimate the total annual entrainment for the Project based on normal operation. Hold Point
6. Estimate potential turbine mortality for fish entrainment based on turbine mortality estimates from similar project studies.
7. Estimate impingement mortality for fish eliminated from entrainment estimates. Draft Report Review

These inputs are described in more detail below.

Development of an Entrainment Database

Comment [b2]: Include turbine mortality description.

Over seventy site-specific studies of resident fish entrainment at hydroelectric sites in the United States have been reported to date, which provide order-of-magnitude estimates of annual fish entrainment (FERC, 1995). Descriptive information will be gathered from available entrainment studies and will include:

- Location: geographic proximity (preference given to same river basin).
- Project size: discharge capacity and power production.
- Mode of operation - e.g., peaking, run-of-river, etc.
- Biological factors: fish species composition.
- Impoundment characteristics: general water quality, impoundment size, flow regime.
- Physical project characteristics: trash rack spacing, intake velocity, etc.

This information will be assembled into a "matrix" of data to be used as a database for the desktop study. After review of the "matrix", specific studies that are most applicable to the Project developments will be selected for use in the entrainment database. Key criteria to be used in acceptance of candidate studies may include:

- Similar geographic location, with preference given to projects located in the same river basin.

- Similar station hydraulic capacity.
- Similar station operation (peaking, run-of-river, etc.).
- Biological similarities: fish species, assemblage and water quality.
- Availability and type of entrainment data (netting vs hydroacoustic).

Estimation of Fish Entrainment

Fish entrainment by species for the proposed Project will be estimated on a monthly basis (if possible) to provide an order-of-magnitude fish entrainment estimate. As noted, the entrainment rates will be presented in fish entrained per hour of operation and fish per volume of water passed through project turbines (fish/million cubic feet). The data will be grouped by season, where appropriate, to determine an entrainment density for each season of the year. The seasonal data from each entrainment study will be averaged to develop a seasonal mean entrainment estimate at each Project development.

Species Composition Analysis

Species composition data from the accepted entrainment studies will be analyzed and compiled to determine the fish species typically entrained at other hydroelectric projects. This information will be grouped to yield predicted seasonal estimates of species-specific data for entrained fish to determine:

- Likelihood of entrainment by species.
- Expected relative abundance of each species identified as potentially entrained.
- Prediction of seasonal entrainment by species and size, if applicable.

Application of Physical or Biological Filters

Adjustment of fish entrainment rates based on site-specific characteristics of the Project may be appropriate. Factors potentially affecting entrainment rates that may warrant adjustment of estimates include:

- Trashrack spacing.
- Fish habitat available at the intakes.
- Other site specific factors as determined during the study.

Total Annual Entrainment Estimate

Total fish entrainment for each Project development will be estimated on an annual basis to provide an order of-magnitude entrainment estimate. The total fish entrainment estimate will be produced for a typical water and operating year.

Turbine Mortality

As fish move through hydroelectric turbines, a percentage are killed due to turbine mortality (i.e. blade strikes, shear forces, and pressure changes, etc.). Turbine passage survival studies have been performed at numerous hydroelectric projects throughout the country. Characteristics of these known project studies will be compared to the characteristics of the Parr and Monticello development turbines and appropriate studies will be selected for the transfer of turbine mortality data. Selected turbine survival rate data will also be obtained from the literature and used to estimate the number of fish lost due to turbine mortality. Important turbine characteristics viewed as general criteria for accepting turbine mortality studies will include but are not limited to:

- Turbine design type.
- Operating head.
- Turbine runner speed.
- Turbine diameter, and peripheral runner velocity.

Species specific turbine mortality rate data available from source studies will also be reviewed and consolidated. Where multiple tests are available for a given fish genus or family, a mean survival rate will be computed. For genus or families where no acceptable data can be identified, the survival rate data from surrogate genus and/or family groups will be utilized.

Once turbine mortality rates are developed from the study database, the rates will be applied to the fish entrainment estimates for the Project. This will be accomplished by multiplying fish entrainment estimates by the composite mortality rates for each family/genus group (where applicable).

Impingement Estimates

Fish eliminated from entrainment estimates due to their size in relation to the trashrack spacing will be considered susceptible to impingement. Swim speed information for these species and size groups will be compared to intake velocities to estimate the potential for impingement. Those species or size groups lacking the ability to avoid impingement will be considered

impinged and subsequently killed due to impingement mortality.

7.0 SCHEDULE AND PRODUCTS

This study will occur during 2015. Background research for entrainment and mortality analyses will occur early in the year. Data analysis and report writing are scheduled for later in the year. In an attempt to reach consensus during the entrainment desktop study, the following process steps will be reviewed with TWC members:

Comment [ACJ3]: We would like to discuss which steps the TWC would like to review during the desktop process.

- *[TBD]*
- *[TBD]*
- *[TBD]*

Comments from the TWC will be addressed during each phase of the analysis. Upon completion of the study, a draft report will be prepared and distributed to the TWC for review and comment. The draft report will summarize the results obtained in the study; will contain appropriate tables and figures depicting estimated fish entrainment; and will contain all supporting correspondence among the TWC members. After receipt of all comments, the draft report will be revised to address final comments by TWC members and will be resubmitted as the Final Report.

8.0 USE OF STUDY RESULTS

Study results will be used as an information resource during discussion of relicensing issues and developing potential Protection, Mitigation and Enhancement measures with the South Carolina Department of Natural Resources, USFWS, RT&E TWC, and other relicensing stakeholders.

9.0 REFERENCES

Federal Energy Regulatory Commission (FERC). 1995. Preliminary assessment of fish entrainment at hydropower projects – volume 1 (Paper No. DPR-10). Office of Hydropower Licensing, FERC, Washington, DC.

Normandeau Associates (Normandeau) 2007. *Monticello and Parr Reservoirs Fisheries Surveys: Final Report.* Prepared for Tetra Tech NUS, Inc., Aiken, SC, by Normandeau Associates, Bedford, NH. September 2007.

Normandeau Associates (Normandeau). 2008. *Monticello and Parr Reservoir Fisheries Surveys:* Summer *Report.* Prepared for Tetra Tech NUS by Normandeau Associates, Bedford, NH. August 2008.

Normandeau Associates (Normandeau). 2009. *Monticello and Parr Reservoir Fisheries Surveys: Summer Report.* Prepared for Tetra Tech NUS by Normandeau Associates, Bedford, NH. April 2009.

SCANA Services, Inc (SCANA). 2013. Fish Community Assessment of Parr Reservoir 2012. March, 2013.

South Carolina Department of Natural Resources (SCDNR). 2005. SC Comprehensive Wildlife Conservation Strategy.