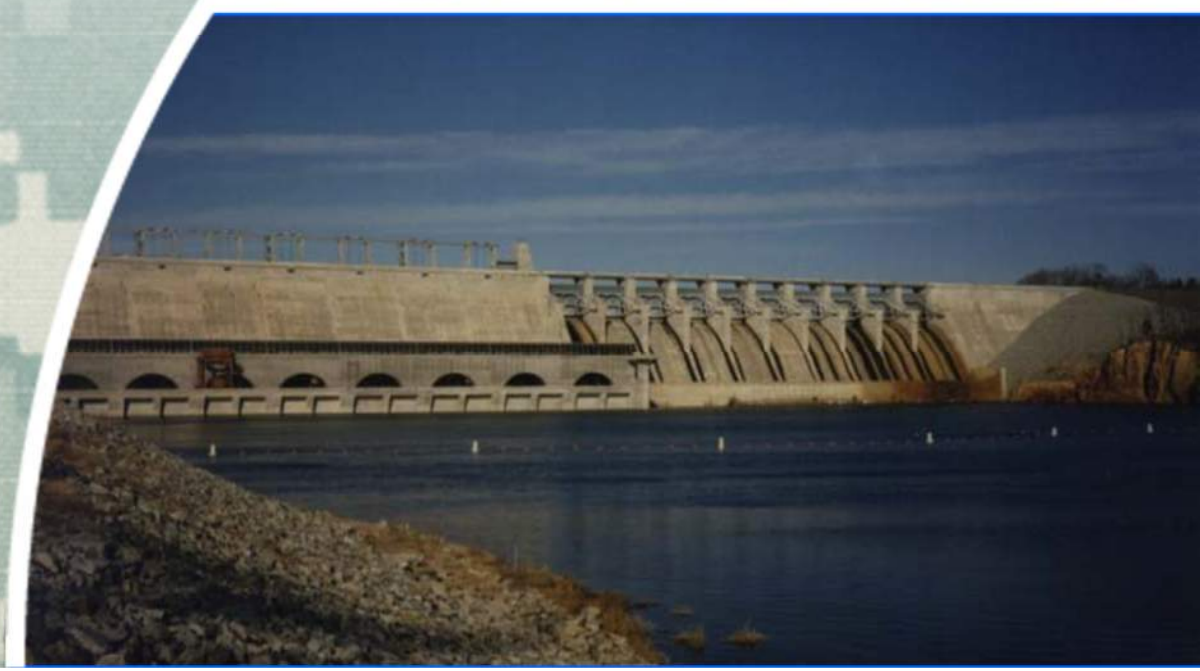
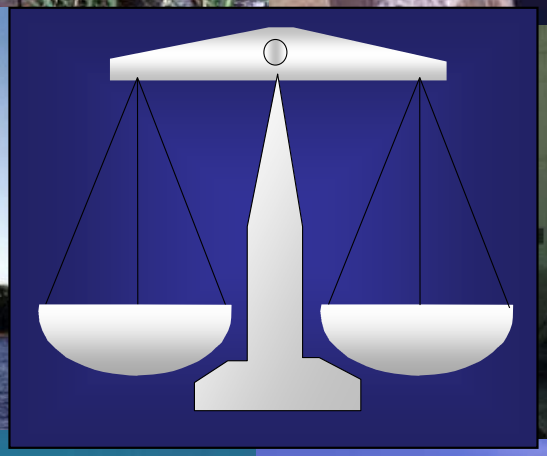
Multipurpose Reservoir Management in the Savannah River Basin

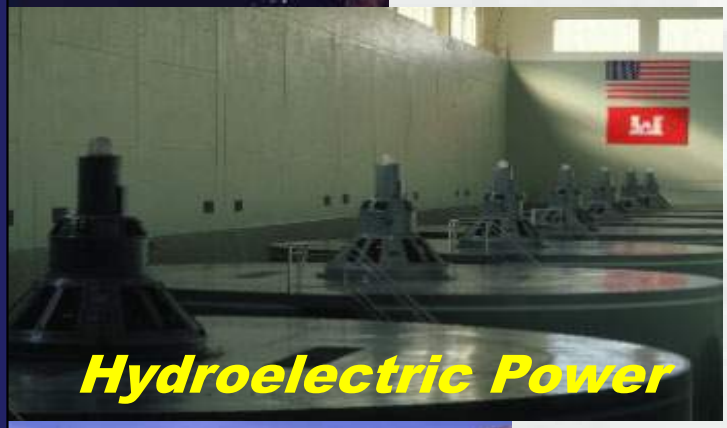
Presented by
Stan Simpson
Feb, 2024

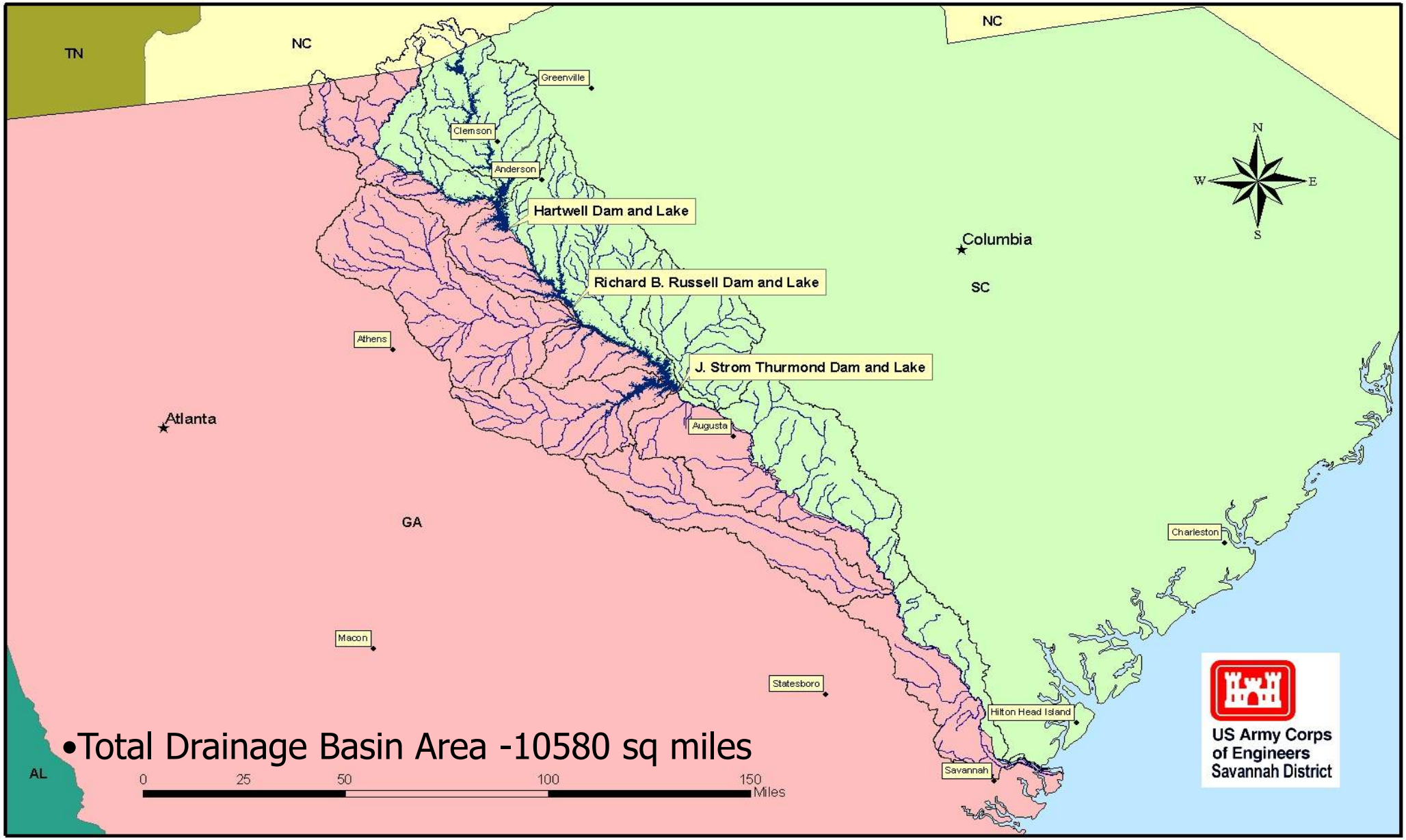


US ARMY
CORPS OF ENGINEERS
SAVANNAH DISTRICT

Multi-Purpose Projects







- Total Drainage Basin Area -10580 sq miles

The Savannah River Basin

BUILDING STRONG®

Congressional Authorization

Authorized Purpose	Congressional Authorization		
	Hartwell	Russell	Thurmond
Flood Damage Reduction	Flood Control Act of 1950	Flood Control Act of 1966	Flood Control Act of 1944
Hydropower			
Navigation		No Navigation Authorization	
Water Supply	Water Supply Act of 1958		
Water Quality	Federal Water Pollution Control Act of 1972		
Fish and Wildlife	Federal Water Project Recreation Act of 1965	Federal Water Project Recreation Act of 1965, WRDA 1986	WRDA 1986
Recreation		Federal Water Project Recreation Act of 1965	

Hartwell	Russell	Thurmond
3rd most-visited Corps project in the Nation - 10.1M visitors/year	**Largest Corps power plant east of Mississippi River**	**8th most-visited Corps project in the Nation-6M visitors/year**
Completed in **1962**	Completed in **1984**	Completed in **1952**
56,000 acres (660 ft), 962-mile shoreline	26,653 acres (475 ft), 540-mile shoreline	71,100 acres (330 ft), 1200-mile shoreline
5 turbines , 422 MW	8 turbines, (4 as pump-back) 648 MW	7 turbines, 364 MW
85 Recreation areas (50 Corps operated)	32 Recreation areas (3 Corps operated)	55 Recreation areas (35 Corps operated)
Largest shoreline management program in the Corps		

Partners


ASU
Augusta State University


U.S. Fish & Wildlife Service


NOAA


USGS
science for a changing world


US Army Corps
of Engineers
Savannah District


The Nature
Conservancy
Protecting nature. Preserving life.™


DEPT OF NATURAL RESOURCES
WILDLIFE RESOURCES
DIVISION
GEORGIA

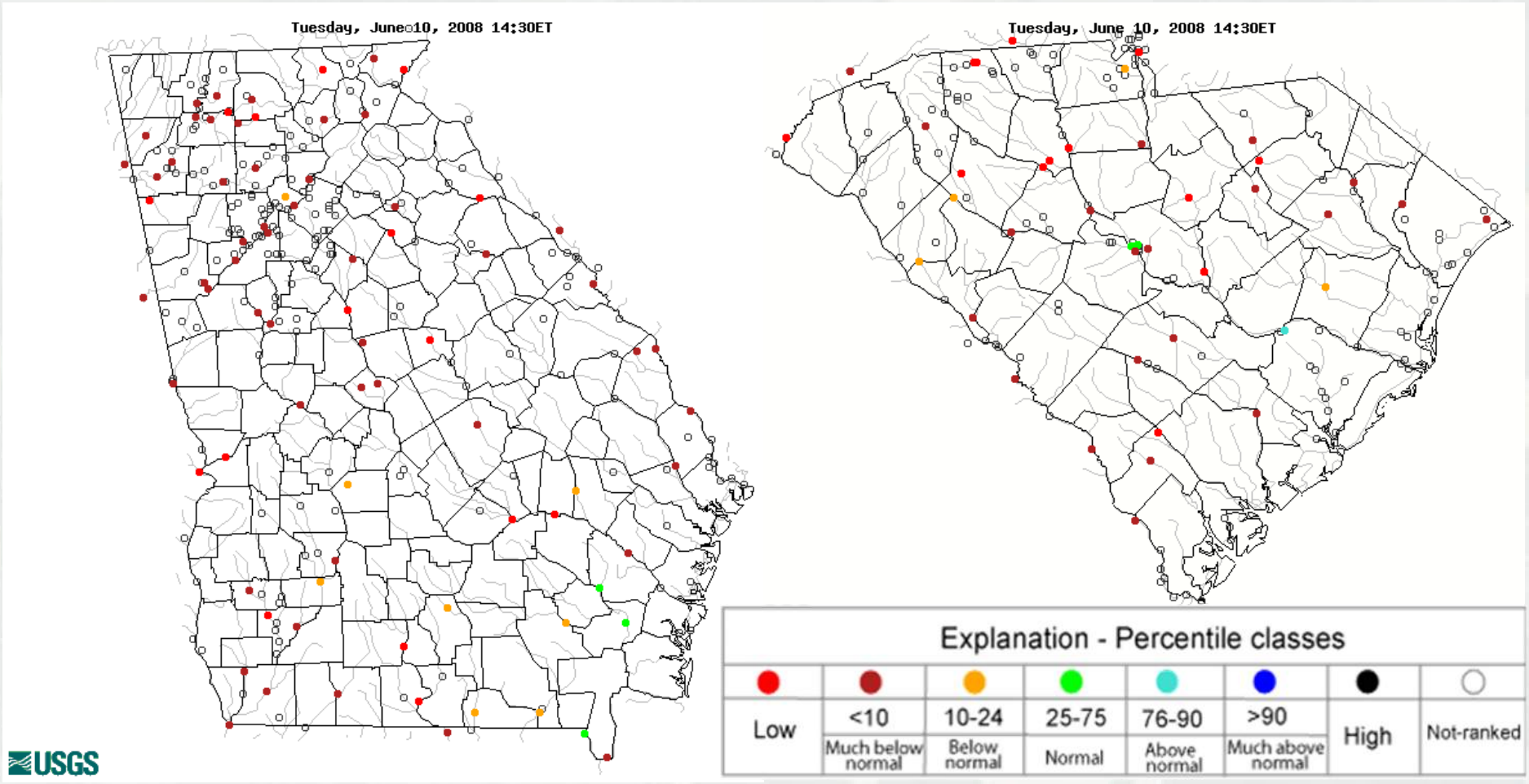

SAVANNAH STATE UNIVERSITY
1890
SAVANNAH, GEORGIA


SOUTHEASTERN
NATURAL
SCIENCES
ACADEMY
PHINIZY SWAMP
NATURE PARK
CENTER FOR URBAN
RIVER RESEARCH
CENTER FOR
ECOLOGICAL RESTORATION


SOUTH CAROLINA
DEPARTMENT OF NATURAL RESOURCES


The University of Georgia

Stream Gage Networks



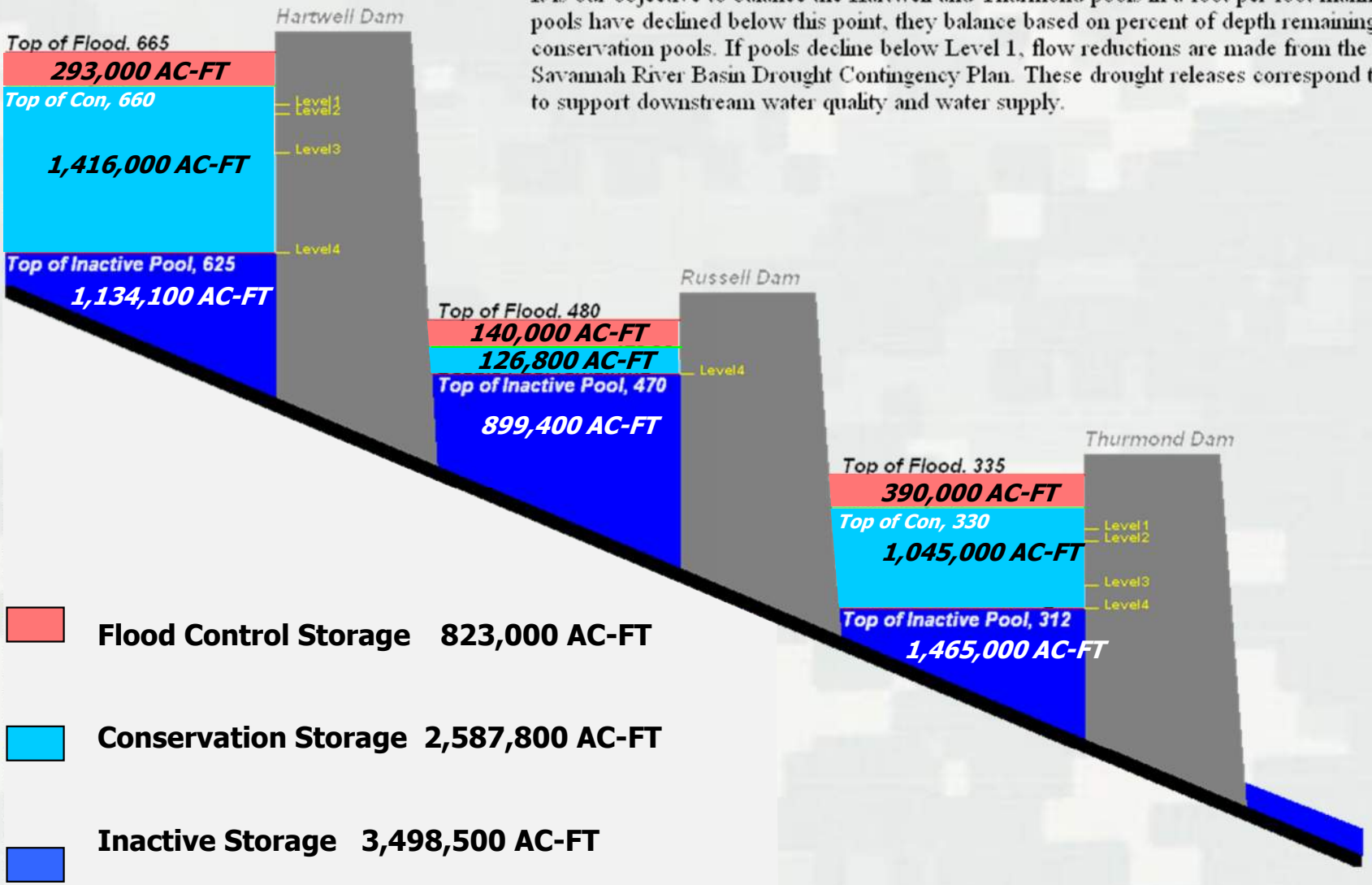
Drainage Basins

- Hartwell = 1294 Square Miles (Local Basin Area)
  1” Runoff = 1.2’ pool elevation @ 660.0
- Russell = 802 Square Miles (Local Basin Area)
  1” Runoff = 1.5’ pool elevation @ 475.0
- Thurmond = 2890 Square Miles (Local Basin Area)
  1” Runoff = 2.2’ pool elevation @ 330.0

Savannah River Reservoir System

Pool Schematic

It is our objective to balance the Hartwell and Thurmond pools in a foot per foot manner for the top 15 feet. Once the pools have declined below this point, they balance based on percent of depth remaining in their respective conservation pools. If pools decline below Level 1, flow reductions are made from the system in accordance to the Savannah River Basin Drought Contingency Plan. These drought releases correspond to the minimum flows needed to support downstream water quality and water supply.



Flood Control Storage 823,000 AC-FT

Conservation Storage 2,587,800 AC-FT

Inactive Storage 3,498,500 AC-FT

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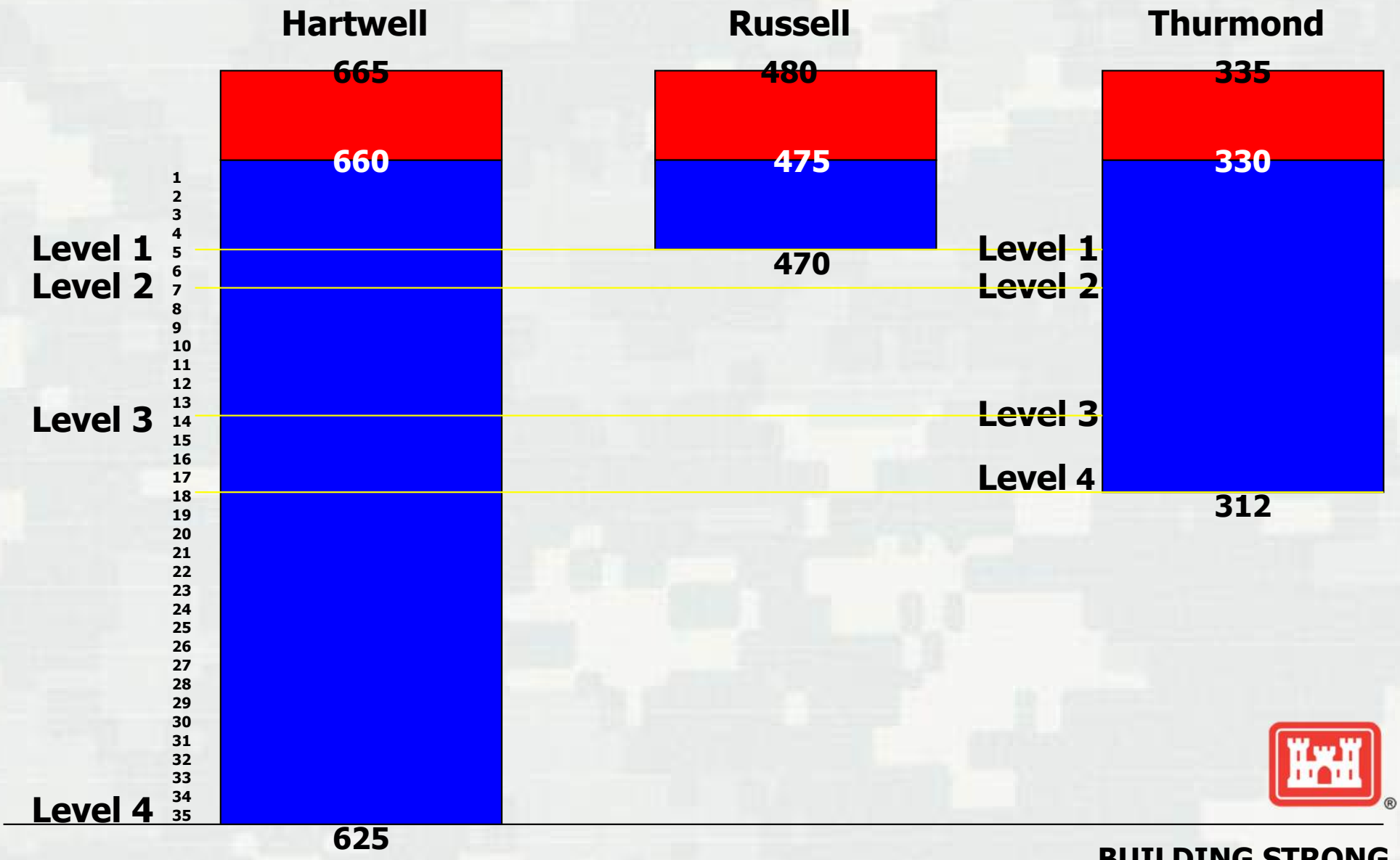
Pool Comparison



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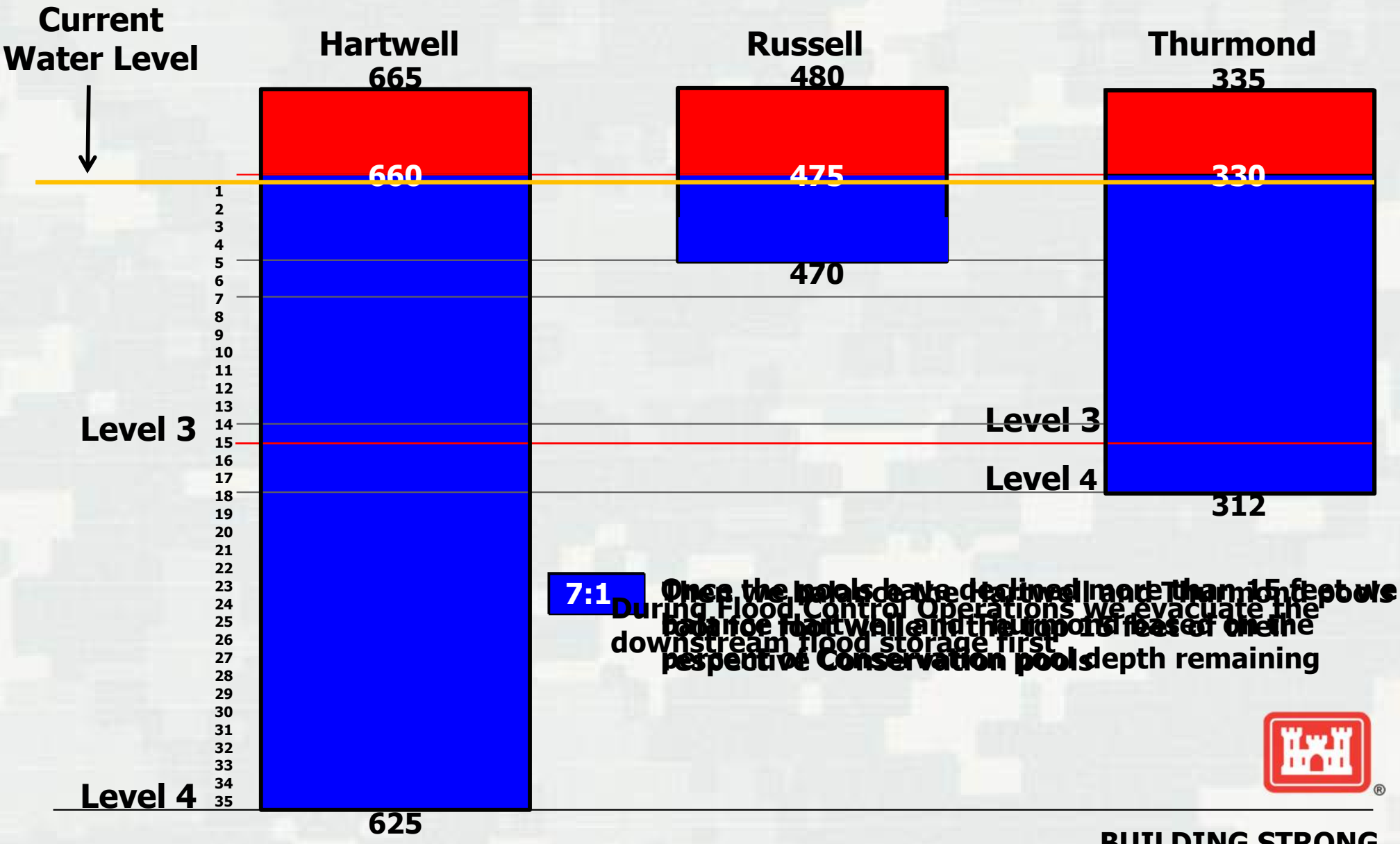
Pool Balancing Procedure



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Reservoir System Operations

- Flood Control (Water Control Plan)
  - Public Safety & Flood Damage Reduction
- Hydropower Production (SEPA Contract)
  - Control Area Concept
- Drought Management (Drought Contingency Plan)
  - Balanced Impacts
- Environmental Releases (Incidental to Flood Management)
  - Adaptively Manage Storage
- Navigation Windows (Incidental to Flood Management)
  - Plan and Manage Storage Requirements

Typical Operating Range

- Flood Operations (30,000 cfs Channel Capacity)
- Normal Operations (3800 cfs – 30,000 cfs)
  - ▶ In-Lake Fish Spawn (keep pools up in spring)
  - ▶ Meet Ecological Flow Needs
- Drought Management
  - ▶ Level 1 Limit Max Weekly Average 4200 cfs
  - ▶ Level 2 Limit Max Weekly Average 4000 cfs
  - ▶ Level 3 Limit Max Daily Average 3800 cfs

Drought Plan History

Event	Action	Description
1986-1989 Drought (New Drought of Record)	1989 Drought Contingency Plan	Introduced flow restrictions Level 1 – Safety Advisory for boaters Level 2- Max weekly average 4500 cfs Level 3- Specified 3600 cfs daily average at Thurmond
1998-2002 Drought (New Drought of Record)	2006 Drought Plan Update Environmental Assessment - (Step 1 Savannah River Basin Comprehensive Study)	Level 1 – Max weekly average 4200 cfs Level 2- Max weekly average 4000 cfs Level 3- Specified 3800 cfs daily average at Thurmond
2007-2009 Drought (New Drought of Record)	Temporary deviation to 3600cfs at Thurmond Oct2007-May2009 (supported by Federal and State agencies without an EA)	Reduction occurred at Drought Level 2 (Hartwell @ 649.85/ Thurmond@319.76)
	Temporary Deviation to 3100cfs Dec2008-Jan2009 (supported by Federal and State agencies without an EA)	Used adaptive management to maintain 3600 min @ Savannah River at Augusta gage
	Drought Level 4 Study and Environmental Assessment	Developed standard operating procedure for inactive storage (Level 4)
2011-? Drought	2012 Drought Plan Revision Environmental Assessment	Evaluation and modification of the 2006 EA rules in the 2007-2009 drought and temporary deviations

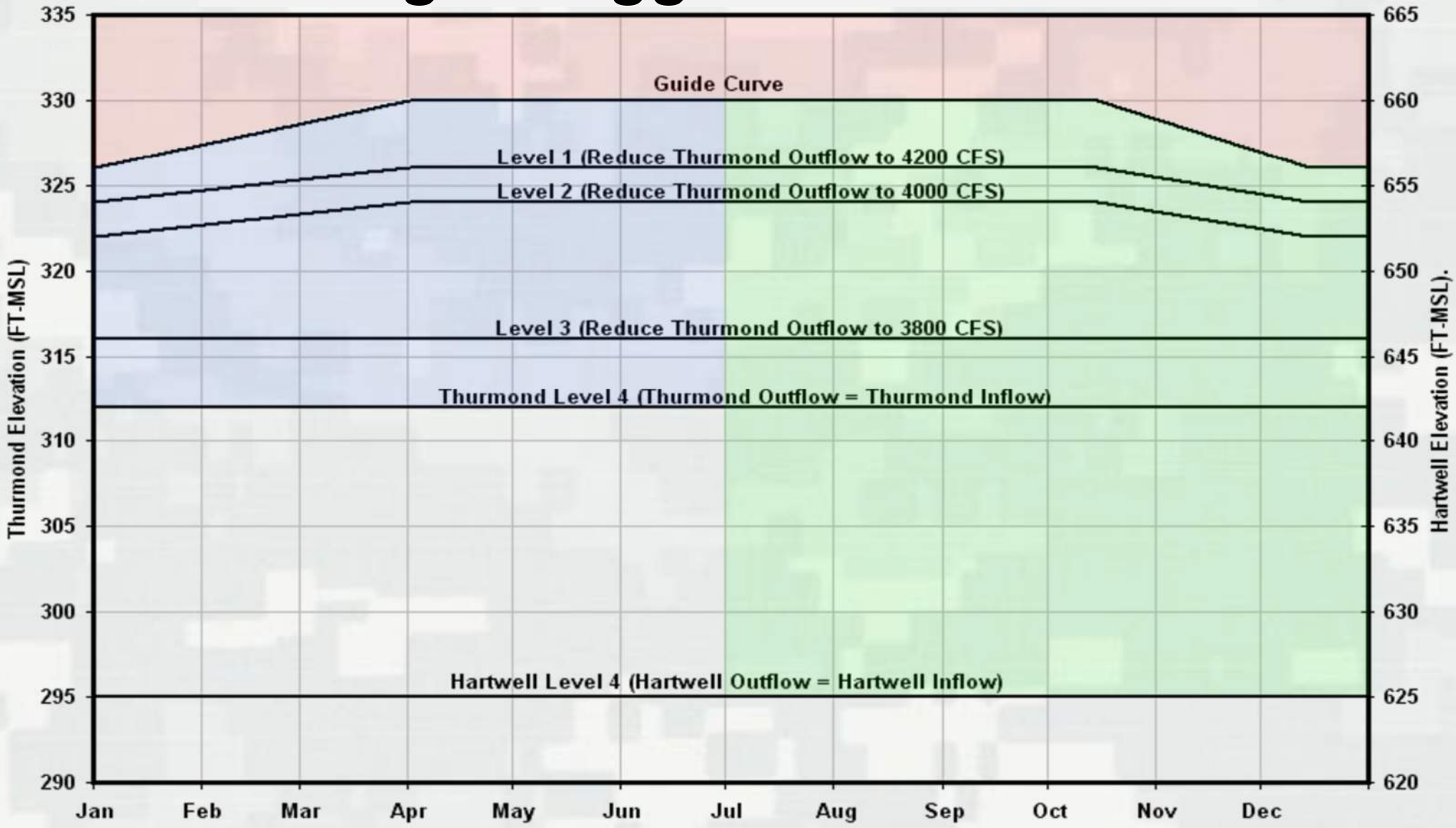
✓Plan to allow pools to refill above guide curve up to summer full pool

✓Seeking resource agency concurrence to hold 3,800 cfs during refill

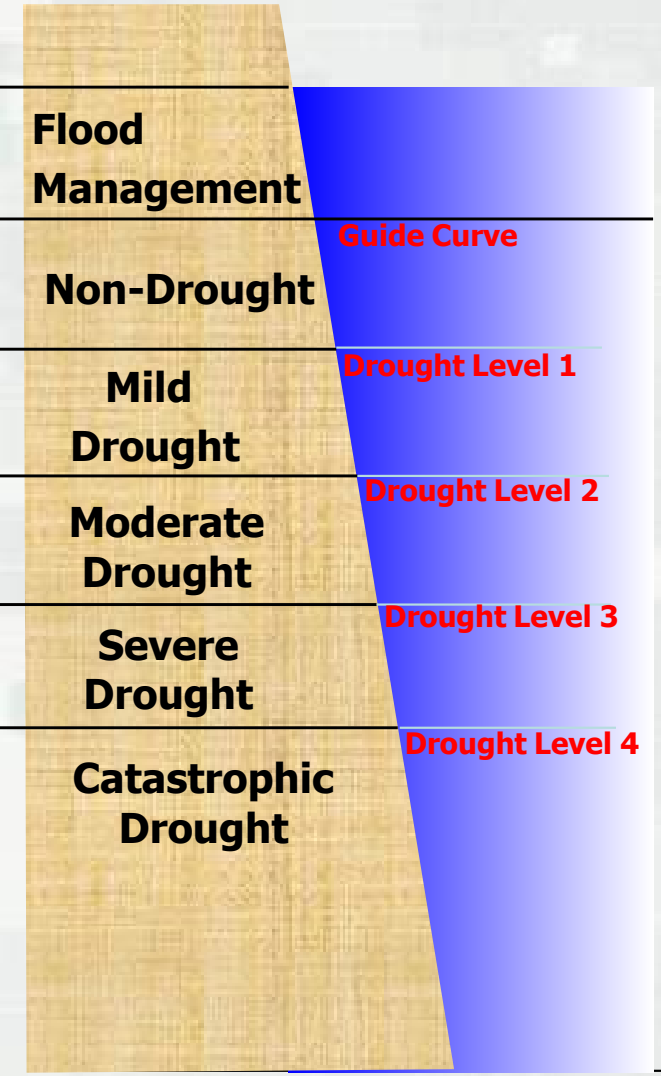
2012/14 Drought Plan

Trigger Level	Time of Year	Drought Response
1	Jan 1 - Dec 31	IF BR index >10%, Target 4200 cfs (daily average) release at Thurmond Dam IF BR index <10%, Target 4000 cfs (daily average) release at Thurmond Dam
2	Feb 1 - Oct 31	IF BR index >10%, Target 4000 cfs (daily average) release at Thurmond Dam IF BR index <10%, Target 3800 cfs (daily average) release at Thurmond Dam
	Nov 1 - Jan 31	Target 3600 cfs (daily average) release at Thurmond Dam
3	Feb 1 - Oct 31	Target 3800 cfs (daily average) release at Thurmond Dam
	Nov 1 - Jan 31 (Feb 1 – Feb 28 w/NMFS approval)	Target 3100 cfs (daily average) release at Thurmond Dam
4	Feb 1 - Oct 31	Target 3600 cfs (daily average) release at Thurmond Dam
	Nov 1 - Jan 31 (Feb 1 – Feb 28 w/NMFS approval)	Target 3100 cfs (daily average) release at Thurmond Dam

Drought Trigger Action Levels



Balanced Multiple Purposes



- Flood Risk Management
- Navigation
- Hydropower
- Recreation
- Fish and Wildlife
- Water Quality
- Water Supply

Flood Management

Channel Capacity = 30,000 cfs (850 cms)

Seasonally Varying Flood Storage

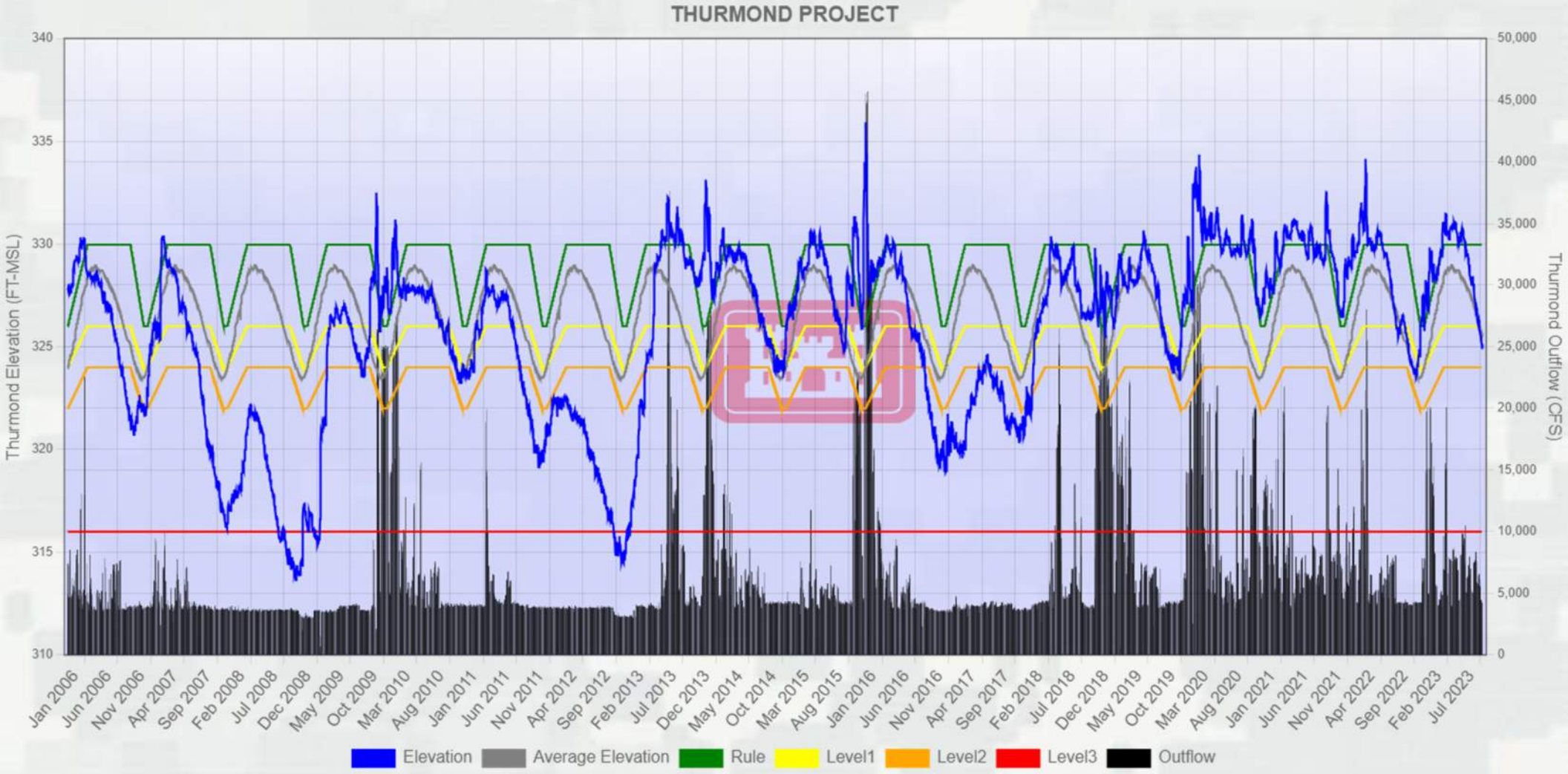
- (Hartwell and Thurmond)

Operate as a system

- Minimize Downstream Flooding
- Evacuate Flood Storage in most downstream project first
- Induce Flood Surcharge Storage if necessary

Flood Damages Prevented (Cumulative)

- Hartwell $68,887,000
- Russell $23,545,000
- Thurmond $114,639,000


THURMOND PROJECT
Thurmond Elevation (FT-MSL)
Thurmond Outflow (CFS)
340
335
330
325
320
315
310
50,000
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Jan 2006
Jun 2006
Nov 2006
Apr 2007
Sep 2007
Feb 2008
Jul 2008
Dec 2008
May 2009
Oct 2009
Mar 2010
Aug 2010
Jan 2011
Jun 2011
Nov 2011
Apr 2012
Sep 2012
Feb 2013
Jul 2013
Dec 2013
May 2014
Oct 2014
Mar 2015
Aug 2015
Jan 2016
Jun 2016
Nov 2016
Apr 2017
Sep 2017
Feb 2018
Jul 2018
Dec 2018
May 2019
Oct 2019
Mar 2020
Aug 2020
Jan 2021
Jun 2021
Nov 2021
Apr 2022
Sep 2022
Feb 2023
Jul 2023
Elevation
Average Elevation
Rule
Level1
Level2
Level3
Outflow

Weekly Declaration

To: SEPA
To: CESAD
From: (CESAS-EN-H)

1 Week Declaration
SAVANNAH RIVER SYSTEM
Revised 2/7/2024 10:40

1 Reset=0 | 1 Iteration Increment

Usable Pump Window(HRS): 10.00

TGen (Sched/Observed): 0.999
Allowed Imbalance: 0.00

		0:00 SOP POOL (FT-MSL)	RULE CURVE (FT-MSL)	STARTING STORAGE (AC-FT)	NET TOTAL INFLOW (CFS)	LOCAL IN (CFS)	NATURAL IN (CFS)	GEN TOTAL OUT (CFS)	TOTAL SPILL (CFS)	EST GEN (MWH)	DAILY TOTAL MIN GEN (MWH)	DAILY TOTAL MAX GEN (MWH)	EST PUMP (AC-FT)	ENDING STORAGE (AC-FT)	COMP ENDING POOL (FT-MSL)	RAINFALL (INCHES)	Hart Inf HART	RBR Inf RBR	JST Inf JST
HARTWELL	Wed 31-Jan-2024	659.75	657.29	2535750	5157	5157	5157	14712	0	4808			n/a	2516774	659.41		660.00	475.00	330.00
	Thu 01-Feb-2024	659.75	657.33	2535750	8288	8288	8288	8847	0	2913			n/a	2534640	659.73		1500	100	1200
	Fri 02-Feb-2024	659.73	657.38	2534642	2707	2707	2707	8857	0	2910			n/a	2522429	659.51		0		
	Sat 03-Feb-2024	659.51	657.42	2522454	2512	2512	2512	6705	0	2204			n/a	2514127	659.36		1.00	1.00	1.00
	Sun 04-Feb-2024	659.36	657.47	2514144	5237	5237	5237	6635	0	2204			n/a	2511368	659.31		1.0	1.0	1.2
	Mon 05-Feb-2024	659.31	657.51	2511374	3476	3476	3476	6272	0	2110			n/a	2505822	659.21			7050	
	Tue 06-Feb-2024	659.21	657.56	2505834	1561	1561	1561	6872	0	2213	250	250	n/a	2495287	659.02			0	
	Wed 07-Feb-2024	659.02	657.60	2495308	2802	1500	2802	6470	0	2130	1880	2380	n/a	2488024	658.89				
	Thu 08-Feb-2024	658.89	657.64	2488024	2802	1500	2802	6250	0	2057	1807	2307	n/a	2481177	658.76				
	Fri 09-Feb-2024	658.76	657.69	2481177	2802	1500	2802	6250	0	2057	1807	2307	n/a	2474331	658.64				
	Sat 10-Feb-2024	658.64	657.73	2474331	5761	4458	5761	0	0	0	0	250	n/a	2485772	658.85	1.25			
	Sun 11-Feb-2024	658.85	657.78	2485772	8224	6921	8224	0	0	0	0	250	n/a	2502104	659.14	0.50			
	Mon 12-Feb-2024	659.14	657.82	2502104	9086	7784	9086	5815	0	1914	1664	2164	n/a	2508600	659.26	0.50			
	Tue 13-Feb-2024	659.26	657.87	2508600	6293	4991	6293	5817	0	1915	1665	2165	n/a	2509546	659.28				
	Wed 14-Feb-2024	659.28	657.91	2509546	5302	3999	5302	5817	0	1915	1665	2165	n/a	2508523	659.26				
	Thu 15-Feb-2024	659.26	657.96	2508523	4706	3403	4706	5817	0	1915	1665	2165	n/a	2506316	659.22				
	Fri 16-Feb-2024	659.22	658.00	2506316	4199	2896	4199	5817	0	1915	1665	2165	n/a	2503101	659.16				
					NET	LOC	NAT			GEN	MIN	MAX					PUMP HR	PUMP CFS	AVL UNITS
RUSSELL	Wed 31-Jan-2024	474.82	475.00	1016153	14761	49	5206	17432	0	4666			0	1010849	474.42		0	0	2
	Thu 01-Feb-2024	474.42	475.00	1010872	9758	912	9200	9761	0	2619			0	1010867	474.42		0	0	2
	Fri 02-Feb-2024	474.42	475.00	1010872	9390	533	3240	9800	0	2634			0	1010057	474.39		0	0	2
	Sat 03-Feb-2024	474.39	475.00	1010082	6197	-508	2004	10450	0	2803			0	1001636	474.07		0	0	2
	Sun 04-Feb-2024	474.07	475.00	1001681	6862	227	5464	10424	0	2792			0	994606	473.80		0	0	2
	Mon 05-Feb-2024	473.80	475.00	0994634	6917	645	4121	10201	0	2739			0	988113	473.55		0	0	2
	Tue 06-Feb-2024	473.55	475.00	0988143	6508	-364	1197	10164	0	2721	250	250	0	980881	473.27		0	0	2
	Wed 07-Feb-2024	473.27	475.00	0980910	6570	100	2902	9199	0	2467	2217	2717	0	975689	473.07		0	0	2
	Thu 08-Feb-2024	473.07	475.00	0975689	6350	100	2902	6250	0	1676	1426	1926	0	975888	473.07		0	0	2
	Fri 09-Feb-2024	473.07	475.00	0975888	6350	100	2902	6250	0	1676	1426	1926	0	976087	473.08		0	0	2
	Sat 10-Feb-2024	473.08	475.00	0976087	333	333	6094	0	0	0	0	250	0	976747	473.11	1.25	0	0	2
	Sun 11-Feb-2024	473.11	475.00	0976747	944	944	9168	0	0	0	0	250	0	978623	473.18	0.75	0	0	2
	Mon 12-Feb-2024	473.18	475.00	0978623	8495	2680	11767	3229	0	866	616	1116	0	989082	473.59	0.50	0	0	2
	Tue 13-Feb-2024	473.59	475.00	0989082	8231	2414	8708	3232	0	867	617	1117	0	999011	473.97		0	0	2
	Wed 14-Feb-2024	473.97	475.00	0999011	7991	2174	7476	3232	0	867	617	1117	0	1008463	474.33		0	0	2
	Thu 15-Feb-2024	474.33	475.00	1008463	7775	1958	6664	3232	0	867	617	1117	0	1017486	474.67		0	0	2
	Fri 16-Feb-2024	474.67	475.00	1017486	7578	1861	6060	3232	0	867	617	1117	0	1026315	475.00		0	0	2
					NET	LOC	NAT			GEN	MIN	MAX					0		
THURMOND	Wed 31-Jan-2024	329.39	327.29	2467300	26475	9042	14248	20122	0	5077			0	2479916	329.57		0.33	0.27	0.25
	Thu 01-Feb-2024	329.53	327.33	2477100	12086	2325	12086	18438	0	4604			0	2464484	329.35		0.33	0.27	0.25
	Fri 02-Feb-2024	329.37	327.38	2465900	13711	3911	13711	18299	0	4598			0	2456788	329.24		0.33	0.27	0.25
	Sat 03-Feb-2024	329.25	327.42	2457500	11995	1546	11995	18348	0	4605			0	2444884	329.07		0.33	0.27	0.25
	Sun 04-Feb-2024	329.09	327.47	2446300	13835	3411	13835	18423	0	4615			0	2437188	328.96		0.33	0.27	0.25
	Mon 05-Feb-2024	328.96	327.51	2437200	11711	1510	11711	18416	0	4613	0	1000	0	2423883	328.77		0.34	0.27	0.25
	Tue 06-Feb-2024	328.81	327.56	2426700	16754	6590	16754	18519	0	4579	3600	30000	0	2423196	328.76		0.32	0.27	0.25
	Wed 07-Feb-2024	328.69	327.60	2418300	11699	2500	11699	12220	0	3056	3056	3306	0	2417265	328.68		0.33	0.27	0.25
	Thu 08-Feb-2024	328.68	327.64	2417265	8952	2702	8952	10000	0	2501	2501	2751	0	2415184	328.65		0.33	0.27	0.25
	Fri 09-Feb-2024	328.65	327.69	2415184	9170	2920	9170	10000	0	2501	2501	2751	0	2413536	328.62		0.33	0.27	0.25
	Sat 10-Feb-2024	328.62	327.73	2413536	9169	9169	9169	7320	0	1831	1831	2081	0	2417209	328.67	1.25	0.33	0.27	0.25
	Sun 11-Feb-2024	328.67	327.78	2417209	11845	11845	11845	7320	0	1831	1831	2081	0	2426195	328.80	1.00	0.33	0.27	0.25
	Mon 12-Feb-2024	328.80	327.82	2426195	14600	11371	14600	7320	0	1831	1831	2081	0	2440653	329.01	0.50	0.33	0.27	0.25
	Tue 13-Feb-2024	329.01	327.87	2440653	9850	6618	9850	7320	0	1831	1831	2081	0	2445678	329.08		0.33	0.27	0.25
	Wed 14-Feb-2024	329.08	327.91	2445678	8676	5444	8676	7320	0	1831	1831	2081	0	2448370	329.12		0.33	0.27	0.25
	Thu 15-Feb-2024	329.12	327.96	2448370	8142	4910	8142	7320	0	1831	1831	2081	0	2450003	329.14		0.33	0.27	0.25
	Fri 16-Feb-2024	329.14	328.00	2450003	7953	4721	7953	7320	0	1831	1831	2081	0	2451260	329.16		0.33	0.27	0.25

	SOP POOL (FT-MSL)	RULE CURVE (FT-MSL)	STARTING STORAGE (AC-FT)	LOCAL IN (CFS)	NATURAL IN (CFS)	TOTAL OUT (CFS)	TOTAL SPILL (CFS)	EST GEN (MWH)	MIN GEN (MWH)	MAX GEN (MWH)	EST PUMP (AC-FT)	ENDING STORAGE (AC-FT)	ENDING POOL (FT-MSL)		HART Gen/Q	0.27 Gen/Q	THUR Gen/Q
Local this week =>				4134	213	4048	18652	4670							0.33	0.27	0.25
																0.00	
Weekly Generation Totals --->				9569	4329	12817											
for week beginning	Sat 10-Feb			Hartwell	Russell	Thurmond											
Weekly Average Discharge				4155	2308	7320											
Previous Week Gen Total Targets				17172	21154	31752											

Week ending Fri 09-Feb-24
26714 (MW-HR) Contracted
70078 Originally Declared
58319 Generated

Week ending Fri 16-Feb-2024
26714 (MW-HR) Contracted
26715 (MW-HR) Declared
Ending Pool Babance 0 ft
80 unit-hours Contracted next week
0 unit-hours Pumping next Week

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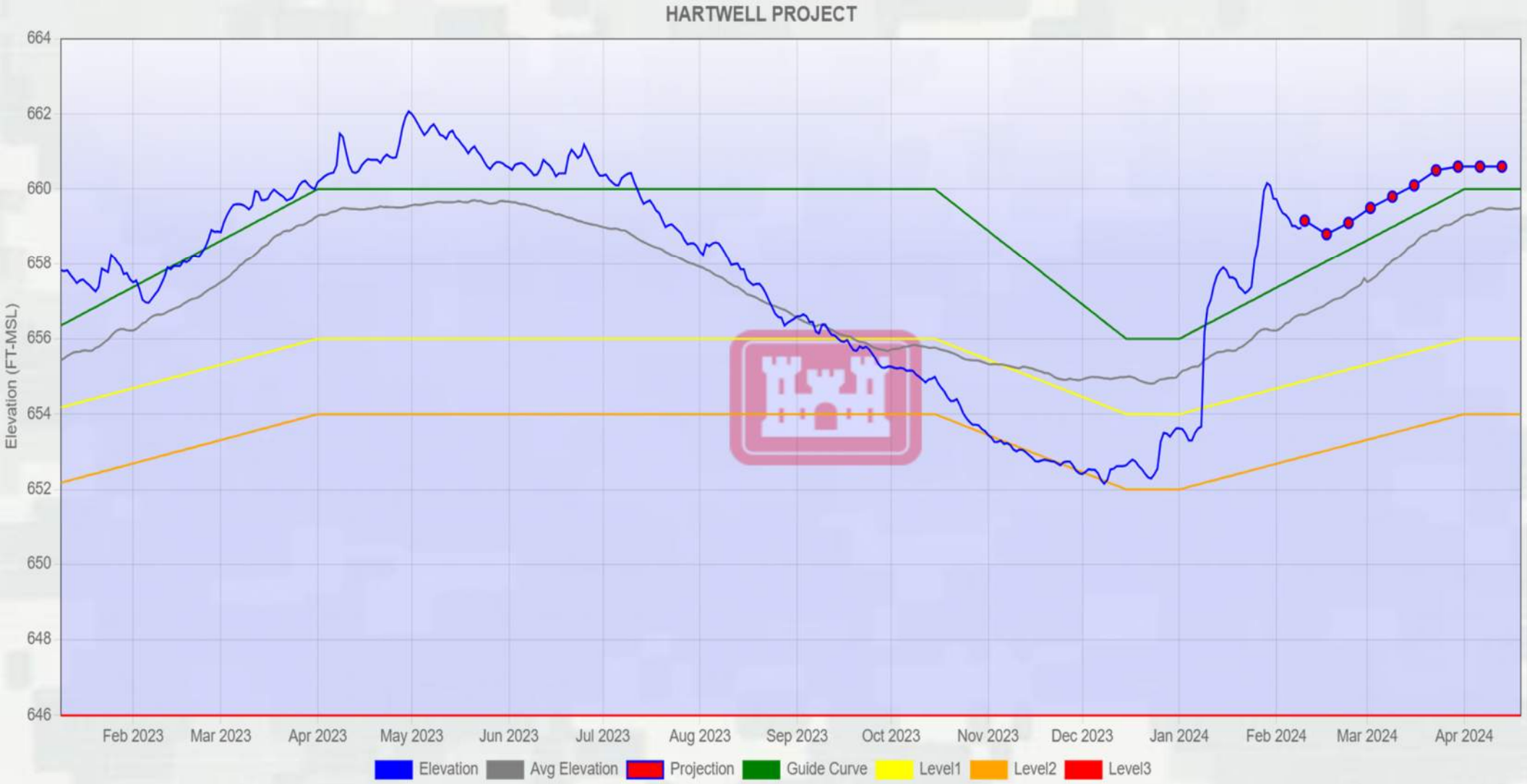
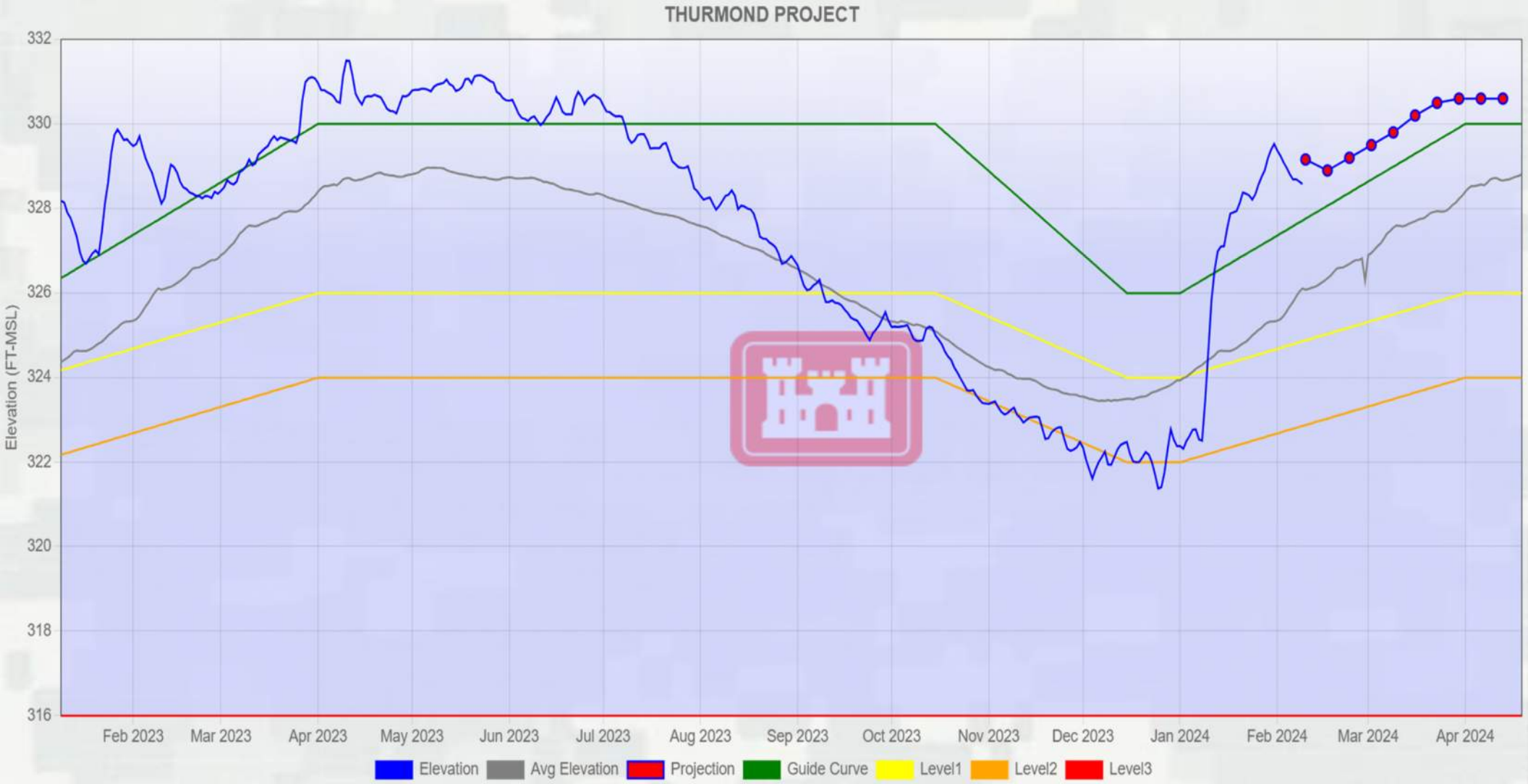
10 Week Projection



BUILDING STRONG®

10 Week Projection



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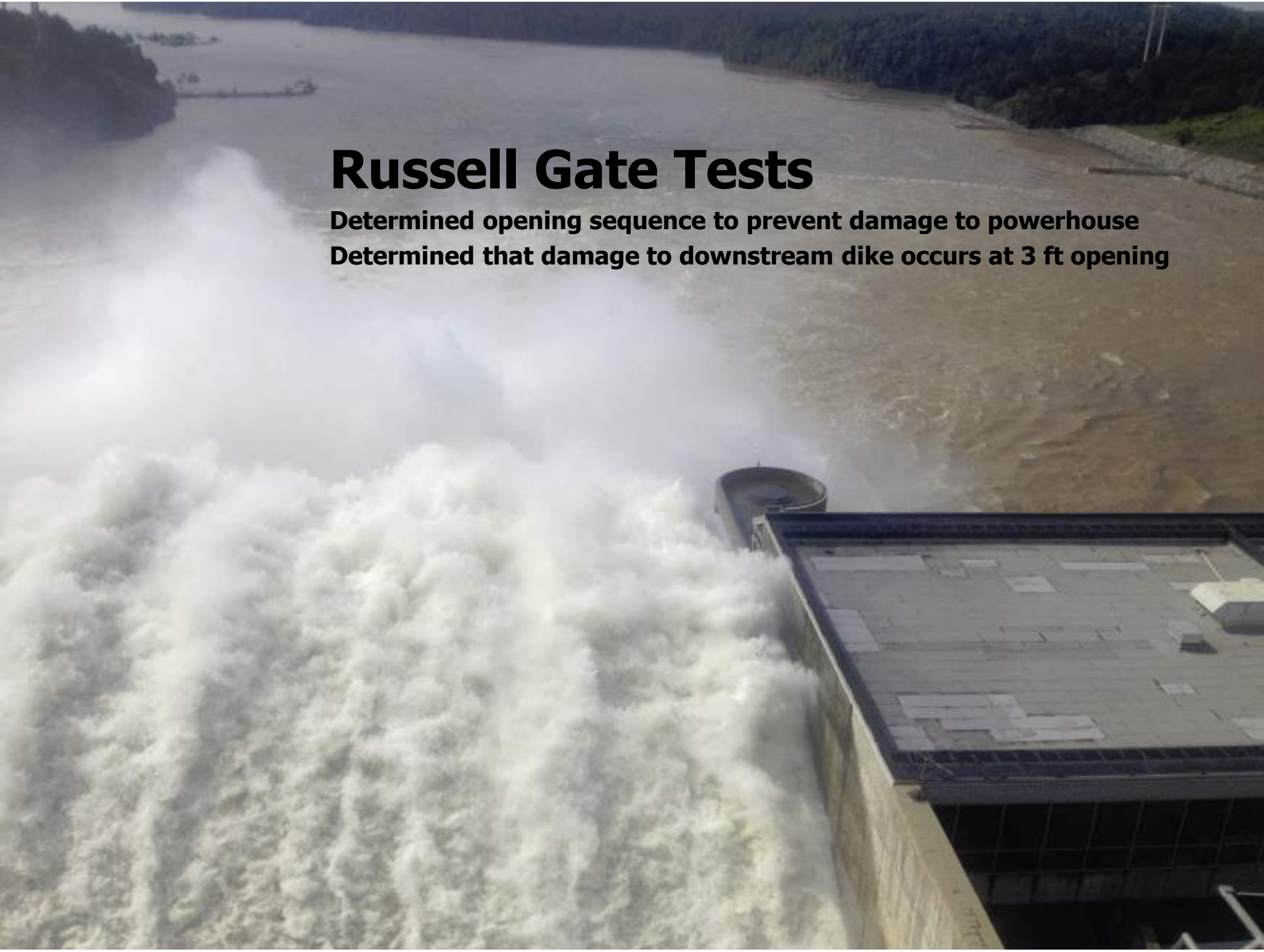
Hartwell Gate Operations

July 2013

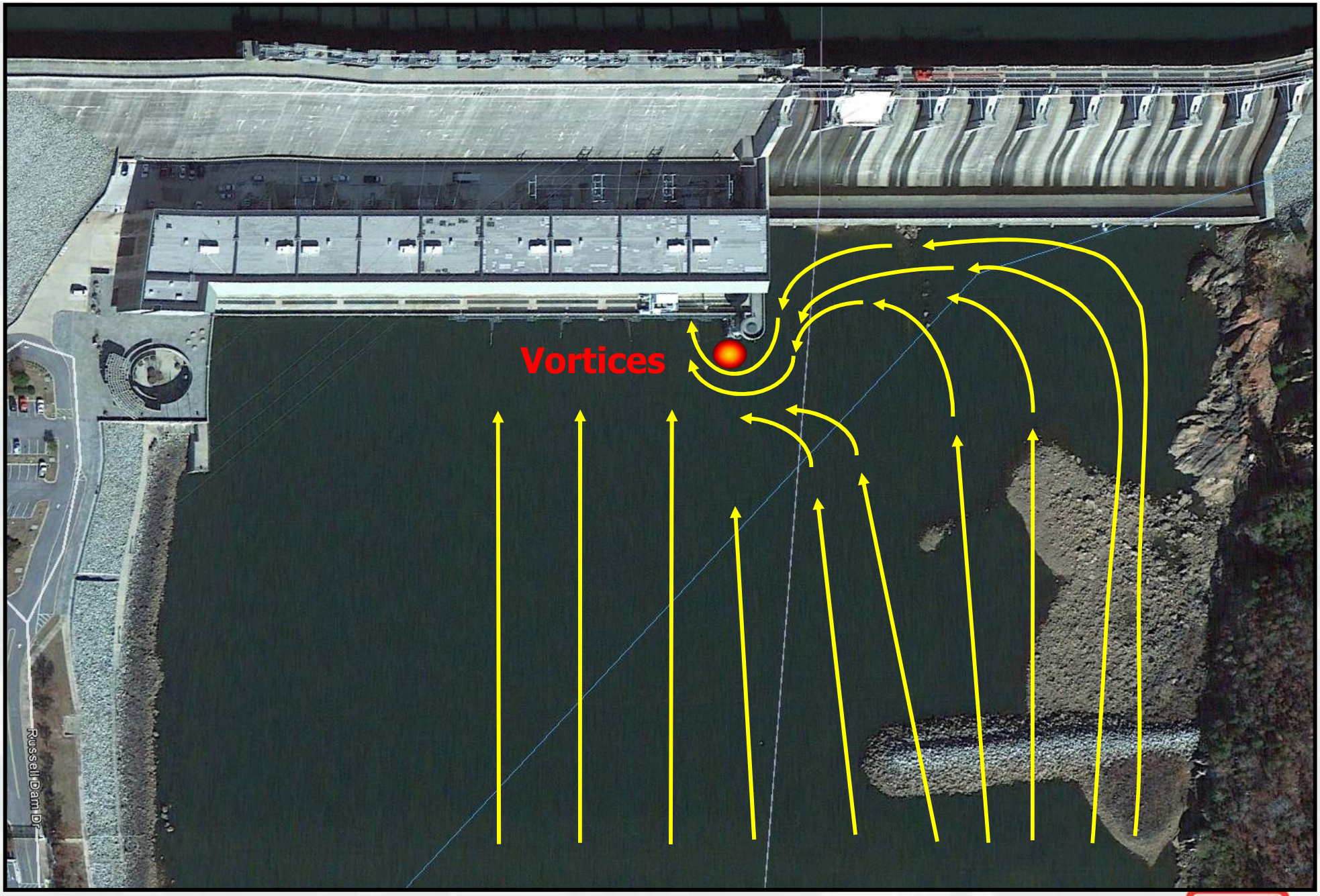


Russell Gate Tests

Determined opening sequence to prevent damage to powerhouse

Determined that damage to downstream dike occurs at 3 ft opening

Russell Gate Tests


Vortices
Russell Dam Dr

Thurmond Gate Tests

Upper Augusta

July 2013

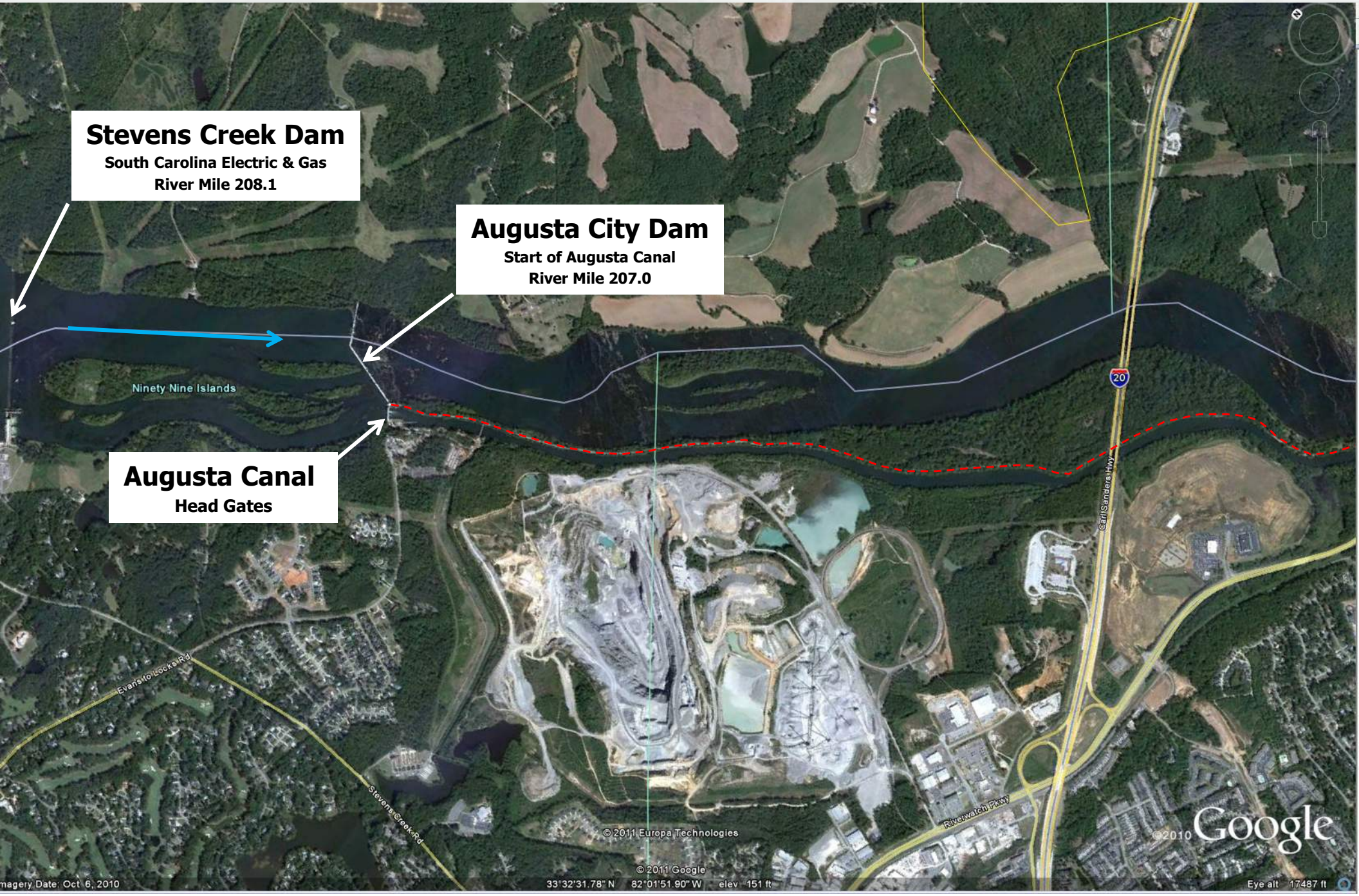
38,000 cfs

River North Subdivision

Augusta Shoals

River Mile 202.8

Upper end of Augusta Levee



Operational Procedures for Emergencies – Appendix C

- Possible Failure of Hartwell
  - ► Rapidly Developing Condition
    - Draw Hartwell down at fast as possible to prevent failure.
    - Minimize releases at Duke and GA Power projects.
    - Notify Emergency Management
      - ▷ Initiate closure of Augusta Levee breaches
      - ▷ Begin downstream evacuations.
    - Initiate Maximum Releases from Russell.
    - Set Thurmond Discharge to…
      - ▷ 30,000 cfs for 2 hours
      - ▷ then increase to 60,000 cfs.
    - Then match Thurmond pool with top of gates as pool rises.
    - Lower Lock & Dam Pool to minimum normal operating level.

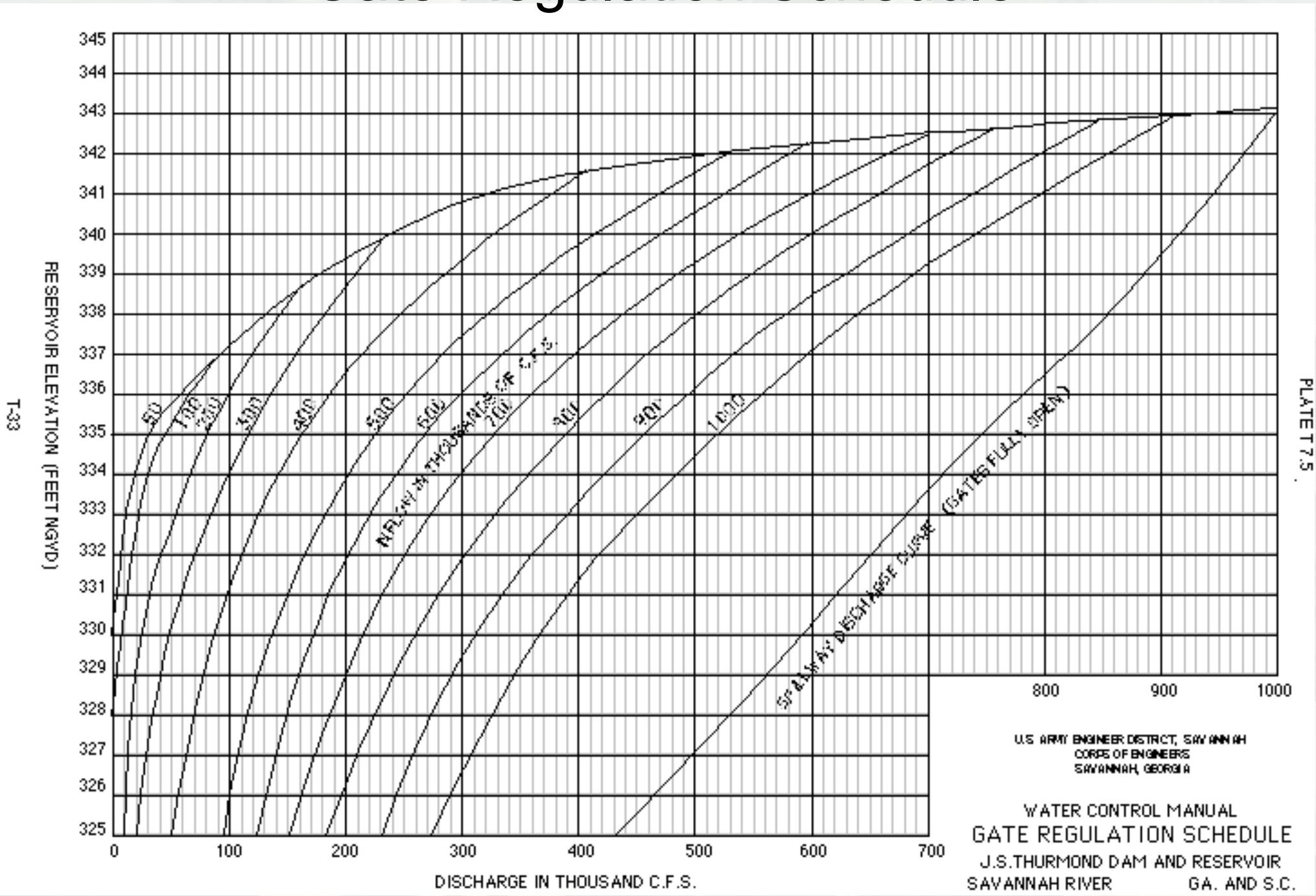
Operational Procedures for Emergencies – Appendix C

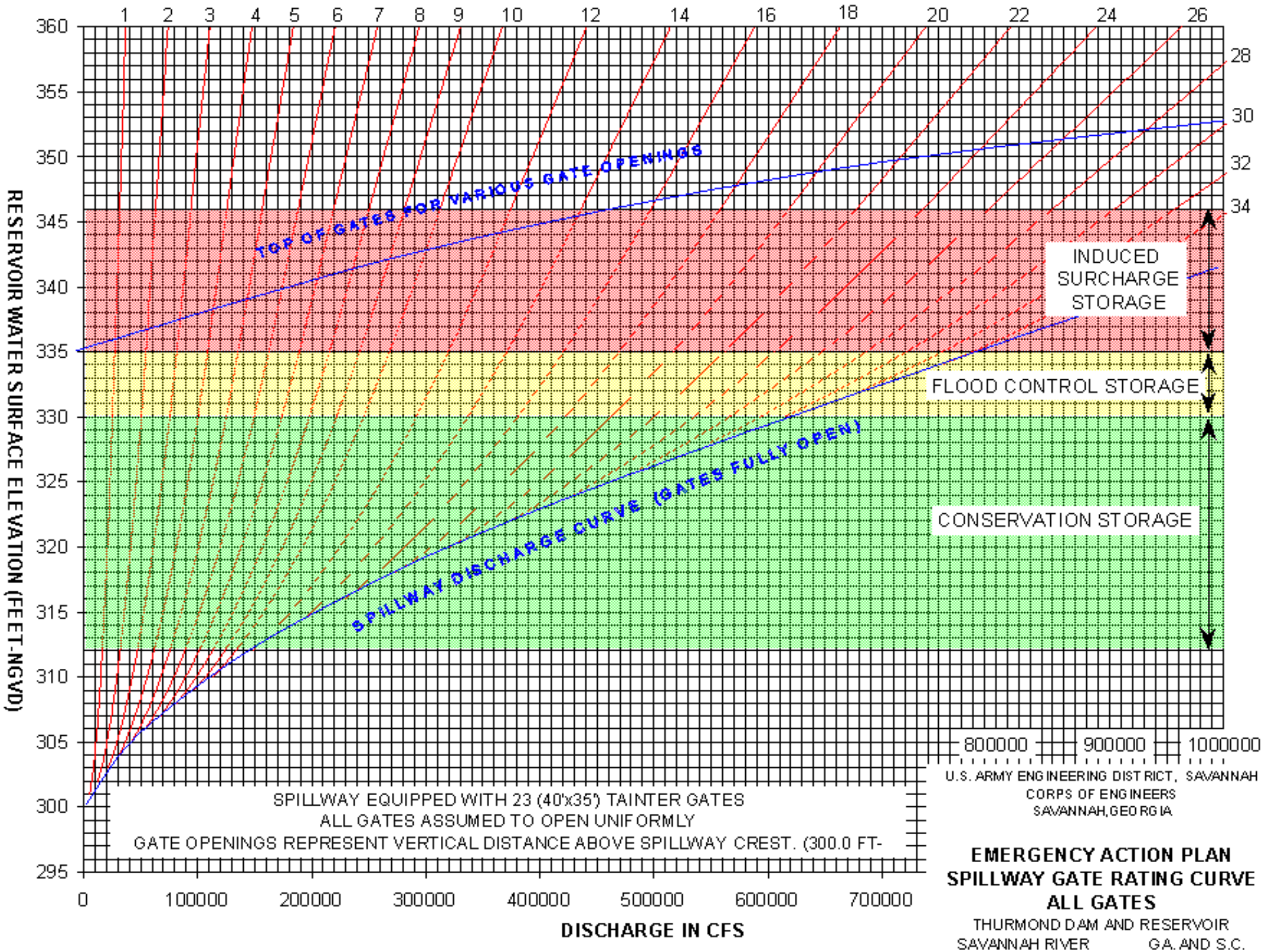
- Possible Failure of Thurmond
  - Slowly Developing Condition
    - Minimize upstream releases
    - Lower Lock & Dam Pool to minimum normal operating level.
    - Notify Emergency Management
      - Initiate closure of Augusta Levee breaches
      - Begin downstream evacuations.
    - Draw Thurmond down to level where failure is not likely to occur.
      - Initially set Thurmond discharge to 30,000 cfs for 2 hours.
      - Then increase Thurmond releases to 60,000 cfs for next 4 hours to allow levee closure is complete.
      - (Then continue to lower pool to spillway crest in 5 days or less)
        - Maintain minimum of 150,000 cfs until failure is not likely to occur.
    - If Engineering Division cannot give estimate of time of failure
      - Assume “Rapidly Developing Condition”.

Operational Procedures for Emergencies – Appendix C

- Possible Failure of Thurmond
  - ► Rapidly Developing Condition
    - Notify Emergency Management
      - ▷ Initiate closure of Augusta Levee breaches
      - ▷ Begin downstream evacuations.
    - Minimize upstream releases
    - Lower Lock & Dam Pool to minimum normal operating level.
    - Set Thurmond releases…
      - ▷ Initially set Thurmond release to 30,000 cfs for 2 hours.
      - ▷ Then increase Thurmond release to 60,000 cfs for next 4 hours to allow levee closure.
        - ○ Relocate non-essential personnel to top of dam.
      - ▷ Then increase Thurmond Discharges to 500,000 cfs.

Thurmond Spillway
Gate Regulation Schedule




RESERVOIR WATER SURFACE ELEVATION (FEET-NGVD)
360
355
350
345
340
335
330
325
320
315
310
305
300
295
1
2
3
4
5
6
7
8
9
10
12
14
16
18
20
22
24
26
28
30
32
34
TOP OF GATES FOR VARIOUS GATE OPENINGS
SPILLWAY DISCHARGE CURVE (GATES FULLY OPEN)
INDUCED SURCHARGE STORAGE
FLOOD CONTROL STORAGE
CONSERVATION STORAGE
0
100000
200000
300000
400000
500000
600000
700000
800000
900000
1000000
DISCHARGE IN CFS
SPILLWAY EQUIPPED WITH 23 (40'x35') TAINTER GATES
ALL GATES ASSUMED TO OPEN UNIFORMLY
GATE OPENINGS REPRESENT VERTICAL DISTANCE ABOVE SPILLWAY CREST. (300.0 FT-
U.S. ARMY ENGINEERING DISTRICT, SAVANNAH
CORPS OF ENGINEERS
SAVANNAH, GEORGIA
EMERGENCY ACTION PLAN
SPILLWAY GATE RATING CURVE
ALL GATES
THURMOND DAM AND RESERVOIR
SAVANNAH RIVER GA. AND S.C.

Spillway Gate Rating for (23 Gates)

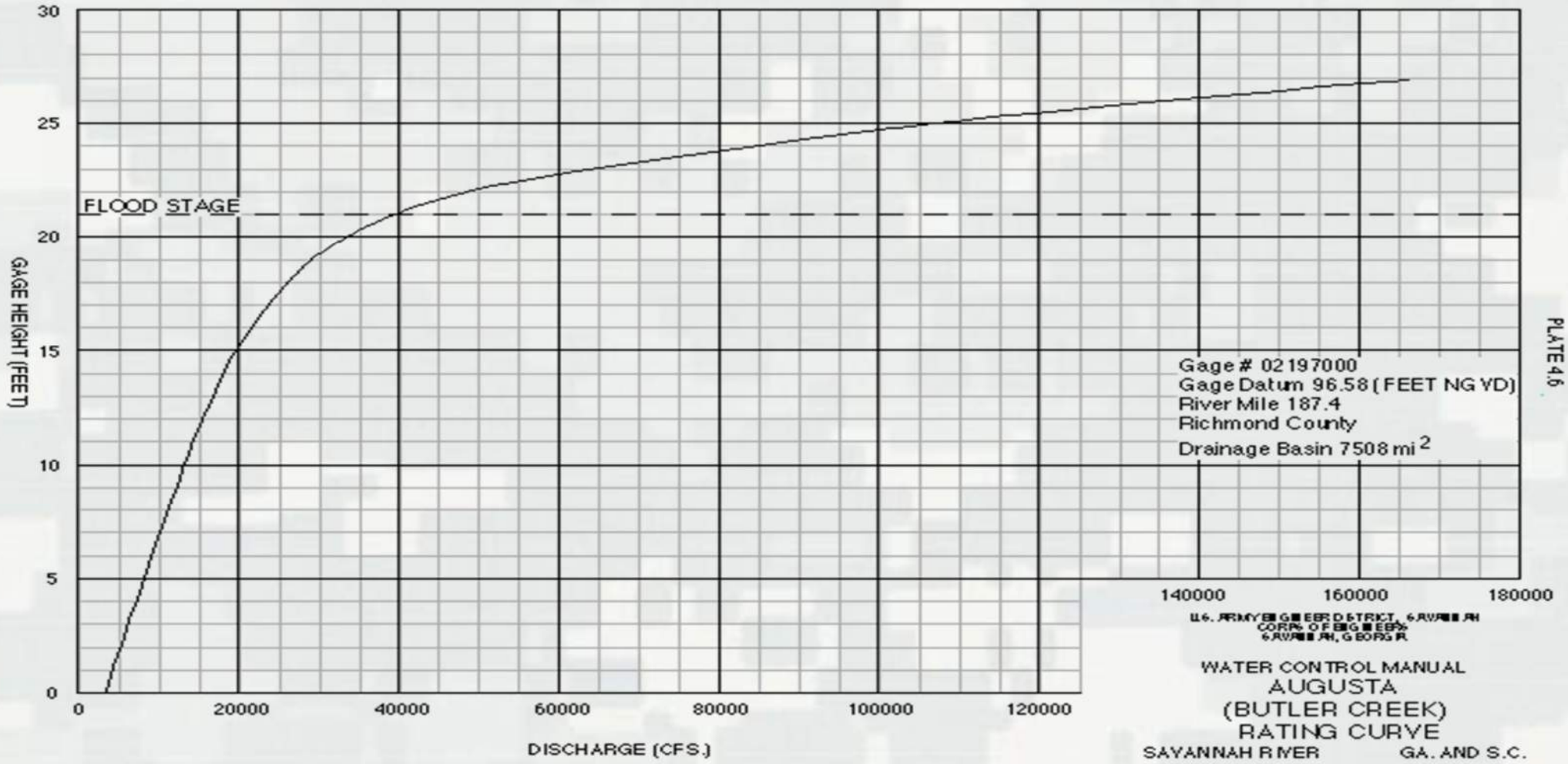
J. Strom Thurmond Dam
Spillway Gate Rating for (23 Gates)

Discharge in CFS
Pool Elevation (FT-MSL)

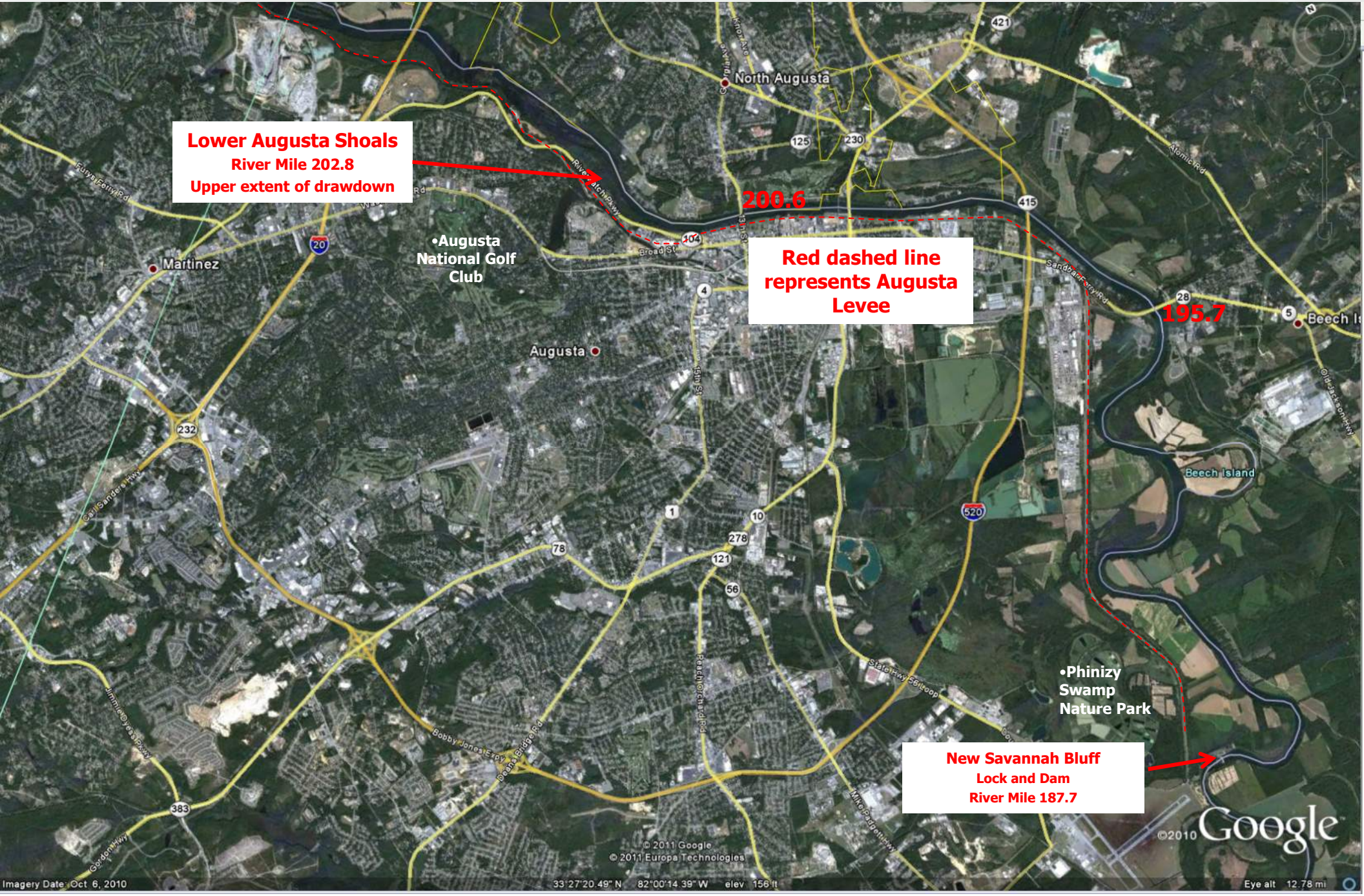
Gate Opening Feet	Top of Gate	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346
1	335.90	18507	19063	19604	20130	20643	21144	21633	22111	22579	23037	23487	23928	24361	24786	25204	25616	26021	26420	26812	27200											
2	336.78	36664	37802	38906	39980	41025	42045	43040	44013	44965	45897	46810	47707	48586	49450	50299	51134	51955	52764	53560	54345	55119										
3	337.64	54443	56187	57879	59523	61123	62681	64202	65687	67140	68562	69954	71320	72660	73976	75268	76539	77789	79019	80231	81424	82600	83759									
4	338.47	71810	74190	76496	78735	80911	83030	85096	87113	89084	91012	92900	94751	96566	98347	100097	101817	103508	105171	106809	108422	110011	111578	113123								
5	339.29	88730	91778	94727	97587	100364	103066	105699	108267	110776	113229	115629	117981	120286	122548	124769	126951	129096	131206	133282	135326	137340	139325	141282	143212							
6	340.07	105165	108915	112539	116048	119454	122764	125986	129127	132194	135190	138121	140990	143803	146561	149267	151926	154538	157107	159635	162123	164573	166987	169367	171713	174028						
7	340.84	121070	125562	129896	134087	138150	142094	145931	149669	153314	156874	160354	163760	167096	170366	173574	176724	179818	182860	185852	188796	191694	194550	197364	200138	202874						
8	341.59	136398	141676	146759	151668	156419	161028	165506	169864	174112	178257	182307	186268	190146	193946	197672	201328	204919	208448	211917	215331	218690	221999	225259	228472	231641	234766					
9	342.31	151093	157208	163085	168751	174226	179531	184680	189686	194561	199315	203956	208493	212932	217279	221540	225720	229823	233854	237815	241712	245546	249321	253039	256703	260315	263877	267392				
10	343.01	165091	172103	178825	185291	191531	197568	203419	209103	214632	220020	225276	230411	235431	240345	245159	249880	254512	259060	263529	267922	272244	276498	280688	284815	288882	292893	296849	300753			
11	343.70	178315	186294	193921	201241	208290	215098	221689	228082	234296	240344	246241	251996	257620	263121	268508	273788	278965	284048	289039	293945	298770	303517	308190	312793	317329	321800	326209	330559			
12	344.36	190673	199707	208311	216544	224454	232078	239448	246587	253517	260256	266820	273222	279473	285584	291564	297422	303164	308798	314329	319763	325105	330360	335531	340623	345640	350583	355458	360265	365009		
13	345.00	202047	212248	221916	231134	239965	248459	256652	264578	272261	279723	286984	294059	300963	307707	314303	320759	327086	333290	339378	345357	351232	357010	362694	368289	373799	379228	384580	389858	395064	400202	
14	345.63	212280	223799	234643	244934	254759	264182	273252	282009	290486	298708	306699	314478	322061	329464	336699	343777	350708	357502	364165	370707	377133	383448	389660	395773	401791	407720	413562	419321	425002	430607	
15	346.23	221142	234201	246373	257851	268758	279183	289191	298832	308147	317170	325928	334443	342737	350826	358726	366449	374007	381411	388670	395793	402786	409657	416413	423059	429600	436041	442387	448641	454809	460893	466896
16	346.81	228233	243224	256948	269765	281868	293384	304402	314988	325196	335065	344630	353919	362956	371762	380354	388748	396957	404994	412869	420592	428172	435617	442933	450128	457206	464175	471039	477802	484470	491045	497532
17	347.37		250465	266135	280515	293967	306689	318807	330412	341573	352341	362760	372864	382681	392237	401552	410644	419531	428224	436738	445083	453269	461306	469200	476961	484594	492106	499502	506788	513969	521049	528032
18	347.91			273531	289870	304898	318978	332311	345025	357213	368942	380268	391232	401871	412214	422285	432107	441698	451075	460252	469241	478054	486703	495194	503539	511743	519814	527758	535582	543290	550888	558381
19	348.44				297423	314423	330090	344792	358731	372036	384801	397095	408974	420481	431652	442517	453102	463428	473516	483382	493040	502503	511784	520893	529840	538633	547280	555789	564165	572416	580547	588562
20	348.94					322136	339789	356090	371408	385946	399837	413175	426031	438459	450505	462205	473591	484687	495516	506099	516451	526589	536526	546274	555843	565244	574485	583575	592521	601330	610008	618561
21	349.42						347665	365966	382893	398821	413955	428428	442335	455748	468723	481305	493532	505435	517040	528371	539447	550286	560902	571311	581525	591554	601408	611097	620630	630013	639254	648359
22	349.88							374008	392949	410498	427031	442756	457806	472279	486246	499765	512881	525632	538051	550164	561994	573562	584885	595980	606860	617539	628027	638334	648471	658446	668266	677938
23	350.32								401161	420736	438902	456036	472347	487971	503006	517525	531585	545232	558506	571439	584057	596386	608444	620252	631823	643174	654317	665264	676024	686608	697025	707282
24	350.73									429120	449326	468103	485834	502728	518923	534517	549584	564183	578360	592155	605600	618723	631548	644096	656386	668434	680255	691862	703266	714480	725511	736369
25	351.13										457885	478715	498100	516424	533898	550661	566811	582425	597560	612265	626578	640534	654160	667481	680518	693290	705814	718104	730175	742037	753702	765181
26	351.50											487452	508903	528893	547806	565856	583184	599889	616046	631716	646947	661778	676243	690371	704187	717712	730965	743964	756724	769257	781577	793695
27	351.85												517821	539889	560479	579978	598603	616493	633750	650450	666653	682408	697755	712728	727357	741667	755679	769413	782887	796115	809112	821889
28	352.18													548990	571672	592859	612942	632138	650588	668395	685635	702370	718648	734510	749991	765120	779923	794421	808636	822584	836280	849740
29	352.48														580958	604251	626032	646697	666462	685470	703825	721604	738868	755668	772044	788031	803660	818955	833940	848635	863056	877221
30	352.76															613725	637625	659999	681242	701574	721139	740041	758357	776150	793470	810359	826852	842979	858767	874237	889412	904307
31	353.02																647291	671796	694759	716579	737476	757596	777042	795895	814215	832055	849456	866454	883080	899359	915315	930968
32	353.24																	681655	706763	730313	752708	774168	794841	814831	834219	853066	871425	889337	906840	923963	940733	957174
33	353.44																		716818	742526	766662	789629	811652	832876	853409	873330	892704	911580	930004	948010	965630	982892
34	353.62																			752779	779085	803805	827344	849927	871702	892776	913231	933129	952523	971457	989967	1008084
35	353.76																				789539	816442	841744	865853	888995	911320	932935	953921	974344	994255	1013699	1032712
36	353.87																					822904	850262	876013	900566	924146	946904	968946	990355	1011195	1031519	1051371
37	353.95																						856724	884531	910726	935717	959730	982915	1005379	1027206	1048459	1069191
38	353.99																							890993	919244	945877	971300	995741	1019348	1042230	1064469	1086131
39	354.00																								925706	954395	981461	1007311	1032174	1056199	1079494	1102142
40	353.96																									960857	989979	1017472	1043745	1069025	1093463	1117166

When do damages occur?

(It depends on where you are)



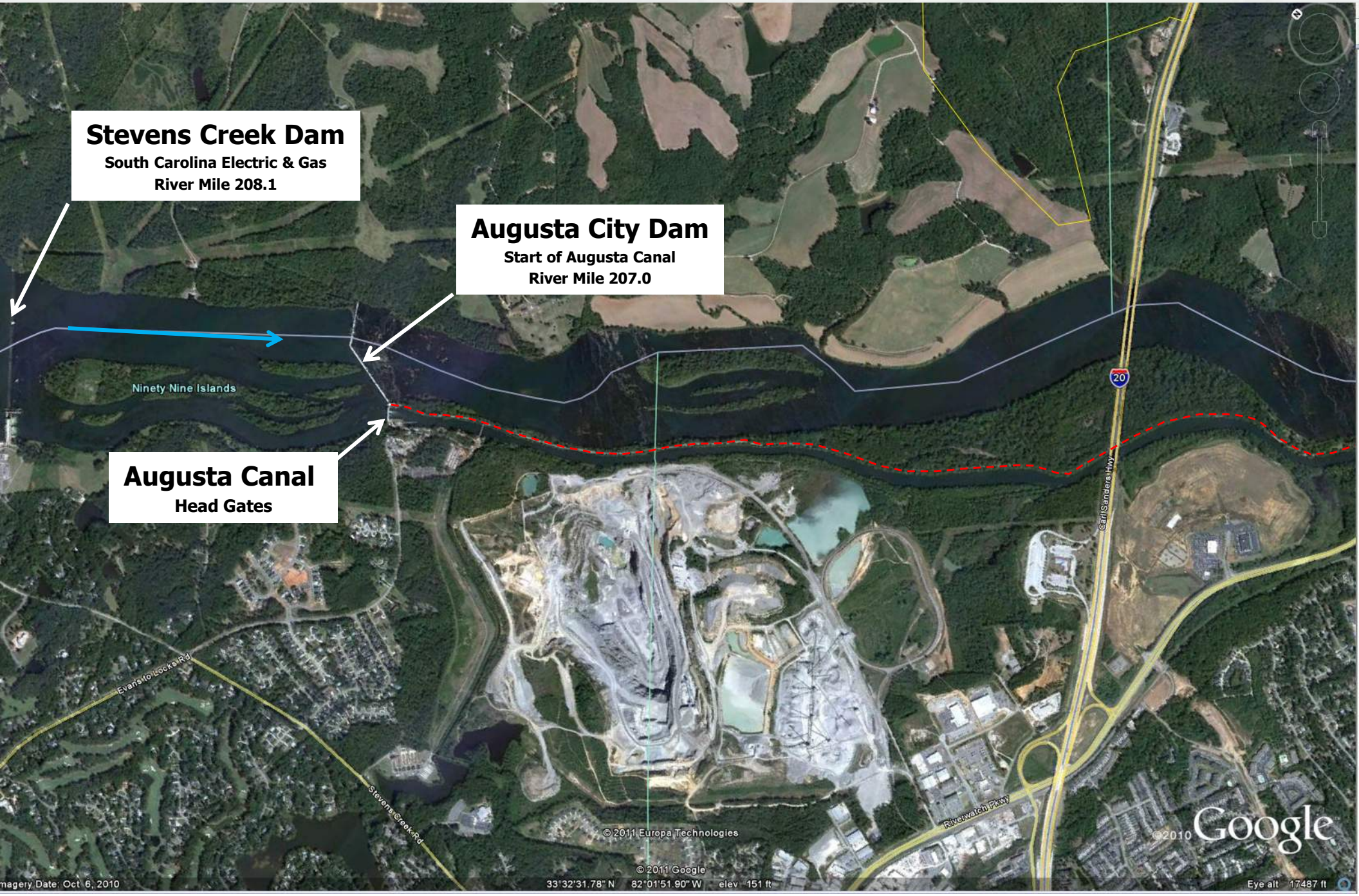
Savannah River at Augusta



Augusta Shoals

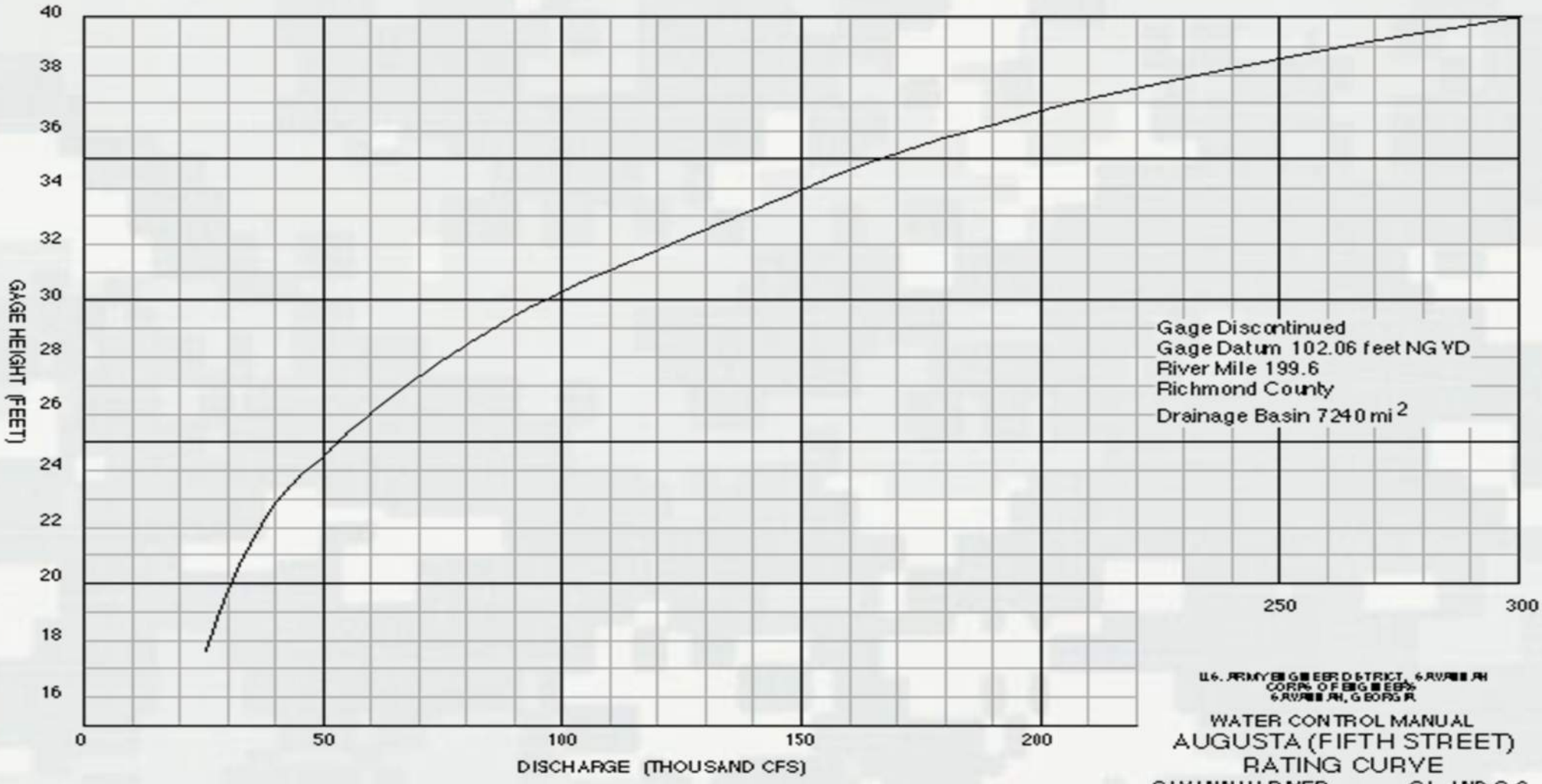
River Mile 202.8

Upper end of Augusta Levee



•Top of Levee ~ 52 ft, 154 ft-msl, (550,000 cfs)

5th Street Downtown Augusta



B-6

PLATE 45

•Normal Pool ~ 15 ft, (<30,000)

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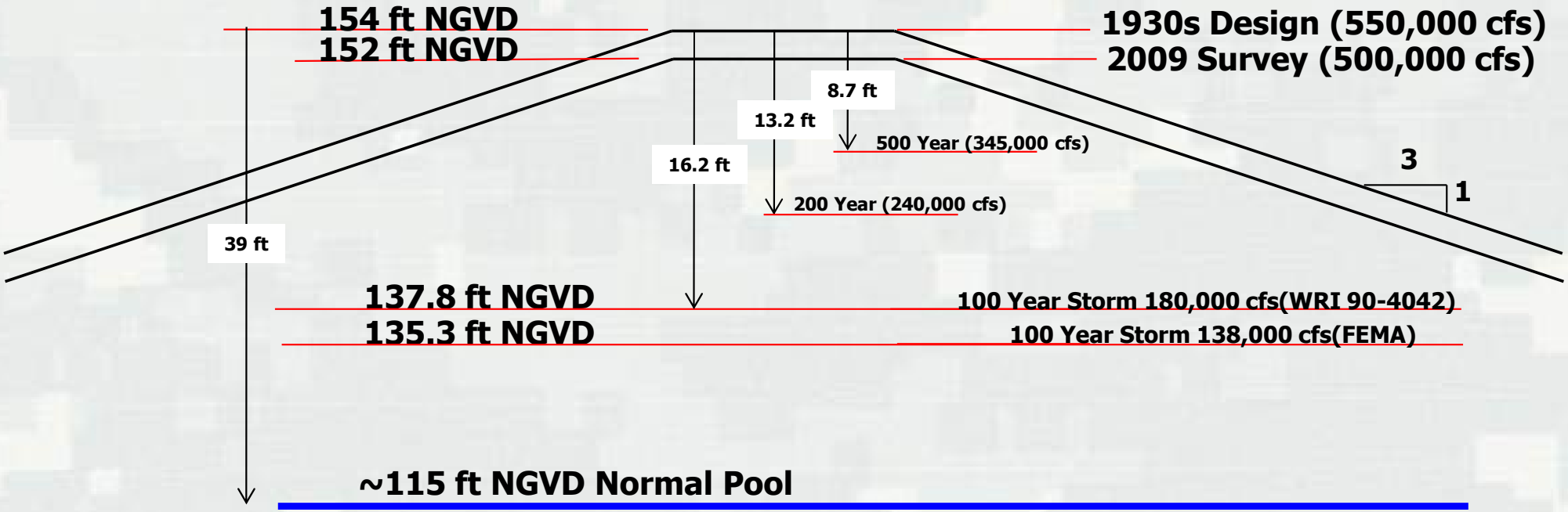
Condition of the Augusta Levee



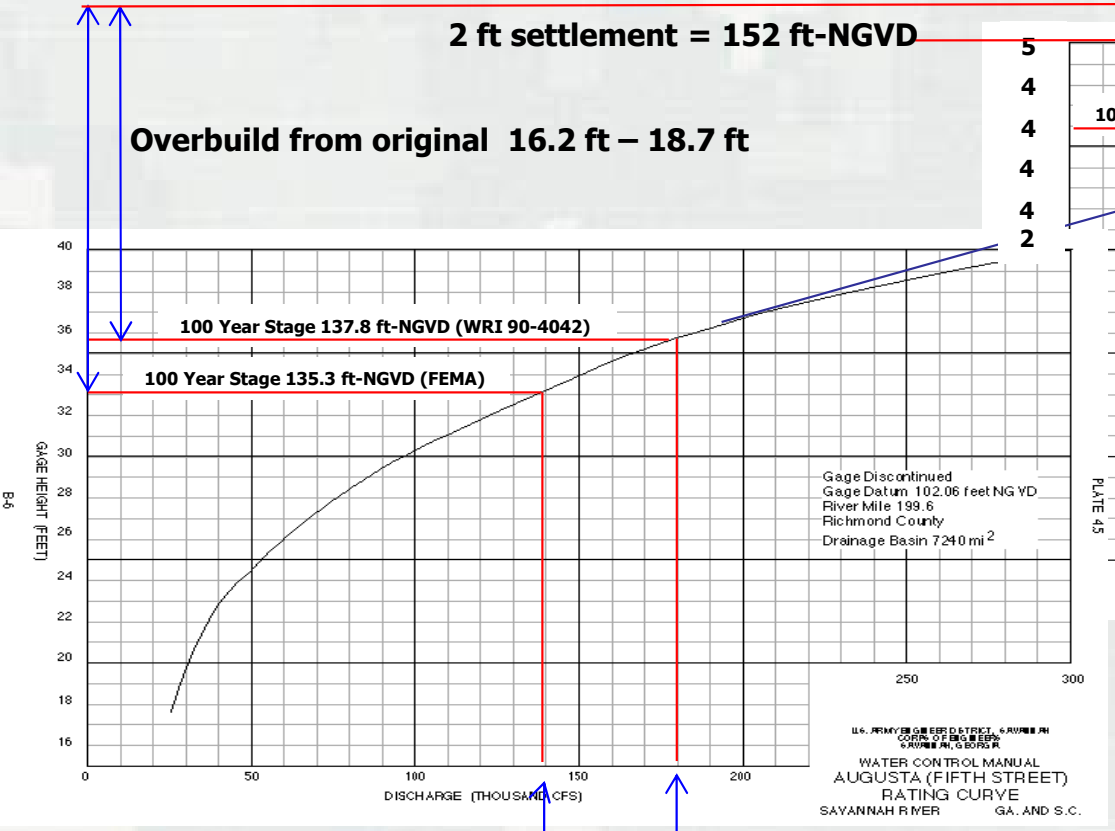
500,000 cfs unregulated = 0.1 % exceedance (1000 yr)
0.1 % exceedance regulated = 410,000 cfs (1000 yr)
0.2 % exceedance regulated = 345,000 cfs (500 yr)
0.5 % exceedance regulated = 240,000 cfs (200 yr)

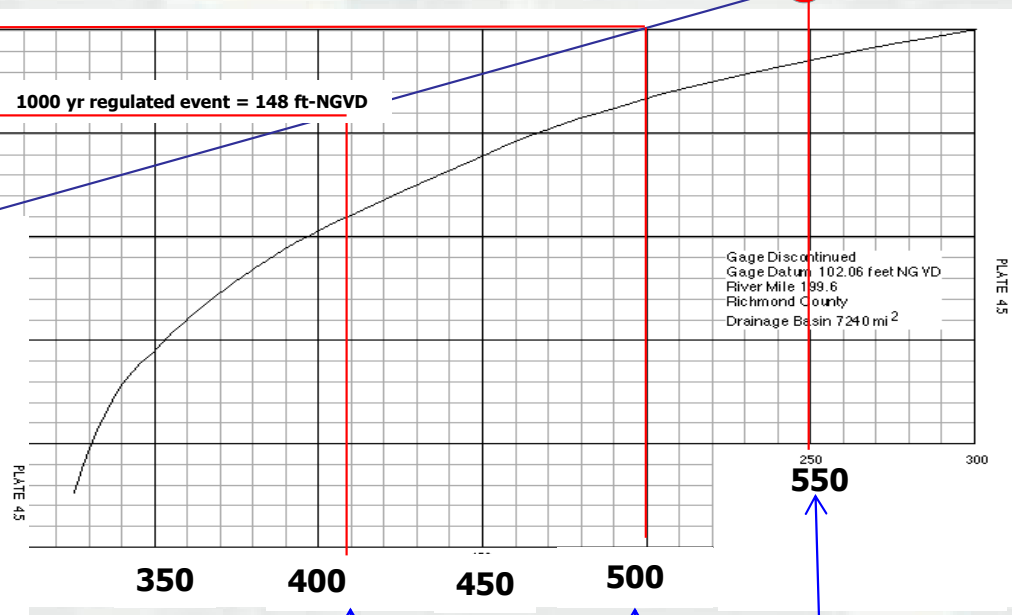
Condition of the Augusta Levee

~52 = 154 ft-NGVD Design Storm

2 ft settlement = 152 ft-NGVD

Overbuild from original 16.2 ft – 18.7 ft





Design Level of Protection
550,000 cfs (1930s)

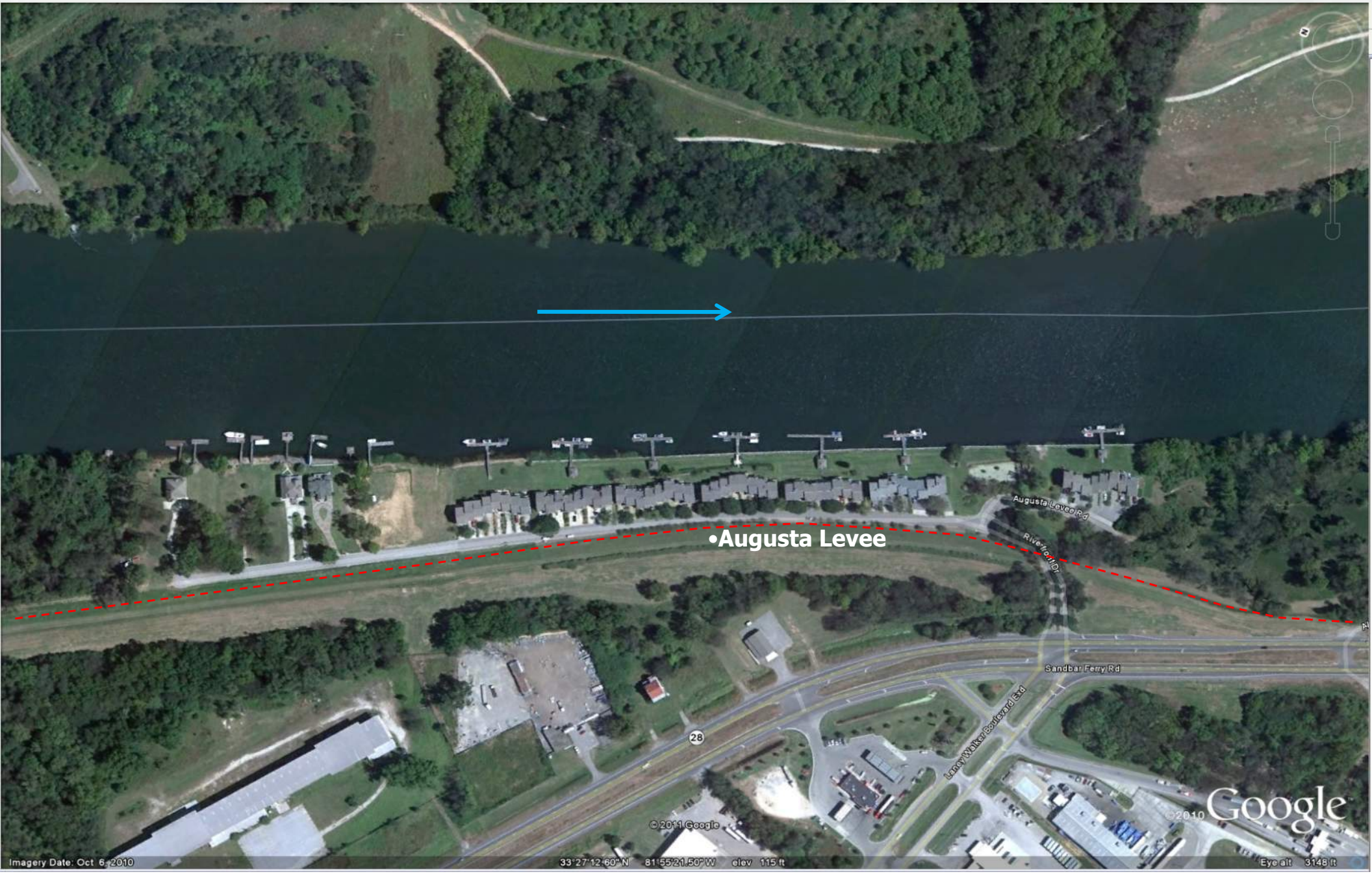
Current Level of Protection
500,000 cfs

100 Year regulated Storm (FEMA)
138,000 cfs

100 Year regulated Storm (WRI Report 90-4024)
180,000 cfs

From WRI Report 90-4024
0.1 % Unregulated event = 500,000 cfs (1000 yr)
0.1% Regulated event= 410,000 cfs

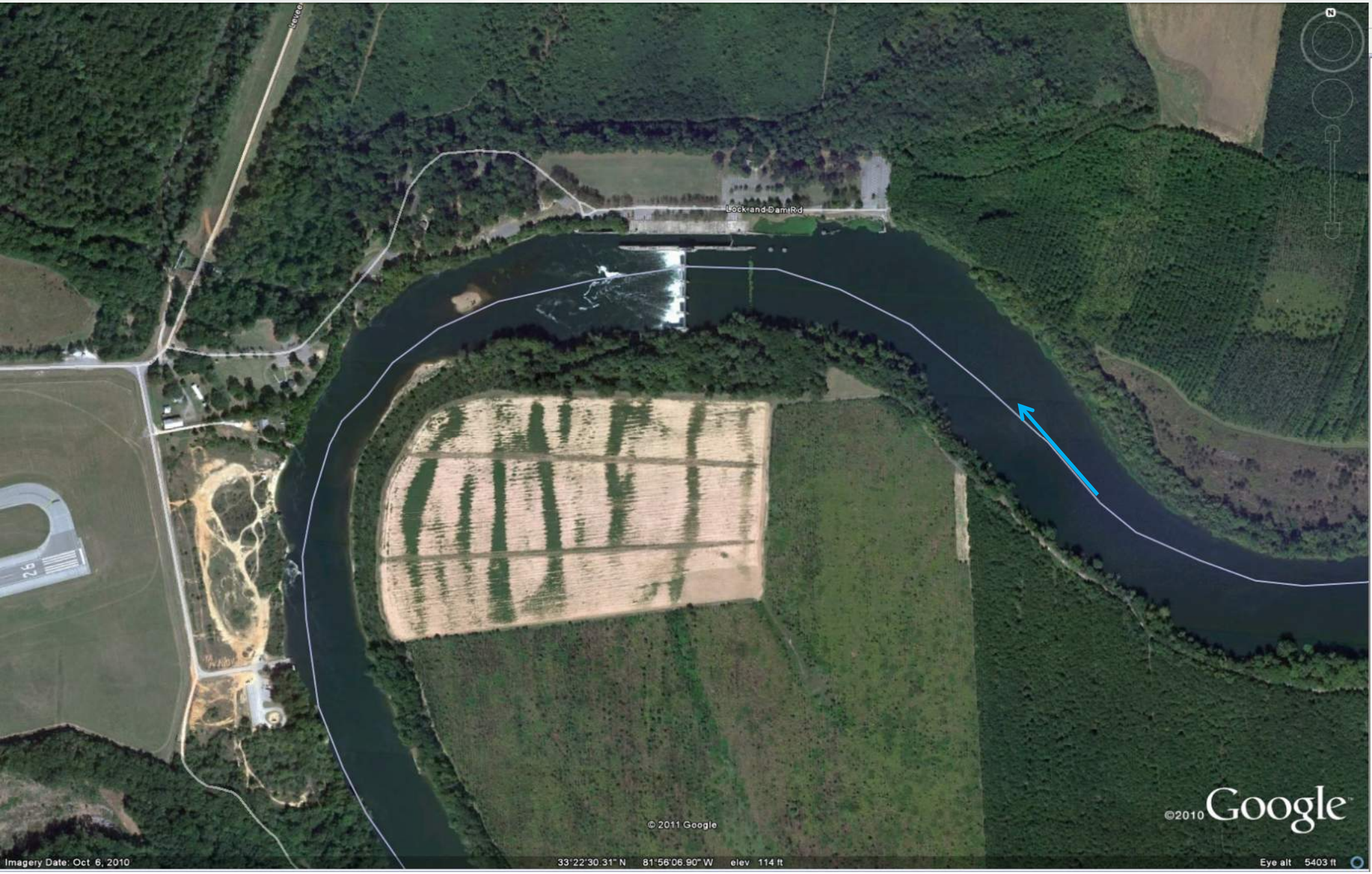
Encroachment into floodplain



Dropped from Federal Levee Program

New Savannah Bluff Lock and Dam

Obstacle to fish Migration



Hydropower at the Corps Projects

- SEPA South Eastern Power Administration
  - ► US Department of Energy
- Market Hydropower at the Corps of Engineers Projects for the Southeastern U.S.
  - ► Georgia Alabama System (10 projects)
  - ► Savannah System > 60% of total
- Dedicated to providing power to the Rural Communities

Shortnose Sturgeon

Although this population of shortnose sturgeon was once one of the largest in US waters, construction of New Savannah Bluff Lock and Dam (NSBLD) in 1929 impeded access to historical shortnose sturgeon spawning habitat.

Shortnose Sturgeon

Acipenser brevirostrum (brevi – short, Rostrum – beak, snout

Spawning may occur 1-16 years after reaching maturity (females at age 6) and may skip 3-10 years between spawning

Amphidromous – spawn in freshwater but move between fresh and saltwater to feed

Spawning takes place in February in swift moving freshwater rocky or gravel substrates

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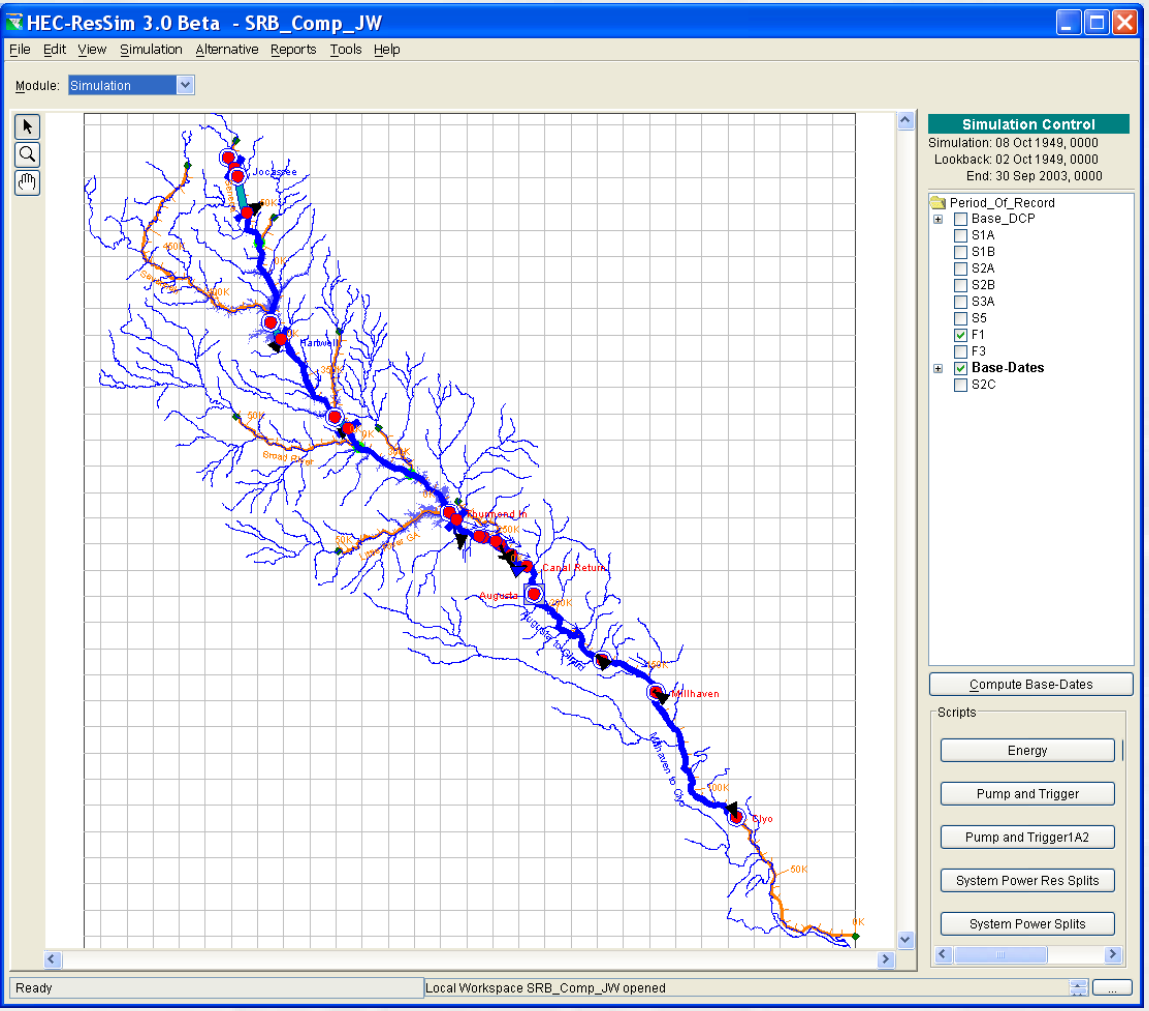
Controlled Flood Pulse vs. Flood Control

USACE Modeling Tools
HEC-ResSim



Reservoir Operation Model

Helps evaluate tradeoffs with new reservoir operation criteria

Water Management Web Page

Https://water.sas.usace.army.mil

US Army Corps of Engineers

Savannah District Water Management

Jan 25, 2023 11:04	HARTWELL	RUSSELL	THURMOND
Current Pool Elevation	657.92	473.96	328.70
Guide Curve Elevation	657.02	475.00	327.02
Average Elevation	656.04	474.09	325.01
Todays Precip (in)	0.30	0.10	0.11
Monthly Precip (in)	6.39	5.69	5.71

MORNING REPORT

HOURLY PROJECT DATA

DECLARATIONS

POOL SCHEMATIC

OBSERVED RAINFALL

Rainfall Forecast Day	1	2	3	4	5	6	7
	1-3			4-5		6-7	
	1-5						
	1-7						

DROUGHT PLAN INFO

HISTORIC DATA

MISCELLANEOUS PRODUCTS

WATER CONTROL MANUAL

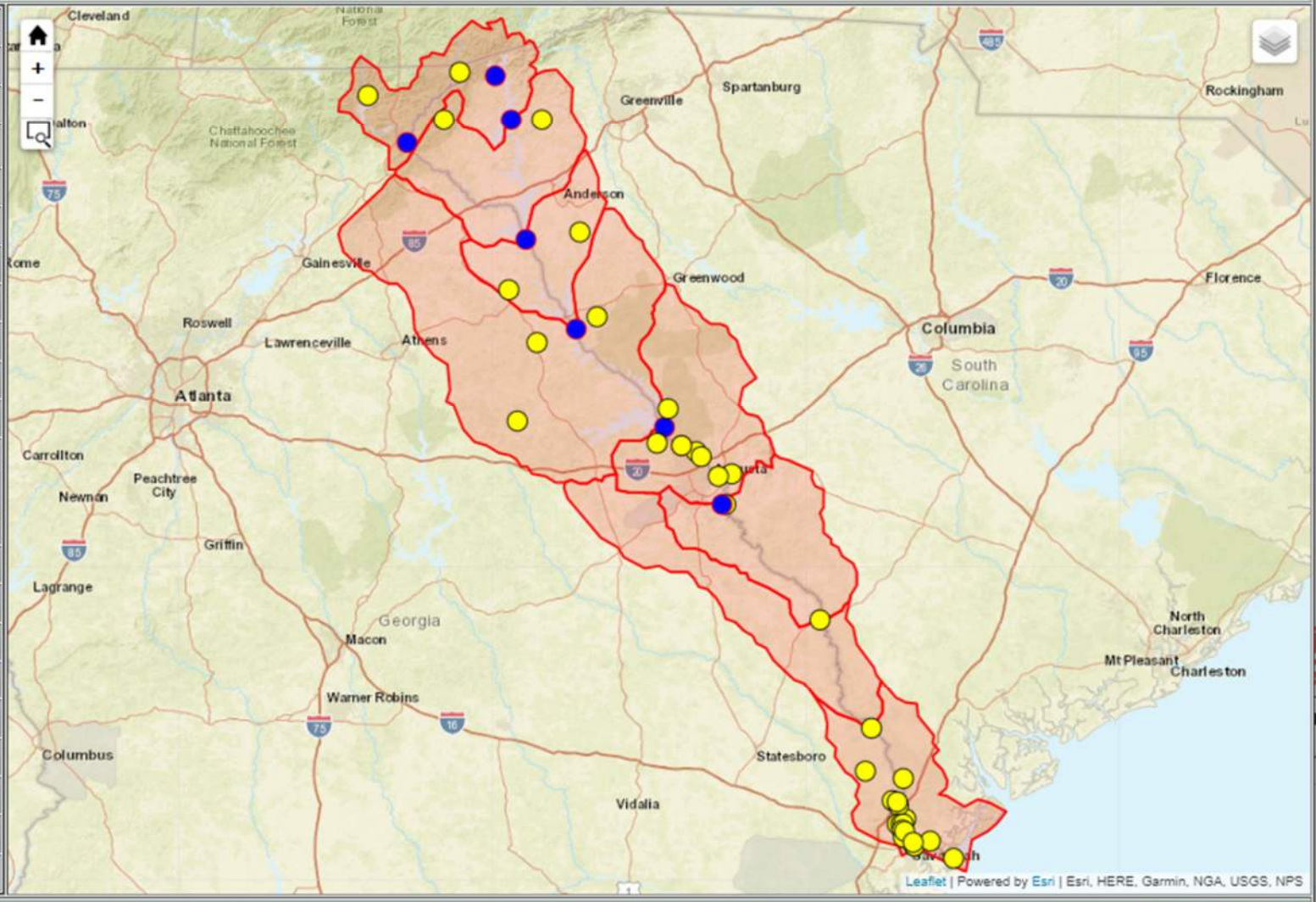
PUBLIC PAGE

OTHER USEFUL LINKS

AUGUSTA INUNDATION MAPS

MOBILE PAGE

Please contact us if you are having Technical Difficulties with this Site.



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This data is provisional and subject to change