

POTENTIAL BRASFIELD DAM EIGHTEEN INCH PROJECT SUMMARY

Presented to Appomattox River Water Authority
Board of Directors
September 25, 2014

Raising Brasfield Dam

“Appomattox River Water Authority: From the appropriation and bond authorization provided in this item, up to \$5,000,000 shall be provided for the Department of Environmental Quality to provide a grant for the Appomattox River Water Authority, **to increase the supply of drinking water** for the counties of Dinwiddie, Prince George, and Chesterfield, the cities of Colonial Heights and Petersburg, and the U.S. Army Garrison at Fort Lee, **and to improve stream flow within the Appomattox River.** The amount provided shall be **matched by local contributions from any one or more of the affected local governments totaling \$5,000,000.”**

Raising Brasfield Dam

Reservoir Volume and Operational Annual Average Increases

Present Reservoir Volume: 9.3 BG (2011)

Present Reservoir Reliable Service Level: 71 MGD (2014)

Model estimated Reliable Service Level: 67 MGD (2030)

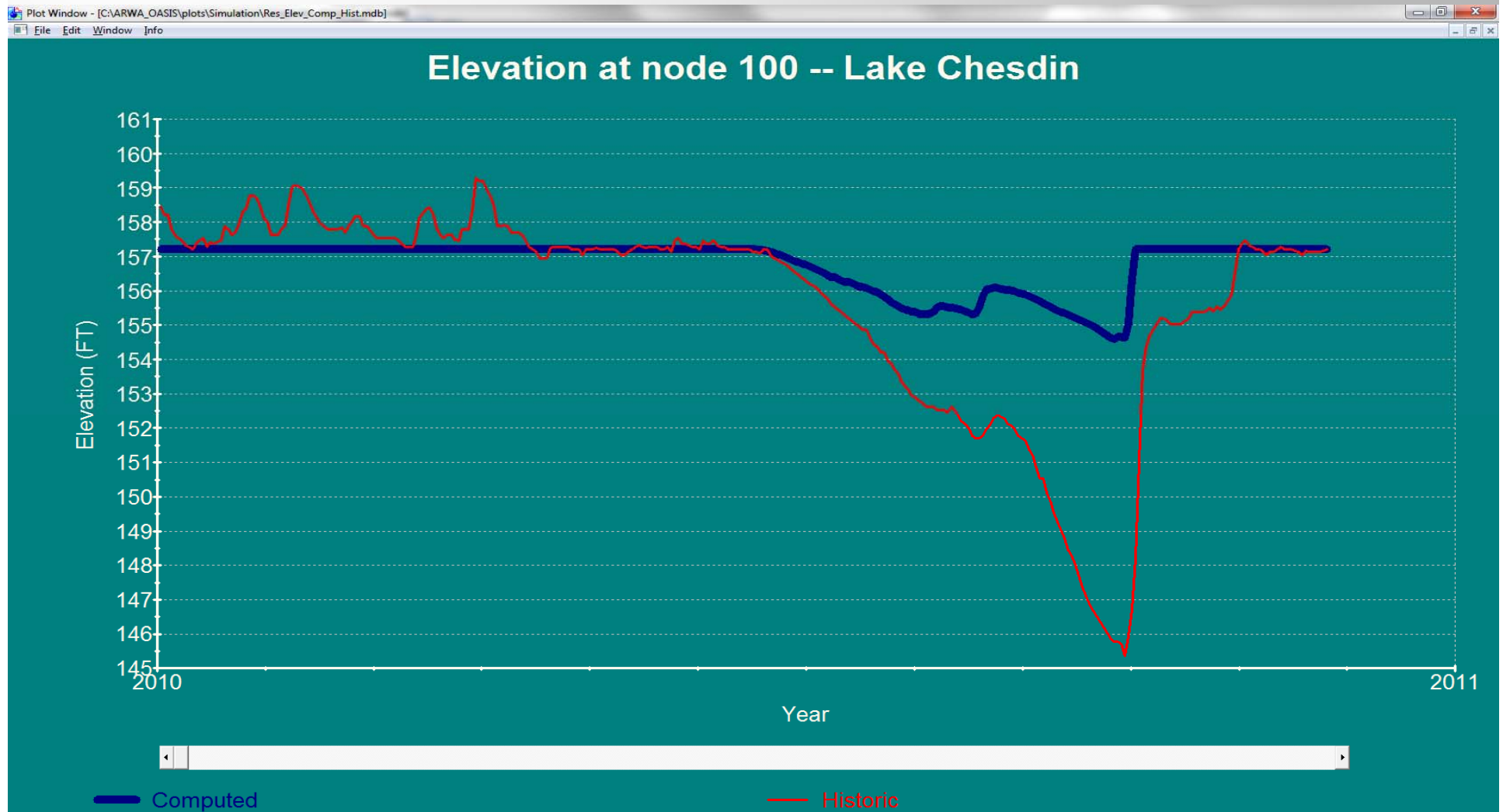
Raise Height : 18"

Reservoir Volume Increase: 1.9 BG

Reliable Service Level Increase 2030 Conditions: 15 MGD

- **Reliable Service Level is a planning figure and represents the annual average demand above which a water provider will need additional capacity to avoid violating the specified reserve (60 days) or the acceptable frequency of invoking its drought management plan.**
- **Reliable Service Level has been impacted favorably by the 2013 DEQ Water Protection Permit and the 2014 ARWA Drought Management Plan**

Reservoir in 2010 with 2013 Permit: A difference of 9 feet



Brasfield Dam

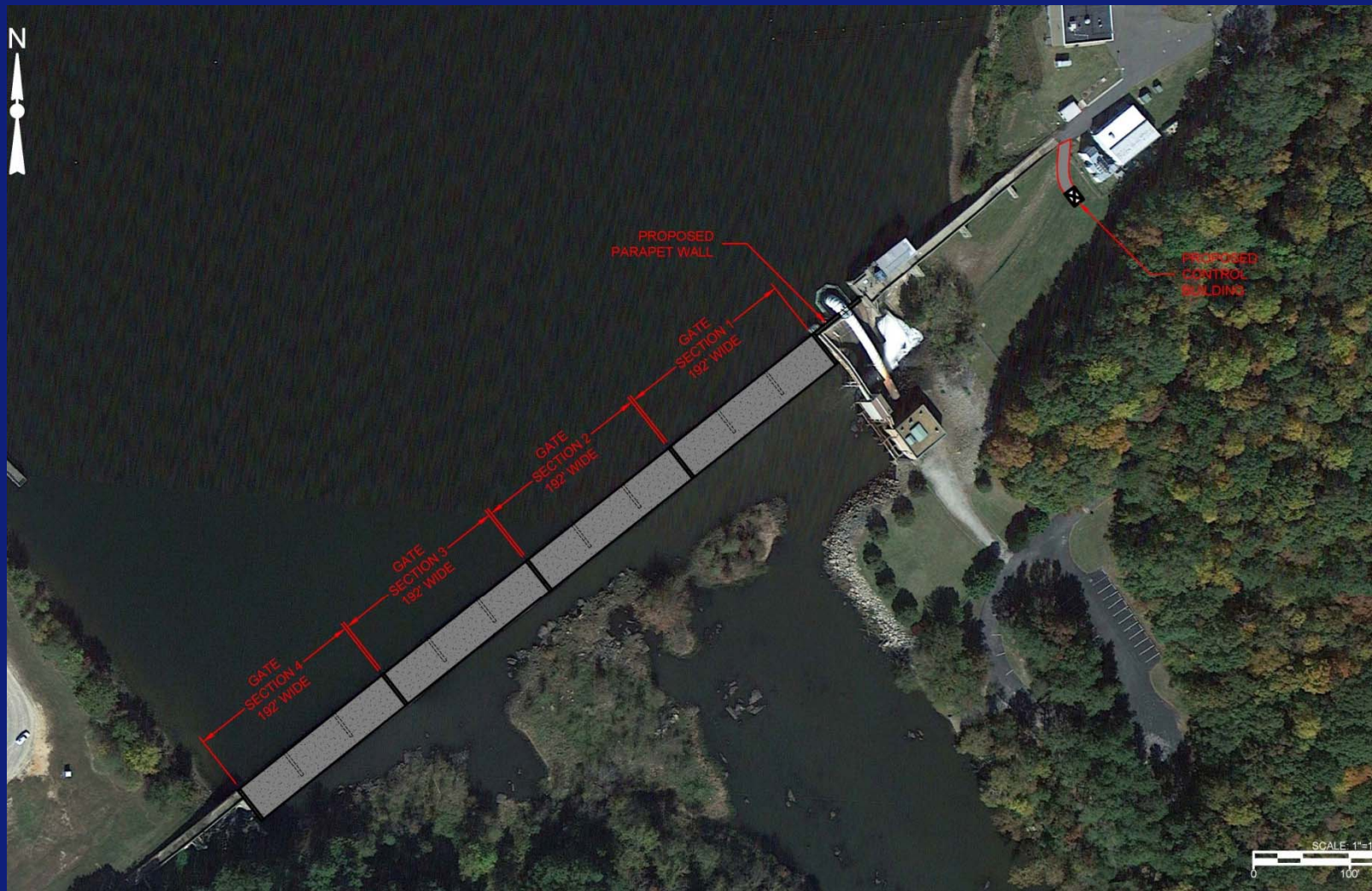
- ✓ Type: Concrete Gravity
- ✓ Length in feet: 1455
- ✓ Height in feet: 54
- ✓ Spillway Crest Elevation in feet: 157.2
- ✓ Top of Dam Elevation in feet: 166.7
- ✓ Top of Parapet Elevation in feet: 169.2

Brasfield Dam





Proposed Plan



AUGUST 13, 2013 Estimates			DOLLARS
Construction Subtotal			2,855,800
Bonds and Insurances	4%		114,200
Construction Contingency	25%		714,000
Engineer's Opinion of Estimated Probable Construction Cost			3,684,000
Design Services and Bid Phase Services			200,000
Construction Phase Engineering Services	10%		285,600
Engineer's Opinion of Estimated Probable Project Cost			4,169,600



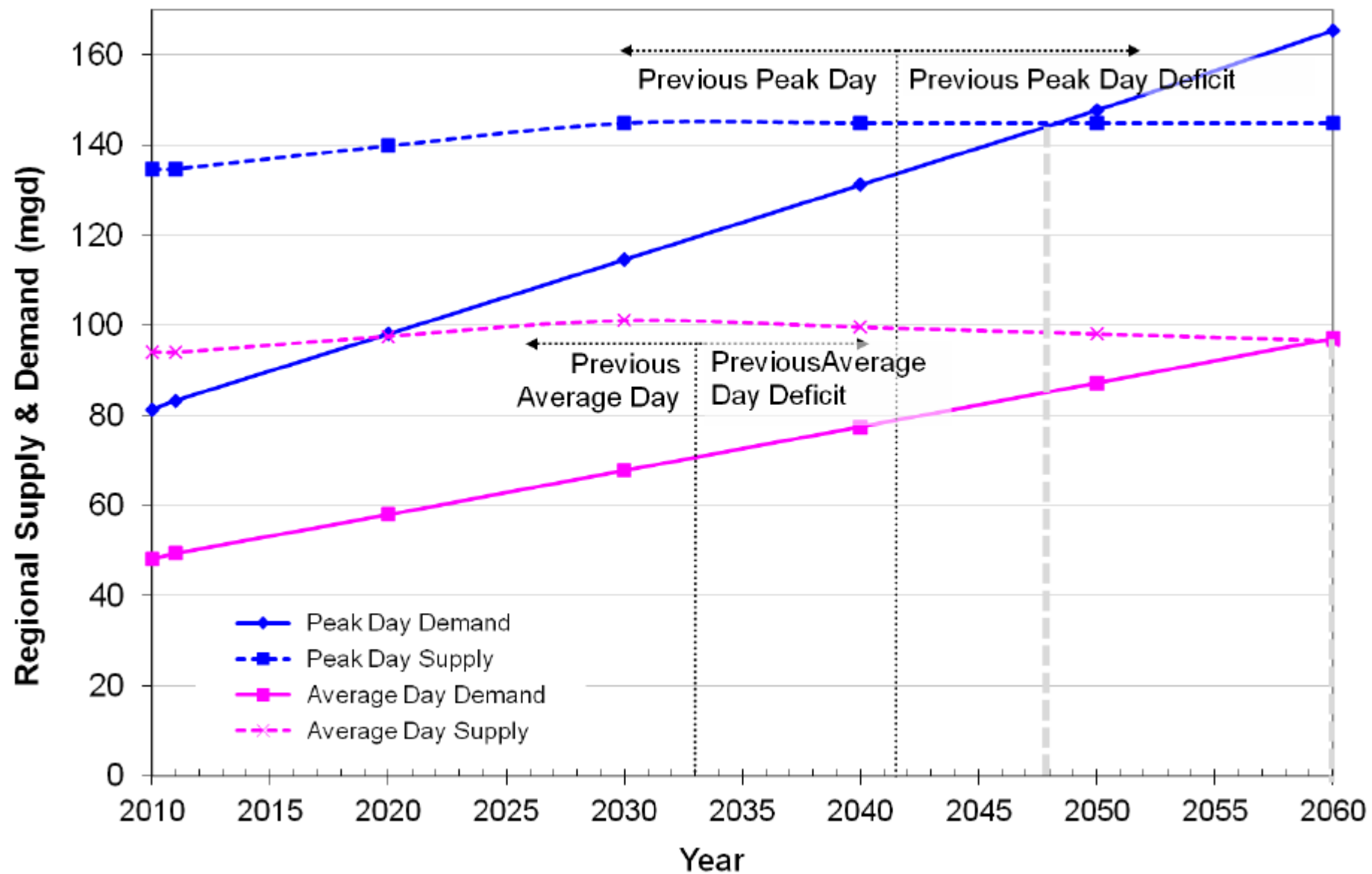












Based on a June 2012 Regional Raw Water Adequacy
Review:

- **Regional average day deficit is expected to occur around 2060**
- **Regional peak day deficit is expected around 2048**

		Current Conditions (34.5 MGD)	2030 Conditions (48 MGD)	
Drought Plan	Trigger	Under Existing DEQ VWP Permit	Under Existing DEQ VWP Permit	Dam Raised 5/1 – 8/31 (Corps & DEQ concerns)
Frequency	Stage 1 (Voluntary)	1 in 21 yrs	1 in 5 yrs	1 in 14 yrs
	Stage 2 (Mandatory)	1 in 84 yrs	1 in 21 yrs	1 in 84 yrs
	Stage 3 (Emergency)	< 1 in 84 yrs	1 in 84 yrs	< 1 in 84 yrs
Median Duration (min-max)	Stage 1 (Voluntary)	85 days (31-115)	62 days (12-186)	57 days (40-144)
	Stage 2 (Mandatory)	68 days (68-68)	118 days (67-165)	102 days (102-102)
	Stage 3 (Emergency)	n/a	n/a	n/a
Drawdown		DEQ Enhanced	DEQ Enhanced	Dam Raised 5/1 – 8/31
Frequency	Rec > 2 ft	1 in 6 yrs	1 in 3.5 yrs	1 in 10.5 yrs
	Rec > 4 ft	1 in 21 yrs	1 in 9 yrs	1 in 84 yrs
	Mig > 3.5 ft, 45+ days	1 in 42 yrs	1 in 17 yrs	1 in 42 yrs
Median Duration (min-max)	Rec > 2 ft	17 days (1-89)	27 days (2-98)	11 days (2-69)
	Rec > 4 ft	16 days (1-63)	26 days (5-80)	49 days (49-49)
	Mig > 3.5 ft	42 days (3-86)	35 days (6-91)	24 days (3-65)
Preserves 60-day supply?		Yes	No (55 days)	Yes
Reliable Service Level		71 MGD	67 MGD	82 MGD

Drought Plan	Trigger	Current Permit 2030 Conditions 48 MGD	2030 Conditions Current Permit w/ Chesdin Raised 18"	2030 Conditions (48 MGD) With Offline Storage			
				5 BG Storage Base Scenario	7 BG Storage Base Scenario	5 BG Storage w/ Chesdin Raised	7 BG Storage w/ Chesdin Raised
Frequency	Stage 1 (Voluntary)	1 in 5 yrs	1 in 7 yrs	1 in 5 yrs	1 in 5 yrs	1 in 8 yrs	1 in 8 yrs
	Stage 2 (Mandatory)	1 in 21 yrs	1 in 42 yrs	< 1 in 84 yrs	< 1 in 84 yrs	< 1 in 84 yrs	< 1 in 84 yrs
	Stage 3 (Emergency)	1 in 84 yrs	< 1 in 84 yrs	< 1 in 84 yrs	< 1 in 84 yrs	< 1 in 84 yrs	< 1 in 84 yrs
Median Duration (min-max)	Stage 1 (Voluntary)	62 days (12-186)	68 days (11-186)	61 days (12-145)	61 days (12-145)	63 days (18-140)	63 days (18-140)
	Stage 2 (Mandatory)	118 days (67-165)	127 days (110-144)	n/a	n/a	n/a	n/a
	Stage 3 (Emergency)	102 days (102-102)	n/a	n/a	n/a	n/a	n/a
Drawdown		Current Permit	Current Permit w/ Chesdin Raised 18"	5 BG Storage Base Scenario	7 BG Storage Base Scenario	5 BG Storage w/ Chesdin Raised	7 BG Storage w/ Chesdin Raised
Frequency	Rec > 2 ft	1 in 3.5 yrs	1 in 6 yrs	1 in 3.5 yrs	1 in 3.5 yrs	1 in 6 yrs	1 in 6 yrs
	Rec > 4 ft	1 in 9 yrs	1 in 17 yrs	1 in 9 yrs	1 in 9 yrs	1 in 42 yrs	1 in 42 yrs
	Mig > 3.5 ft, 45+ days	1 in 17 yrs	1 in 28 yrs	1 in 21 yrs	1 in 21 yrs	1 in 42 yrs	1 in 42 yrs
Median Duration (min-max)	Rec > 2 ft	27 days (2-98)	29 days (5-87)	27 days (2-98)	27 days (2-98)	28 days (5-86)	28 days (5-86)
	Rec > 4 ft	26 days (5-80)	15 days (1-63)	17 days (4-62)	17 days (4-62)	6 days (2-10)	6 days (2-10)
	Mig > 3.5 ft	35 days (6-91)	29 days (4-84)	35 days (5-91)	35 days (5-91)	19 days (1-73)	19 days (1-73)
Preserves 60-day supply?		No (55 days)	Yes (89 days)	Yes (98 days)	Yes (98 days)	Yes (125 days)	Yes (125 days)
Pumping frequency from offline storage to WTP		n/a	n/a	1 in 5 yrs	1 in 5 yrs	1 in 7 yrs	1 in 7 yrs
Avg. # days pumping Chesdin to offline		n/a	n/a	20 (max = 74)	20 (max = 74)	22 (max = 61)	22 (max = 61)
Avg. # days pumping at full capacity Chesdin to offline		n/a	n/a	5 (max = 24)	5 (max = 24)	5 (max = 21)	5 (max = 21)
Reliable Service Level		67	82	80	87	90	96

Planning Level Schedule for Project to Raise the Brasfield Dam

Phase 1

- October –November 2013: Developed and received approved on study plan from Corps & DEQ: **COMPLETE**
- March 2014: Completed Lidar aerial work on reservoir related to streams and wetlands determination of mitigation costs; **COMPLETE**
- April 2014: Completed field work related to streams and wetlands for determination of mitigation costs; **COMPLETE**
- Late April –Early June 2014: Received digital Lidar files to initiate modeling; **COMPLETE**
- June-July 2014: Conducted modeling to determine inundation and net wetland and stream impacts; **COMPLETE**
- August 26, 2014: Both Corps and DEQ for day on reservoir to discuss streams and wetlands study findings and receive their approval; **COMPLETE**
- Late July to early August HydroLogics conducted model runs to determine impact on water supply from off-site storage and raising the dam with off-site storage facility: **COMPLETE**
- September 25, 2014: Presentation to the ARWA Board of Directors on the wetlands and streams findings, and expected stream and wetlands mitigation costs on raising the dam eighteen inches; **COMPLETE**

Total estimated time for Phase 1 completion: 9 months

➤ If project is approved to move forward by ARWA Board of Directors, then proceed to

Phase 2

- **Project funding source determination (funded by cash, bond, rate adjustment);**
- **Development by DEQ and ARWA of written Grant Agreement . This can be concurrent with other on-going project items;**
- **Develop RFP, advertise and hire engineering firm for project. Allow three to four months. This can be concurrent with other on-going project items;**
- **Submit ARWA Virginia Water Protection Permit modification to DEQ/Corps: This will require ARWA's design engineering firm to be on-board (part of the application will determine and present impacts, if any, on VDOT bridges, reservoir landowners, and recreational boating/marinas). Allow under best of circumstances twelve months. If negative comments are received during public comment period and public meetings are held by DEQ, this process could last two years. If a lawsuit is filed in objection to the project, this process stops until the suit is satisfied.**

Total estimated time for Phase 2 completion: 12 months to 2.5 years

Phase 3

Once ARWA VWP permit is approved/issued, then allow for the following time:

- **4-5 months for design**
- **4-6 months for Federal Energy Regulatory Commission review and approval**
- **one month for bid preparation documents**
- **2-3 months for bidding, contractor selection and contract documents**
- **10-12 months for formal construction and phase out of construction**

Total estimated times for Phase 3: 22-28 months

Total estimated project time: 43-67 months (3.6 - 5.6 years)

Brasfield Dam

Dam Raise Summary of Probable Costs 18" Raise

Estimated Costs August 2014

Item

Construction Costs	\$ 4,169,600
Bridge (2 @ \$3.0M each) replacement	\$ 6,000,000
Legal & Permitting (JPA, FERC, NEPA)	\$ 500,000
Environmental Mitigation	\$10.7-14.4M (use \$12.5M)
Additional Perimeter Infrastructure Impacts	none expected
(Land Acquisition/Flood Easement: ARWA owns up to elevation 164 [18" raise 157.2 ft. to 158.7 ft. leaving 5.3 ft. buffer])	

Subtotal	\$ 23,169,600
Contingency (10%)	\$ 2,316,960
Total Opinion of Probable Project Cost	\$ 25,486,560
Minus Commonwealth Grant (\$5M)	\$ 20,486,560

Brasfield Dam

<u>Alternative</u>	<u>Est. Cost</u>	<u>Reliable Service Level Increase</u>	<u>Storage Increase</u>	<u>Cost per MDG</u> <u>Reliable</u> <u>Service</u> <u>Increase</u> <u>Level</u>
Raise – 18” (With 5M Grant)	\$25.5 M \$20.5M	15.0 MGD 15.0 MGD	1.9 BG 1.9 BG	\$ 1.7 Million/MDG \$ 1.4 Million/MDG
Offsite Storage (With 5M Grant)	\$96.6 M* \$91.6 M*	20.0 MGD 20.0 MGD	7.0 BG 7.0 BG	\$ 4.8 Million/MDG \$ 4.6 Million/MDG
Offsite Storage (With 5M Grant)	\$91.6 M* \$86.6 M*	13.0 MGD 13.0 MGD	5.0 BG 5.0 BG	\$ 7.0 Million/MDG \$ 6.7 Million/MDG

*September 2014 Concept Estimates Only: +/- 35% confidence level.

Reliable Service Level Increase Estimates: 2030 at 67 MGD and 48 MGD demand

Compliance with Clean Water Act

Section 404

- ✓ The Army Corps of Engineers and U.S. Environmental Protection Agency will consider if there is an practicable alternative to a proposed project (Off-Site Storage versus Dam Raise) that would have less adverse impact on the aquatic ecosystem (Wetlands & Streams)
- ✓ An approved permit modification most likely would not be issued in circumstances where a less environmentally damaging practicable alternative exists
- ✓ “CWA Section 230.10(a) allows permit issuance for only the **least environmentally damaging practicable alternative**” Taken from: Memorandum of Agreement Between Department of the Army and U.S.E.P.A.

Multi-objective Decisions

- ▣ Technical Feasibility: Can the water project be implemented?
- ▣ Policy Issues: Are specific constraints imposed on the project as the result of policy determinations?
- ▣ Political Issues: Must specific political influences, issues, special interests, play deciding roles?
- ▣ Economic Factors: Is the project an efficient, effective use of the scarce available resources?

$$\text{Net Benefit} = \text{Total Benefits} - \text{Total Costs}$$

- ▣ The difference between the long-term water supply provided by each project and the costs of completing and operating the project.

ARWA Obligation

Taken from narrative in the Service Agreements:

ARWA shall expand, operate and maintain the ARWA System in an efficient and economical manner, consistent with good business and operating practices.....

Reliable Water Supply

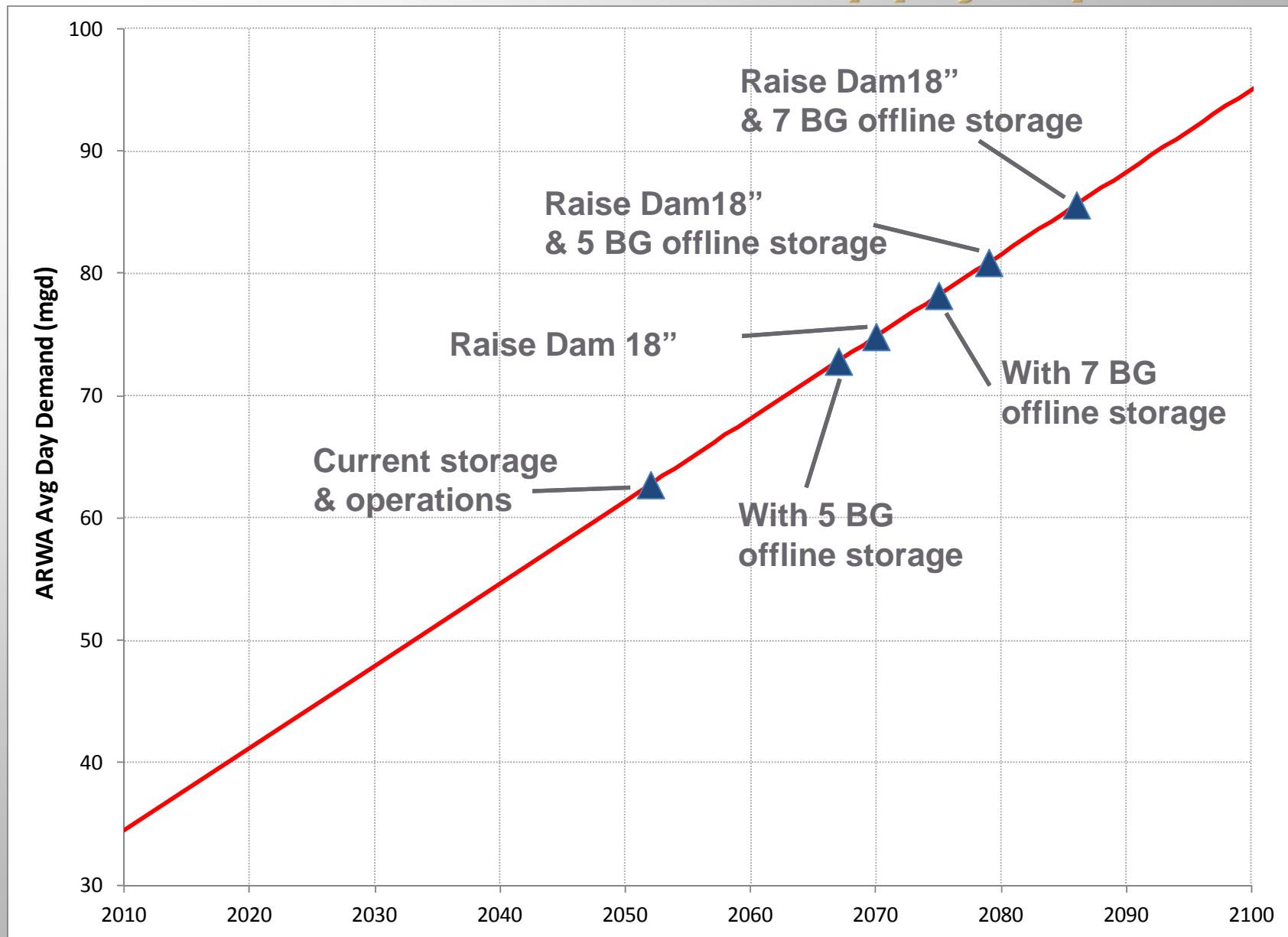
- ▣ The concept of a reliable water supply clearly requires a ***long-term*** view of water systems and must therefore factor into ***long-term*** water supply planning.

October 7, 2010 ARWA Board Adopted Resolution on the Management of the Chesdin Reservoir

“Prudent management of Lake Chesdin requires a balancing between and among three priorities which are:

- ❑ Preservation and enhancement of a reliable source of high-quality treated water to meet the current and future needs of the residents and businesses of the Member Jurisdictions;
- ❑ Protection of the environmental health of Lake Chesdin;
- ❑ Protection of the environmental health of the six-mile non-tidal stream reach of the Appomattox River below the Brasfield Dam”

ARWA Demand and Supply Options



STAFF RECOMMENDATION

Based on the lack of any significant long-term differences in the frequency of entering into and the duration of remaining in water restrictions with the addition of the 18" dam raise to a long-term off-site storage facility and the upcoming (2015-2022: \$44.2 million) capital project funding needs, staff recommends proceeding forward only on a long-term off-site storage project predicated upon this site being formalized within the next five years. Staff recommends that every five years an evaluation of ARWA supply and demand be conducted.

STAFF RECOMMENDATION

- ▣ However, since **the dam raise project presented the lowest cost per MGD of reliable service level increase**, staff suggests that the Board determines if this is an overarching priority to continue proceeding with this project despite the expected difficulty of receiving regulatory approvals.

BOARD ACTION REQUESTED:

Staff requests that the Board provide direction by January 22, 2015 on whether to proceed into Phase 2 of the dam raise project or to halt activity on this project until further Board direction.

QUESTIONS?