Appomattox River Water Authority

Storage Management Plan Stakeholder Engagement Meeting

as required by Virginia Water Protection Permit (#01-1719)
ARWA Executive Directors Welcome

History of Chesdin Reservoir

Meeting Purpose
Storage Management Plan Purpose

- ARWA Virginia Water Protection permit requires a storage management plan for Chesdin Reservoir
Overview

a) Stakeholder Participation
b) Sedimentation Analysis
c) Water Supply Alternatives
d) Bathymetric Survey
e) DEQ Reporting

Public Comment

The permittee shall develop a Storage Management Plan for the Chesdin Reservoir for maintaining the storage volume during the permit term (the “Plan”). The Plan shall be submitted to DEQ for review and approval within four (4) years of permit issuance. Development of the plan shall be coordinated with DEQ. The Plan shall include, at a minimum, the following:

a. Stakeholder participation in the development of the Plan. The Plan shall include documentation of stakeholder involvement.

b. A description and analysis of the storage management alternatives considered in developing the Plan, including, at a minimum, raising the height of the Brasfield Dam, dredging, and offstream storage. The Plan shall acknowledge that any proposed dredging activity will require environmental permits from both state and federal agencies.

c. An analysis of the main sources of sedimentation to the reservoir from sources in Chesterfield and Dinwiddie Counties. This analysis should include sedimentation from instream as well as offstream sources and those actions proposed to manage these sources of sediment. This analysis shall be updated when a bathymetric survey is conducted.

d. Schedule for conducting a bathymetric survey of the reservoir to provide an updated analysis of sedimentation in the reservoir, including identification of areas of accumulated sediment and areas having a high potential for accumulation during the permit term. The survey shall be conducted at least once during the permit term but no later than year 10.

e. The permittee shall submit a report to DEQ documenting progress towards procurement of a preferred alternative for a future alternative source of supply every two (2) years, with the first report due two (2) years after permit issuance. The reports shall document actions taken to secure additional raw water supply by the end of the permit term, including a proposed timeline with implementation milestones. The reports shall include any applicable documentation of stakeholder involvement.
Introduction to Chesdin Reservoir Watershed
Chesdin Reservoir Background

- Impounded (1968) by George F. Brasfield Dam
- Primary purpose: water supply
  - Current average: 34.5 mgd
- Also provides:
  - Recreation
  - Hydropower
  - Downstream water quality & flood control
- Surface Area: 2,590 acres
- Storage Volume: 9.3 BG (2011 est.)
- ARWA easement to the 160 ft contour
Chesdin Reservoir Watershed

Drainage area of 1,330 sq. mi.
- 63% forested
- 18% agriculture
- 15% open water, wetlands, and other
- 4% developed
What is sedimentation?

An analysis of the main sources of sedimentation to the reservoir from sources in Chesterfield and Dinwiddie Counties. This analysis should include sedimentation from instream as well as offstream sources and those actions proposed to manage these sources of sediment. This analysis shall be updated when a bathymetric survey is conducted.
Watershed Erosion

• Movement of soil particles is a normal, natural process.
• Some sources of erosion include:
  • Agriculture
  • Livestock grazing
  • Construction sites
  • Unprotected stream crossings
  • Increased flows
  • Steep, unprotected banks
Implications of Sedimentation on the Reservoir

• Reduced storage volume
• Reduced water quality
• Deposition at water supply and hydropower intakes
• Reduced accessibility in shallower areas
Quantifying Erosion and Reservoir Sedimentation at Chesdin Reservoir

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Estimated Sediment Yield from Chesdin Reservoir Watershed

*Includes areas within Chesdin Reservoir watershed only.
Sedimentation Model vs Actual Measured Storage Volume

Comparison of storage volume in 2000 and 2011

- 5% (473 MG)
- 3% (297 MG)
- 0%
- 10%
- 20%
- 30%
- 40%
- 50%
- 60%
- 70%
- 80%
- 90%
- 100%

RUSLE Model
 Actual 2011 Survey

2011 Bathymetric Survey
Comparison of Sediment Yield Estimates and References

- NC Study of Numerous Reservoirs: 1,249 lbs/ac-yr
- National Study (Dendy and Bolton): 1,063 lbs/ac-yr
- Chesdin RUSLE Model: 577 lbs/ac-yr
- Chesdin Bathymetric Survey: 361 lbs/ac-yr
- Chesapeake Bay Watershed Monitoring Stations: 247 lbs/ac-yr
Conclusions

• Chesdin Reservoir sediment movement is natural and influenced by land use
• Chesdin Reservoir watershed is predominantly undeveloped
• Chesdin Reservoir sedimentation estimate is within the expected ranges
• Model can be used to identify areas of watershed that are more susceptible to increased rates of erosion
• Possible actions to reduce erosion:
  • Riparian buffers
  • Enforcement of the required 100’ Chesapeake Bay Preservation Buffer
  • Agricultural best management practices (BMPs)
  • Enforcement of construction erosion and sediment (E&S) control
Storage Management Alternatives
Storage Management Alternatives

- Raise Brasfield Dam
- Dredge Chesdin Reservoir
- Develop Offstream Storage

Permit Requires:

b. A description and analysis of the storage management alternatives considered in developing the Plan, including, at a minimum, raising the height of the Brasfield Dam, dredging, and offstream storage. The Plan shall acknowledge that any proposed dredging activity will require environmental permits from both state and federal agencies.
Raise Brasfield Dam
Raise Brasfield Dam

- Increase dam height
- Provides additional storage volume
- Pool level increases
- 2012 engineering work analyzed 3 alternatives
  - 18” = +1.9 BG
  - 24” = +2.55 BG
  - 36” = +3.86 BG
Raise Brasfield Dam Considerations

• Public & private infrastructure
  • Route 623 (Sutherland Road) and two bridges
  • Docks and bulkheads
  • Marinas
  • Wells/septic systems

• Permits
  • Environmental (USCOE, VDEQ, VMRC, JPA, local)
  • Historical / archeological sites
  • FEMA
  • Federal Energy Regulatory Commission (FERC)

• ARWA facility operation
• Aquatic
Dredging
Dredging

- Physically removes deposited sediment
- Recovers lost storage volume
- Pool level remains
- 2012 engineering work estimated 3-4 MCY resulting in 0.6 BG
Dredging Considerations

• Disposal
  • Upper reaches
  • Dewatering area(s) adjacent to reservoir
  • Off-site
  • Traffic

• Permits
  • Environmental (USCOE, VMRC, VPDES, JPA, local)
  • Historic

• ARWA facility operation
• Aquatic
Offstream Storage
Offstream Storage

- Create a water impoundment external to Chesdin Reservoir
- High river flow conditions transfer water in
- Release/pump water from during drought conditions
- 2012 engineering work identified 7.08 BG
Offstream Storage Considerations

- Public & private infrastructure
  - Site
  - Piping/Pumping
  - Potential intake or bi-directional flow

- Permits
  - Environmental (USCOE, VDEQ VMRC, JPA, local)
  - Historical / archeological sites

- ARWA facility operation
## Planning Level Estimates of Water Supply Volumes and Costs

<table>
<thead>
<tr>
<th>Description</th>
<th>Raise Brasfield Dam 18”</th>
<th>Dredge Chesdin Reservoir</th>
<th>Offstream Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage Increase (BG)</td>
<td>1.9&lt;sup&gt;1&lt;/sup&gt;</td>
<td>0.6&lt;sup&gt;1&lt;/sup&gt;</td>
<td>5.0 - 7.0&lt;sup&gt;3&lt;/sup&gt;</td>
</tr>
<tr>
<td>Safe Yield / Reliable Service Level Increase (mgd)</td>
<td>11&lt;sup&gt;1&lt;/sup&gt; - 15&lt;sup&gt;4&lt;/sup&gt;</td>
<td>3.5&lt;sup&gt;1&lt;/sup&gt;</td>
<td>20 - 33&lt;sup&gt;3&lt;/sup&gt;</td>
</tr>
<tr>
<td>Estimated Construction Cost</td>
<td>$24.4M - $33M&lt;sup&gt;2&lt;/sup&gt;</td>
<td>$23.5M&lt;sup&gt;1&lt;/sup&gt; - $73M&lt;sup&gt;5&lt;/sup&gt;</td>
<td>$91.6M - $96.6M&lt;sup&gt;3&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

1. Values taken from Raw Water Supply Alternatives Analysis by Black and Veatch, dated September 2012
2. ARWA Board Meeting minutes, February 23, 2017
3. Evaluation of ARWA Capacity Expansion Options, September 25, 2014
4. Potential Brasfield Dam Eighteen Inch Project Summary, September 25, 2014
5. ARWA Source Water Study by Gannett Fleming, February 2001
Federal & State Regulatory Agencies are required to approve the project with the “least environmentally damaging practicable alternative”

Section 404 of the Clean Water Act Memorandum of Agreement

https://www.epa.gov/cwa-404/memorandum-agreement
Bathymetric Survey
d. Schedule for conducting a bathymetric survey of the reservoir to provide an updated analysis of sedimentation in the reservoir, including identification of areas of accumulated sediment and areas having a high potential for accumulation during the permit term. The survey shall be conducted at least once during the permit term but no later than year 10.
DEQ Reporting
Next Steps

http://arwava.org/
Comments on Storage Management Plan
Thank you