# DRBC Storage Study Update

## Water Management Advisory Committee: June 28, 2023

Prompton Reservoir: Photo courtesy of U.S. Army Corps of Engineers

Chad Pindar, P.E.

Manager, Water Resource Planning Section



Delaware River Basin Commission
DELAWARE • NEW JERSEY
PENNSYLVANIA • NEW YORK
UNITED STATES OF AMERICA

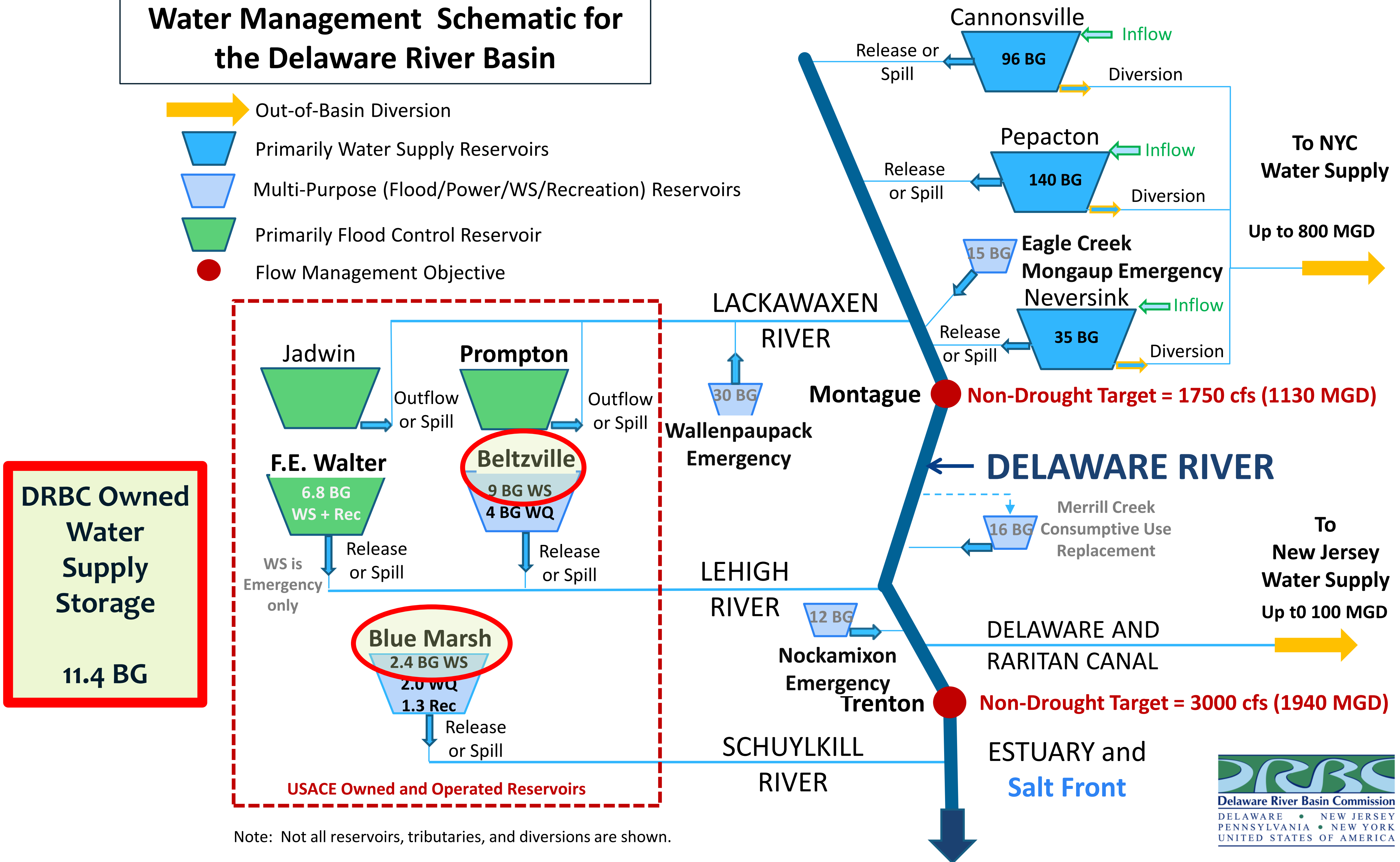
# DRBC Storage Study Update

## Water Management Advisory Committee: June 28, 2023

## AGENDA

* DRB Water Management Schematic
* How to Access Report
* Report Overview
* Storage Project Summary Example
* Online GIS tool
* Questions / Discussion

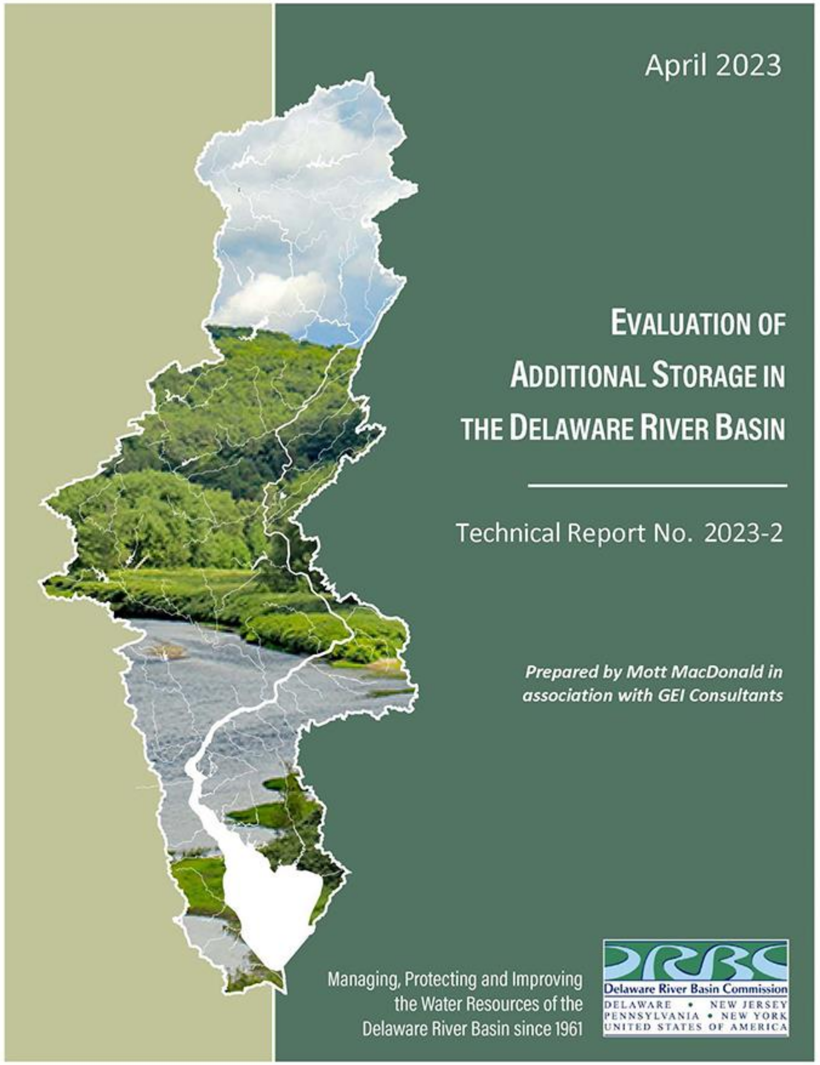
# Water Management Schematic for the Delaware River Basin




Note: Not all reservoirs, tributaries, and diversions are shown.

# DRBC Storage Study Update

## Water Management Advisory Committee: June 28, 2023




## *Evaluation of Additional Storage in the Delaware River Basin* - published April 2023

- Technical Report No. 2023-2
- https://www.state.nj.us/drbc/programs/flow/reservoir-storage-study.html
- Prepared by Mott MacDonald in association with GEI Consultants
  - Mott MacDonald team: Kirk Barrett, Gary Snyder, Jane Rowan, Ken Najjar
  - GEI team: Katie Laird, Roger Putty
  - Normandeau Associates
  - Advisors: Anthony Bonasera, Tony Fernandes, Frank Falcone
- Suggested Citation:

DRBC (2023). *Evaluation of Additional Storage in the Delaware River Basin: Technical Report No. 2023-2*. Prepared by Mott MacDonald in association with GEI Consultants. West Trenton, New Jersey. Delaware River Basin Commission.

Delaware River Basin Commission
DELAWARE • NEW JERSEY
PENNSYLVANIA • NEW YORK
UNITED STATES OF AMERICA

# DRBC Storage Study Update

## Water Management Advisory Committee: June 28, 2023

**Table of Contents**



**Appendices**



Delaware River Basin Commission
DELAWARE • NEW JERSEY
PENNSYLVANIA • NEW YORK
UNITED STATES OF AMERICA

# DRBC Storage Study Update

## Water Management Advisory Committee: June 28, 2023

### Chapter 1 - Executive Summary

* Most comprehensive evaluation of storage options in DRB was performed by USACE in the late 1950s, through 1961: publication of the Comprehensive Survey of the Water Resources of the Delaware River Basin (House Document 522) (Revised, May 1961).

* A number of smaller initiatives by the Delaware River Basin Electric Utilities Group (DRBEUG) evaluated additional storage options in the Basin throughout the early 1970s.

* The Delaware River Basin Comprehensive Level B Study was published in 1983 and the Commission worked with partners to do a large update to its Comprehensive Plan in 2001.

* Since it had been approximately 40 years since a thorough review of storage options was evaluated within the Basin, the Commission deemed the development of a comprehensive updated inventory of potential storage options to be prudent.

Delaware River Basin Commission
DELAWARE • NEW JERSEY
PENNSYLVANIA • NEW YORK
UNITED STATES OF AMERICA

# DRBC Storage Study Update

## Water Management Advisory Committee: June 28, 2023

### Chapter 1 - Executive Summary

* The goal of this study was to inventory and evaluate potential projects to provide additional storage to meet potential water supply and flow management needs in the Delaware River Basin.

* This planning level study is intended to provide the Commission with a prioritized list of storage projects to further evaluate if the Commission determines that additional storage is necessary.

* To date, the Commission has not determined that additional storage is necessary.

Delaware River Basin Commission
DELAWARE • NEW JERSEY
PENNSYLVANIA • NEW YORK
UNITED STATES OF AMERICA

# DRBC Storage Study Update

## Water Management Advisory Committee:  June 28, 2023

### Chapter 1 - Executive Summary

**Table 1.3-1: Number of Potential Projects Involved at Different Stages in the Study**

| | Potential Storage Project Category | | | | |
|---|---|---|---|---|---|
| **Project Stage** | **New reservoirs** | **Existing reservoirs** | **Quarries** | **Abandoned mines** | **Total** |
| Identifying potential projects | 22 | 1,041 | 1,421 | 29 | 2,513 |
| Passing pre-screening | 22 | 34 | 66 | 5 | 127 |
| Passing initial screening | 7 | 16 | 33 | 5 | 61 |
| Passing supplemental screening (evaluated projects) | 7 | 8 | 18 | 5 | 38 |
| Recommended projects | 0 | 2 | 12 | 0 | 14 |

These 38 projects all had Storage Project Summaries (SPS) developed.

Pre-Screening

Initial Screening

Supplemental Screening

Delaware River Basin Commission
DELAWARE • NEW JERSEY
PENNSYLVANIA • NEW YORK
UNITED STATES OF AMERICA

# DRBC Storage Study Update

## Water Management Advisory Committee:  June 28, 2023

## Chapter 3 - Identification & Screening of Potential Projects

**Table 3.1.1-1: New Dam/Reservoir Studies**

| | | |
|---|---|---|
| A. | Initial Comprehensive Plan | |
| | a. | House Document (HD) 522: prepared in 1961 by US Army Corps of Engineers and published by the US House of Representatives in 1962. (Seminal document setting the stage for identification of potential reservoir storage locations.) |
| | b. | DRBC Comprehensive Plan 1962, follows HD 522 |
| B. | Water Resources Programs 1965-1976 | |
| | a. | Resolutions 64-15, 65-4, etc. |
| | b. | A-List and B-List Projects |
| C. | DRB Electric Utilities Group (DRBEUG) Studies: 1972, 1975, 1976 | |
| D. | Subsequent studies | |
| | a. | 1975 URS study of Tocks Island and Alternatives |
| | b. | 1983 Level B study |
| | c. | 2001 Comprehensive Plan |
| | d. | 2008 USACE Multijurisdictional study |
| E. | 2009 DRBC Staff reservoir evaluation | |

Delaware River Basin Commission
DELAWARE • NEW JERSEY
PENNSYLVANIA • NEW YORK
UNITED STATES OF AMERICA

# DRBC Storage Study Update

## Water Management Advisory Committee: June 28, 2023

### Chapter 3 - Identification & Screening of Potential Projects

**Existing dams/reservoirs:**

- the primary data source was the National Inventory of Dams, which is maintained by the USACE
- the database is comprehensive (all dams impounding more than 50 acre-feet) and records many important parameters useful to this evaluation
  - coordinates, river name, owner, purpose (water supply, flood control, hydropower, recreation, habitat), drainage area, maximum volume, pool elevation and pool area.
- the Inventory listed 1,041 dams within the Basin: 501 in PA, 335 in NJ, 199 in NY, 6 in DE.

**Quarries:**

- state databases were initially used:
  - PA Industrial Mineral Mining Operations
  - NJ Quarries (Sand and Gravel)
  - NY Mining Database

Delaware River Basin Commission
DELAWARE • NEW JERSEY
PENNSYLVANIA • NEW YORK
UNITED STATES OF AMERICA

## Table 3.1.1-2: Key Reviewed Mine Pool Documents

| Source | Title | Primary Author | Description |
|---|---|---|---|
| USBM TP#727-1949 | Water Pools in Pennsylvania Anthracite Mines | S. H. Ash, et.al. | Signature study that compiled available mining data and estimated mine pool volumes based on then current water level information. |
| USGS SIR 2010-5261 | Water Budgets and Groundwater Volumes for Abandoned Underground Mines in the Western Middle Anthracite Coalfield | D. J. Goode, et al. | Estimates of water budgets and groundwater volumes stored in abandoned underground mines in the Western Middle Anthracite Coalfield |
| USGS WRI Report 95-4243 | Water Quality of Large Discharges from Mines in the Anthracite Region of Eastern Pennsylvania | Charles R. Wood, et.al. | Compilation of key water quality information in many of the major mine pools in the four anthracite regions. |
| EPCAMR | Mine Water Resources of the Anthracite Coal Fields of Eastern Pensylvania | R.E. Hughes, et.al. | This document draws from prior mining information and initial mine pool estimates and uses current data mapping technology to update mine water resources estimates and opportunities. |

# DRBC Storage Study Update

## Water Management Advisory Committee: June 28, 2023

### Chapter 3 - Identification & Screening of Potential Projects

**Table 3.1.2-1: Prescreening Criteria**

Pre-Screening

| |
|---|
| Must feed the Delaware River's mainstem above its confluence with the Christina River (near Wilmington, DE) to suppress the salt line |
| New reservoirs must provide >1 BG storage |
| Existing reservoirs must provide >2 BG of storage currently |
| Quarries must have area of >25 acres and depth >50 feet (giving a minimum volume of approximately 0.5 BG) |
| Deep mines must provide >1 BG of storage and should have a surface expression of water |

This is how we got from ~2,500 projects down to 127.

# DRBC Storage Study Update

## Water Management Advisory Committee: June 28, 2023

## Chapter 3 - Identification & Screening of Potential Projects

Initial Screening

**Table 3.1.3-1: Initial Screening Criteria**

| Criteria | Relative Importance (high, med., low) | Rationale |
|---|---|---|
| Volume of storage | high | More volume provides greater and/or longer (in time) flow augmentation |
| Sufficiency of water supply | high | Reliable and sufficient supply is desirable for filling/refilling storage |
| Environmental resource impact | high | Inundation of high-value resources (e.g., presence or habitat for endangered species, trout streams, wetlands) is undesirable |
| Infrastructure and social impact | high | Inundation of roads, pipelines, electrical lines, buildings or recreational/cultural facilities is undesirable |
| Position in Basin | med | High in the Basin benefits more stream miles |
| Owner cooperativeness | med | Certain reservoir owners are not likely to support certain projects, or obtaining approval may be very cumbersome |
| Water retention | med | Applicable to quarries only --- leaky is undesirable |
| Proximity to mainstem | low | Close to the mainstem delivers water quicker when needed; the reason importance is low is that travel time from all points to the mainstem is only a few days |

This is how we got from 127 projects down to 61.

Delaware River Basin Commission
DELAWARE • NEW JERSEY
PENNSYLVANIA • NEW YORK
UNITED STATES OF AMERICA

# DRBC Storage Study Update

## Water Management Advisory Committee: June 28, 2023

## Chapter 3 - Identification & Screening of Potential Projects

**Table 3.1.3-2: Rubrics for Rating Each Initial Screening Criterion**

| Criteria | Reservoirs | Quarries | Deep Mines |
|---|---|---|---|
| Volume of storage | existing/estimated new storage<br>>10 BG = 3<br>>5 BG = 2<br><5 BG = 1 | estimated storage volume<br>>2 BG = 3<br>>1 BG = 2<br><1 BG = 1<br>water filled = 2 | All 3; > 2 BG |
| Sufficiency of water supply | based on drainage area:<br>>100 sq. mi. = 3<br>> 20 = 2<br>< 20 = 1 | distance to DRBC-mapped stream<br><1 mi = 3<br>< 2 mi = 2<br>> 2 mi = 1 | All assumed 3 |
| Environmental resource impact | relative area/length of wetlands/high-quality streams inundated<br>low =3<br>medium = 2<br>high = 1 | all 3 (low impact) | |
| Infrastructure and social impact | relative number of buildings and length and importance of roads inundated<br>low =3<br>medium = 2<br>high = 1 | surrounding land use<br>completely rural = 3<br>mostly rural = 2<br>suburban/urban = 1 | all 3 (low impact) |

Initial Screening

| Criteria | Reservoirs | Quarries | Deep Mines |
|---|---|---|---|
| Position in Basin | Enters mainstem above Trenton = 3<br>Schuylkill to Trenton = 2<br>Below Schuylkill = 1 | | All 2 (in upper Schuylkill) |
| Owner cooperativeness | Dam raise<br>water or power = 3<br>NYC/USACE/state = 2<br>private = 1<br>Operational change<br>power co. = 3<br>USACE/state = 2<br>water utilities/ private = 1 | all 2 | all 2 |
| Water retention | Not applicable | Ponded area<br>>5 ac = 3<br>>2 ac = 2<br><2 ac = 1 | Not applicable |
| Proximity to mainstem | < 10 stream miles = 3<br>< 50 stream miles = 2<br>> 50 stream miles = 1 | | All Schuylkill |

Delaware River Basin Commission
DELAWARE • NEW JERSEY
PENNSYLVANIA • NEW YORK
UNITED STATES OF AMERICA

# DRBC Storage Study Update

## Water Management Advisory Committee: June 28, 2023

### Chapter 3 - Identification & Screening of Potential Projects

**Supplemental Screening** got us from 61 projects down to ~38 (which is what the budget could reasonably accommodate).

Strategy was to perform early project characterization to identify any major flaws.

Existing reservoirs: Contact made with owners to gage hypothetical willingness to acquire "excess" water or feasibility to expand reservoir. 9 screened out.

Quarries: Cursory review of nearby stream sources and water availability. 15 quarries screened out.

# DRBC Storage Study Update

## WMAC: June 28, 2023

## Chapter 4 – Evaluation Criteria

DRBC
*Feasibility Evaluation of Additional Storage Options*

**STORAGE PROJECT SCORING**

STORAGE PROJECT: M19
NAME: Phoenix Park Deep Mine

| SIX PRIMARY CRITERIA | Quantitative Evaluation Metric (when appropriate) (enter values only | Score (5=best, 1=worst) | | | Weight | Weighted Score | Project Specific Comments |
|---|---|---|---|---|---|---|---|
| 1. Water Quantity and Quality | | 2.83 | | | 30% | 0.85 | |
| o Volume of storage provided (BG) | 2.05 | 1 | | | | | |
| o Hydrologic reliability of supply (months to fill) | 7 | 4 | | | | | Recharge of the mine is unclear; others have recharged quickly |
| o Release rate (cfs) | 25 | 2 | | | | | May need to further reduce release rate or change discharge |
| o Promptness of delivery to mainstem (day) | 2.6 | 3 | | | | | |
| o Geographic Benefit | | 3 | | | | | |
| o Quality of stored water | | 4 | | | | | Assumes treatment |
| 2. Infrastructure Design, Construction and Operation | | 2.90 | | | 10% | 0.29 | |
| o Site/Civil, Land & Easements | | 3 | | | | | Longer pipeline may create land issues |
| o Subsurface conditions | | 2 | | | | | Mines create complexity |
| o Infrastructure Complexity | | 4 | | | | | No complex design |
| o Construction complexity | | 3.5 | | | | | Pipeline construction can be difficult |
| o Operational complexity | | 2 | | | | | Treatment makes for more complex operations |
| 3. Environmental Impacts | | 4.21 | | | 15% | 0.63 | |
| o Protected species | | 4 | | | | | None known, but likely |
| o Water quality degradation | | 5 | | | | | Quality may be improved by treatment |
| o Obstruction to passage of aquatic animals | | 5 | | | | | Not likely |
| o Hydromodification | | 1 | | | | | Change to low flow stream; mine dewatering will have likely impact |
| | | | special two-factor scoring for habitat impacts | | | | |
| Habitat Type | | Combined average | replaceability (5=easy; 1=difficult) | quantity impacted (5=large, 1=small) | | | |
| o Wetlands inundated or filled (ac) | | 5 | 5 | 5 | | | |
| o Stream length inundated (mi) | | 5 | 5 | 5 | | | |
| o Uplands inundated or developed (ac) | | 4.5 | 5 | 4 | | | Pipeline could minimally impact |
| 4. Social and Economic Impacts | | 5.00 | | | 10% | 0.50 | |
| o Disruption/displacement | | 5 | | | | | |
| o Safety and health | | 5 | | | | | |
| o Social equity | | 5 | | | | | |
| o Recreational loss | | 5 | | | | | |
| o Cultural/historical resources | | 5 | | | | | |
| o Aesthetic | | 5 | | | | | May prompt further area reclamation |
| o Loss of tax revenue | | 5 | | | | | |
| o Loss of production from farmland, timberland, quarries | | 5 | | | | | |
| o Emissions of greenhouse gases | | 3 | | | | | |
| 5. Project Costs & Schedule | | 2.00 | | | 30% | 0.60 | |
| o Land acquisition cost ($) | $0.150M | | | | | | |
| o Construction Cost ($) | $23M | | | | | | |
| o Operating Cost ($/yr) | $1.25M | | | | | | |
| o Overall Cost ($) | $49M | 2 | | | | | |
| o Cost effectiveness ($/BG) | 24 | 1 | | | | | |
| o Schedule (Time to make Operational, years) | 13 | 3 | | | | | |
| 6. Ancillary Benefits | | 2.40 | | | 5% | 0.12 | |
| o Flood control | | 1 | | | | | |
| o Recreation/tourism | | 1 | | | | | |
| o Habitat/fishery enhancement | | 1 | | | | | |
| o water quality improvement/environmental remediation (i.e. acid mine discharge; quarry reclamation) | | 4 | | | | | Could be flow related stream impacts |
| o Ability to leverage funding from other programs | | 5 | | | | | |
| OVERALL | | 3.22 | | | | 2.99 | |

| Primary Criteria | Weight |
|---|---|
| Water Quantity & Quality | 30% |
| Infrastructure Design, Construction and Operation | 10% |
| Environmental Impacts | 15% |
| Social & Economic Impacts | 10% |
| Project Costs & Schedule | 30% |
| Ancillary Benefits | 5% |

Delaware River Basin Commission
DELAWARE • NEW JERSEY
PENNSYLVANIA • NEW YORK
UNITED STATES OF AMERICA

# DRBC Storage Study Update

## Water Management Advisory Committee: June 28, 2023

### Chapter 5 – Project Characterization

* describes the concept development and approach for each of the four "types" of projects

**1. New dams**

**2. Modification to existing dams:**

**3. Quarries:**

**4. Deep Mines:**

Delaware River Basin Commission
DELAWARE • NEW JERSEY
PENNSYLVANIA • NEW YORK
UNITED STATES OF AMERICA

**Table 6.1-1: Criteria Scores and Key Metrics for all Projects (grouped by project type, then sorted by weighted score)**

| ID | Project Name | County (PA unless indicated) | Vol-ume (BG) | Total Cost (PV M$) | Cost effec-tiveness (M$/BG) | Pump in or Gravity | OVERALL WEIGHTED SCORE | 1. Water quantity and quality | 2. Infra. design, const. & ops. | 3. Environ. impacts | 4. Social & Economic Impacts | 5. Project Costs & Schedule | 6. Ancillary Benefits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **NEW RESERVOIRS** | | | | | | | | | | | | | |
| N4 | Rattling Run | Berks | 1.3 | 293 | 225 | G | **3.05** | 3.83 | 3.40 | 3.36 | 4.22 | 1.83 | 1.60 |
| N5 | Equinunk | Wayne | 42.0 | 1150 | 27 | G | **3.03** | 4.50 | 2.60 | 2.00 | 3.00 | 2.33 | 2.40 |
| N2 | Milanville | Wayne | 42.0 | 950 | 23 | G | **2.95** | 4.17 | 2.60 | 2.16 | 3.00 | 2.33 | 2.40 |
| N1 | Red Creek | Schuylkill | 13.3 | 366 | 28 | P | **2.90** | 3.67 | 2.20 | 2.93 | 3.22 | 2.33 | 2.40 |
| N6 | Hawley | Wayne | 1.3 | 182 | 140 | G | **2.87** | 4.17 | 2.80 | 2.18 | 3.33 | 2.00 | 1.60 |
| N3 | Little Martins Creek | Northampton | 7.1 | 353 | 50 | P | **2.87** | 4.17 | 2.20 | 1.96 | 3.44 | 2.17 | 2.20 |
| N7 | Silver/Big Creek | Schuylkill | 11.3 | 921 | 81 | P | **2.77** | 3.50 | 1.80 | 2.68 | 4.33 | 1.83 | 3.00 |
| **EXISTING RESERVOIRS – STORAGE INCREASE** | | | | | | | | | | | | | |
| E4 | Prompton | Wayne | 2.0 | 2 | 1 | G | **4.04** | 4.17 | 3.80 | 3.25 | 4.78 | 4.50 | 1.80 |
| E2 | Cannonsville | Delaware, NY | 13.0 | 77 | 6 | G | **3.99** | 4.67 | 3.60 | 3.21 | 4.89 | 4.00 | 1.20 |
| E1 | Wild Creek | Carbon & Monroe | 1.0 | 135 | 135 | G | **3.29** | 4.00 | 2.80 | 3.50 | 4.89 | 2.50 | 1.00 |
| E3 | Blue Marsh | Berks | 5.0 | 65 | 13 | G | **3.19** | 3.83 | 2.20 | 3.43 | 4.11 | 2.67 | 1.80 |
| **EXISTING RESERVOIRS – TRANSFERABLE STORAGE** | | | | | | | | | | | | | |
| T2 | Rio | Sullivan, NY | 2.0 | 27 | 14 | NA | **4.16** | 4.17 | 4.60 | 5.00 | 5.00 | 3.83 | 1.00 |
| T4 | Lake Ontelaunee | Berks | 1.0 | 27 | 27 | NA | **4.01** | 3.33 | 4.60 | 5.00 | 5.00 | 4.17 | 1.00 |
| T1 | Merrill Creek | Warren, NJ | 2.0 | 110 | 55 | NA | **3.91** | 4.50 | 4.60 | 5.00 | 5.00 | 2.67 | 1.00 |
| T3 | Penn Forest/Wild Creek | Carbon/ Monroe | 3.0 | 162 | 54 | NA | **3.87** | 3.83 | 4.60 | 5.00 | 5.00 | 3.17 | 1.20 |
| **QUARRIES** | | | | | | | | | | | | | |
| Q19 | Rush Valley | Bucks | 1.7 | 26 | 15 | | **4.07** | 3.75 | 3.60 | 4.79 | 4.88 | 4.00 | 3.60 |
| Q02 | Mccoy | Montgomery | 6.2 | 30 | 5 | P or G | **4.06** | 3.50 | 3.10 | 4.61 | 4.75 | 4.50 | 3.60 |
| Q04 | Penns Park | Bucks | 3.3 | 31 | 10 | P | **4.04** | 3.58 | 3.60 | 4.57 | 4.88 | 4.17 | 3.60 |
| Q12 | Solebury | Bucks | 2.3 | 38 | 16 | P | **4.03** | 3.75 | 3.20 | 4.57 | 5.00 | 4.00 | 4.00 |
| Q25 | Oxford | Warren, NJ | 1.2 | 28 | 23 | P | **4.02** | 4.00 | 3.60 | 4.57 | 4.88 | 3.83 | 2.80 |
| Q07D | Stockertown(Delaware) | Northampton | 4.6 | 26 | 6 | P | **4.01** | 4.08 | 3.70 | 4.93 | 4.25 | 3.67 | 3.00 |
| Q22 | Whitehall | Lehigh | 1.2 | 34 | 28 | P | **3.96** | 3.83 | 3.00 | 4.86 | 4.69 | 3.67 | 4.20 |
| Q21 | Ormrod | Lehigh | 1.3 | 45 | 35 | P | **3.92** | 3.83 | 3.10 | 4.93 | 4.63 | 3.50 | 4.20 |
| Q23 | Lehigh Perkiomenville | Montgomery | 1.0 | 26 | 26 | P | **3.91** | 3.58 | 3.80 | 4.79 | 4.88 | 3.67 | 3.00 |
| Q01 | Wadesville Mine Pit | Schuylkill | 6.9 | 39 | 5 | P or G | **3.91** | 3.42 | 3.40 | 4.21 | 4.63 | 4.17 | 4.00 |
| Q08 | Evansville | Berks | 3.1 | 44 | 14 | P or G | **3.91** | 3.75 | 3.20 | 4.79 | 4.00 | 3.83 | 3.90 |
| Q27 | NESL Nazareth | Northampton | 1.0 | 25 | 25 | P | **3.86** | 3.67 | 3.40 | 4.21 | 5.00 | 3.83 | 2.80 |
| Q03 | Plymouth Meeting | Montgomery | 3.5 | 39 | 11 | P | **3.76** | 3.50 | 3.10 | 3.89 | 4.75 | 3.83 | 3.80 |
| Q14 | Telford | Bucks | 1.0 | 25 | 25 | P | **3.50** | 3.17 | 2.90 | 4.07 | 4.75 | 3.67 | 1.40 |
| Q07B | Stockertown (Bushkill) | Northampton | 4.6 | 26 | 6 | P | **3.47** | 3.42 | 2.50 | 3.43 | 4.50 | 3.67 | 2.60 |
| Q16 | Temple | Berks | 1.0 | 30 | 30 | P | **3.42** | 3.25 | 2.20 | 4.64 | 3.25 | 3.67 | 2.00 |
| Q05 | Lehigh Nazareth | Northampton | 4.2 | 48 | 12 | P | **3.37** | 3.25 | 2.30 | 3.00 | 4.38 | 3.83 | 2.60 |
| Q06 | Imperial | Northampton | 3.8 | 51 | 13 | P | **3.34** | 3.25 | 2.30 | 3.14 | 4.38 | 3.67 | 2.60 |
| **DEEP MINES** | | | | | | | | | | | | | |
| M32 | Morea Basin | Schuylkill | 2.7 | 65 | 24 | P | **3.58** | 3.08 | 3.20 | 4.43 | 5.00 | 3.50 | 2.40 |
| M20 | Otto | Schuylkill | 2.3 | 65 | 28 | P | **3.53** | 3.17 | 3.00 | 4.43 | 5.00 | 3.33 | 2.40 |
| M5 | Silver Creek | Schuylkill | 1.7 | 65 | 38 | P | **3.12** | 3.00 | 3.20 | 4.50 | 5.00 | 2.00 | 2.40 |
| M19 | Phoenix Park | Schuylkill | 2.1 | 65 | 31 | P | **2.99** | 2.83 | 2.90 | 4.21 | 5.00 | 2.00 | 2.40 |
| M10 | Wadesville | Schuylkill | 3.6 | 65 | 18 | P | **0.00** | NA | NA | NA | NA | NA | NA |

# DRBC Storage Study Update

## WMAC: June 28, 2023

### Chapter 6 – Project Evaluation

Each project's detailed scoresheet is appended to its Storage Project Summary (SPS) – Appendix A

Scored 1 (low) to 5 (high)

Delaware River Basin Commission
DELAWARE • NEW JERSEY
PENNSYLVANIA • NEW YORK
UNITED STATES OF AMERICA

**Table 7-1: All Evaluated Projects Sorted by Weighted Score (recommended projects in bold)**

| ID | Recommendation (1=No Recommendation, 2=Not Recommended, 3= Recommended) | Project Name | Location | Project type | Vol. (BG) | Total Cost (PV M$) | Cost effective-ness (M$/BG) | Pump in or Gravity | Years to complete | OVERALL WEIGHTED SCORE | 1. Water quantity & quality | 2. Infra. design, const. & ops. | 3. Environ. impacts | 4. Social & Economic Impacts | 5. Project Costs & Schedule | 6. Ancil. Benefits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T2 | 1 | Rio | Sullivan, NY | Transfer | 2.0 | 27 | 14 | NA | 1 | 4.16 | 4.17 | 4.60 | 5.00 | 5.00 | 3.83 | 1.00 |
| Q19 | 3 | Rush Valley | Bucks | Quarry | 1.7 | 24 | 14 | P | 9 | 4.07 | 3.75 | 3.60 | 4.79 | 4.88 | 4.00 | 3.60 |
| Q02 | 3 | Mccoy | Montgomery | Quarry | 6.2 | 30 | 5 | P | 7 | 4.06 | 3.50 | 3.10 | 4.61 | 4.75 | 4.50 | 3.60 |
| E4 | 3 | Prompton | Wayne | Dam mod | 2.0 | 2 | 1 | G | 10 | 4.04 | 4.17 | 3.80 | 3.25 | 4.78 | 4.50 | 1.80 |
| Q04 | 3 | Penns Park | Bucks | Quarry | 3.3 | 31 | 10 | P | 10 | 4.04 | 3.58 | 3.60 | 4.57 | 4.88 | 4.17 | 3.60 |
| Q12 | 3 | Solebury | Bucks | Quarry | 2.3 | 38 | 16 | P | 11 | 4.03 | 3.75 | 3.20 | 4.57 | 5.00 | 4.00 | 4.00 |
| Q25 | 3 | Oxford | Warren, NJ | Quarry | 1.2 | 28 | 23 | P | 9 | 4.02 | 4.00 | 3.60 | 4.57 | 4.88 | 3.83 | 2.80 |
| T4 | 1 | Lake Ontelaunee | Berks | Transfer | 1.0 | 27 | 27 | NA | 5 | 4.01 | 3.33 | 4.60 | 5.00 | 5.00 | 4.17 | 1.00 |
| Q07D | 3 | Stockertown (Delaware) | Northampton | Quarry | 4.6 | 26 | 6 | P | 9 | 4.01 | 4.08 | 3.70 | 4.93 | 4.25 | 3.67 | 3.00 |
| E2 | 3 | Cannonsville | Delaware, NY | Dam mod | 13.0 | 77 | 6 | G | 10 | 3.99 | 4.67 | 3.60 | 3.21 | 4.89 | 4.00 | 1.20 |
| Q22 | 3 | Whitehall | Lehigh | Quarry | 1.2 | 34 | 28 | P | 11 | 3.96 | 3.83 | 3.00 | 4.86 | 4.69 | 3.67 | 4.20 |
| Q21 | 3 | Ormrod | Lehigh | Quarry | 1.3 | 45 | 35 | P | 9 | 3.92 | 3.83 | 3.10 | 4.93 | 4.63 | 3.50 | 4.20 |
| T1 | 1 | Merrill Creek | Warren, NJ | Transfer | 2.0 | 110 | 55 | NA | 10 | 3.91 | 4.50 | 4.60 | 5.00 | 5.00 | 2.67 | 1.00 |
| Q23 | 3 | Perkiomenville | Montgomery | Quarry | 1.0 | 26 | 26 | P | 1 | 3.91 | 3.58 | 3.80 | 4.79 | 4.88 | 3.67 | 3.00 |
| Q01 | 3 | Wadesville Mine Pit | Schuylkill | Quarry | 6.9 | 39 | 5 | P | 8 | 3.91 | 3.42 | 3.40 | 4.21 | 4.63 | 4.17 | 4.00 |
| Q08 | 3 | Evansville | Berks | Quarry | 3.1 | 44 | 14 | P | 10 | 3.91 | 3.75 | 3.20 | 4.79 | 4.00 | 3.83 | 3.90 |
| T3 | 1 | Penn Forest/Wild Creek | Carbon/ Monroe | Transfer | 3.0 | 162 | 54 | NA | 5 | 3.87 | 3.83 | 4.60 | 5.00 | 5.00 | 3.17 | 1.20 |
| Q27 | 3 | NESL Nazareth | Northampton | Quarry | 1.0 | 25 | 25 | P | 10 | 3.86 | 3.67 | 3.40 | 4.21 | 5.00 | 3.83 | 2.80 |
| Q03 | 2 | Plymouth Meeting | Montgomery | Quarry | 3.5 | 39 | 11 | P | 8 | 3.76 | 3.50 | 3.10 | 3.89 | 4.75 | 3.83 | 3.80 |
| M32 | 2 | Morea Basin | Schuylkill | Mine Pool | 2.7 | 65 | 24 | P | 12 | 3.58 | 3.08 | 3.20 | 4.43 | 5.00 | 3.50 | 2.40 |
| M20 | 2 | Otto | Schuylkill | Mine Pool | 2.3 | 65 | 28 | P | 13 | 3.53 | | | | | | |
| Q14 | 2 | Telford | Bucks | Quarry | 1.0 | 25 | 25 | P | 10 | 3.50 | | | | | | |
| Q07B | 2 | Stockertown (Bushkill) | Northampton | Quarry | 4.6 | 26 | 6 | P | 8 | 3.47 | | | | | | |
| Q16 | 2 | Temple | Berks | Quarry | 1.0 | 30 | 30 | P | 9 | 3.42 | | | | | | |
| Q05 | 2 | Lehigh Nazareth | Northampton | Quarry | 4.2 | 48 | 12 | P | 8 | 3.37 | | | | | | |
| Q06 | 2 | Imperial | Northampton | Quarry | 3.8 | 51 | 13 | P | 8 | 3.34 | | | | | | |
| E1 | 2 | Wild Creek | Carbon/ Monroe | Dam mod | 1.0 | 135 | 135 | G | 10 | 3.29 | 4.00 | 2.80 | 3.50 | 4.89 | 2.50 | 1.00 |
| E3 | 2 | Blue Marsh | Berks | Dam mod | 5.0 | 65 | 13 | G | 20 | 3.19 | 3.83 | 2.20 | 3.43 | 4.11 | 2.67 | 1.80 |
| M5 | 2 | Silver Creek | Schuylkill | Mine Pool | 1.7 | 65 | 38 | P | 12 | 3.12 | 3.00 | 3.20 | 4.50 | 5.00 | 2.00 | 2.40 |
| N4 | 2 | Rattling Run | Berks | New dam | 1.3 | 293 | 225 | G | 15 | 3.05 | 3.83 | 3.40 | 3.36 | 4.22 | 1.83 | 1.60 |
| N5 | 2 | Equinunk | Wayne | New dam | 42.0 | 1150 | 27 | G | 15 | 3.03 | 4.50 | 2.60 | 2.00 | 3.00 | 2.33 | 2.40 |
| M19 | 2 | Phoenix Park | Schuylkill | Mine Pool | 2.1 | 65 | 31 | P | 13 | 2.99 | 2.83 | 2.90 | 4.21 | 5.00 | 2.00 | 2.40 |
| N2 | 2 | Milanville | Wayne | New dam | 42.0 | 950 | 23 | G | 15 | 2.95 | 4.17 | 2.60 | 2.16 | 3.00 | 2.33 | 2.40 |
| N1 | 2 | Red Creek | Schuylkill | New dam | 13.3 | 366 | 28 | P | 15 | 2.90 | 3.67 | 2.20 | 2.93 | 3.22 | 2.33 | 2.40 |
| N6 | 2 | Hawley | Wayne | New dam | 1.3 | 182 | 140 | G | 20 | 2.87 | 4.17 | 2.80 | 2.18 | 3.33 | 2.00 | |
| N3 | 2 | Little Martins Creek | Northampton | New dam | 7.1 | 353 | 50 | P | 15 | 2.87 | 4.17 | 2.20 | 1.96 | 3.44 | 2.17 | |
| N7 | 2 | Silver/Big Creek | Schuylkill | New dam | 11.3 | 921 | 81 | P | 15 | 2.77 | 3.50 | 1.80 | 2.68 | 4.33 | 1.83 | |
| M10 | 2 | Wadesville | Schuylkill | Mine Pool | 3.6 | 65 | 18 | P | | NA | NA | NA | NA | NA | NA | |

# WMAC: June 28, 2023

## Chapter 7 – Recommendations

Delaware River Basin Commission
DELAWARE • NEW JERSEY
PENNSYLVANIA • NEW YORK
UNITED STATES OF AMERICA

# DRBC Storage Study Update

## Water Management Advisory Committee: June 28, 2023

### Chapter 7 – Recommendations

**Table 7.3-1: Project Recommended as Most Feasible, Sorted by Overall Score**

| Rank | Project Name | Project ID | County/ State | Overall Weighted Score | Volume (BG) | Cost, (PV M$) | Cost Effectiveness, M$/BG |
|---|---|---|---|---|---|---|---|
| 1 | Rush Valley | Q19 | Bucks, PA | 4.07 | 1.7 | 24 | 14.1 |
| 2 | McCoy | Q02 | Montgomery, PA | 4.06 | 6.2 | 30 | 4.9 |
| 3 | Prompton | E4 | Wayne, PA | 4.04 | 2.0 | 2 | 1.0 |
| 4 | Penns Park | Q04 | Bucks, PA | 4.04 | 3.3 | 31 | 9.5 |
| 5 | Solebury | Q12 | Bucks, PA | 4.03 | 2.3 | 38 | 16.3 |
| 6 | Tilcon Oxford | Q25 | Warren, NJ | 4.02 | 1.2 | 28 | 23.3 |
| 7 | Stockertown (Delaware River) | Q07D | Northampton, PA | 4.01 | 4.6 | 26 | 5.7 |
| 8 | Cannonsville | E2 | Delaware, NY | 3.99 | 13.0 | 77 | 5.9 |
| 9 | Whitehall | Q22 | Lehigh, PA | 3.96 | 1.2 | 34 | 28.0 |
| 10 | Ormrod | Q21 | Lehigh, PA | 3.92 | 1.3 | 45 | 34.6 |
| 11 | Wadesville Mine Pit | Q01 | Schuylkill, PA | 3.91 | 6.9 | 39 | 4.8 |
| 12 | Evansville | Q08 | Berks, PA | 3.91 | 3.1 | 44 | 14.3 |
| 13 | Perkiomenville | Q23 | Montgomery, PA | 3.91 | 1.0 | 26 | 26.0 |
| 14 | NESL Nazareth | Q27 | Northampton, PA | 3.86 | 1.0 | 25 | 25.0 |

No transfers included

Most are quarries

Most are located in PA

Delaware River Basin Commission
DELAWARE • NEW JERSEY
PENNSYLVANIA • NEW YORK
UNITED STATES OF AMERICA

# DRBC Storage Study Update

Water Management Advisory Committee:  June 28, 2023

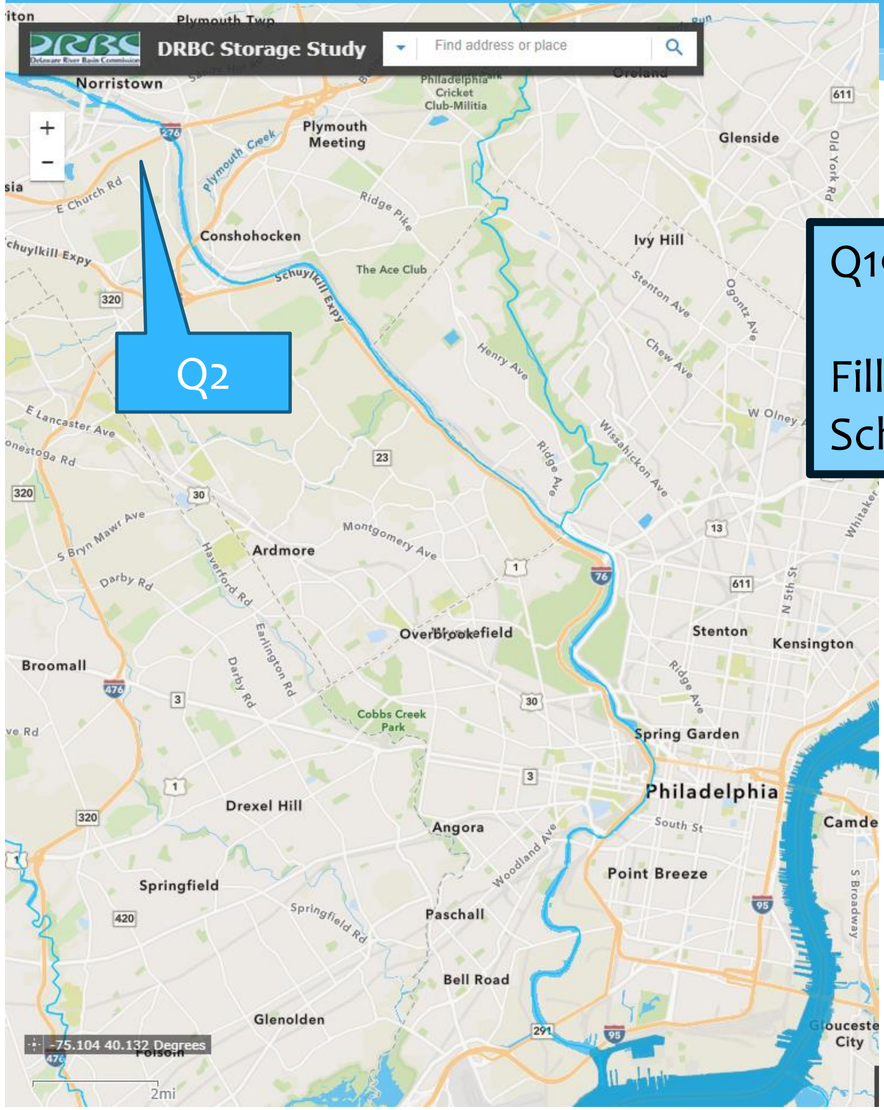
## Appendix A – Storage Project Summaries:  Top 38 projects

Delaware River Basin Commission
DELAWARE • NEW JERSEY
PENNSYLVANIA • NEW YORK
UNITED STATES OF AMERICA

# DRBC Storage Study Update

Water Management Advisory Committee: June 28, 2023

## Q2 – Dyer (aka McCoy) Quarry




Q19: ~ 6.2BG

Fill from Schuylkill River

# DRBC Storage Study Update

## Water Management Advisory Committee: June 28, 2023


Q19: ~ 6.2BG

Fill from Schuylkill River

## Q2 – Dyer (aka McCoy) Quarry

# DRBC Storage Study Update

## Water Management Advisory Committee: June 28, 2023

## Appendix A – Storage Project Summaries: Q2 – McCoy Quarry

MOTT MACDONALD

# Storage Project Summary

| | | |
|---|---|---|
| **Project:** | McCoy Quarry (Q2) | |
| **Location:** | King of Prussia, Montgomery County, PA | |
| **Storage Type:** | Quarry (Fill & Draw) | |
| **Est. Volume:** | 6.2 Billion Gallons | |
| **Score:** | 4.06 | |

## 1 Project Overview

The McCoy Quarry is located in King of Prussia within Upper Merion Township and is adjacent to Plymouth Township, Pennsylvania (Figure 1.1). The quarry has a maximum estimated volume of 6.2 billion gallons. This quarry is approximately 123 acres in area and has an estimated fillable rim elevation of 70 ft. At the quarry's deepest point, it has an elevation of -237 ft, giving the quarry a nominal depth of 307 ft. The Schuylkill River is about 1040 ft away. The quarry is composed of quartz sand and gravel and generally mined for aggregate products. Water would be extracted during times of high flows (possibly by gravity) from the Schuylkill River, stored in the quarry, then discharged back to the River to augment flow during low flow.

**Figure 1.1 Project location**

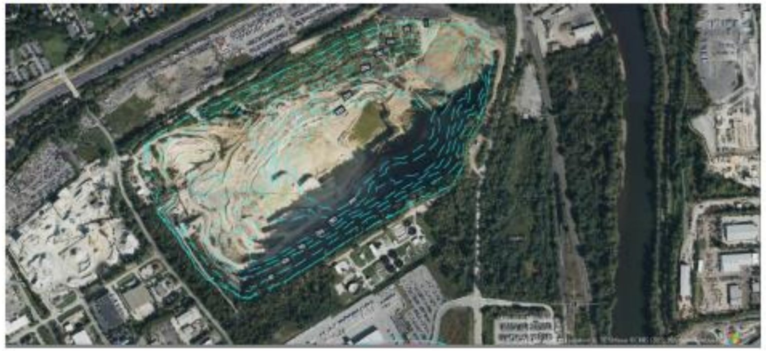

## 2 Water Quantity & Quality

### 2.1 Quarry Storage Volume

Table 2.1 presents key dimensions of the quarry, foremost its estimated operable water storage volume of over 5.0 BG.

The storage volume was calculated using available topographic information from Pennsylvania Spatial Data Access and AutoCAD Civil 3D 2020. The top elevation of full storage was assumed to be the stated rim elevation. The quarrying over the years excavated from an essentially flat surface grade, creating a deepening depression. Therefore, no additional structures such as dams or retaining walls are needed to further increase the storage volume for this project. Figure 2.1 below shows contours showing the depth of the quarry. The stored water volume assumes the interior of the quarry to generally be impervious with minimal leakage. Further analysis will be needed to account for storage lost to pervious areas.

**Figure 2.1: Arial View with Contours**



### 2.2 Fill and Discharge

This project is unique in its proximity to a major river and the potential to gravity feed into the quarry for a large portion of the storage volume. Additional gravity filling or low head pumping could be performed during high flow periods of the adjacent Schuylkill River, allowing for the project to effectively "skim" flows from the Schuylkill River.

The key parameters relating to storage volume and fill/discharge supply are also summarized in Table 2.1 below.

**Table 2.1: Storage and Fill/Discharge Parameters**

| DESCRIPTION | VALUE |
|---|---|
| **Storage** | |
| Area (Acres) | 123 acres |
| Nominal Rim Elev. | 70 ft. |
| Bottom Elev. | -237 ft. |
| Maximum Water Level Change (Ft.) | 307 ft. |
| Maximum Volume (Billion Gallons) | 6.2 BG |
| Operating Water Range (70 ft to -176 ft) | 246 ft. |
| Operating Volume (Billion Gallons) - ~80% of max. vol. | 5.0 BG |
| **Water Supply – Quarry Fill (Stream Withdrawal)** | |
| Anticipated Source Stream | Schuylkill River |
| Anticipated Source Stream Drainage Area (Sq. Miles) | 1770 sq. mi. |
| Mean Annual Stream Flow Rate (cfs/mgd) | 2910 cfs / 1880 mgd |
| Proposed Average Pumping Rate (mgd) | 31 mgd |
| Average Vol. Pumped during 6 month Pumping Term | 5.6 BG |
| **Water Release – Quarry Discharge (Stream Augmentation)** | |
| Quarry Operating Water Elevation Range (ft) | 70 ft to -176 ft |
| Proposed discharge pumping rate (cfs/mgd) | 50 cfs / 32 mgd |
| Estimated Time to Release Operating Volume from Storage | 5.1 months |
| **Water Supply – Travel to Use** | |
| Stream Miles to Delaware River | 67.7 miles |
| Travel Time at 2 mph (hours) | 56 hours |

### 2.3 Water Quality

The Schuylkill River has marginal to good water quality based on the PA 303D listing. Table 2.2 below summarizes the listed impairments.

**Table 2.2: 303D Listing Impairments**

| IMPAIRMENT | | | |
|---|---|---|---|
| Aquatic Use | Recreational | Fish Consumption | Potable Supply |
| IMPAIRED - siltation due to urban runoff, habitat alterations other than hydromodification, flow regime modification due to urban runoff, point discharges and agriculture | Not Assessed | Impaired - PCBs | Supporting |

The Chapter 93 stream designation is warm water fishery (WWF).

Water quality may change after pumping from the Schuylkill River and settling in the quarry. There may be potential for mixing with adjacent groundwater quality. It is assumed that the stored quality will not decrease relative to the source stream, and quality will likely increase by settling of suspended solids similar to other upstream desilting facilities located on the Schuylkill River. The water quality should be adequate for flow augmentation but this needs to be confirmed by further investigation.

# DRBC Storage Study Update

## Water Management Advisory Committee: June 28, 2023

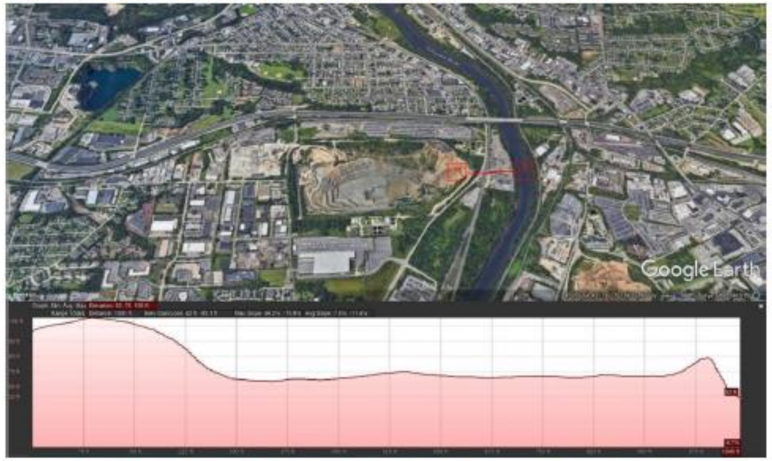
## Appendix A – Storage Project Summaries: Q2 – McCoy Quarry

Delaware River Basin Commission
DELAWARE • NEW JERSEY
PENNSYLVANIA • NEW YORK
UNITED STATES OF AMERICA

### 3 Infrastructure Design, Construction & Operation

The infrastructure required includes the quarry storage, stream withdrawal facilities, quarry discharge pumping facilities and interconnecting pipeline. Figure 3.1 shows a schematic plan and profile illustrating the typical major facilities required.

**Figure 3.1: Approximate Pipe (red line) and Pump Station (P) Location and Profile**




The elevation of the Schuylkill River is approximately 53 ft, the quarry rim is 70 ft (90 ft highpoint shown in the above profile). This geometry may allow for gravity "skimming" of the river as will be explained further below. Even if pumping is used to fill the quarry storage, the geometry is advantageous relative to others in that the distance is minimal and the static head to overcome for filling the quarry is low.

However, for consistency and comparison with other facilities, filling by pumping was assumed, as described below. The option for gravity will be mentioned in a later section.

#### 3.1 Pumping Facilities

The base case quarry fill/stream withdrawal pumping station is envisioned to be the typical standard intake and pumping arrangement. Submerged screen intakes would be placed on the river bottom adjacent to the proposed fill/stream withdrawing pumping station shaft. The shaft and facilities would be fitted with pumps as noted below. The total head to overcome by lifting water from the river elevation above the highpoint of the proposed pipeline is relatively small. Given the relatively high flows of the Schuylkill River, the source does not limit withdrawal pumping. Rather, the pumping rate is based on the practical pumping station sizing. Larger intakes and pumping arrangements can be considered, as shown by other downstream potable water pumping facilities. However, there is no need given the quarry filling objectives.

The quarry discharge/stream augmentation pumping station would include the typical withdrawal shaft and pumping arrangement as described in the body of the report. Given the depth of the quarry, significant head must be overcome to pump from the lowest quarry operating level and over the rim and pipeline highpoint for discharge back to the Schuylkill River.

#### 3.2 Pipeline

The proposed pipeline route is also schematically shown in Figure 3.1. The pipeline is assumed to be 30 inch diameter ductile iron pipe (DIP) installed at nominal depths below grade on essentially a direct alignment from the river pumping station to the quarry. A private easement would be required for a portion of the pipeline, but other public right-of-way (ROW) options exist. The pipeline would need to cross under a railroad and state Route 23. These crossings would be accomplished with typical trenchless methods. Table 3.1 below summarizes the piping and pumping facility parameters.

**Table 3.1: Piping and Pumping Facility Parameters**

| Parameter | Value |
|---|---|
| Quarry Fill (Stream Discharge) | |
| Design Flow | 31 mgd |
| Pump Capacity (3 x 10.4 mgd) | 31 mgd |
| Quarry Discharge (Stream Augmentation) | |
| Design Flow | 31.64 mgd (50 cfs) |
| Pump Capacity (5 x 7.2 mgd) | 36 mgd |
| Pipeline Distance | 1,040 lf |
| Elevation at Discharge Point | 52 ft |
| Elevation at High Point on Pipeline | 100 ft |
| Static Head | 48 ft |
| Pipe Diameter with 10 ft/s Velocity Limit | 30 in |

Components and quantities of the envisioned facilities are detailed further in the Section 6, Project Cost & Schedule.

The pumping facilities are intended to be remotely operated and monitored as described in the main report. For the purposes of estimating costs, the quarry is assumed to be dewatered during the dry season and refilled in the wetter off-season months. However, given the high flows in the Schuylkill River, the pump can run continuously to fill the quarry storage as needed.

#### 3.3 Alternate Pumping/Piping Configuration

As mentioned above, a gravity fill option exists on this site. This would require a trenchless installation of a conveyance conduit between the river and quarry at an approximately elevation of +40 ft. Conceptually, this would involve a 42" microtunnelled conduit connecting the intake wetwell and the quarry wetwell/shaft. Valve controls and by-pass pipe connections would be installed such that one could fill most of the quarry by gravity and utilize the same conduit to convey discharge water from the quarry back to the stream, albeit discharging into the river at a separate outfall point. While some additional infrastructure costs are incurred, this could eliminate the need to pump from the river to fill the quarry, thereby eliminating the recurring operating cost. Under this passive filling option, the quarry storage volume is reduced to approximately 3.5 BG.

### 4 Environmental Impacts

This storage project was reviewed against several environmental parameters as described in the body of the report. Overall, the project scored high because it reuses a mined quarry and anticipated environmental impacts are negligible. Minimal impacts would occur to wetlands, forests, streams, endangered species or other concerns. Intakes and pumping would consider fish impingement and other permitted criteria. No other significant environmental impacts are apparent. In addition, there could possibly be improvements to the river by adding the stored and settled quarry water back to the river, particularly during periods of low flow.

Permitting the project appears achievable and should occur within an acceptable timeframe. The major permits for this project, as can be reasonably identified at this concept level of development, are discussed further in the main report. Additional permits may be required.

### 5 Social and Economic Impacts

Stakeholder and social impacts are expected to be minor. The area immediately surrounding the quarry is industrial, but transitions to residential. The quarry site, transitioned to a water storage reservoir, could conceivably be converted to an environmental enhancement and, if so, could have a positive impact on the social and economic outcome in the area. Figure 5.1 provided some land use information for the surrounding area.

**Figure 5.1: Land Ownership**

# DRBC Storage Study Update

## Water Management Advisory Committee: June 28, 2023

## Appendix A – Storage Project Summaries: Q2 – McCoy Quarry

Delaware River Basin Commission
DELAWARE • NEW JERSEY
PENNSYLVANIA • NEW YORK
UNITED STATES OF AMERICA

### 6 Project Cost & Schedule

Mott MacDonald prepared a feasibility-level cost estimate consistent with the general approach described in the main report. The costs are based on the project assumptions and the developed infrastructure concepts as outlined in Section 3 above. The following Table 6.1 presents summary capital cost line items. Additional cost estimating justification can be provided upon request. Capital costs have a contingency (+50%) commensurate with the concept development level of detail.

**Table 6.1: Capital Cost Summary**

| Item | Unit | Quantity | Cost/Unit | Extended Cost |
|---|---|---|---|---|
| FILL PUMPING STATION | | | Subtotal | $3,565,500.00 |
| Intake | | | | |
| Screens | LS | 3 | $80,000.00 | $240,000.00 |
| Structure | VF | 12 | $50,000.00 | $600,000.00 |
| Other | LS | 1 | $90,000.00 | $90,000.00 |
| Pumping Station | | | | |
| Pumps | # | 3 | $450,000.00 | $1,350,000.00 |
| MEP | LS | 1 | $265,500.00 | $265,500.00 |
| Structure | SF | 1200 | $350.00 | $420,000.00 |
| Other | LS | 1 | $100,000.00 | $100,000.00 |
| Dissipation | LS | 1 | $500,000.00 | $500,000.00 |
| PIPELINE | | | Subtotal | $1,082,000.00 |
| Pipeline | LF | 1040 | $800.00 | $832,000.00 |
| Valves | # | 5 | $50,000.00 | $250,000.00 |
| DISCHARGE PUMPING SYSTEM | | | Subtotal | $8,847,000.00 |
| Intake Structure | VF | 245 | $25,000.00 | $6,125,000.00 |
| Pumping Station | | | | |
| Pumps | # | 5 | $450,000.00 | $2,250,000.00 |
| MEP | LS | 1 | $42,000.00 | $42,000.00 |
| Structure | SF | 800 | $350.00 | $280,000.00 |
| Electrical Service | LS | 1 | $50,000.00 | $50,000.00 |
| Other | LS | 1 | $100,000.00 | $100,000.00 |
| ACCESS ROADS | | | | $1,000,000 |
| New roads | Mile | 2 | $500,000 | $1,000,000 |
| SUBTOTALS | | | | |
| Construction Costs Subtotal | | | | $14,494,500 |
| Contingency | | | 50% | $7,247,250 |
| CONST. COST + CONTINGENCY | | | | $21,741,750 |

The total capital is shown above. Land costs are not included and are assumed to be approximately $4M based on comparable quarry values in the region.

Operating costs for this project are estimated to be approximately $0.375M/year. This assumes annual discharge of 5.5 BG and subsequent filling for the following year. Assuming a 30 year operating horizon and ignoring routine maintenance costs, the Present Value (PV) of the operating cost is $7.35M. This brings the combined total of capital and PV of operating cost to a project total of $31.05.

The schedule for putting this project in service after general concurrence of all major parties is expected to be approximately 7 years. This includes:

- Design, permitting and land acquisition 3 years
- Construction 3 years
- Startup and initial filling of quarry 1 years

### 7 Potential Ancillary Benefits

Converting the quarry to water storage could provide ancillary benefits. There may be environmental benefit as mentioned above. Also, there could be additional social and economic benefits associated with a water reservoir in the community.

### 8 Storage Project Score

This project was scored relative to the criteria as presented in the main report. Categories, descriptions and individual scores are summarized in Table 8.1 below. Individual scores for the criteria and sub-criteria are provided in the attached Storage Project Scoring sheet.

**Table 8.1: Storage Project Score**

| CATEGORY | Assigned Score | Assigned Weight | Weighted Score |
|---|---|---|---|
| Water Quantity & Quality | 3.50 | 30% | 1.05 |
| Infrastructure Design, Construction & Operation | 3.10 | 10% | 0.31 |
| Environmental Impacts | 4.61 | 15% | 0.69 |
| Social & Economic Impacts | 4.75 | 10% | 0.48 |
| Project Cost & Schedule | 4.50 | 30% | 1.35 |
| Ancillary Benefits | 3.60 | 5% | 0.18 |
| AVERAGE | 4.01 | | 4.06 |

**Appendix**

Score sheet

DRBC
Feasibility Evaluation of Additional Storage Options

STORAGE PROJECT SCORING

STORAGE PROJECT: Q2
NAME: McCoy Quarry

| SIX PRIMARY CRITERIA | Quantitative Evaluation Metric (when appropriate) (enter values only) | Score (5=best, 1=worst) | | | Weight | Weighted Score | Project Specific Comments |
|---|---|---|---|---|---|---|---|
| 1. Water Quantity and Quality | | 3.50 | | | 30% | 1.05 | |
| o Volume of storage provided (BG) | 6.3 | 3 | | | | | |
| o Hydrologic reliability of supply (months to fill) | 5.5 | 5 | | | | | |
| o Release rate (cfs) | 50 | 3 | | | | | |
| o Promptness of delivery to mainstem (day) | 2.33 | 3 | | | | | |
| o Geographic benefit | | 3 | | | | | |
| o Quality of stored water | | 4 | | | | | Same as source, but settled |
| 2. Infrastructure Design, Construction and Operation | | 3.10 | | | 10% | 0.31 | |
| o Site/Civil, Land & Easements | | 2 | | | | | Typical, but need private easement for pipeline |
| o Subsurface conditions | | 3 | | | | | |
| o Infrastructure Complexity | | 4 | | | | | Typical; shorter pipeline |
| o Construction complexity | | 3 | | | | | Typical |
| o Operational complexity | | 3.5 | | | | | Automated ops; Possible option for gravity fill |
| 3. Environmental Impacts | | 4.61 | | | 15% | 0.69 | |
| o Protected species | | 5 | | | | | Potential for freshwater mussels issues, but no protected |
| o Water quality degradation | | 5 | | | | | Should be minimal; potential for improvement |
| o Obstruction to passage of aquatic animals | | 5 | | | | | None identified |
| o Hydromodification | | 4 | | | | | Minimal impacts, if any; easy to assimilate flows |
| | | | special two-factor scoring for habitat impacts | | | | |
| Habitat Type | | Combined average | replaceability (5=easy; 1=difficult) | quantity impacted (5=small, 1=large) | | | |
| o Wetlands inundated or filled (ac) | | 4.75 | 4.5 | 5 | | | Minor disruptions from intake/bank |
| o Stream length inundated (mi) | WWF; 0.1 mile | 4 | 4 | 4 | | | |
| o Uplands inundated or developed (ac) | | 4.5 | 5 | 4 | | | Short pipeline in industrial area |
| 4. Social and Economic Impacts | | 4.75 | | | 10% | 0.48 | |
| o Disruption/displacement | | 4 | | | | | |
| o Safety and health | | 5 | | | | | |
| o Social equity | | 5 | | | | | |
| o Recreational loss | | 5 | | | | | |
| o Cultural/historical resources | | 5 | | | | | |
| o Aesthetic | | 5 | | | | | Land improvements |
| o Loss of tax revenue | | 4 | | | | | Quarrying would cease |
| o Loss of production from farmland, timberland, quarries | | 5 | | | | | Minor quarry impact |
| o Emission of greenhouse gases | | 3 | | | | | No data |
| 5. Project Costs & Schedule | | 4.50 | | | 30% | 1.35 | |
| o Land acquisition cost ($) | ~$4M | | | | | | |
| o Construction Cost ($) | $21.7M | | | | | | |
| o Operating Cost ($/yr) | ~$0.375M | | | | | | Possible lower cost with gravity fill |
| o Overall Cost ($) | $31.05M | 4.5 | | | | | |
| o Cost effectiveness ($/BG) | 5 | 5 | | | | | |
| o Schedule (Time to make Operational, years) | 7 | 4 | | | | | |
| 6. Ancillary Benefits | | 3.60 | | | 5% | 0.18 | |
| o Flood control | | 3 | | | | | No real benefit perceived |
| o Recreation/tourism | | 4 | | | | | Increase in residential urban area a plus |
| o Habitat/fishery enhancement | | 4 | | | | | Potential for creation of new habitat |
| o water quality improvement/environmental remediation (i.e. acid mine discharge; quarry reclamation) | | 3 | | | | | May support reclamation efforts |
| o Ability to leverage funding from other programs | | 4 | | | | | Recreational and reclamation money may be available |
| OVERALL | | 4.01 | | | | 4.06 | |

# DRBC Storage Study Update

## Water Management Advisory Committee: June 28, 2023

## Appendix I – 1 Page Project Summaries Top 10

**RECOMMENDED STORAGE PROJECT – ONE PAGE SUMMARY**
*(Refer to the Storage Project Summary located in Appendix A for more detailed information.)*

PROJECT NUMBER: Q19

PROJECT NAME AND LOCATION (City and State)
*Rush Valley Quarry*
*Furlong (Bucks County), Pennsylvania*

STORAGE TYPE: Quarry
ESTIMATED VOLUME: 1.7 BG

KEY PROJECT INFORMATION

| PROJECT OVERVIEW | PROJECT SCORE & RANK | PROJECT COST |
|---|---|---|
| Quarry Storage; Neshaminy Creek source; Pump fill/discharge | SCORE: 4.07<br>RANK: 1 | CAPITAL COST: $ 17.0M (2022)<br>CAPITAL+O&M: $ 26.05M (Present Value) |

DESCRIPTION OF PROJECT AND RELEVANCE TO THIS STUDY

The Eureka Rush Valley Quarry is an active quarry located in Furlong, PA in Bucks County, Pennsylvania. The site lies within Buckingham Township and borders Wrightstown Township, Doylestown Township, and Warwick Township. The quarry has a maximum volume of 1.7 billion gallons. This quarry is approximately 97 acres in area and has an estimated fillable rim elevation of 160 ft. At the quarry's deepest point, it has an elevation of 50 ft, giving the quarry a nominal depth of 110 feet. The nearest pumpable stream to the quarry is the Neshaminy Creek. The quarry is composed primarily of siltstone and mined for various aggregate products.

The intended design is to fill the quarry from the Neshaminy Creek located only about 250 ft away from the quarry interior. The flow of the source stream is substantial and should not affect the planned pumping rate and project target to replenish the storage with a 6-month period. The planned average withdrawal is approximately 29 mgd. The discharge of quarry storage to augment stream flow in times of need is governed by the limitations of the quarry pumping station and protection of the receiving stream from erosion. The discharge rate back into the stream has been established at 50 cfs (31 mgd).


The infrastructure required includes the quarry, stream withdrawal pumping facilities, quarry discharge pumping facilities and interconnecting pipeline. Withdrawal will be accomplished with an arrangement of 3 x 10 mgd pumps in the wetwell. Discharge from the quarry back to the source stream is approximately 50 cfs (32 mgd) using 4 x 8.6 mgd pumps. The proposed pipeline route is schematically above and is approximately 250 feet of 30-inch diameter ductile iron pipe (DIP).

Mott MacDonald prepared a cost estimate for this storage project consistent with the general approach described in the main report. Capital costs have a contingency (+50%) commensurate with the concept development level of detail. Capital construction cost is $17.0M. $2M was carried for land costs associated with this project. Operating costs for this project are estimated to be approximately $0.375M/year. This assumes annual discharge of 1.4 BG and subsequent filling for the following year. Assuming a 30-year operating horizon and ignoring routine maintenance costs, the present value (PV) of the operating cost is $7.35M. This brings the combined total of capital and PV of operating cost to a project total of $26.05M. The schedule for putting this project in service after general concurrence of all major parties is expected to be approximately 9 years.

This project was scored relative to the criteria as presented in the main report. Categories, descriptions and individual scores are presented below, with individual scores sub-criteria provided in the Storage Project Scoring sheet.

| CATEGORY | Assigned Score | Assigned Weight | Weighted Score |
|---|---|---|---|
| Water Quantity & Quality | 3.75 | 30% | 1.13 |
| Infrastructure Design, Construction & Operation | 3.60 | 10% | 0.36 |
| Environmental Impacts | 4.79 | 15% | 0.72 |
| Social & Economic Impacts | 4.88 | 10% | 0.49 |
| Project Cost & Schedule | 4.00 | 30% | 1.20 |
| Ancillary Benefits | 3.60 | 5% | 0.18 |
| AVERAGE | 4.10 | | 4.07 |

TITLE

| FIRM NAME | STUDY | CLIENT NAME |
|---|---|---|
| MOTT MACDONALD M M Mott MacDonald | *Evaluation of Additional Storage in the Delaware River Basin* | Delaware River Basin Commission |

DATE: 11/15/22

---

**RECOMMENDED STORAGE PROJECT – ONE PAGE SUMMARY**
*(Refer to the Storage Project Summary located in Appendix A for more detailed information.)*

PROJECT NUMBER: Q2

PROJECT NAME AND LOCATION (City and State)
*McCoy Quarry*
*King of Prussia (Montgomery County), Pennsylvania*

STORAGE TYPE: Quarry
ESTIMATED VOLUME: 6.2 BG

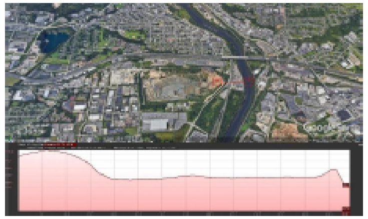
KEY PROJECT INFORMATION

| PROJECT OVERVIEW | PROJECT SCORE & RANK | PROJECT COST |
|---|---|---|
| Quarry Storage; Schuylkill River source; Pump fill/discharge with possible gravity | SCORE: 4.06<br>RANK: 2 | CAPITAL COST: $ 21.7M (2022)<br>CAPITAL+O&M: $ 31.05M (Present Value) |

DESCRIPTION OF PROJECT AND RELEVANCE TO THIS STUDY

The McCoy Quarry is located in King of Prussia within Upper Merion Township and is adjacent to Plymouth Township, Pennsylvania. The quarry has a maximum estimated volume of 6.2 billion gallons. This quarry is approximately 123 acres in area and has an estimated fillable rim elevation of 70 ft. At the quarry's deepest point, it has an elevation of -237 ft, giving the quarry a nominal depth of 307 ft. The Schuylkill River is about 1040 ft away. The quarry is composed of quartz sand and gravel and generally mined for aggregate products. Water would be extracted during times of high flows (possibly by gravity) from the Schuylkill River, stored in the quarry, then discharged back to the River to augment flow during low flow.

The infrastructure required includes the quarry, stream withdrawal facilities, quarry discharge pumping facilities and interconnecting pipeline. The elevation of the Schuylkill River is approximately 53 ft, the quarry rim is 70 ft (90 ft highpoint shown in the above profile). This geometry may allow for gravity "skimming" of the river. Even if pumping is used to fill the quarry storage, the geometry is advantageous relative to others in that the distance is minimal and the static head to overcome for filling the quarry is low.



Mott MacDonald prepared a feasibility-level cost estimate consistent with the general approach described in the main report. The costs are based on the project assumptions and the developed infrastructure concepts as outlined above. Capital costs have a contingency (+50%) commensurate with the concept development level of detail. Land costs are assumed to be approximately $4M based on comparable quarry values in the region. Operating costs for this project are estimated to be approximately $0.375M/year. This assumes annual discharge of 5.5 BG and subsequent filling for the following year. Assuming a 30-year operating horizon and ignoring routine maintenance costs, the present value (PV) of the operating cost is $7.35M. This brings the combined total of capital and PV of operating cost to a project total of $31.05. The schedule for putting this project in service after general concurrence of all major parties is expected to be approximately 7 years.

This project was scored relative to the criteria as presented in the main report. Categories, descriptions and individual scores are summarized in below.

| CATEGORY | Assigned Score | Assigned Weight | Weighted Score |
|---|---|---|---|
| Water Quantity & Quality | 3.50 | 30% | 1.05 |
| Infrastructure Design, Construction & Operation | 3.10 | 10% | 0.31 |
| Environmental Impacts | 4.61 | 15% | 0.69 |
| Social & Economic Impacts | 4.75 | 10% | 0.48 |
| Project Cost & Schedule | 4.50 | 30% | 1.35 |
| Ancillary Benefits | 3.60 | 5% | 0.18 |
| AVERAGE | 4.01 | | 4.06 |

Individual scores for the criteria and sub-criteria are provided in the Storage Project Scoring sheet.

TITLE

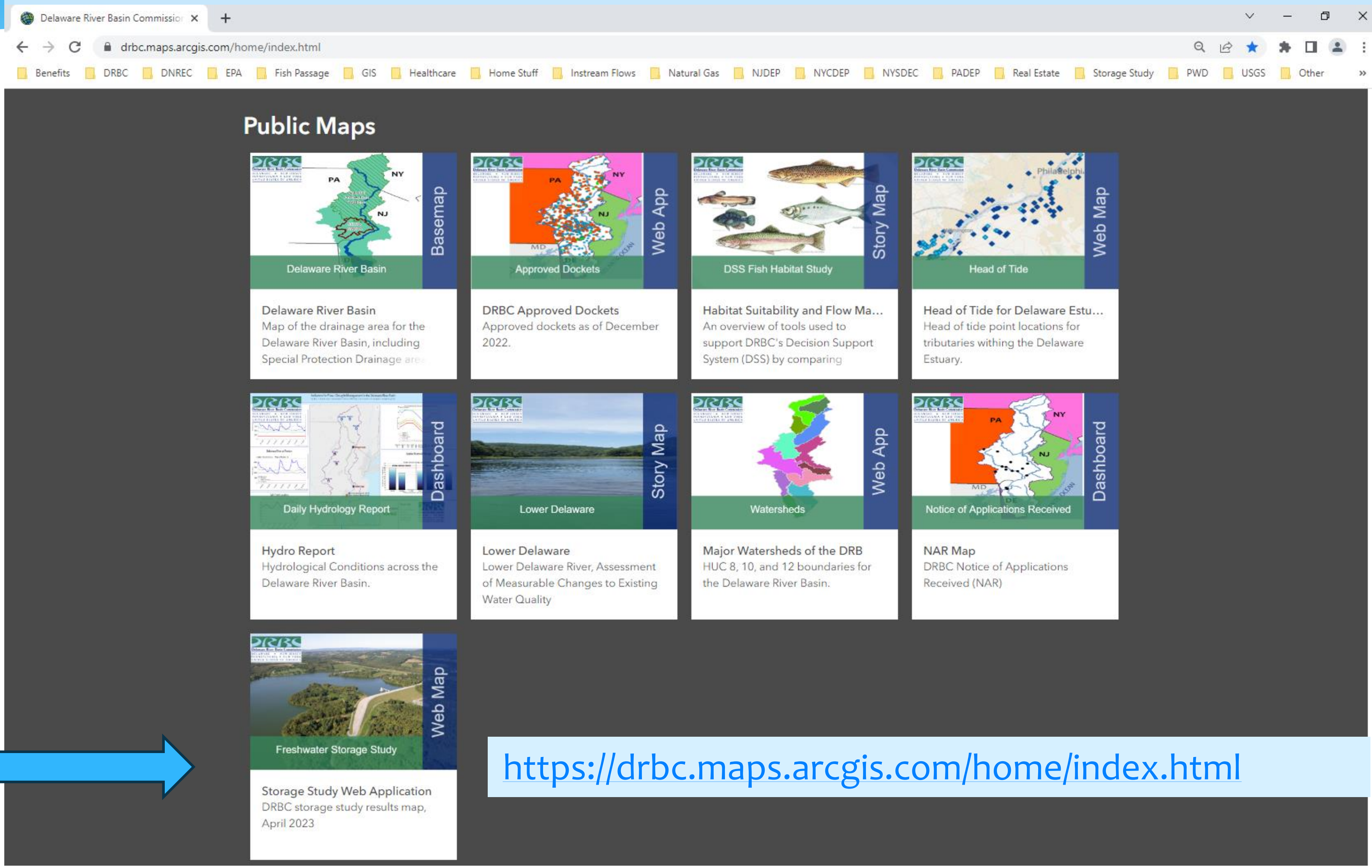
| FIRM NAME | STUDY | CLIENT NAME |
|---|---|---|
| MOTT MACDONALD M M Mott MacDonald | *Evaluation of Additional Storage for the Delaware River Basin* | Delaware River Basin Commission |

DATE: 11/15/22

# DRBC Storage Study Update

## Water Management Advisory Committee: June 28, 2023

### Online GIS Tool



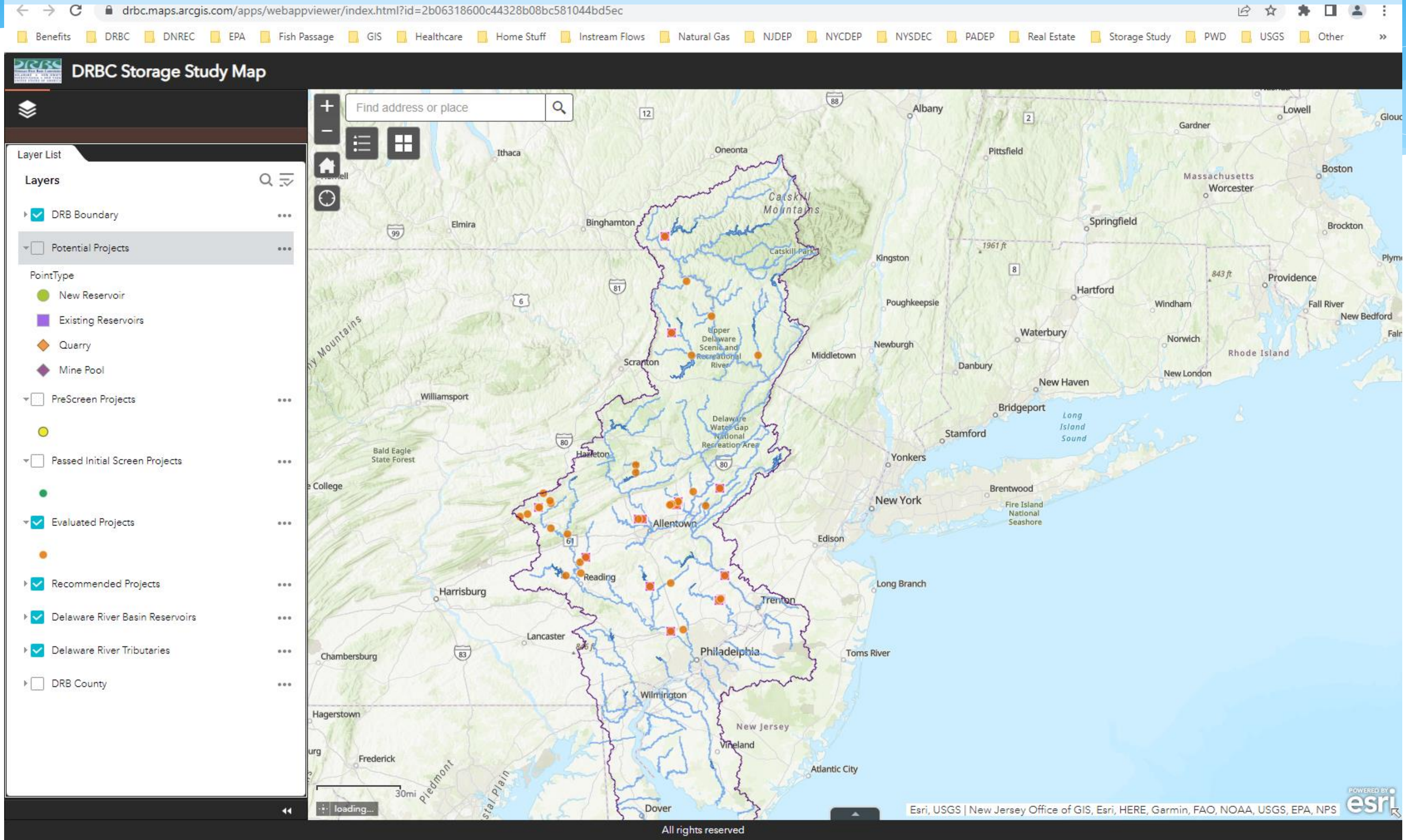

https://drbc.maps.arcgis.com/home/index.html

# DRBC Storage Study Update

Delaware River Basin Commission
DELAWARE • NEW JERSEY
PENNSYLVANIA • NEW YORK
UNITED STATES OF AMERICA

## Water Management Advisory Committee: June 28, 2023

### Online GIS Tool



# DRBC Storage Study Update

Water Management Advisory Committee: June 28, 2023

## What's next?

* DRBC staff continue to perform water availability studies – do we have enough water?
  * DOR considerations, climate change / SLR, other planning scenarios
* DRBC staff to work with Commissioners to determine "next steps"

## Discussion / Questions

* Committee members first
* Public next

Delaware River Basin Commission
DELAWARE • NEW JERSEY
PENNSYLVANIA • NEW YORK
UNITED STATES OF AMERICA