Delaware Canal Vision Study 2016
New Partnerships for a New Era
The Delaware & Lehigh National Heritage Corridor, Inc. and Delaware Canal 21 wish to thank our partners for their active participation in the Delaware Canal Vision Study 2016, including:

- Bucks County Planning Commission
- Delaware Canal State Park Advisory Committee
- Delaware Valley Regional Planning Commission
- Discover Lehigh Valley
- Easton Main Street Initiative
- Easton Department of Planning & Zoning
- Friends of the Delaware Canal
- Heritage Conservancy
- Lehigh Valley Planning Commission
- Lower Bucks Canal Conservation Committee
- National Park Service
- Pennsylvania Department of Conservation and Natural Resources
- Pennsylvania Department of Transportation
- Pennsylvania Historical & Museum Commission
- Pennsylvania Environmental Council
- Visit Bucks County
- William Penn Foundation
Welcome to the Delaware Canal Vision Study

You are part of a growing community who seek a sustainable Delaware Canal. Use this report to understand the issues and become a steward of the Delaware Canal in the 21st Century.

Overview

Project: The Delaware Canal Vision Study is the first step in a comprehensive partnership strategy to assist DCNR with the complexities of Delaware Canal stewardship.

Partners: The study was conducted by Delaware & Lehigh National Heritage Corridor, Inc. (D&L, Inc.) in partnership with Delaware Canal 21 (DC21) and in cooperation with the PA Department of Conservation and Natural Resources (DCNR). Multiple organizations and agencies participated in the process. Refer to acknowledgements.

Funding: The William Penn Foundation funded the study and DCNR dedicated critical staff support. D&L, Inc. was the grant recipient.

Scope: The “visioning” process included gathering, organizing, and presenting public ideas for sustaining the Delaware Canal.

Process

Steering Committee: D&L, Inc. and DC21 retained Simone Collins Landscape Architecture (SC) and Harris Steinberg, AIA to conduct the study tasks, working closely with DCNR.

Project Committee: Representatives from state and federal agencies, the Friends of the Delaware Canal, and other non-profit partners met periodically to review progress and provide guidance to the team.

Meetings: Six public and five stakeholder meetings were conducted across the 60-mile corridor during the process. Additional local and agency meetings were conducted.

Synthesis: Comments and research were recorded, assessed, and formatted for re-presentation. Seven major “Principles” were distilled from the findings that represent the core values of the community vision for the Delaware Canal.

Products

Public comments: A record of public / stakeholder comments was published, as recorded and collated, within the study appendix.

Mapping / Graphics: GIS databases from DCNR and various sources were used to create new mapping for the corridor. Other data were developed as pictorial graphics by SC.

Website: D&L, Inc. created and maintained a website with all project information: www.delawarecanalvision.org

Next Steps

The Vision Study doesn’t provide all the answers, but identifies multiple opportunities to advance a sustainable Delaware Canal.

A list of vision opportunities are included in this summary section. Most of these opportunities demand dedicated partnerships with DCNR to solve the complex issues that cannot be achieved by any single agency.

Federal, state, municipal, county, non-profits, resident, and visitor support are all needed to assist DCNR to restore, maintain, and operate a watered Delaware Canal.

Next steps include “early action” projects; feasibility studies to identify technical and cost details; and programming / administrative improvements. DCNR professional staff provides technical, cost estimates and administrative changes.

The project partners look forward to continued collaboration with DCNR.

The 2031 Bicentennial anniversary was identified as an achievable target to complete the sustainability strategy for the Delaware Canal. Much will need to be decided in 2016-17 to reach that goal.
This section introduces the study project and describes its contents and navigation tools. This report is designed for on-line viewing and navigation. The format is 11x17 for viewers who wish to print a paper document.

**Navigation** – The report document has two navigation bars. The bottom bar will access “sections” and “pages” by number. The side bar will access the subsections of Sections 2 and 3.

**Orientation** – A corridor map is modified along the bottom of each page in Section 2 to help orient the reader to the issues geographically.

**Graphics** – Photographic and sketch images are used to illustrate information discussed in the narrative.

**Location**

This section describes existing conditions, issues, and partnership opportunities for the Delaware Canal, within three major categories:

**Locations** – Key locations along the Delaware Canal are described geographically – beginning at Mile 0 in Bristol Borough and ending at Mile 60 in Easton. Locations are subdivided by page to begin to address individual issues within each community. Each issue is described by Place, Existing Assets, and Partnership Opportunities.

**Elements** – Eight primary categories define the diverse aspects of the Delaware Canal, including: Safety, Water, Structures, Access, Services, Historic, Civic, and Environment. Multiple aspects are discussed within each element, for example: “Safety” addresses: Infrastructure, Operations, Watering, Flooding, Obstructions, Firefighting and Rescue. The discussions include: Context, Challenges, and Partnership Opportunities for each aspect.

**Administrative** – This section is presented in four major subcategories: Physical Plant, Maintenance, Management, and Planning.

This section includes the data collected and developed in the process of the Delaware Canal Vision Study. Other related data can be accessed by internet links that are provided. This section includes:

- Graphics – maps/diagrams
- Data – analyzed as part of the Vision Study process
- Notes – from Vision Study meetings
- Findings – distillations of stakeholder comments
- Images – courtesy SC and others
- References – to previously published documents
- Stakeholder Comments – on Draft Report

**Locations**

- Bristol Borough
- Bristol
- Tullytown
- Falls
- Morrisville
- Lower Makefield
- Yardley
- Upper Makefield
- Solebury
- New Hope
- Point Pleasant
- Tinicum
- Bridgeton
- Nockamixon
- Durham
- Riegelsville
- Williams
- Easton

**Elements**

- Safety
- Water
- Structures
- Access
- Services
- Historic
- Civic
- Environment

**Administrative**

- Physical Plant
- Maintenance
- Management
- Planning

**Site Map**
Our Stories About the Delaware Canal - NORTH
as told at Vision Study Public Meetings July 14th, 15th, and 16th, 2015

Meeting Dates
- August 14th, Riegelsville
- August 15th, New Hope
- August 16th, Morrisville

"Here is the oldest concrete arch bridge in PA over canal. I would love to ice skate on canal again. It needs aggressive policy to control flooding. The historic character needs to be saved. Open all culvert crossings over canal to bridges."

“We spent as high school sweethearts, the summer of 1982-83 water skiing at my grandmother home in Upper Black Eddy."

“D&B Trail (Delaware Canal Towpath)"

“Showing friends how strong the concrete is. Odette’s along the canal. I frequently find small (3” diameter) pieces of wood on the sidewalk only.”

“Ralph walked with William O. Calhoun down the towpath only!”

“We discovered the canal and river by accident on an exploratory trip, and fell in love with Rieglesville and Durham. We moved here in 1979, and have great admiration for the rural character of this area. The new bridge over the canal in Rieglesville turned out extremely well, even if it took time coming.”

“In 2015, after 32 years, we purchased our own property together in Point Pleasant Community Association. Our home for the past 32 years. Found it in January ’83. “Our home for the past 32 years. Found it in January ’83.”

“Here, the ice was, I found myself inside the Delaware River Heritage Trail below Wheatsheaf Road.”

“Washington also planned battle of Trenton at Constitution. Washington also planned battle of Trenton at Constitution.”

“Home of two signers of the Declaration of Independence and home in Upper Black Eddy.”

"We live next to the Aquetong cemetery accessible by towpath only!"

“The Riegelsville Inn is right on the canal and bike friendly. Great place to stop on the trail.”

“There are Native American artifacts at Durham cave, adjacent to canal.”

“Here, the melting ice was thrown by riders of the barges.”

“Wide-waters, spectacular beauty and scenery beautiful shaded and quiet.”

“Biking the Ringing Rocks trail will connect to Dilly’s.”

“Biking the Ringing Rocks trail will connect to Dilly’s."

“The Delaware Canal has Odette’s along the canal. I frequently find small (3” diameter) pieces of wood along the sidewalk only!”

"One of the most scenic beautiful sections between the hills and wetland. Shaded and quiet.”

“Here, the ice was, I found myself inside the Delaware River Heritage Trail below Wheatsheaf Road.”

“Here, the ice was, I found myself inside the Delaware River Heritage Trail below Wheatsheaf Road.”
Our Stories About the Delaware Canal - CENTRAL
as told at Vision Study Public Meetings July 14th, 15th, and 16th, 2015

1. Details
   - "Our home for the past 32 years. Found it in January '83 while ice skating on the canal and bought it a few weeks later."
   - "My Great Grandmother is Virginia Forrest."
   - "Biking the towpath to Dilly's."
   - "Here is the A.O. Martin Archeologist has confirmed their existence."
   - "Toured here in 60's and loved canal barge rides."
   - "The Yellow Throated Warbler, now a rare Bucks PA breeder is heard here throughout the summer."
   - "Here the Revolutionary War cemetery accessible by towpath only."
   - "I loved ice skating from Washington Crossing to New Hope several times during the year."

2. Backstory
   - "On September 15, 2001, the Point Pleasant Community Association celebrated the re-opening of the Tohickon Aqueduct, four days after 9-11. The community decided after working nine years with state and federal partners, the best way to show respect, resolve and unity was to acknowledge our American achievement together behind the old firehouse. It was an emotional day."
   - "The Yellow Throated Warbler, now a rare Bucks PA breeder is heard here throughout the summer."
   - "Here the Revolutionary War cemetery accessible by towpath only."
   - "I loved ice skating from Washington Crossing to New Hope several times during the year."

3. Summary
   - "My family member while ice skating on the canal allegedly found corpse in the water."
   - "The Point Pleasant Community Association celebrated the re-opening of the Tohickon Aqueduct, four days after 9-11."
   - "Our home for the past 32 years. Found it in January '83 while ice skating on the canal and bought it a few weeks later."
   - "Married at Lumberville Station along the river and learned to row at swan creek rowing. It would be great to have Odette's along the canal reopened."
   - "I live next to the AQuetong Aqueduct and I get a kick out of all the walkers who stop and try to figure out what's happening with the intersection of the creek and canal."
   - "I lived here in 60's and loved canal barge rides."
   - "It is a special walking experience along New Hope section. Also up to Center Bridge."
   - "The Yellow Throated Warbler, now a rare Bucks PA breeder is heard here throughout the summer."
   - "Here the Revolutionary War cemetery accessible by towpath only."

4. Locations
   - "Point Pleasant"
   - "Ralph Stover"
   - "Virginia Forrest"
   - "Our home for the past 32 years. Found it in January '83 while ice skating on the canal and bought it a few weeks later."
   - "My family member while ice skating on the canal allegedly found corpse in the water."
GOALS BY ELEMENT

1 – SAFETY

Challenge:
A significant percentage of the State Park capital and maintenance budget is dedicated toward inspecting and maintaining the safety of structures.

Goal:
Focus on all aspects of public safety as the highest priority in managing the Delaware Canal.

Specifics:
Flooding; Structures (bridges/culverts/towpaths/walls); Firefighting; River rescue access.

2 – WATER

Challenge:
Water management is the most publicly recognized challenge for the Delaware Canal.

Goal:
Re-envision water as an irreplaceable asset and manage it technically in all aspects.

Specifics:
Supply; Backup; Bypass; Constriction; Stormwater; Quality.

3 – STRUCTURES

Challenge:
The age and complexity of the Delaware Canal structures make it the most technically intricate and costly Pennsylvania state park to maintain and operate safely and efficiently.

Goal:
Develop protocols that increase the current preventative maintenance capabilities that help expand proactive stewardship – with a comprehensive partnership approach to future treatments that are worthy of its National Landmark and National Register of Historic Places status.

Specifics:
Prism; River walls; roadway walls; Locks; Aqueducts; Culverts; Waste gates; Stopgates; Overflows; Dams.

4 – ACCESS

Challenge:
The quality of public access to the Delaware Canal; of travel along the towpath and waterway; and of public access to the adjacent Lehigh and Delaware Rivers varies significantly along the 60-mile state park – and in many locations public access to the state park relies on facilities managed by local partners.

Goal:
Re-envision a comprehensive public access strategy to the Delaware Canal with DCNR, the counties, and municipalities – in which the state park serves as the “core regional resource.” DCNR is the primary steward of the Delaware Canal and works in symbiotic cooperative agreements with local partners to provide benefits to all partners.

Specifics:
Portal; Landing; Linkages; Parking; Upgrades; Trail Loops; River access; Obstructions.
GOALS BY ELEMENT

5 – SERVICES / AMENITIES

Challenge:
User services vary significantly in availability along the 60-mile state park – and beyond public access challenges – they present the most immediate and essential human demands on DCNR and its partners to serve local residents and distant visitors.

Goal:
Unite public service and public access issues to develop a partnership to deliver a comprehensive public service strategy for the Delaware Canal – between DCNR, the counties, and municipalities to provide benefits to all partners

Specifics:
Toilets; ADA; Signage; Maintenance; Information; Amenities

6 – HISTORIC

Challenge:
The Delaware Canal retains most of its original alignment; its potential to convey water; integrity of many historic artifacts; and its context within local geographic features and villages that surround it – but it requires continual maintenance which can result in changes to the historical resource.

Goal:
Acknowledge that changes have always occurred to the Delaware Canal and must continue to occur so that “character-defining features” may be conserved to the greatest degree possible through a proactive partnership review process.

Specifics:
Landmark, National Register of Historic Places, Daylighting, Adaptive reuse, Cultural Landscape

7 – CIVIC

Challenge:
The Delaware Canal is intricately connected to its local communities and serves multiple civic functions that often overlap the jurisdictions of various agencies.

Goal:
Broaden the stewardship responsibilities and benefits to local, county, state and federal partners through cooperative agreements and other tools that conserve and sustain the Delaware Canal by sharing resources and serving constituencies of each partner.

Specifics:
Recreation; Community, Economic; Education; Environmental; Transportation

8 – ENVIRONMENTAL

Challenge:
The Delaware Canal is a human-made, naturalized ecosystem that relies on consistent watering to maintain the balances for preferred plant and animal habitats.

Goal:
Work with other agencies and partners to assist DCNR with sustainable maintenance programs for water, plants and animal species within the Delaware Canal State Park

Specifics:
Habitat, Vegetation (Fauna)
The list of partnership opportunities was developed within the framework of the eight essential Delaware Canal “Elements” – Safety; Water; Structures; Access; Services/Amenities; Historic; Civic; and Environment.

The list of Opportunities is advisory, but reflects achievable actions and important next steps to advance the ideas expressed during the public Vision Study process. The list should be used as a menu of tasks that can be accomplished when the right partners are engaged and the appropriate mix of funding sources are nurtured and funds become available to undertake specific priorities.

Strategic partners will need to collaborate with each other and DCNR to prioritize, undertake and conduct these projects.

Refer to each Element section in the study report to learn more about each Opportunity.

1. Safety
   1.1 Infrastructure
      A. Annual PennDOT Legislative Briefing
   1.2 Operations
      A. GIS Recordkeeping
      B. Delaware Canal Operations & Maintenance Manual
      C. Ongoing System Inspections Upgrades
   1.3 Watering
      A. Watered Canal Policy
   1.4 Flooding
      A. Delaware / Lehigh River Dam Policy
      B. Economic Impact Study of the Delaware Canal
   1.5 Obstructions
      A. Waterway Obstruction Policy
   1.6 Firefighting
      A. Firefighting Water Policy
      B. Firefighting Water Access
   1.7 Rescue
      A. Emergency Rescue Access
   1.8 Vectors

2. Water
   2.1 Management
      A. Watering Subcommittee of the CAC
      B. Remote Sensors / Operations
   2.2 Sources
      A. River Dam Feasibility Study
   2.3 Backup
      A. Backup Pump Watering System: Capital Costs
      B. Backup Pump Watering System: Electricity Costs
      C. Point Pleasant Pump Backup
      D. New Hope Backup
   2.4 Bypass
      A. Bypass Specifications
      B. Bypass Equipment and Training
   2.5 Constrictions
      A. Constriction Elimination Program
   2.6 Stormwater
      A. Preliminary Stormwater Study
   2.7 Quality
      A. Water Quality Monitoring
   2.8 Resource
      A. Water Supply Feasibility
   2.9 Hydropower
      A. Low-head Hydro Feasibility

3. Structures
   3.1 Dams
      A. Lehigh Dam Replacement Study
      B. Delaware Wing Dam Replacement Study
   3.2 Prism
      A. Retaining Wall Waterproof Testing
   3.3 Towpath
      A. Towpath Expedited Repair Strategy
   3.4 River Walls / Canal Walls
      A. River Wall / Canal Wall Conservation Program
      B. DCNR-ACOE Partnership
   3.5 Roadway walls
      A. Stone Wall Conservation
   3.6 Locks
      A. Lock Restoration Feasibility
   3.7 Bridges
      A. Camelback Structural Guidelines
   3.8 Aqueducts
      A. Tohickon Aqueduct Assessment
   3.9 Culverts
      A. Rabbit Run Culvert Priority
   3.10 Waste Gates
      A. Hydraulic Operations Assessment
   3.11 Overflows
      A. Geometric / topographic survey
   3.12 Stopgates (addressed under Hydraulic Assessment Study)
   3.13 Locktenders Houses
      A. Historic District Mapping / Assessment

4. Access
   4.1 Portals
      A. Bristol Partnership
      B. Morrisville Partnership
      C. DRJTBC Partnership
      D. Easton Partnership
   4.2 Landings
      A. Washington Crossing State Park Partnership
      B. Bucks County Partnership
      C. Mountainside Partnership
      D. SEPTA Partnership
   4.3 Linkages
      A. Canal-Roadway Intersection Program
   4.4 Gaps
      A. Trail Gap Clearance 2020
   4.5 Upgrades to Existing Areas

Refer to each Element section in the study report to learn more about each Opportunity.
PARTNERSHIP OPPORTUNITIES (by Element)

A. Standard Upgrade Specifications
4.6 Pedestrian and Bicycle
   A. PA-NJ Trail Loops
   B. Lumberville Bridge-Delaware Canal Linkage
4.7 Waterway
   A. Water Trail Loops
4.8 Transit
   A. Interstate Bus Connections
4.9 Parking
   A. Delaware Canal Parking Assessment

5. Services / Amenities
5.1 Toilets
   A. Comprehensive Public Services Assessment
5.2 Waste (Refer to 5.1 for Partnership Opportunities)
5.3 Potable Water (Refer to 5.1 for Partnership Opportunities)
5.4 Recreation
   A. Carrying Capacity Estimates
5.5 Signage
   A. Expand / Proliferate D&L, Inc. Identity Signage
5.6 Information
   A. Web-based Information Directory
   B. DCNR Park Map Update
5.7 Interpretation / Education
   A. D&L, Inc. Delaware Canal Interpretive Partnerships
   B. Geo-referenced Audio Tour
5.8 Concessions / Vending
   A. Canal Boat Tour
   B. Odette’s
5.9 Visitor Centers
   A. Site Selection / Development Process
5.10 Associated DCNR Assets (related holdings)
   A. Adjacent Asset Integration

6. Historic
6.1 National Register of Historic Places

A. Programmatic Agreement
B. PennDOT NRHP Documentation
6.2 National Historic Landmark
   A. Character-Defining Features
   B. Treatment Guidelines
6.3 Local Historic Districts
   A. Historic District Zoning Comparison
6.4 Cultural Landscape
   A. Cultural Landscape Assessment
   B. Visual Values Survey
6.5 Conservation Options
   A. Treatment Priorities
6.6 Education
   A. DCNR School Outreach

7. Civic
7.1 Park-Community Integration
   A. Events Integration
7.2 Economic development
   A. Canal-River Promotion
   B. Economic Benefits Analysis
7.3 Transportation
   A. Scenic Highway Designation
7.4 National Heritage Area / Wild and Scenic River
   A. Expand NGO Partnerships
   B. Expand D&L, Inc. Programs and Partnerships

8. Environment
8.1 Habitat
   A. Fish Stocking
   B. Red Bellied Turtles
8.2 Vegetation
   A. Invasives / Maintenance
## ACRONYM LIST

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LOCATIONS MAP -
History

Bristol Borough is the southern terminus of the Delaware Canal where canal boats were unloaded and water flowed through the canal boat basin to return to the Delaware River. Local cargo was off-loaded in Bristol and cargo headed to the cities was towed in canal boats. Canal boats were lashed together and towed down river by steamboat. Mile 1 of the Delaware Canal in Bristol was severely disrupted after World War II, including obstructions to towpath – now the D&L Trail, and a complete obliteration of the watered prism.

People

Bristol Borough’s population is 9,657. The median age is 38 years. Median household income is $41,446 and the percentage of residents below the poverty level is 15.6%. 3.3% of commuters take public transportation to work and 10% of households have no availability to a personal vehicle. A SEPTA Regional Rail station is one block from the Delaware Canal, across from the Grundy Tower.

Priorities

Canal priorities in Bristol include: removing obstructions and restoring the D&L Trail; developing the southern approach of the East Coast Greenway trail; upgrading the boat basin area as a visitor Portal; creating safe trail crossings at local streets; restoring the towpath as a thru-trail; linking the SEPTA station to the Canal as a major trailhead – with public-private partnerships and concessionaires; possibly daylighting Mile 1; and employing the Delaware Canal as a stormwater BMP.
Delaware Canal - Mile 1 in Bristol Borough

- Watered canal ends
- Canal prism filled in - There is a gravel trail with interpretive signs, but it is not continuous
- Missing Canal ROW, no water, no trail within this segment of Canal ROW
- Portal Location - Marker denotes location of former crane as base of lagoon
MP 0.1 ACCESS: Portal – South Portal

Place

The South Portal is the southern terminus of the Canal and is located north of the tidal marsh at Canals End Road. Riverfront parks, businesses and the Borough Storage Tank and Pumping Facility are also nearby.

- Canal Structures – Tide Lock, Lock 1

Existing Assets

- Parking Lot – A large lot exists north of the marsh that serves the parks and businesses. Paths from the lot lead up into the Borough proper and the covered sections of the Canal. The Borough is re-envisioning this area.

- Borough Businesses and Parks – The Borough core businesses are located a short distance upriver, along with Bristol Lions Park, the Wharf and riverfront paths that connect the Portal to the Borough and identify it as a contributing element of Bristol.

Opportunities / Potential Partners

An opportunity exists to clearly brand this area as the terminus “portal” of the Canal and the historic spot where local cargo was unloaded. Existing interpretive signage can also reinforce the role the southern end played and also help establish the sense of history as people start their journey along the Canal.

Where the prism has been filled, interpretation and directional signs can lead users to the towpath trace up canal.

A portion of the parking lot can serve as parking space for the South Portal.

- Potential Partners – Bristol Borough, DVRPC, DCNR, LBCCCC, Visit Bucks County, D&L, Inc., FODC, DC21
MP 0.4 SAFETY: Obstruction – Mill Street Obstacle

Place

Mill Street completely obstructs a filled in Canal at Old Route 13, south of the Grundy Tower apartments and Snyder-Girotti School. The existing configuration does not have the benefit of introducing visitors to Mill Street.

Existing Assets

- Crosswalk – A crosswalk currently exists at the intersection of Mill and Old Route 13.
- Public Transit – SEPTA bus routes 128 and 129 stop at the intersection.
- Park – The Bristol Spurline Park, which runs north through the Borough, crosses here.

Opportunities / Potential Partners

Old Route 13 is elevated above the filled in Canal. Below the Mill Street Bridge, the canal alignment is completely filled in causing a complete obstruction to the D&L Trail. Canal users are forced to travel up to the street level, and cross the street at the traffic light to continue their towpath journey. An opportunity exists to continue the towpath trail to the turning basin portal area under the bridges to create a grade-separated D&L trail at this busy location.

- Potential Partners – Bristol Borough, DCNR, PennDOT, DVRPC, BCPC, LBCCCC, FODC
MP 0.6 SAFETY: Obstruction – Missing Trail / Encroachment

Place
The Snyder-Girroti Elementary School recently built a new facility at Beaver Street and Pond Street, just south of their former building site, which is currently a 6-acre open parcel with 2 small parking lots. The Canal and towpath are buried below the lot and are unidentified.

Existing Assets
The open space adjacent to the school offers a potential to reconstruct this missing piece of the Canal towpath as another upgrade of the D&L Trail.

The existing trail created by Bristol Borough is shown on the photograph. Ideally, now that the school has been moved, the trail would run parallel to Lock 3, shown in this photograph and straight on to Beaver Street to connect to the existing trail that runs to Washington Street.

Opportunities / Potential Partners
Bristol Borough can partner with DCNR, the school district, D&L, Inc. and other partners to restore this critically missing segment of the towpath as the D&L Trail. Daylighting the prism through this area will require feasibility study.

• Potential Partners – Bristol Borough, Bristol Borough School District, DCNR, D&L, Inc., BCPC, FODC
MP 0.9 ACCESS: Linkage – Local Cross Streets

**Place**
The intersection of Jefferson Avenue and Prospect Street, next to the historic Grundy Mill, marks the southern end of the daylighted Canal and towpath and is adjacent to the Grundy Lagoon.

**Existing Assets**
The local cross streets from Grundy Industrial Complex southward have sidewalks and drainage that need upgrading, and many are missing crosswalks, curb ramps, and signage where the Delaware Canal crosses them mid-block.

**Opportunities / Potential Partners**
Bristol Borough can take the lead in a partnership to plan, fund and construct these improvements.
**MP 1.0 ACCESS: Landing – SEPTA Train Station**

**Place**
Bristol Regional Rail Station is located at the north end of the Mile 1 filled in Canal at Washington and Prospect Streets and is serviced by the Trenton Line.

**Existing Assets**
The SEPTA regional rail station is located across the street from Grundy Industrial Complex and connects to Philadelphia and Trenton, NJ.

**Opportunities / Potential Partners**
This location is considered a potential Landing site for the Delaware Canal, due to the regional rail transit stop and the potential for this location in Bristol to serve residents and travelers who can ride the train to access the Delaware Canal. Bristol Borough is currently considering the SEPTA station area as a potential Transit-oriented Development (TOD) area of the Borough. Including Canal-related services, such as café, bike rentals, and other recreation services are opportunities for the Delaware Canal to become an integral part and feature of Bristol’s TOD vision.

* Potential Partners – Bristol Borough, SEPTA, DCNR, DVRPC, BCPC, PennDOT, LBCCCC, FODC
MP 1.4 WATER: Stormwater – Flooding at Adams Hollow Creek

Place
Adams Hollow is a small stream that crosses under the Delaware Canal through a culvert, located north of Lagoon Park, east of Route 13 and west of the Regional Rail station in Bristol Borough. The Hubbell Lighting factory is nearby. A perennial forest wetland is found on the east side of the Canal that is fed by Adams Hollow. Sediment collects in the culvert under the Canal and causes flooding on the upstream and downstream sides of the Canal. DCNR periodically removes this sediment that threatens the structural integrity of the Canal.

Existing Assets
This location was identified in the Delaware Canal Preliminary Stormwater Study 2016 as vulnerable place where the local creek floods at a culvert under the Canal

Opportunities / Potential Partners
Stormwater BMP opportunities are identified in the Delaware Canal Preliminary Stormwater Study 2016, including: the installation of riser pipes on the upstream and downstream ends of the culvert, and the boring of an additional culvert below the Canal. The installation of riser pipes would likely result in the establishment of wetlands on the upstream side of Canal. The existing parking lot north of the site off of Route 13 is owned by the Bucks County Redevelopment Authority (BCRDA) and presents an opportunity for a stormwater BMP.

• Potential Partners – Bristol Borough, DCNR, PennDOT, BCCD, DVRPC, BCPC
BRISTOL TOWNSHIP

History
The Pennsylvania Turnpike (I-276) passes over the Canal in Bristol Township, where it is conveyed through a culvert under Route 13. D&L trail users can now use the Route 13 crosswalks at the new Green Lane intersection to continue travel between the open towpath sections. Within Bristol Township, the Canal traverses the southern end of Levittown, one of the first successful post-World War II suburban communities. Many of the original homes abut the Canal in this section.

People
Bristol Township’s population is 54,431. The median age is 39.7 years. Median household income is $57,128 and the percentage of residents below the poverty level is 9.2%. 2.8% of commuters take public transportation to work and 4.3% of households have no availability to a personal vehicle.

Priorities
Canal priorities in Bristol Township include: improving the Canal connections at Green Lane; the future treatment / use of the remnant section of the Canal under the Turnpike, improving connections / crosswalks at local streets; and management of and improvements to Lock 4 to facilitate higher water levels and better water flow.
MP 2.1 ACCESS: Linkage – Crossing at Green Lane

Place
North of Green Lane, the Canal and towpath are covered by a parking lot and Turnpike pilings in a section under the Pennsylvania Turnpike and east of Route 13.

Existing Assets
- Public Transit – SEPTA Bus Route 128 stops in front of the Rama-da Inn on Route 13 and provides service to Neshaminy and Oxford Valley Malls.
- Local Businesses – A Wawa convenience store and Amish Market are located on Green Lane.
- Previous Studies – PEC had identified this as an obstruction that needed to be addressed. PEC is also working to establish a crossing on Green Lane between the Wawa and Amish Market.

Opportunities / Potential Partners
The obstruction created by the presence of the Turnpike forces users to cross busy Route 13 at the traffic light. The PennDOT Route 13 improvement project has recently completed sidewalks along Route 13 and a crosswalk at Green Lane so that users can safely traverse this section without interacting with the pilings and risking a hazardous crossing on Route 13. The potential has been identified to establish a Canal boat ride embarking from Green Lane, southward to the Bristol lagoon.

- Potential Partners – Bristol Borough, PEC, PennDOT, DVRPC, Bucks County TMA
TULLYTOWN

History
The Canal prism is piped and covered over and the towpath is not the original historic character in Tullytown through the Levittown Shopping Center site adjacent to Route 13. Towpath alignment remains, but the original character has been reduced to a small footpath. Community members and Canal enthusiasts have advocated for the daylighting of the Canal in this section. Recently, an underpass has opened at the divided section of Route 13 near the Bucks County Courier-Times building to enable a safe, grade separated crossing of the D&L Trail under the state highway.

People
Tullytown's population is 1,781. The median age is 43 years. Median household income is $49,231 and the percentage of residents below the poverty level is 11.4%. 2% of commuters take public transportation to work and 13% of households have no availability to a personal vehicle. The Levittown-Tullytown SEPTA Regional Rail station is approximately 400 feet from the Canal.

Priorities
Canal priorities in Tullytown include: daylighting the Canal at the shopping center to restore the waterway and towpath. Improving local access to the Canal. Stakeholder meetings are underway to improve Tullytown and the D&L Trail.
**MP 4.1 ACCESS: Barrier – Canal under Levittown Shopping Center**

**Place**

The Canal is piped and covered through roadway frontage of the Levittown Town Center, located at Route 13 and Levittown Parkway. The towpath trail is defined, but is not the same character as the intact, historic sections of the Delaware Canal towpath.

- Canal Structures – culvert inlet

**Existing Assets**

- Public Transit – SEPTA Bus Routes 127 and 128 stop in front of the Center and provide service to Neshaminy and Oxford Valley Malls and Trenton Transit Center. The Levittown-Tullytown Regional Rail Station is also 500 feet from the towpath and Town Center and is serviced by the Trenton Line.

**Opportunities / Potential Partners**

The covered section in front of the Levittown Town Center has the potential to be daylighted as an attraction for patrons of the Levittown Town Center. One concept is to feature the open waterway as a catalyst for a redesigned mixed-use development that is pedestrian-orientation aligned with the Canal. Many suburban communities are looking at ways to repurpose shopping centers to attract, not just shoppers, but workers and residents as well, who might be inclined to new apartments and offices in redeveloped environments. If the Levittown Town Center was interested in exploring this idea, the daylighted Canal can act as a contributing asset to a rebranded development.

- Potential Partners – Tullytown Borough, private owner, DCNR, PennDOT, D&L, Inc.
MP 4.6 ACCESS: Linkage – Route 13 Underpass

Place
The Route 13 Underpass is situated at the split of Route 13 north of the Bucks County Courier Times Building.

Existing Assets
- Link – The underpass itself is a new asset that has introduced a safe and convenient continuation of the towpath under busy Route 13.

Opportunities / Potential Partners
The underpass opened in Fall 2013 thanks in part to a $1.3 million Transportation Enhancements Grant and money provided by PennDOT and is a successful model of a grade separated trail improvement.

Similar opportunities exist to daylight the Canal waterway at the Tyburn Road and Conrail spur obstructions.

Additional opportunities and partner projects are noted below:
- Opening the Canal for navigation through the underpass
- Drainage improvements
- Vigilant graffiti removal
- Canal boat graveyard located north of Route 13. Documented by marine archeologist through the Friends of the Delaware Canal. Site covered upon recommendation by PHMC.
History
In Falls Township, the Canal travels between a series of lakes in the historic area of Wheat Sheaf and an Amtrak rail line. Along its course, the Canal crosses local streets and runs perpendicular to streets which have no direct connection to the Canal, preventing nearby neighborhoods from easily accessing the towpath. Tyburn Road and its interchange with Old Bristol Pike presents an obstruction to Canal users. Falls Township is also home to William Penn’s historic mansion of Pennsbury.

People
Falls’ population is 34,172. The median age is 39.6 years. Median household income is $64,533 and the percentage of residents below the poverty level is 7.0%. 2.3% of commuters take public transportation to work and 5.6% of households have no availability to a personal vehicle.

Priorities
Canal priorities in Falls include: improving local street connections; conducting a study to determine the feasibility of watering the Canal from nearby lakes; and addressing the Tyburn Road obstruction.
MP 5.4 ACCESS: Linkage – Local Street Connections

Place
Between Mill Creek Road and the eastern edge of the Village of Pennbrook Apartments, two local roads on the western side of the Canal prism, 1st Street and 2nd Street, terminate at the Canal edge within the residential neighborhood off Lynn Avenue.

Existing Assets
Potential local neighborhood connection improvements to the Canal exist.

Opportunities / Potential Partners
Falls Township can take the lead in advancing a partnership with DCNR and D&L, Inc. to improve the local connections to the Delaware Canal.
MP 6.2 WATER: Backup – Watering the Canal from Wheatsheaf Lake

Place
Wheatsheaf Lake is located along Wheatsheaf Road between Penn Valley Road and Old Bristol Pike and is surrounded by vegetation, homes, a quarry and park and recreation space.

Existing Assets
Wheatsheaf Lake is a former sand and gravel quarry that has filled with groundwater and serves as the centerpiece of a wildlife habitat and local walkway network. The Lake was formerly pumped into the Canal and the derelict pipeline can still be seen.

Opportunities / Potential Partners
• Potential Partners – If supported by DC21, FODC and other partners, DCNR can help to advance the assessment, planning and potential use of Wheatsheaf Lake as a source of backup water for the section of the Canal south to Bristol.
MP 7.7 SAFETY: Obstruction – Tyburn Road Obstruction

Place

The Tyburn Road obstruction is located south of Tyburn Road between Newbold Road and the Amtrak corridor. The Canal is blocked here by Tyburn Road and the ramps that lead onto it from Newbold Road.

Existing Assets

The only assets that help address this complete highway obstruction are the adjacent railroad underpass directly east of the Delaware Canal, that might be used as a D&L trail bypass under Tyburn Road and, the existing D&L-DVRPC-PEC partnership that is already formed to address the issue of a towpath trail bypass. The D&L trail bypass solution does not solve the canal waterway obstruction – which is currently a single undersized pipe culvert between up and downstream Canal.

Opportunities / Potential Partners

• Potential Partners – D&L, Inc., DCNR, DVRPC, PennDOT, PEC
MORRISVILLE

History
Morrisville is located at the “Falls” of the Delaware, across the River from Trenton, New Jersey – on the geological divide between the Appalachian piedmont and Atlantic coastal plain. The waters of the Delaware are tidally affected below the Trenton falls. At Morrisville, the Delaware Canal turns inland from the River and runs south as a straight and level course through delta soils to Bristol. Due to its geography, Morrisville became a place where multiple highways and railroads railroad alignments converge. Three highway bridges span the Delaware River between Morrisville and Trenton. In the 20th Century, many of “modern” structures were built to encroach on the Delaware Canal with little regard to historic value, thoroughfare, or hydraulic operations.

People
Morrisville’s population is 8,689. The median age is 35.6 years. Median household income is $61,689 and the percentage of residents below the poverty level is 5.4%. 5% of commuters take public transportation to work and 8.2% of households have no availability to a personal vehicle. Residents are served by SEPTA Bus Route 127 with service to the Trenton Transit Center with access to points north, including New York. SEPTA regional rail service to Morrisville was discontinued.

Priorities
Canal priorities in Morrisville include: removing a Conrail railroad embankment obstruction (just south of the Borough Line in Falls
**MP 8.7 SAFETY: Obstruction – Railroad Spur Obstruction**

**Place**
An elevated railroad spur embankment was built by filling in the Delaware Canal waterway and towpath directly south of the Morrisville-Falls Township line. The flooding issues caused by this obstruction affect Morrisville most directly and severely.

**Existing Assets**
No assets currently exist in this location, only liabilities. The railroad structure completely obstructs the towpath and a dangerously inadequate culvert through it restricts normal canal water flow. The culvert becomes blocked during high flows, and during the Delaware River floods of 2004, 2005, 2006, the obstruction blocked the flooded Canal from flowing southward – causing water to back up and flood Williamson Park. The public swimming pool in that park was lost from flooding and has never been replaced. River water overflowing into the Canal north of Morrisville contributes to the Canal flooding within Morrisville Borough. DCNR engineers are considering a new Canal outlet/overflow near the northern Borough line that might help alleviate flooding. A combined feasibility study of the two remedies - a new waterway culvert under the railroad obstruction, and a new overflow structure has been suggested. DCNR has suggested moving directly into design of the new outlet. This strategy assumes one solution and does not address the issue comprehensively. The RR Spur obstruction is an indefensible environmental justice issue on the Delaware Canal that must be solved by an aggressive partnership to allow both the D&L Trail and Canal waterway to pass through it. This obstruction needs to be removed as soon as possible to provide safe pedestrian / bike passage.

**Opportunities / Potential Partners**
A new trail-only culvert design was completed in 2016 by a D&L-DCNR-DVRPC-PennDOT partnership to solve the trail obstruction issue. The trail culvert construction project was pending in fall 2016. The current trail culvert design will not remedy flooding that can happen again any time the Delaware River floods the Delaware Canal. Removing this RR spur obstruction from the Delaware Canal should be an urgent public safety issue for the state park – and it demands the most aggressive partnership strategy to solve the waterway issues expeditiously and comprehensively. The waterway obstruction project needs to begin with a feasibility study for a culvert design that will accommodate the full waterway – for safety, access, environmental, recreation, and economic reasons. Morrisville Borough can take the lead on its own behalf with DCNR, D&L, Inc., PEC, and to advance this project – by asking Bucks County and state/federal legislators to help negotiate the solution with the railroad. DC21 will help catalyze funding partners for the project with the goal of achieving a full remedy before 2020.
**MP 9.3 WATER: Constriction – Route 1 Bridge Constriction**

**Place**
When the modern Route 1 highway was constructed through Morrisville, the piers of the elevated PennDOT bridge structure were constructed within the Delaware Canal waterway. The embankment of the southern highway approach was also graded into the Canal waterway causing a significant constriction to the water flow. The Route 1 footprint over the Delaware Canal includes an enlarged backwater area below the bridge where overheard scuppers drain directly into the Delaware Canal. The bridge dominates the historic canal and the industrial nature of the structure has created a public alienation that is visible in graffiti reaction, litter, and under-utilization of the cultural landscape below.

**Existing Assets**
The Towpath is uninterrupted in this location. The waterway exists and is generally watered through this section of the Delaware Canal. An area that appears as a wetland exists directly to the east of the canal, also below the Route 1 Bridge.

**Opportunities / Potential Partners**
The Delaware Canal waterway in the area of the Route 1 bridge complex can be re-envisioned as a modern green infrastructure – in the same ways so many urban US areas are now reclaiming industrial landscapes to include modern recreation and cultural assets. An engineering assessment is needed to identify the constraints and opportunities to restoring this section of the Delaware Canal. Opportunities to be considered include:

- Restoring the current “backwater” area to the historic geometry of the Delaware Canal prism
- Creating a retaining wall at the base of the Route 1 embankment to restore full waterway width
- Rerouting scupper outfalls away from the Delaware Canal to adjacent wetland with the ROW.
- Supporting a community “art in infrastructure” program with PennDOT to replace bridge graffiti

Morrisville Borough can convene a coalition with DCNR for Canal rehabilitation in this area. Partners may include; PennDOT, DRJTBC, Bucks County and local businesses who can collectively re-envision a sustainable co-existence between essential public infrastructure and the Delaware Canal National Landmark within this intensive industrial corridor.
MP 9.5 ACCESS: Obstruction – Bridge Street Crossing / Towpath Ramps

Place
Bridge Street in Morrisville was the former alignment of US Route 1, before the modern highway was constructed directly to the south. The Bridge Street Bridge over the Delaware Canal was constructed in the 1940s as a modern bridge of its time, but the structure design completely obstructed towpath travel and significantly constricted the width of the canal waterway below.

Existing Assets
The Bridge Street Bridge includes sidewalks on both side of the deck that are heavily used by local residents. Preliminary designs were developed to create ramps up from the Canal towpath to meet both sidewalks on the bridge deck. Funding has not yet been secured for this project design and construction. The design includes two towpath ramps and a modern, mid-block crosswalk where the ramps meet the bridge sidewalks. The Bridge Street – D&L Trail crossing project might possibly be funded through DVRPC and PennDOT programs for design and construction in partnership with D&L, Inc. and PEC.

Opportunities / Potential Partners
The public expects obstructions to the Delaware Canal waterway and towpath to be reopened. The design of the new towpath ramps and crosswalk should not preclude the ultimate replacement of the existing Bridge Street Bridge with a new bridge structure that re-establishes the historic width of the canal waterway for water trail recreation below. Modern vertical constraints of the Bridge Street state highway will likely not enable a towpath to be re-established below a new bridge over the Canal, but other opportunities to improve public access to the Delaware Canal in this location include:

- Create ADA grades on the new towpath ramps (Morrisville, PennDOT)
- Add “Placemaking” features to denote the historic Canal crossing (Morrisville, PennDOT)
- Design context sensitive features in the new ramp structures (Morrisville, PennDOT)
- Develop proactive program for the future bridge Street Bridge (Morrisville, PennDOT)
- Acquire the abandoned Lehigh Rubber building which could be turned into a parking area and access point (Morrisville)
**MP 9.7 ACCESS: Upgrade - Pennsylvania Avenue Bridge**

**Place**
The Pennsylvania Avenue Bridge spans the Delaware Canal in Morrisville between Union and Hillcrest Streets.

**Existing Assets**
Pennsylvania Avenue is a state highway. The existing concrete and steel bridge over the Delaware Canal includes sidewalks on both sides of the highway, and a clear span over the Canal waterway and towpath. The towpath below the existing bridge is a concrete deck that is partially cantilevered over the waterway, without railing. A cultural path exists between the towpath and Union Street.

**Opportunities / Potential Partners**
This PennDOT bridge is listed for eventual replacement, and deserves public input regarding a preferred program for the new replacement structure. The new bridge design will follow the PennDOT process, including review by PHMC and consulting parties such as the Borough of Morrisville. Morrisville can assume a proactive partnership with PennDOT to negotiate a replacement bridge program that may include:

- Sidewalks on both sides of the new deck (PennDOT, Morrisville)
- Reduce vehicular cartway widths, if possible (PennDOT, Morrisville)
- Maintain new bridge clear span over the Canal right of way (PennDOT, Morrisville)
- Maintain the traditional width of the waterway below the bridge (PennDOT, Morrisville)
- Re-establish a full-width earthen towpath below the bridge (PennDOT, Morrisville)
- Straighten the towpath alignment below the new bridge (PennDOT, Morrisville)
- Incorporate context-sensitive architectural features in the bridge (PennDOT, Morrisville)
- Formalize public access between the towpath and Union Street (PennDOT, Morrisville)
- Include signage: directional (Summerseat), interpretive (PennDOT, Morrisville, D&L, Inc.)
MP 10.3 ACCESS: Portal – East Coast Greenway Portal

Place
The East Coast Greenway Trail enters Pennsylvania via the Calhoun Street Bridge from Trenton, NJ and connects to the D&L Trail through a Morrisville park site adjacent to the Delaware Canal. This location is a cultural hub and is poised to serve as a major Portal where the interstate trail connects to the D&L Trail.

Existing Assets
- Public access to the Canal – from Delmorr Avenue
- Crosswalks – from Calhoun Street Bridge
- Delaware River loop walking trail – on adjacent levee and historic Calhoun Street Bridge
- Public parking – across Delmorr Ave
- Public toilets – adjacent to the canal,
- Community playhouse – adjacent
- East Trenton Ave Bridge – historic concrete structure with sidewalks that spans canal and towpath
- River overlook public deck – across Delmorr Avenue

Opportunities / Potential Partners
This location can be re-envisioned as a major Portal entry into Pennsylvania – and a strategic place to welcome residents and visitors with facilities that support public access to the Delaware Canal and the Morrisville business community. Morrisville can act as the central local catalyst to organize multiple partners ensure that these improvements are realized:

- Structure maintenance / repair – East Trenton Ave Bridge (PennDOT)
- Sidewalk repair – East Trenton Ave Bridge (PennDOT)
- Towpath – sidewalk connections (PennDOT, DCNR)
- Public amenities (benches, toilets, etc) (Morrisville, DCNR)
- Signage (entry, directional, interpretive) (Morrisville, DCNR)
- Planning / funding (DC21, D&L, Inc.)
- Explore feasibility of a new Canal overflow north of the Calhoun Street Bridge as a way to help to reduce future river flooding in Morrisville
History
Yardley is charming borough on the Delaware River and Canal with quaint shops, dining and cultural attractions for the community and visitors. SEPTA regional rail service to Yardley makes it a bedroom community to Philadelphia and a potential major trailhead for recreation transit users from Center City. Yardley was an important historic transportation point as a former ferry site that provided connections between Philadelphia and New Jersey. A 20th Century trolley line also operated between Yardley and New Hope, linking the borough to points further north.

People
Yardley’s population is 2,324. The median age is 40 years. Median household income is $77,337 and the percentage of residents below the poverty level is 3.9%. 7.2% of commuters take public transportation to work and 2% of households have no availability to a personal vehicle. Commuters are serviced by the West Trenton SEPTA Regional Rail Line which stops at Yardley station.

Priorities
Canal priorities in Yardley include: linking the nearby Yardley SEPTA station to the Canal and pursuing the link to Middletown as part of the Circuit trail system. The Brock Creek Aqueduct needs to be replaced. Yardley is a low-lying area and during high river levels, flood water enter the Canal near Yardley and have caused damage downstream in Morrisville where remedies to canal obstructions must be made. Yardley can support Morrisville in these efforts.
Lock 5 configuration contributes to canal flow issues. Rehabilitating this structure with operable wicket gates can help remedy the flow issues.

MP 13.3 ACCESS: Landing – Yardley Station

Place
Yardley Station is located along Main Street in Yardley, approximately half a mile from the Canal and borough businesses.

Existing Assets
Yardley Station is serviced by the West Trenton Line which provides connections between Philadelphia and West Trenton. The station itself has 2 large parking lots and is well-situated to accommodate local residents and businesses.

Opportunities / Potential Partners
The Canal is located 850 feet directly northeast of the station but because of the presence of private lots, users have to travel up Main Street and Letchworth Avenue and down Canal Street to reach the towpath opening. An opportunity exists to improve this location as a Delaware Canal Landing by creating a direct route from the station to the towpath. The area around the reservoir can also be upgraded with landscaping, benches, lights and public art which would make this a new destination for the Borough.

Potential Partners – D&L, Inc., DCNR, Yardley Borough, private landowners
MP 14 STRUCTURES: Aqueduct – Brock Creek Aqueduct

Place
The Brock Creek Aqueduct carries the Canal and towpath over the Brock Creek in downtown Yardley near Afton Avenue.

Existing Assets
The aqueduct is in a prime location in Yardley, close to restaurants, shops and homes, some of which have direct frontage onto the towpath. A ramp off of Afton Avenue provides access into town.

Opportunities / Potential Partners
With all eyes on ensuring a continuously watered Canal in the southern section, it becomes imperative that this aqueduct can sufficiently handle expected water supplies and steady foot traffic. As of Winter 2016, a project to rehabilitate the aqueduct was underway. A structural analysis should be conducted to determine if this structure needs replacement. If it does, it could be redesigned to fit into the surrounding architectural fabric, thereby making it an integral part of the community as well as a new local destination.

DCNR performs inspections of aqueducts every two years.

- The aqueduct rehabilitation project has been funded
- Future funding could be obtained from PennDOT through Federal Transportation Enhancement funds
History
I-95 passes over the Delaware Canal in Lower Makefield before it crosses the Delaware River at the Scudders Falls Bridge into New Jersey. A new Scudders Falls Bridge under development by the DRJTBC will address congestion, interchange, and structural issues, in addition to introducing new pedestrian/bike paths that will provide linkages to the Delaware Canal from the D&R Canal Trail on the New Jersey side. The existing I-95 Park & Ride facility on Woodside Road in Lower Makefield can become a new trailhead for users who wish to enjoy both the Delaware Canal and the D&R Canal along the New Jersey riverfront.

People
Lower Makefield population is 32,622. The median age is 44 years. Median household income is $126,492 and the percentage of residents below the poverty level is 2.5%. 6.6% of commuters take public transportation to work and 1.7% of households have no availability to a personal vehicle.

Priorities
Canal priorities in Lower Makefield include: creating bicycle and pedestrian ramps from the new Scudder Falls Bridge (currently in final design); studying the feasibility of a Visitor’s Center at the base of the new I-95 bridge; and marketing the area, as a major Portal access point for the Delaware Canal. DCNR will not participate in a Visitor’s Center at this location but supports one at this location through other partnerships.
MP 15.1 ACCESS: Linkage – Scudder Falls Bridge

Place
The Scudder Falls Bridge carries I-95 into New Jersey and crosses over the Canal north of the Yardley Borough line between River Road and Taylorsville Road.

Existing Assets
I-95 carries tens of thousands of people daily, and will serve as a major route for those seeking to access the Delaware Canal from New Jersey and southeast Pennsylvania via the Taylorsville interchange. A Park & Ride lot currently exists at Taylorsville and Woodside Road, where Canal users can park their vehicles and walk the approximately 700 feet to towpath access along the Woodside shoulder.

Opportunities / Potential Partners
The Delaware River Joint Toll Bridge Commission (DRJTBC) is completing final design of this bridge in 2016 and construction is scheduled to begin in 2017. DRJTBC has included a separate pedestrian bicycle facility into the new bridge that will connect via ADA-accessible ramps to both the Delaware Canal and the Delaware & Raritan Canal trails.
MP 15.2 ACCESS: Portal – I-95
Park & Ride

Place
The existing Park & Ride is located off of Woodside Road near the intersection with Taylorsville Road.

Existing Assets
The site of the existing park and ride facility is owned and maintained by Lower Makefield Township. According to DRJTBC the facility needs upgrades and is currently not used to capacity. From here, the Canal can be accessed approximately 700 feet to the east along Woodside Road shoulder.

Opportunities / Potential Partners
If the site were to be acquired by DRJTBC, the Park & Ride facilities can be improved and the possibility exists for the site to serve as a Portal to the Delaware Canal and D&L Trail. Potential partners – including DRJTBC, DCNR and PennDOT should discuss opportunities to collaborate in some form of visitor contact facility at this location. Once the pedestrian bicycle facility on the new Scudder Falls Bridge is completed, users will be able to use it to cross the bridge and access the D&R Towpath on the New Jersey side and vice versa. The connection between the Canal Towpath and the Park & Ride facility should be improved to include an off-road ped-bike connection.
UPPER MAKEFIELD / WASHINGTON CROSSING

History
Upper Makefield is home to Washington Crossing Historic Park, which was recently brought under the management of the Department of Conservation and Natural Resources (DCNR). Some aspects of the park are managed in partnership by the Friends of Washington Crossing Park and Bowman’s Hill Wildflower Preserve. The park provides parking, picnic areas, sports fields, restrooms and visitor information and features important public access locations in several places to the adjacent Delaware Canal.

People
The Upper Makefield population is 8,222. The median age is 48 years. Median household income is $172,125 and the percentage of residents below the poverty level is 4.9%. 4.3% of commuters take public transportation to work and 1.0% of households have no availability to a personal vehicle.

Priorities
Canal priorities in Upper Makefield include: establishing Washington Crossing Historic Park as an official Landing for the Canal; emphasizing its importance as a historic destination of multiple eras; featuring its recreational amenities; and interpreting its relationship to Washington Crossing State Park in New Jersey.
MP 17.9-22.2 ACCESS: Landing – Washington Crossing

Place
Washington Crossing Historic Park encompasses 500 acres, stretching from the intersection of River Road and Route 532 to Bowman’s Hill Tower Road south of Aquetong Road, and contains attractions such as the Memorial Building and Visitor Center, Thompson-Neely House; Bowman’s Hill Tower; Bowman’s Wild Flower Preserve and the Taylorsville village. In 2016, management of the park was transferred from PHMC to DCNR with portions operated by the Friends of Washington Crossing Park and Bowman’s Hill Wildflower Preserve. The Canal is a half mile from the Visitor Center in the Lower Park and a quarter mile from the Wild Flower Preserve in the Upper Park. Access to the Thompson-Neely house provides restrooms, direct access and parking for the Delaware Canal and Delaware River.

• Canal Structures – Pidcock Creek waste gate, Pidcock Creek overflow

Existing Assets
The Park is a regional treasure and National Historic Landmark due to its importance during the American Revolution. Thousands of people visit the Park each year, from school-age children to tourists from other countries. They come to experience the living history and significant events that have occurred at the Park and the proximity to the Canal makes this a perfect landing for new and experienced users.

Opportunities / Potential Partners
As Washington Crossing Historic Park is now under DCNR management, both the Park and Canal can cross-market and cross-promote together to reach the largest target markets, which can range from history buffs to nature lovers to avid hikers and bikers. DCNR can also partner with a shuttle service that can transport people between parts of Washington Crossing and the Canal, traversing the whole area of the landing.

• Potential Partners – DCNR, Friends of Washington Crossing Park, Visit Bucks County, private shuttle company
Solebury

History
The “upper park” portion of Washington Crossing Historic Park is located in Solebury Township and is comprised of Bowman’s Hill Tower, which sits on a possible lookout point for the Continental Army; and the Thompson-Neely House, which was used as a hospital during the Revolution. The northern reaches of the Township, once home to a number of mills, are marked by three green spaces. Canal Park near the US 202 bridge, Hal C. Clark Park and the Virginia Forrest Recreation Area, as well as the villages of Centre Bridge, where a bridge staircase leads to the towpath, and Lumberville where a Delaware River footbridge connects the village to Raven Rock, New Jersey and the head of the D&R Trail.

People
Solebury’s population is 8,674. The median age is 49.2 years. Median household income is $114,547 and the percentage of residents below the poverty level is 4.0%. 1.6% of commuters take public transportation to work and 0.6% of households have no availability to a personal vehicle.

Priorities
Canal priorities in Solebury include: identifying the area near Thompson-Neely House as a Canal Landing; rehabilitating the Rabbit Run culvert south of US 202; featuring trail access and creating new boat access to the Canal from Canal Park and the upcoming
Route 32 section of the Route 202 cross-county trail; ensuring continued maintenance and support for the new Centre Bridge backup pump; linking the Lumberville foot bridge to the Canal towpath; rehabilitating Lumberville Lock #12; rehabilitating the Paunacussing Aqueduct; and supporting the idea of a pump at New Hope or Bowman’s Hill that would tap into local electricity.

(Note: due to shape of municipality, mile marker distances will vary.)

MP 22.2 ACCESS: Landing – Thompson-Neely House

Place
The Thompson-Neely House is part of Washington Crossing Historic Park and is located in the Upper Park at Bowman’s Hill Tower Road. A camelback bridge to the Canal is 300 feet away.

• Canal Structures – Thompson-Neely Camelback Bridge

Existing Assets
Thompson-Neely House is a fine example of Georgian architecture and served as a temporary hospital during the American Revolution. Nearby are public pavilions, soldier’s graves and Bowman’s Tower, which attracts visitors for its sweeping views of the Delaware River and bucolic countryside of Bucks County, and the Wild Flower Preserve.

Opportunities / Potential Partners
Opportunities here can complement the opportunities for the entire Washington Crossing Park, including marketing efforts and shuttle services between destinations. In addition, the parking lot for the Preserve can be formalized as a landing lot for all DCNR assets, including the Canal, with wayfinding signage, lights and benches.

• Potential Partners – DCNR, Friends of Washington Crossing Park, Visit Bucks County, private shuttle company
MP 25.4 STRUCTURES:
Culvert – Rabbit Run Culvert Rehabilitation

Place
The Rabbit Run Culvert carries the Rabbit Run Creek under the Canal, about 1,000 feet south of the Route 202 Bridge.

• Canal Structures – Rabbit Run Culvert

Existing Assets
The Rabbit Run Bridge over the Delaware Canal was rehabilitated by PennDOT within the past decade and includes a façade Camelback truss. Directly adjacent to the bridge, the Rabbit Run runs through a culvert below the Delaware Canal and flows into the Delaware Canal.

Opportunities / Potential Partners
This culvert has been identified by DCNR as needing replacement. The timing and logistics of this culvert replacement project will affect the watering of the Canal through New Hope. The Rabbit Run project may also have significant impacts on the timing and negotiations with a potential concessionaire to resume commercial Canal boat rides from New Hope to Center Bridge. DCNR can seek assistance from many partners in strategizing this rehabilitation project to ensure that a watered canal during construction is the highest priority after safety. This applies to all projects.
MP 25.7 ACCESS: Landing – Canal Park Access at Routes 32 and 202 interchange

Place
Canal Park is situated adjacent to the Routes 32 and 202 interchange, between a residential subdivision and the Route 202 Bridge. The Canal is accessed via a pedestrian camelback-shaped bridge at the east end of the park that steps down directly onto the towpath.

- Canal Structures – Malcolm Crooks Camelback Bridge

Existing Assets
Solebury has worked in cooperation with DCNR and DRJTBC over years to fund and construct Canal Park – including a pedestrian bridge over the Canal that links the municipal and state parks. The Route 32 segment of the Route 202 Cross-County Trail is scheduled for construction in 2017, and will create the final missing trail link to access the D&L Trail by retiring one of four highway lanes on Route 32 (a “road diet”) to create a dedicated bike route that is separated from vehicular traffic by a bio-swale stormwater BMP.

Opportunities / Potential Partners
This off road ped-bike link and pedestrian bridge between the Township and state parks makes Canal Park a municipal access location to the Delaware Canal. Solebury can take the lead on planning for increased public use of this site – including resuming its original plans with DCNR to install an ADA small boat access ramp from Canal park into the Delaware Canal prism.
MP 27.7 WATER: Backup – Centre Bridge Pump

Place
The Centre Bridge Pump is located adjacent to the Centre Bridge-Stockton Bridge that carries Route 263 into New Jersey. The Canal is located at the base of the bridge and can be reached by a set of stairs from the structure.

Existing Assets
A pump in this location has been used for years by DCNR to augment backup water from the Delaware River into the Delaware Canal during low flow periods through New Hope. This pump has been essential in past years to provide sufficient backup water to the New Hope section of the Canal to physically operate the commercial Canal boat during peak seasons.

Opportunities / Potential Partners
The challenge is to install, maintain and operate backup pumps like the Centre Bridge pump to augment low flows in the Delaware Canal that result from multiple issues. The Vision Study revealed a strong public consensus that operating backup systems to keep the Delaware Canal watered should be a primary goal. Strategic partners need to work with state legislators to ensure that DCNR and other partner agencies are tasked and funded annually to perform this critical function. The budget needs to be supplemented in a strategic way.

• Potential Partners – DCNR, D&L, Inc., DC21, DRBC, FODC, New Hope for Our Canal
MP 28.9 SERVICES / AMENITIES: Recreation – Facilities at Virginia Forrest Recreation Area

Place
Virginia Forrest Recreation Area is located along River Road near the intersection of Paxson Road and provides direct access to the towpath.

Existing Assets
Virginia Forrest is a well-developed Landing area, including parking, restroom and Canal and river access.

Opportunities / Potential Partners
The Camelback bridge here is a prototype timber structure with the potential to be raised to create a grade-separated towpath that can re-establish the capability for mule-drawn tour barges (Canal boats) to continue their journeys farther north.

• Canal Structures – Virginia Forrest waste gate

Water fountains might be added to allow for the filing-up of water bottles and nozzles for dogs. New signage might be added that talks about the local history and attractions along this stretch of the Canal. In addition, access down to the River can be improved with new stairs.
**MP 30.9 ACCESS: Linkage – Lumberville Footbridge**

**Place**
The Lumberville-Raven Rock Bridge connects Lumberville to Bull's Island and is located in Lumberville next to the historic Black Bass Hotel, established in the 1740s. There is no existing direct access to the Canal from the Bridge.

**Existing Assets**
The Raven Rock Bridge connects to the Recreation Area on Bull's Island and onward to the D&R Canal in New Jersey and links to the Delaware Canal upriver. The Bridge is heavily used by visitors who frequent the commercial establishments in Lumberville. There is little public parking in Lumberville, but Bull's Island Park across the bridge has ample public parking.

**Opportunities / Potential Partners**
With recent renovations to the Black Bass Hotel and the Lumberville Store, the pedestrian activity along Route 32 in this area of Solebury has increased significantly. An idea was expressed during the Vision Study to create a pedestrian walkway that will physically connect the Lumberville portal of the pedestrian bridge to the Delaware access – approximately 500 feet upstream. Currently, pedestrians and bikers must share a minimal highway shoulder with vehicular traffic to walk between the two trail destinations. Solebury can take the lead to advance this linkage – similar to its Route 32 trail project – by engaging DCNR, PennDOT, DRJTBC and FODC as essential partners.
MP 31.0 STRUCTURES: Lock – Rehabilitating Lumberville Lock #12

Place
Lock #12 is located in Lumberville near the intersection of River Road and Old Carversville Road.

Existing Assets
The lock at Lumberville is stabilized but not operable.

Opportunities / Potential Partners
This lock and two locks in Point Pleasant would need to be made operable – if commercial Canal boat operations were to be extended from New Hope, beyond Center Bridge to reach the recreation destination of Point Pleasant.
MP 31.1 STRUCTURES: Aqueduct – Rehabilitating Paunnacussing Aqueduct

Place
The Paunnacussing Aqueduct carries the Canal and towpath over the Paunnacussing Creek, near the intersection of River Road and Fleecy Dale Road.

Existing Assets
The current Paunnacussing Aqueduct is obsolete and structurally incapable of carrying a watered canal. DCNR has limited water passing through the structure and the concrete superstructure needs a modern replacement that can be retrofitted into the existing stone abutments. A stormwater-related issue at this location is the geologic nature of the Paunnacussing Creek and its perennial alluvial deposits at the constricted hydraulic opening below the aqueduct.

Opportunities / Potential Partners
Strategic partners can assist DCNR to advance the rehabilitation of the Paunnacussing Aqueduct as a priority. The program for the new structure should include:

- Concepts for stormwater BMPs in the Paunnacussing – as described in the Delaware Canal Preliminary Stormwater Study 2016.
NEW HOPE

History
New Hope is a central location on the Delaware Canal and was an important manufacturing hub in the 19th Century. Today it is a bustling residential and tourism destination for recreation, shopping, dining and the arts, including the recently reopened Bucks County Playhouse. The Canal is a beloved central amenity in New Hope.

People
New Hope’s population is 2,526. The median age is 47 years. Median household income is $83,313 and the percentage of residents below the poverty level is 3.8%. 1.4% of commuters take public transportation to work and 9% of households have no availability to a personal vehicle.

Priorities
Canal priorities in New Hope include: improving visitor services, ensuring the structural stability and service of the Delaware River wing dam that feeds the Delaware Canal; the redevelopment of the former Odette’s site; creating a safe Route 32 crossing in the southern end of the Borough; the feasibility of an Archimedes Screw pump to augment water flow to the Delaware Canal; the careful adaptive reuse of the historic stone core of the Odette’s Inn – as it is presently planned to be relocated within the Borough; and the enhancement of the Lock 11 area.

Legend:
1. WING DAM
2. ODETTE’S
3. RIVER INLET/ARCHIMEDES SCREW (POTENTIAL)
4. ROUTE 32 CROSSING
5. LOCKTENDER’S HOUSE
MP 23.8 WATER: Resource – New Hope-Lambertville Wing Dam

Place
The wing dam is a structure in the Delaware River located below the Delaware Canal inlet between Lambertville, NJ and New Hope, PA. Similar to the Delaware River wing dam located above Lambertville, the New Hope-Lambertville Wing Dam was constructed to raise a pool level of the Delaware River behind it, while the open center area allows free flow navigation and fish migration. A functioning wing dam is and remains essential to maintaining water in the southern reach of the Delaware Canal.

Existing Assets
- **Ownership** – Pennsylvania owns at least half of the New Hope-Lambertville wing dam.
- **Water Source** – The wing dam waters the southern reach of the Delaware Canal during non-low flow periods.

Opportunities / Potential Partners
**Begin Investigation and Planning** – The Commonwealth should begin a proactive engineering investigation of the conditions of the wing dam structure to ensure that engineering designs, partners and funding is planned, and contingency designs are in place for the inevitable event that the dam structure is damaged, needs repair, or replacement. (DCNR, State of New Jersey, DRBC, ACOE.)
MP 24 HISTORIC: National Historic Landmark- Odette’s Site Redevelopment

Place
The Odette’s Inn sits between Lock #8 and the inlet / outlet canal, overlooking the Delaware River in New Hope. The inn has been a cultural center, at the place where Canal boats would cross the Delaware River to reach the Delaware and Raritan Canal for points south and east in New Jersey. A series of floods in recent years through New Hope have rendered the Odette’s Inn resource derelict.

Opportunities / Potential Partners
The Odette’s owner is in negotiations with DCNR to redevelop the Inn site for resumed commercial uses. Issues to be resolved include:

• Access/parking agreement
• Historic stone inn core structure
• Lock #8

Existing Assets
• Odette’s is a privately-owned resource listed on the National Landmark designation
• The existing parking lot is owned by the Commonwealth

Other issues that deserve consideration as part of the Odette’s adaptive reuse agreement include:

• Towpath Trail Bridge – Access / Safety – the temporary bridge to be constructed at the north end of the site should be the permanent location for a primary trail crossing and construction access between the two sides of the canal.

• Traffic study – this should be prepared to identify impacts to river road traffic from renewed operation of a new Odette’s, including the advantages to creating a northbound deceleration/staging lane to serve the northern entrance.

• Driveway entrance – eliminate the non-historic southern (single lane) culvert located directly south Lock #8.

• Pedestrian bridge – after the upstream construction bridge is in place, eliminate non-historic existing bridge over the canal (south of Odette’s). Replace with a pedestrian-only bridge at the point where the Delaware Canal meets the river outlet canal.

• Control Lock – reconstruct lock structure in combination with the new canal bridge at the upstream construction bridge location

None of the structures (above) that would be demolished or reconstructed at a modified location are historic resources.
MP 24 WATER: Backup – Archimedes Screw Pump

Place
The location for a proposed Archimedes Screw is at the river inlet north of the Odette’s site. Here, the towpath sits on the west side of the inlet.

Existing Assets
The site for the proposed Screw might allow it to tap Delaware River water to augment water in the Canal south of New Hope.

Opportunities / Potential Partners
Friends of the Delaware Canal proposed the installation of an Archimedes Screw at the River inlet in New Hope as a means to pump water into the Canal to points south of New Hope. This device is a shaft that, as it turns, picks up water from one body, pushes it up the screw coils in the shaft to the top, and deposits it into another water body. The presence of this type of augmentation device might assist in keeping the Canal watered in the southern end. A feasibility study is needed.

• Potential Partners – DCNR, D&L, Inc., Friends of the Delaware Canal
MP 24.2 ACCESS: Pedestrian and Bicycle – Route 32 Crossing

Place
The towpath crosses Route 32 in New Hope just south of the business district, next to the large parking lot between New and Main Streets.

Existing Assets
This crossing is at the southern end of the densely developed, diverse and popular business district of New Hope, with constant interaction between auto traffic and pedestrians. The existing crossing is not defined or up to standards.

Opportunities / Potential Partners
This crossing is a major pedestrian interaction with a busy streetscape. An opportunity exists to stripe and a crossing, possibly with signalization to give pedestrians and bicyclists a safe right-of-way to cross Main Street and continue south on the Canal from the Borough center. A grade-separated (pedestrian bridge) crossing would be the safest option for this location, but would require feasibility studies to address geometry, cost and cultural resource issues.
MP 24.3 HISTORIC: Conservation Options – Adaptive Reuse of Odette’s Stone Core

Place

Odette’s Inn was originally constructed in 1794 and retains much of its original integrity, including the stone core walls, which have survived many major storm events over the course of its 200+ year history. In 2016, the Odette’s owner entered into a negotiation with DCNR to move the historic stone core to a new location – to be determined – within the Borough instead of demolishing the structure.

Existing Assets

The stone core structure is listed as an element of the National Landmark. Moving the core structure will destroy its original context, but the structure as a historic artifact will survive for adaptive reuse within a local relationship to New Hope.

Opportunities / Potential Partners

DCNR may consider adaptively reusing the structure as a facility for new administrative offices or a visitor’s center. Alternatively, the core can stay as it is, as a “snapshot” of a historic structure which might serve as an educational tool for Canal and New Hope history.
History

Point Pleasant is a village located in both Plumstead and Tinicum Townships in Bucks County and divided by the Tohickon Creek to its confluence with the Delaware River. The Delaware Canal is carried over the creek on the latest incarnation of the Tohickon Aqueduct, a heritage Burr Truss structure of modern timber materials, completed in 2001.

People

Plumstead population is 12,730. The median age is 40 years. Median household income is $90,670 and the percentage of residents below the poverty level is 3.8%. 4.6% of commuters take public transportation to work and 2% of households have no availability to a personal vehicle.

Priorities

Canal priorities in Point Pleasant include: Improving public access at the Mountainside Inn property; restoring Locks 13 and 14 to operability for commercial Canal Boat traffic; utilizing the Point Pleasant pumping station to deliver backup water into the Canal; making flood damage repairs to the Tohickon Aqueduct; improving public access to the towpath via Kings Island Bridge;
MP 32.3 ACCESS: Pedestrian and Bicycle; Parking – Mountainside Site

Place
The Mountainside is a 25 acre parcel located along River Road south of the Point Pleasant Pumping Station. The property includes 1,300 feet of Delaware River frontage and approximately the same frontage along the Canal.

- Canal Structures – Lock 13, Canal bridge at Lock 13

Existing Assets
The Mountainside site includes a large 45-car parking lot and a former Colonial-era inn that predates the Canal and served early river ferry traffic that crossed the Delaware River from this property before the American Revolution. The site has served as a de facto public access site to the Canal since the 1980s.

Opportunities / Potential Partners
This site has the potential to be a public access site and major trailhead for the Canal and Delaware River. As a public site the property can be stabilized for adaptive reuse of the old Colonial inn. This site is located near the mid-point of the 60-mile Canal and could serve as a major landing locations and Trailhead for the D&L Trail and Delaware River Water Trail.

- Potential Partners – Plumstead Township, DCNR, D&L, Inc., DCED, Bucks County Open Space Program, Mercer County and Mercer Museum (for archaeology connection)
**MP 32.3 STRUCTURES: Locks – Lock 13 and 14 Restoration**

**Place**
Lock 13 is located north of the Mountainside parking lot and Lock 14 is located approximately 300 feet north of the Point Pleasant Pumping Station, east of the intersection of River Road and Old Ferry Road.

**Existing Assets**
Locks 13 and 14 are not stabilized. Neither is operable.

**Opportunities / Potential Partners**
These two locks will need to be made operable if commercial Canal boat operations were extended from New Hope to the recreation destination of Point Pleasant. Additionally, the installation of miter gates would improve upstream water levels.
MP 32.4 WATER: Backup – Point Pleasant Pumping Station

Place
The Point Pleasant Pumping Station is about 360 feet south of the intersection of River Road and Old Ferry Road.

Existing Assets
There is no current asset to the Canal at the Pumping Station. The Station was built to pump water from the River and pipe it to cool the Limerick nuclear plant 30 miles away.

Opportunities / Potential Partners
Some of the water pumped from the Delaware River by the pumping station facility can potentially be used to water the Canal from this point south to Center Bridge. The strategy is to utilize this facility as a backup watering supply between Point Pleasant and Center Bridge (there is no study to justify its range of effectiveness). DC21 has initiated discussions among partners to utilize this potential backup watering resource.

• Potential Partners – DCNR, D&L, Inc., DC21, DRBC, Exelon Energy, Forest Park Water Authority
MP 32.7 STRUCTURES: Aqueduct – Repairs to Tohickon Aqueduct

Place
The Tohickon Aqueduct carries the Canal and towpath over the Tohickon Creek just south of Byram Road.

Existing Assets
The Aqueduct was completed in 2001. It is a traditional Burr Arch timber structure that uses modern timber technology and geotextiles to seal the prism. The Aqueduct was the recipient of numerous awards, including the National Timber Bridge Award given by the U.S. Forest Service and the Transportation and Historic Preservation Award given by the Federal Highway Administration.

Opportunities / Potential Partners
Due to its age, the Tohickon Aqueduct should undergo an assessment to determine if there are any deficiencies with all of its components. DCNR can partner with groups like the Timber Framers Guild to conduct an assessment to ensure that this aesthetically-pleasing and functionally-efficient superstructure and the hidden liner remain in peak condition.
History

The tranquil community of Tinicum is home to Ralph Stover State Park, home of High Rocks, as well as the Giving Pond, a former quarry that was sold to PA DCNR. The site has been transformed into a pond and habitat for fish. The area, with pond, picnic and play areas, has become a popular destination for visitors along the Canal. Tinicum is also home to the villages of Erwinna, where a vertical turbine-wheel grist mill once operated, and Uhlerstown, named for a canal boat builder and reputed to be the best preserved Canal hamlet in America. The Golden Pheasant Inn, where canal boatmen would stop for rest and food, is also located here near the Marshall Island in the Delaware River.

People

Tinicum’s population is 3,993. The median age is 49.8 years. Median household income is $68,125 and the percentage of residents below the poverty level is 11.3%. 6% of commuters take public transportation to work and 4.4% of households have no availability to a personal vehicle.

Priorities

Canal priorities in Tinicum include: replacing the Tinicum Creek Aqueduct; rehabilitating Golden Pheasant Bridge; installing a backup pump on Marshall Island; improving access at Tinicum Park; and improving access at Giving Pond.
MP 37.2 STRUCTURES: 
Aqueduct – Tinicum Aqueduct Replacement

Place
The Tinicum Aqueduct carries the Canal and towpath above the Tinicum Creek next to River Road between Tinicum Creek and Stagecoach Roads.

Existing Assets
The aqueduct is a shallow, steel beam superstructure, supported on timber crib piers, and needs to be replaced. It is not navigable by kayak or canoe.

Opportunities / Potential Partners
Tinicum Township can request a partnership with DCNR in the redesign of the new Tinicum Creek Aqueduct – to ensure that it includes a full depth channel for water flow and navigation, and high-value aesthetic treatments. A new design might incorporate features of the Tohickon Aqueduct (5 miles south.)

• Potential Partners – DCNR, Tinicum Township, William Penn Foundation, other potential funders
MP 37.5 STRUCTURES: Bridge – Golden Pheasant Bridge

Place
This bridge carries River Road over the Canal just south of the Golden Pheasant Inn and the access road to Sand Castle Winery.

Existing Assets
The Canal passes behind the mid-19th Century Golden Pheasant Inn, the longest operating restaurant along the Delaware Canal. The inn served Canal boaters along their trek, as well as the local farmers and visitors, providing them with food and lodging. The current Route 32 Bridge that crosses the Canal directly south of the Golden Pheasant Inn is currently under engineering assessment by PennDOT for replacement.

Opportunities / Potential Partners
There is access to the Canal at the southeastern end of the bridge that is well-suited for pedestrians and bikers. This access area can be enhanced by a walkway or path along the bridge that can connect to the access road leading up to the winery, which provides elevated views of the Canal, inn and River. The design of the replacement Route 32-Golden Pheasant Bridge is a critical context-sensitive design opportunity for PennDOT, DCNR and Tinicum Township. Early partnership meetings are essential for this bridge project to move through the long design and approval process as quickly as appropriate design decisions allow.

• Potential Partners – DCNR, PennDOT, Tinicum Township, other potential funders

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MP 37.5 WATER: Backup – Marshall Island Pump

Place
Marshall Island in the Delaware River is opposite the Golden Pheasant section of Tinicum. The location of the proposed pump is approximately 100 yards south of the Golden Pheasant Bridge on the banks of the River.

Existing Assets
There are no existing assets at this point.

Opportunities / Potential Partners
An opportunity exists to purchase, install and operate a pump at this location that will be able to water the Canal for 5 miles south to the Point Pleasant Pumping Station. DC21 has advanced this project with DCNR as part of a comprehensive backup system-wide watering strategy. DCNR currently requires that an external funding source, outside the agency budget, will be necessary to operate the pump.

• Potential Partners – DCNR, D&L, DC21, DRBC
MP 38.6 ACCESS: Upgrade – Tinicum Park

Place

Tinicum Park is a 126-acre County park located to the east of the Canal between the village of Erwinna and the northern tip of Pennington Island.

Existing Assets

Tinicum Park is home to the historic John Stover House and the Tinicum Barn, which can be rented for events. Recreational amenities at the park include picnic tables, a pavilion, playground, Frisbee golf course, ball fields and camping. Polo matches are also held at the park between May and October. The towpath traverses the park on its western border.

Opportunities / Potential Partners

As the towpath lies along the western edge of the park, new signage can be placed at the entrance path into the park describing the joint amenities and hours of operation. The County provides parking and public toilets within this park. Bicycle racks can also be installed. Existing facilities can be upgraded or new recreational amenities installed that continue the County-state partnership at this location. A major boat access facility to the Delaware River is owned by Tinicum at this location and is approximately 1700 feet from the Delaware Canal access within the park.

• Potential Partners – DCNR, Bucks County
MP 40.8 ACCESS: Upgrade – Giving Pond

Place
The Giving Pond Recreation Area is a 90-acre former quarry located a quarter mile north of the Uhlerstown Bridge and south of Jugtown Hill Road. The Canal lies to the west of the Giving Pond land.

Existing Assets
The Giving Pond area was sold to DCNR in 2002 after quarry operations ceased. It is a popular destination for boating, canoeing and fishing for many warm water species.

Opportunities / Potential Partners
Canal users can leave the towpath at a dirt path just south of the Pond if they wish to recreate at the site, but would still have to circumnavigate the Pond to reach access points. The dirt path here can be paved to provide a more comfortable approach to access points or launch sites can be built along the western and southern edges of the Pond to allow for quicker access by Canal-goers.
History
The village of Upper Black Eddy, once a popular site for fishermen, is situated in Bridgeton. Today, homes, small businesses and a three-span Warren truss bridge to New Jersey identify the location. The natural wonders of Ringing Rocks and High Falls are also in Bridgeton.

People
Bridgeton’s population is 1,296. The median age is 49 years. Median household income is $54,938 and the percentage of residents below the poverty level is 8.9%. 0.3% of commuters take public transportation to work and 1.3% of households have no availability to a personal vehicle.

Priorities
Canal priorities in Bridgeton include: establishing a landing at Upper Black Eddy.
MP 43.8 ACCESS: Landing – Upper Black Eddy

Place
Upper Black Eddy is a village in Bridgeton whose center is located between Bridgeton Hill Road and Canal Lane. A bridge connects the village to Milford in New Jersey. The Canal is located to the southwest of the village.

Existing Assets
Upper Black Eddy is a quiet village that contains a few small businesses and residential areas. Canal users can leave the towpath at a bridge next to the Homestead general store and enjoy the village or cross the bridge into New Jersey. An FBC owned boat launch just south of the bridge is also present.

Opportunities / Potential Partners
Upper Black Eddy can position itself as one of the northern tier Canal Landings through signage at the bridge to guide people to the Canal at Homestead as well as to Ringing Rocks. Access at the southern end of the village can also be established by extending Bridge Lane to the towpath. Water fountains and bike racks might be installed at the Homestead and Bridge Lane access points and the construction of a dedicated restroom facility should be explored if patrons are unable to use restrooms at local businesses.

• Potential Partners – DCNR, local businesses / chamber of commerce
History
The village of Kintnersville is located in Nockamixon and is separated from the Canal by Route 32 and a wide swath of open space. The Nockamixon Cliffs natural feature, a 300 foot rock cut, is also located here.

People
Nockamixon’s population is 3,425. The median age is 46.9 years. Median household income is $70,705 and the percentage of residents below the poverty level is 5.9%. 1.6% of commuters take public transportation to work and 2.4% of households have no availability to a personal vehicle.

Priorities
Canal priorities in Nockamixon include the possibility of establishing a Landing at Kintnersville.
MP 47.5 ACCESS: Landing – Kintnersville

Place
Kintnersville is situated south of the Canal at the intersection of River Road and Easton Road (Route 611).

Existing Assets
Like Upper Black Eddy, Kintnersville is a small village that contains a few small businesses and homes and a natural feature, the Nockamixon Cliffs as well as the Gallows Run which runs north of the village.

Opportunities / Potential Partners
Landing efforts here might focus on connecting the Canal and towpath to Kintnersville and points inward into Upper Bucks County. As the Canal is separated from the village by a wide expanse of open space and the closest connections require people to travel along Easton and River Roads. Signs can also be placed along the towpath directing users to the village and its establishments

• Potential Partners – DCNR, local businesses / chamber of commerce, private landowners
DURHAM

History
Durham was the site of a number of historic furnaces. The oldest furnaces provided cannons for the Revolutionary War and later furnaces operated into the 20th Century. Durham is also the site of a series of caves that were most likely used as shelter for local Native American peoples as well as an 18th Century iron mine that today serves as hibernaculum for the local bat population.

People
Durham’s population is 1,147. The median age is 50.8 years. Median household income is $85,750 and the percentage of residents below the poverty level is 7.1%. The percentages of commuters who take public transportation to work and households that have no availability to a personal vehicle are negligible.

Priorities
Partners can unite to secure sustainable funding for the pump operation. The functioning pump was rebuilt in 2014.
MP 49.3 WATER: Backup – Durham Pump

Place
The location of the Durham Pump is near the Durham Aqueduct in the vicinity of the intersection of Durham and Easton Roads. DCNR worked with FODC to establish the pumping station, and fund it. This pump is functioning, and was rebuilt in 2014.

Existing Assets
The Durham Aqueduct is an asset here, and carries the Canal and towpath over Cooks Creek. There is also a lock at this location.

Opportunities / Potential Partners
The pump at this location can water the Canal for 12 miles down to Marshall Island. The opportunity should be considered by DCNR and partners modify this Durham pump system to deliver water to the Canal at the level above the Lock, so that the system has the potential to water the immediate segment upstream, as well as downstream when needed.

• Potential Partners – DCNR, D&L, Inc., DC21, DRBC, FODC
RIEGELSVILLE

History
Riegelsville Borough marks the Canal boundary of Bucks County with Northampton County. The Riegelsville Bridge is noteworthy for being constructed by the Roebling Company, founded by John Roebling, the designer of the Brooklyn Bridge. Because of the nature of the river at this point, tenders could pull boats and keep them for winter storage.

People
Riegelsville’s population is 842. The median age is 49.4 years. Median household income is $70,952 and the percentage of residents below the poverty level is 6.3%. 2.1% of commuters take public transportation to work and 0.8% of households have no availability to a personal vehicle.

Priorities
Canal priorities in Riegelsville include: assessing the impact of a proposed natural gas line through the Borough.
MP 51.2 ENVIRONMENT: Habitat – Impact of Natural Gas Pipeline

Place
The proposed PennEast Pipeline is a 100+ mile line that would transport natural gas from the Marcellus Shale regions of the state to New Jersey and then to international markets. The proposed route passes Riegelsville and the Canal in an area about 400 feet south of the Penn Community Bank on Easton Road.

Existing Assets
This section of the Canal is just south of the businesses and homes of Riegelsville. Canal users can cross a Camelback bridge on Durham Street into Riegelsville center and visit local businesses and landmarks, including the Furnace site and Roebling Bridge.

Opportunities / Potential Partners
As the construction of the pipeline is a controversial endeavor, partnership opportunities exist between local residents and businesses, DCNR, the PA Fish and Boat Commission, the Federal Energy Regulation Commission (FERC), PennEast, and area environmental groups so that all voices are heard, regarding the potential impacts on the National Landmark and the surrounding natural habitats that are home to many fish and wildlife species.
WILLIAMS

History
Williams Township is just south of the City of Easton in Northampton County. The Theodore Roosevelt Recreation Area, Mariton Wildlife Sanctuary and Wy-Hit-Tuk Park, all located along or adjacent to the Canal, provide additional recreational amenities to users. During the early years of the 20th Century, any overrun of Canal water was used to run nearby turbines which provided power to regional trolley lines.

People
Williams’ population is 5,940. The median age is 50.8 years. Median household income is $94,566 and the percentage of residents below the poverty level is 2.1%. 4% of commuters take public transportation to work and 7.8% of households have no availability to a personal vehicle.

Priorities
Canal priorities in Williams include: improving access at Wy-Hit-Tuk Park, and halting / mitigating erosion from the stormwater runoff from watersheds above the Delaware Canal. This location was identified as a priority site in the Delaware Canal Preliminary Stormwater Study 2016, including some comprehensive mitigation measures that will reduce stormwater damage and possibly improve public access to the Delaware Canal in this densely populated residential location.
MP 56.2 ACCESS: Upgrade; Parking – Wy-Hit-Tuk Park

Place
Wy-Hit-Tuk Park is located along Delaware Drive, about a half mile south of the I-78 overpass. The park can be accessed from the Canal via a wooden bridge near the northern parking lot.

Existing Assets
Wy-Hit-Tuk is a 23-acre county park that offers visitors the use of a playground, picnic areas, camping, and hiking.

Opportunities / Potential Partners
As this park is close to the City of Easton and its large population, opportunities exist for the County to add or upgrade the recreational amenities. They can take cues from parks further south along the Canal and look at adding new ball fields and perhaps community gathering spaces like an amphitheater. In addition, the parking lot at the north can be enhanced with new signage.

• Potential Partners – DCNR, Northampton County
History
Easton is called the “Forks” of the Delaware and the “Head” of the Delaware Canal at the Lehigh River confluence. The two rivers and two canals shaped the cultural patterns of the City and continue today.

People
Easton is the largest and most densely populated center along the entire 60-mile Delaware Canal. Seniors; under 18; low income; minority populations; and regional bedroom commuters to New York are all major sectors of the population. Easton completed its new City Hall in 2014 one block from the Lehigh waterfront, including a bus transit / parking center that serves up to 20 buses / day between Easton and NYC. Easton’s population is 26,977. The median age is 33.4 years. Median household income is $39,773 and the percentage of residents below the poverty level is 22.6%. 4.2% of commuters take public transportation to work and 19% of households have no availability to a personal vehicle.

Priorities
Easton priorities include: preparing a Lehigh River dam multi-use/resiliency strategy; building a safe and accessible ped-bike link from downtown to the Delaware Canal; and revitalizing the Head of the Canal as a major Portal to the D&L Trail, and conception of a “HighLine” type promenade using the abandoned railroad trestle over the Delaware River between Easton and Phillipsburg, NJ.
MP 58.9 STRUCTURES: Dam – Lehigh River Dam

Place
The Lehigh River dam at the Delaware confluence remains a central cultural feature of the Easton landscape and is a major element in the City’s focus on re-imagining its two river waterfronts.

Existing Assets
The dam was originally constructed in 1831 and still serves its purpose to pool Lehigh River water for diversion to the Delaware Canal. Without some form of dam in this location there is no consistent source to sufficiently water the entire northern half of the Delaware Canal. The dam and a shad “ladder” built in the early 1990’s are both owned by the Commonwealth.

The Easton Comprehensive Plan update of 2016 includes a priority recommendation to create a new Waterfront District and Master Plan for Riverfront Development to spur green revitalization. A re-envisioned Lehigh Dam is at the heart of this goal.

Opportunities / Potential Partners
Multiple public expectations have emerged regarding the future of this Lehigh Dam. The visioning process suggests the opportunity to unite the interests of multiple partners – beginning with a feasibility study that assumes the dam structure will require major repair or replacement in the foreseeable future.

A vision sketch combines several ideas from the public that deserve a comprehensive technical analysis to prepare Easton, DCNR, and partners for the inevitable eventuality of rebuilding the dam – as an alternative to waiting until the dam fails to prepare for the contingency. The ACOE should be engaged proactively with DCNR and partners in the planning.

A synthesis of visions for the Lehigh Dam includes modifying the existing structure as partial “wing” dam configuration that will:

- Maintain a Lehigh River pool level to feed the Delaware Canal
- Design the free flowing river channel section on the north side of the Easton Lehigh waterfront to:
  - Re-establish a modern shad / herring passageway
  - Create a whitewater recreation attraction in downtown Easton
  - Stabilize existing river edges
  - Adapt the existing shad ladder structure to a low-head hydropower system, that can:
    - Generate power / income dedicated toward the Delaware Canal
    - Demonstrate modern and sustainable hybrid river management systems

The sketch depicts a partial “wing” dam concept on the Lehigh at Easton – similar in function to the existing Delaware River wing dam at New Hope that feeds the Delaware Canal.
MP 58.9 ACCESS: Portal – Head of the Canal

Place
The distance between the north and south banks of the Lehigh River at the head of the Delaware Canal is approximately 300 feet as the crow flies. Currently, the only pedestrian route between the Delaware Canal head and the downtown Easton waterfront is a 3-foot sidewalk along Route 611. This path is daunting for pedestrians, does not meet transportation standards, and is not safe for bike travel.

Existing Assets
At least three alternative routes require study to determine their feasibility as a future, modern pedestrian-bicycle link for resident and visitor populations in Easton with the 60-mile Delaware Canal greenway, including:

- Widen the Route 611 corridor to accommodate safe, modern ped-bike facilities.
- Adapt a ped-bike grade through the freight station site to reach the Lehigh Canal towpath
- Build a 300-foot ped-bike bridge as a modern Portal structure between downtown and the Delaware Canal

Opportunities / Potential Partners
The Vision Study process revealed a great need to create a safe and inviting pedestrian/bicycle connection between downtown Easton and the Delaware Canal. Major improvements to the precarious existing conditions will be required for any of the three alternatives. In the process of designing this connection, Easton and its partners can envision and create a major “Portal” between Easton downtown and the “head” of Delaware Canal

The Vision Study process revealed a great need to create a safe and inviting pedestrian/bicycle connection between downtown Easton and the Delaware Canal. Major improvements to the precarious existing conditions will be required for any of the three alternatives. In the process of designing this connection, Easton and its partners can envision and create a major “Portal” between Easton downtown and the “head” of Delaware Canal.

The existing Delaware Canal trailhead in Easton is an under-realized node on the D&L Trail system. The site is accessed from Route 611 and is physically limited to approximately 30 parking spaces.

This trailhead is also an important connection to the Easton City-owned Hugh Moore Park, the National Canal Museum and the Josiah White, one of the nation’s only mule-drawn Canal boat rides. It is one of the few places where all historic transportation modes - river, canal, railroads, road, trail - come together.

Easton resident and visitor demographics suggest that a new safe and attractive link between downtown and the 60-mile Delaware Canal greenway will support Easton’s sustainable and economic goals as a riverfront community with enviable assets to meet this modern economic imperative. Easton’s commitment to its waterfront revitalization makes it a likely partner to catalyze this feasibility study in cooperation with DCNR, D&L, Inc., and other partners as soon as possible. A vision graphic depicts a new pedestrian-bicycle bridge Portal as a new alternative access between the Easton downtown waterfront and the Head of the Delaware Canal.

New pedestrian bridge - one of three alternative alignments identified as potential new connections between downtown Easton and head of the Delaware Canal.
Eight primary categories help define the diverse aspects of the Delaware Canal, including:

1. Safety
   1.1 Infrastructure
   1.2 Operations
   1.3 Watering
   1.4 Flooding
   1.5 Obstructions
   1.6 Firefighting
   1.7 Rescue
   1.8 Vectors

2. Water
   2.1 Management
   2.2 Sources
   2.3 Backup
   2.4 Bypass
   2.5 Constriction
   2.6 Stormwater
   2.7 Quality
   2.8 Resource
   2.9 Hydropower

3. Structures
   3.1 Dams
   3.2 Prism
   3.3 Towpath
   3.4 River walls / Canal walls
   3.5 Roadway walls
   3.6 Locks
   3.7 Bridges
   3.8 Aqueducts
   3.9 Culverts
   3.10 Waste gates
   3.11 Overflows
   3.12 Stop Gates
   3.13 Locktenders houses

4. Access
   4.1 Portals
   4.2 Landings
   4.3 Linkages
   4.4 Gaps
   4.5 Upgrades to Existing Areas
   4.6 Pedestrian and Bicycle
   4.7 Waterway
   4.8 Transit
   4.9 Parking

5. Services / Amenities
   5.1 Toilets
   5.2 Waste
   5.3 Potable Water
   5.4 Recreation
   5.5 Signage
   5.6 Information
   5.7 Interpretation / Education
   5.8 Concessions / Vending
   5.9 Visitor Centers
   5.10 Associated DCNR Assets

6. Historic
   6.1 National Register of Historic Places
   6.2 National Historic Landmark
   6.3 Local Historic Districts
   6.4 Cultural Landscape
   6.5 Conservation Options
   6.6 Education

7. Civic
   7.1 Park-Community Integration
   7.2 Economic Development
   7.3 Transportation
   7.4 National Heritage Area / Wild and Scenic River

8. Environment
   8.1 Habitat
   8.2 Vegetation
Public safety remains the paramount concern to DCNR in its management of the Delaware Canal.

Aspects of the Delaware Canal related to safety include:

1.1 Infrastructure
1.2 Operations
1.3 Watering
1.4 Flooding
1.5 Obstructions
1.6 Firefighting
1.7 Rescue
1.8 Vectors
1.1 Infrastructure

Context

The Delaware Canal includes some of the oldest and most operationally-intensive structures in the Pennsylvania state park system, including: bridges, walls, locks, aqueducts, gates, culverts, roads, dams, earthen prism, and towpath.

Challenges

The PA Department of Conservation and Natural Resources (DCNR) has primary responsibility for the safety of all state park structures within the 60’ x 60-mile Delaware Canal boundaries. Two river dams outside the state park boundaries are owned by the Commonwealth and are the responsibility of DCNR. DCNR inspects Delaware Canal State Park bridges every two years and safety is a priority consideration for how DCNR capital and operational budgets are deployed to maintain all park structures.

Many structures that encroach on the Delaware Canal State Park are owned and operated by other partners with independent responsibility for the safety and maintenance of their structural encroachments. Encroaching agencies include: PennDOT, Delaware River Joint Toll Bridge Commission, and PA Turnpike Commission.

PennDOT is responsible for the safety of many state highways, retaining walls, adjacent culverts, and bridges that cross the Delaware Canal. Solebury Township and Riegelsville Borough are municipalities that have accepted responsibility for the safety and maintenance of new pedestrian bridges that span the Delaware Canal. Older pedestrian bridges across the Canal are the responsibilities of other municipalities.

Safety responsibilities of some adjacent private property owners who have encroached on the Canal remain unclear – such as the shopping center in Tullytown where the watered canal prism has been placed into a culvert and the towpath has been severely diminished as a ped / bike facility in this segment.

It may be determined in locations along the 60-mile corridor that county, municipal and private adjacent owners have encroached in various ways into the Canal jurisdiction.

Partnership Opportunities

- Annual PennDOT-Legislative Briefing – PennDOT has multiple locations where its facilities are physically adjacent to; span; or are elements of the Delaware Canal cultural landscape – structurally, visually or based on local stormwatersheds. Safety drives decision-making for PennDOT projects, but alternatives to potential project impacts are usually most effective when options are considered in the early planning stages. The PennDOT project development process can proactively engage DCNR and its primary stakeholder partners in the earliest stages of project planning and programming to help balance safety realities with creative mitigation options. An annual legislators’ briefing with both PennDOT Districts 5 and 6 and DCNR can be convened to bring the two state agencies together with stakeholders to review the scope and timeline of upcoming PennDOT projects that may impact the Delaware Canal. This process will help improve communications and help stakeholders bring resources to PennDOT projects in a timely manner. Similar sessions can be convened with the DRJTBC and the PA Turnpike Commission.
1.2 Operations

Context

DCNR operates all Commonwealth state parks to provide standard state park recreation and conservation functions. Delaware Canal operations require most of those general management, education, and maintenance tasks – plus a staff capability to operate and maintain the historic hydraulic transportation system. No other state park in Pennsylvania presents the operational challenges to operate as the Delaware Canal. Except for the Delaware and Raritan Canal (D&R) that is operated as public water supply authority, the Delaware Canal is the only other historic canal in the US that remains capable of being fully watered. Operational decisions in managing a watered Delaware Canal have deep safety implications – including: monitoring of structures, water management during river and local flood events, and record-keeping as due diligence.

Challenges

Hydraulic operations of the Delaware Canal State Park have changed since 1945, such as the DCNR policy to minimize river flooding impacts by maintaining a fully-watered prism in anticipation of floods. Institutional knowledge of the Delaware Canal has been passed on orally or has been lost between generations of park staff and DCNR engineers. Numerous weather and structural contingencies can and have affected the Delaware Canal that demand that operational responses by DCNR staff be modified for almost every situation. Hydraulic operational decisions, in anticipation of, and as responses to weather events present multiple safety implications. A major challenge is to clearly document every water management decision and record the results of each operational event so that a body of institutional knowledge can be used to analyze and guide future decisions. This management resource can be kept up to date and passed on to future generations of Delaware Canal staff and within DCNR in general.

Documentation, analyses, and planning are understandable challenges for DCNR operation of the Delaware Canal, considering that routine DCNR tasks are continually being pre-empted by the need to respond to emergencies. Operating a historic, hand-controlled, hydraulic system is even more challenging without modern monitoring and record-keeping technologies, such as remote monitoring of water levels and using a GIS database for Delaware Canal operational recordkeeping. Investments into modernizing DCNR operational management systems of the Delaware Canal State Park can be considered a direct safety benefit and should be justified by an engineering cost-benefit analysis.

Partnership Opportunities

- GIS Recordkeeping – Modern consistent recordkeeping needs to be central to a rational, modern waterway management system that will benefit DCNR safety, efficiency and stewardship decision-making. GIS (geographical information system) is a logical, geo-referenced database system for the Delaware Canal State Park to employ. At the time of the Vision Study, all GIS functions at DCNR were managed centrally at DCNR in Harrisburg, however, over the last year, the Park has gained the ability to use a GIS module to collect and analyze data in house. They also have an iPad to document needs. Given the complexity of managing a watered Delaware Canal – akin to managing a public utility, local DCNR staff GIS recordkeeping is essential for this unique, data-intensive state park. DCNR has the discretion to expand its Bureau of Information Technology that manages its GIS program statewide to create a satellite office at Delaware Canal State Park. Within this paradigm shift, DCNR partners may be able to help deliver resources to fund GIS recordkeeping and supplement DCNR staff with capable interns.

- Delaware Canal Operations & Maintenance Manual – Creating a document that captures the institutional knowledge within DCNR and describes the basic standard operating procedures is a fundamental and proactive response to the safety and maintenance challenges of the Delaware Canal. All parties with knowledge of the waterway system are important partners in this initiative to assemble a DCNR manual. DC21 initiated a partnership in 2016 by contacting a group of international canal experts, who agreed to tour the Delaware Canal in May 2016. DCNR was receptive and helped host the visit as a first step toward information sharing between its staff and other canal experts. The next step is to assist DCNR to fund and create a Delaware Canal Operations & Maintenance Manual.

- Ongoing System Inspections Upgrades – DCNR engineers inspect state park bridges every two years, and other structures less frequently. Since the High Falls Culvert failure in 2015, DCNR has added culverts that pass under the canal to its list of structures to be inspected. DCNR inspects the waterway closely after every re-watering for leaks that develop and can threaten structural stability of the prism. River walls pose critical structural safety challenges and require regular, pre-emptive engineering inspections and capital maintenance. Until recently river walls needed to be inspected visually from the river by boat. Consequently, DC21 began two partnership initiatives to help DCNR assess and manage its river walls. In 2015, DC21 fostered a partnership between DCNR and the Army Corps of Engineers to begin an assessment and GPS data-gathering of Delaware Canal river wall conditions. In 2016, DC21 began investigation of the possibility of using remote-piloted drones for river wall inspection – the same technology that has revolutionized bridge inspections. Both these opportunities can be aggressively advanced by DCNR and partners in 2016 and 2017 to develop proactive safety procedures that can be managed using a GIS database system.
**Context**

The Delaware Canal is a 60-mile long, human-made waterway that was originally constructed for transportation between 1827 and 1832, and remains technically capable of being fully watered. DCNR staff is responsible for the many safety issues concerning day-to-day operations and long-term maintenance of water in the canal. A watered prism is the proper maintenance of the Delaware Canal and the best measure to prevent safety issues from a dried out clay liner that is susceptible to leaking and structural breaches.

**Challenges**

Unpredictable weather, inevitable fatigue of the historic infrastructure, and past DCNR policies all create significant challenges to safety, and one of the best preventative maintenance measures for the Delaware Canal – maintaining a watered, clay-lined prism. Aqueducts, waste gates, and other structures also present multiple safety challenges that result from maintaining a watered canal system.

The primary challenges to maintaining a watered Delaware Canal are paradigm shifts needed in DCNR and legislative policies. The Vision Study documents that the public’s number one priority is a fully watered Canal. In addition to the environmental, aesthetic, and economic benefits of a watered Canal, keeping the Canal watered protects the Canal structure itself, as well as the safety of recreational users. An empty Canal is prone to much more rapid deterioration than when watered. When empty, the Canal’s earthen bed and banks are easily penetrated by growing tree saplings and burrowing animals, resulting in leaks that destabilize its base and walls, that are the foundation of the adjacent towpath, now a recreational trail. Wood structures deteriorate more rapidly when not consistently submerged.

Embracing the fundamental concept that a watered Delaware Canal is of greater economic and social value – and ultimately less expensive than an empty channel, is the political rationale to counterbalance previous “single bottom line” engineering recommendations that seek to reduce individual project costs by keeping the prism dewatered during construction – a practice that results in additional direct expenses of sink hole repairs, increased maintenance, safety risks, and multiple economic and civic values lost to an empty Canal.

Public expectations for a watered Delaware Canal are clear, as this Vision Study documents. Dewatering for construction and not pumping backup water cannot continue as a future DCNR policy for the Delaware Canal – even if the additional costs of bypass and backup watering features within each individual project result in the completion of fewer projects per year.

Supplemental funding sources need to be explored and developed by state legislators, DCNR and its non-profit partners fully cover the costs of maintaining a watered Canal during construction and structural failures. The key to supplementing the costs of backup and bypass watering of the Delaware Canal is to engage a wider circle of partners with a combination of interests in public safety, community, economic, and environmental interests.

**Partnership Opportunities**

- Watered Canal Policy – The Delaware Canal Vision Study identifies the needs and the partnership opportunities for a DCNR Watered Canal Policy that addresses the reasons and methods for keeping the Canal watered during all maintenance, capital repair, and emergency response projects. The policy needs to include provisions for bypass and backup watering in every project as a cost-justified, pre-emptive public safety measure that also yields multiple other quantifiable benefits such as tourism economic, public safety, and habitat conservation. DCNR has a water augmentation policy in draft form which is currently in review by CAC.
1.4 Flooding

Context

Delaware Canal floods are caused historically from high water levels of the Lehigh and the Delaware Rivers – often resulting from weather events hundreds of miles upstream, as well as from re-release management policies of upstream dam owners. Devastating Delaware River Valley floods occurred during 2004, 2005, 2006 and 2011.

Occasionally, local weather events cause high water volumes into the Canal from local streams that drain approximately 40,000 acres that are directly intercepted by the Delaware Canal. Some Canal structures are also impacted by stormwater in streams that flow under the Delaware Canal – such as the Tohickon and Paunacussing Creek aqueducts. Super-hardening of certain Canal structures can be looked at as an option to withstand flooding.

Canal inundation from streams that flow directly into the Canal is a significant problem. The Canal’s waters pour over into adjacent properties - ex. Smithtown and Yardley.

Challenges

To protect people, state park resources, and property adjacent to the Canal, DCNR has been forced to react to flooding events from multiple sources located outside its park jurisdiction on an event-by-event basis.

Bucks County and the Delaware River Joint Toll Bridge Commission (DRJTBC) are among public entities that have requested that the Delaware River Basin Commission (DRBC) maintain “voids” in the reservoirs behind the New York City dams in the Catskill headwaters of the Delaware River. Voids are minimum “freeboard” water elevations that would be kept unfilled as a measure to increase preparedness for weather contingencies that could overwhelm the ability of dam operators to release excess reservoir water and/or contribute to multiple major dam releases simultaneously to the Delaware and Lehigh Rivers. The potential for failures of upriver dams on the Lehigh and Delaware must be considered as catastrophic disasters – beyond any magnitude of periodic river flooding that has impacted the Delaware Canal. Dam owners are required to publish flood inundation maps for both rivers. The Delaware Canal is an environmental and historic water structure that is directly exposed to the Delaware River for approximately 18 of its total 60-mile length, and would receive direct impact in the inundation path from an upriver dam breach.

Public safety relating to the Delaware Canal State Park from Delaware and Lehigh River flooding events and from a possible catastrophic upriver dam breach must be pre-emptive actions that begin with strong and effective Commonwealth policy for river management at the DRBC forum, and include emergency preparedness at the DCNR State Parks Department and county levels.

Partnership Opportunities

• Delaware / Lehigh River Dam Policy – DCNR and its sister agency, PA DEP, share common safety and resiliency concerns for public and private resources along the Delaware River. DCNR and DEP can be active partners to develop and promote, and enforce Commonwealth policies that include an official request to DRBC for NYC and other upstream dams to maintain voids – as a due diligence action to help reduce safety risks; reduce the potential for property damage; and to protect eastern Pennsylvania’s interests within the interstate DRBC compact and Supreme Court decrees for the Delaware River management.

• Economic Impact Study of the Delaware Canal – This task should be undertaken for multiple economic reasons, but the most imperative reason is to compare the costs of preventive resiliency measures, such as voids, with documented costs of historic flood repairs.
1.5 Obstructions

Context

“Obstructions” to the Delaware Canal are considered complete obstacles to water flow and/or trail thru-traffic that currently exist in multiple locations along the 60-mile corridor and present potential safety issues that may pose risks to DCNR resources, adjacent properties, and people inside and near the state park.

“Constrictions” are considered partial obstructions to the prism cross-section and are addressed in the “Water” element. Obstacles to boat operations in the Canal are addressed in the “Services” element.

Challenges

The Delaware and Lehigh National Heritage Corridor (D&L, Inc.) and Pennsylvania Environmental Council (PEC) partnered with DVRPC and DCNR in a proactive approach to remove several existing obstacles that pose serious safety issues to users of the D&L Trail who would attempt to travel through or around these obstruction areas.

Two critical D&L Trail crossings of Route 13 were solved in cooperation between PennDOT and DCNR, including the creation of two new trail culverts under Route 13, and a pedestrian crosswalk on Route 13 at Green Lane in Bristol Township.

Three other D&L, Inc.-PEC obstruction-remediation projects are in various stages of development, including: the Tyburn Road intersection; a proposed trail culvert through a Conrail spur south of Morrisville; and proposed towpath ramps to Bridge Street in Morrisville.

A historic and recurring threat to public safety within the Delaware Canal State Park is caused by a Conrail spur that was constructed by filling in the waterway and the towpath in Falls Township, just south of Morrisville. The railroad structure appropriated the Delaware Canal ROW, but it was inadequately designed for drainage and it has blocked towpath travel. The railroad embankment acts as a dam across the Canal waterway – contributing to the flooding of Williamson Park within the Borough of Morrisville in 2004, 2005, and 2006. Removing the railroad obstruction in a way that protects Morrisville; reclaims all state park assets; and continues railroad operations should be elevated to the priority of the highest levels by DCNR, D&L, Inc., PEC, DC21, Bucks County, Morrisville, and partners to solve this man-made flooding threat. DCNR is considering adding a new overflow to the Canal north of the Calhoun Street Bridge. A study is needed to determine the feasibility of this potential remedy and its coordination with an opening of the railroad spur waterway obstruction.

The Delaware Canal is completely obstructed where the entire ROW was filled in under the Mill Street Bridge in Bristol. An early detour was created through areas where no trace of the original Delaware Canal remains. A walkway leads up to Mill Street, but this route cannot be considered the D&L trail, or as safe as reopening the Mill Street obstruction to “thru-trail” traffic as an inviting and safe southern portal entry for visitors to the Delaware Canal.

Partnership Opportunities

- Waterway Obstruction Policy – Safety issues that arise from obstructions to the Delaware Canal waterway must be considered high priorities by DCNR and its partners. The railroad spur obstruction in Morrisville represents the most imminent threat to public safety from preventable flooding. The trail-only “tunnel” project that is currently conceptually designed to pierce the existing RR spur does not solve the flooding safety issues that are critical to support a project of this magnitude at this location. Solving the missing trail issue without solving the flooding issue places new trail improvements at potential risk in a future flood of similar magnitudes to the Floods of 2004, 2005, and 2006.
- DCNR, D&L, Inc., PEC can take this critical opportunity to re-envision the current “trail-only” tunnel scope and modify this project to solve both the trail and waterway safety issues as a single project – before a trail-only construction project is issued for bid.
- Additional partners, including: Bucks County, state and federal legislators must be recruited to collectively envision and create a permanent structural solution to a fourth flood threat to public safety in Morrisville.
1.6 Firefighting

Context

One of the most significant impacts to regional public safety since the Delaware River flood years of 2004, 2005, and 2006, was the loss of a watered Delaware Canal along much of its length – a condition that made it an unreliable water source for local fire companies. DC21 prepared a study of the Delaware Canal as a firefighting asset that includes a statement from a local firefighting official about the life and death difference the Delaware Canal has made as a firefighting water source.

Challenges

Firefighting capacity is a critical life safety issue for all communities. Yet, maintaining a fully watered Delaware Canal as a firefighting asset to local communities has not been a priority for DCNR – perhaps because this important civic function of the waterway is not of direct value to or a primary responsibility of the agency. Comprehensive public safety needs to transcend agency jurisdictions. Other cooperative agreements between agencies can be used as models to remedy an un-watered Delaware Canal, especially based on the imperatives of local emergency preparedness.

Several dry hydrants have been installed in the Canal prism for firefighting, in cooperation with local fire departments. Moreover, all fire companies should be surveyed for their thoughts on utilizing the Canal as a firefighting asset.

Partnership Opportunities

- Firefighting water policy – A task force can be formed that includes two counties, local municipalities, fire companies, and residents – working with DCNR, to articulate and quantify the value of a watered Delaware Canal as a regional asset for firefighting, emergency preparedness, and other community resiliency services. The task force might be conceived as a special committee within the DCNR Canal Advisory Committee (CAC) to identify and marshal alternative funding that can supplement DCNR resources toward a reliably-watered Delaware Canal as a public security priority.

- Firefighting Water Access – A firefighting task force can also undertake an assessment of existing and potential emergency access locations to reach Delaware Canal water for firefighting. An assessment should include physical requirements for emergency access; coordination of canal-related initiatives between local emergency responders; and development of a comprehensive dry hydrant network in priority locations.
1.7 Rescue

Context

In many locations, emergency rescue operations on the Delaware Canal and Delaware River are limited by geography and private property. Safety and emergency access to the Delaware Canal and River are civic priorities that can often serve dual uses for public safety and as amenities for public access to water resources.

Challenges

Acquisition of suitable sites or easements for new public access areas to the Delaware River and Delaware Canal are major challenges to developing these safety facilities. The Mountainside property adjacent to the Canal in Plumstead Township currently serves as an emergency access site to the Delaware River through an informal agreement negotiated by the Township with the private owner. Unless easements are described in a property deed, however, access rights are not in perpetuity and do not automatically transfer to future owners. Other stretches of the Delaware Canal and River would benefit from improving emergency rescue access to both water bodies.

Partnership Opportunities

- Emergency Rescue Access – The 18 local municipalities that host the Delaware Canal can take the lead – in cooperation with the DCNR Bureaus of State Parks and Conservation and Recreation to identify, acquire, and improve new public access sites to the Delaware Canal and River. DCNR and partners can also seek opportunities to increase, formalize, and improve multi-purpose public access locations – in cooperation with state, county, and municipal partners that maintain parks and properties abutting the Delaware Canal. In many cases these partnerships already exist. PA Fish and Boat Commission is a primary partner in helping to create water access facilities in the Commonwealth.
1.8 Vectors

Context

During the Vision Study process, the concern arose that a dewatered Delaware Canal may serve as a habitat to support a vector of disease carrying mosquitos and other potential pests.

Challenges

There is sufficient public concern about the specific health threat, that cannot be answered or possibly even assessed for just the Delaware Canal as a single isolated habitat.

Partnership Opportunities

Perhaps this potential health issue might be one of the economic issues to be addressed in a future study to begin to address the true value of a watered Delaware Canal.
A fully watered-Delaware Canal is acknowledged as a public priority and a multi-faceted challenge. Water management affects multiple aspects of the Delaware Canal including: construction, maintenance, recreation, tourism, and safety.

Aspects of the Delaware Canal related to water include:

2.1 Management
2.2 Sources
2.3 Backup
2.4 Bypass
2.5 Constriction
2.6 Stormwater
2.7 Quality
2.8 Supply
2.9 Hydropower
2.1 Management

Context

Maintaining water flows, improving the naturalized waterway, protecting water quality and enhancing the ecology of the Delaware Canal are DCNR management responsibilities. Maintaining consistent water levels in the Canal is the primary water stewardship responsibility for DCNR for this state park.

Challenges

The demands of the Delaware Canal exceed any other state park in the Commonwealth – given its complexity in operating the historic engineering artifact and respecting its National Register of Historic Places, and National Landmark designations – while providing modern recreation and conservation services to the public.

Partnership Opportunities

- Watering Subcommittee of the CAC – DCNR already has a watering subcommittee in place with CAC. DCNR partners can help DCNR to secure supplemental resources from private and other state sources to augment the DCNR budget for projects that improve canal watering – such as backup pumping and bypass technologies. The coalition can justify a watered Delaware Canal system for multiple reasons – clearly as an amenity, but also for the roles that a watered canal plays in: public safety, decreased maintenance costs, and tourism and economic development. In the short term, providing bypass and backup provisions in all construction projects and all emergency repair projects is a critical DCNR policy priority that can result immediately in maintaining a watered canal in all sections except those under construction. A DCNR policy to maintain water in all Canal sections except for those short stretches under construction, signals a clear Commonwealth commitment to other potential funding partners that their investments into other imperative aspects of a watered Canal, such as firefighting, tourism, economic development, stormwater management, and habitat conservation will be fruitful partnerships.

- Remote Sensors / Operations – DCNR partners can assist with funding a study to determine the feasibility of installing remote sensors along the Canal to monitor water levels and to alert park management if water in the prism rises above or falls below a certain level. The study can highlight similar programs that exist in other canals or bodies of water and analyze the efficacy of such a program at the Delaware Canal. The sensors have the potential to help DCNR maintain consistent water levels as well as bring attention to stress events that may cause the water to rise or drop rapidly, like structural breaches or heavy rains. A successful feasibility study might lead to consideration of automated hydraulic controls where safety needs and appropriateness suggest.
2.2 Sources

Context

The original and primary sources of Delaware Canal water are the Lehigh River at Easton and the Delaware River at New Hope. Each intake system includes river dams constructed to raise water levels that are diverted into the canal. The Delaware Canal also intercepts many local streams that contribute directly, but sometimes only seasonally, to its base flow.

Challenges

The fundamental imperative to sustaining a fully-watered Delaware Canal and to build resiliency into the waterway system is to protect all historic water sources through proactive planning, maintenance, and management – especially at both DCNR-owned dams.

Partnership Opportunities

- River Dam Feasibility Study – Partners can assist DCNR to engage with multiple agencies and NGOs in a river dam feasibility study(s) as a priority resiliency-building opportunity for the Delaware Canal. The assessment tasks and stewardship strategies should include repair or replacement of the two DCNR river dams ultimately as multi-purpose structures that may serve purposes of: water source, recreation, aquatic habitat, and possible small-head hydro-electric generation. The Army Corps of Engineers is already engaged with DCNR in an assessment of the Delaware Canal river walls and the potential for expanding this partnership to include study of the two river dams should be actively explored. The local municipalities of Easton and New Hope will be essential partners in the study process.
2.3 Backup

Context

Uncertainties of weather and the aging conditions of Delaware Canal structures have caused periodic failures that interrupt the volumes and flow of water in various sections. In past years, the Canal boat concessionaire funded the costs of a river pump at Centre Bridge to water the Canal to New Hope. This pump that helped water the upper Solebury-New Hope segment is funded by FODC and New Hope for Our Canal (NHFOC) organizations. Another river pump operated for a short time at Durham with assistance from FODC and DC21.

Challenges

The lack of a backup watering system has resulted in the presence of long, dry sections of the Canal for more than a decade following the floods of 2004, 2005, and 2006.

A comprehensive DCNR back-up watering system is essential to create the most immediate mitigation to a dewatered Canal, and should be designed as a network of strategically placed pumps that can temporally augment flow in sections affected by disruptions of water supply or during canal repairs.

Currently, the Delaware Canal State Park does not have the electricity costs of operating backup pumps programmed into its annual capital budgets, nor is there an operating/maintenance budget line item to cover this cost.

The state of the DCNR backup watering strategy, as of Fall 2016, includes:

• Wheatshafe Lake Pump – The current DCNR Backup Watering Strategy does not include the Wheatshafe Lake site.

• New Hope Pump – FODC has suggested both an Archimedes Screw and a modern backup pump to water the Canal south of the New Hope Delaware River intake. It is likely that DRBC will request a docket for a new pump at this location.

• Center Bridge Pump – FODC and NHFOC are historic sponsors of this pump. Operation costs have been funded in the past by the Canal boat concessionaire. This backup location is a reliable source to water the segment to the locktender’s house in New Hope.

• Point Pleasant Pump – DCNR filed for temporary docket with the Delaware River Basin Commission (DRBC) to partner with the owner of the existing public water supply system - Forest Park Water Authority, to supplement water into the Delaware Canal. The docket has been approved. This location is expected to provide adequate backup water supply to Center Bridge. Operation costs for the testing period are to be assumed by the pump owner. If the test period is successful, a long term agreement will need to be reached.

• Marshall Island Pump – Work is under way to resolve property easement issues at this location. DC21 is working with DCNR to secure operating funds for this and other backup pumps - because DCNR will not currently pay the electricity costs for pumping water.

The option to pump water from Wheatshafe Lake into the southern section of the Canal will require a feasibility study, water testing, negotiation with the property owner, and permitting before a pump may be installed.

Funding the operational costs of electricity to pump backup water is a more complex issue for DCNR, but needs to be raised to a higher Commonwealth priority – so that backup pump investments do not sit idle when needed for lack of operating budget.

A DCNR Watered Delaware Canal policy enables the agency to consider funding both capital costs and operating costs of electricity to run backup pumping infrastructure from sources other than Commonwealth sources, from within DCNR, and from multiple sources outside the Delaware Canal State Park budget.
In the past, nonprofits like FODC, DC21, and community groups like New Hope for Our Canal have helped raise operational funds for the cost of electricity to run two of the backup pumps, but this method relies on using small non-profits to raise funding for electricity through private sources for functions that must be considered basic state park operations and services. Over the long run this is not a sustainable or fair approach to provide a core governmental function.

County, state and federal legislators can help find alternative sources outside of the DCNR budget to fund backup pump operations to maintain a watered Delaware Canal. The benefits include public safety, tourism and economic development, protection of aquatic habitat, stormwater management, and provisional backup water supply for the canal communities.

### Partnership Opportunities

- **Backup Pump Watering System: Capital Costs** – DC21, in partnership with the DCNR Canal Advisory Committee (CAC), prepared a strategy for a draft comprehensive system of backup pumps with a map of six potential pumping locations, including Durham, Marshall Island, Point Pleasant, Center Bridge, New Hope, and Wheatsheaf Lake. Each pump site is in a different state of progress. The pumps, plumbing, and electrical systems associated with this system are infrastructure that in the long run should be purchased and installed through the DCNR capital budget. The annual Delaware Canal State Park budget also needs to include a consistent line item to maintain this infrastructure. Funds for backup pump maintenance should accrue, if not used for backup costs in any given year, and be accounted for and earmarked toward future Delaware Canal State Park backup pumping. Design of the pump systems should include adequate security against vandalism and theft in these remote locations.

- **Backup Pump Watering System: Electricity Costs** – A DCNR Watered Canal Policy must also address electricity costs for backup watering as a priority. This challenge will need to be resolved by a combination of state funding from DCNR and other agencies, other levels of government (such as the counties) and or the private sector. DCNR and its partners need to work closely with the Delaware Canal Legislative Caucus to identify alternative programs that support the goals of a watered canal – such as the Department of Community and Economic Development (DCED) because of the Canal’s tourism and economic development values; flood control remediation funds; casino monies; and possibly DEP programs. Other sources of partnerships, including emergency preparedness funding, need to be requested by a united Delaware Canal partnership.

- **Point Pleasant Pump Backup** – DC21 initiated a partnership between Bucks County, Bucks Forest Park Water Authority and DCNR to use the existing Point Pleasant Pump to add backup water into the Delaware Canal. This project merits individual project status within a comprehensive Backup Watering System for the Delaware Canal based on its capacity, the willingness of the agency to assist DCNR, and the complexities the project has triggered within DRBC regarding rights to Delaware River water. This docket application has been approved by DRBC. The sovereign, grandfathered water rights of the Commonwealth to use Delaware River water in the Delaware Canal – which rights predate the creation of the DRBC -- need to be protected and preserved by the Commonwealth under any DRBC agreement. DC21 can continue its technical support to DCNR for this project.

- **New Hope Backup** – A modern pump is currently being proposed by FODC in this location to replace the function of the former historic waterwheels that supplied necessary Delaware River water in the Delaware Canal – which rights predate the creation of the DRBC -- need to be protected and preserved by the Commonwealth under any DRBC agreement. DC21 can continue its technical support to DCNR for this project.
## Context

The recent history of river flood damages to the Canal; the resulting miles of dry Canal over the past decade; and the uncertain DCNR schedule for structural rehabilitations all demonstrate the need for a major DCNR policy to include bypass watering features as part of every construction, maintenance, and emergency response project, to the maximum extent possible. DCNR decisions for bypass provisions on each project should be guided by a strong and clear Watering Policy.

Bypass features maintain the flow of water already in the prism from the upstream side of a construction site to the downstream side during a construction project by using conduits and/or pumps. Temporary cofferdams are built across the prism to hold back the canal water on either side of a construction project.

### Challenges

Safety, maintenance costs, habitat, environmental quality, and economic development are all critical factors that demand bypass features to be installed for each construction project to balance against the past practices to seek short-term construction cost savings from dewatering long sections of the canal directly upstream and downstream of local construction projects.

DCNR policy for bypass features need to be consistent with DCNR backup watering operations to ensure a consistent Watered Canal Policy that prevents dry sections.

## Partnership Opportunities

- **Bypass Specifications** – Each in-house and contract project for work on the Delaware Canal needs to be considered to include specifications for installation and operations of temporary watering systems that may include cofferdams, pumps, and bypass pipe technologies. The provisions should include penalties for non-performance. DCNR in-house maintenance projects should be conducted with the same level of bypass services as a contract construction project. Partners should explore the potential to deploy alternative funding resources – similar to options for backup projects, to help supplement the costs of bypass elements in Delaware Canal construction projects.

- **Bypass Equipment and Training** – DCNR is in the canal operations business, and the possibility of the Bureau of State Parks purchasing the equipment required to conduct bypass operations – including pumps, cofferdams, piping and generators – should be explored. These capital investments may not need to come from DCNR budgets – but may be funds raised by DCNR partners – such as when FODC raised funds to acquire a dredge machine for the Delaware Canal. These bypass tools might even be shared between DCNR park units. DCNR construction staff will need training for installation and operation of bypass technologies. Sharing resources has been done by DCNR before in the past, and this may be considered for bypasses and coffer dams.
2.5 Constriction

Context

Multiple structures, such as bridges and culverts that have been built within or across the Delaware Canal have constricted the original waterway area and now reduce flows; cause debris accumulation; increase maintenance; increase the potential for flooding; and limit or eliminate mobility for water craft recreation. Constrictions to the towpath trail width also exist in sections of the 60-mile corridor.

Challenges

In contrast to constrictions, “obstructions” are complete obstacles to trail uses and water flow, and are usually considered a higher priority. However, constrictions also pose environmental, access, and service issues that affect the perceptions and public uses of the state park.

Buildings constrict the towpath in places. Bridges, culverts, walls, embankments, and non-DCNR docks are all types of Canal constrictions that limit the Delaware Canal waterway and various uses. State and local bridges and highway slopes in Morrisville constrict the waterway every few blocks – eliminating the opportunity to paddle a boat through the urban borough.

Partnership Opportunities

- Constriction Elimination Program – DCNR partners can be proactive to assist DCNR to prepare a comprehensive Constriction Elimination Program that includes a master project list to identify types and locations, quantify issues, prioritize projects, describe optimum alternatives, and begin initial contacts with the constriction owners – where they are not DCNR-owned. A Constriction Elimination Program should be flexible to address emerging safety, access, service, and environmental priorities and help DCNR and partners to advance remedies for each encroachment. As the service life of a constriction structures approaches its end, DCNR will have the tools and will have negotiated with each partner around how the constriction will be replaced to meet DCNR specifications for a safer, ecologically sound, and user-friendly Delaware Canal ROW.
2.6 Stormwater

Context

The geographic location of the Delaware Canal – much of it built parallel to and directly above the elevation of the Delaware River doom it to receive stormwater from state and local roads, upstream properties and many local watersheds. An increase in the volume of recent stormwater runoff has precipitated significant stormwater impacts to the Delaware Canal that originate outside the state park jurisdiction. Under the current regulatory environment each property owner is becoming responsible for stormwater management within his or her individual property. This change in policy poses opportunities to help relieve DCNR from solely managing stormwater impacts that originate beyond the Delaware Canal State Park boundary.

Challenges

In many locations, the impact of stormwater runoff threatens the integrity of Delaware Canal structures and increases risks to public safety – such as undermining highways, walls, towpath, as well as local flooding in areas adjacent to the State Park.

District stormwater management partnerships need to be explored as an alternative to DCNR continuing to assume a “default” liability and costs of serving as an unfunded stormwater manager for the collective 40,000-acre watershed area that contributes directly into the Delaware Canal.

Partnership Opportunities

Preliminary Stormwater Study

A preliminary stormwater study for the Delaware Canal was funded by the William Penn Foundation and DCNR, and was completed during the course of the Vision Study process. The goal of the stormwater study is to identify critical locations where stormwater is currently impacting the Delaware Canal, and to suggest model best management practices (BMPs) to address typical types of impacts. Project partners include DC21, Heritage Conservancy, PennDOT, and Bucks and Lehigh Conservation Districts. Stormwater management jurisdictions include BMPs within the state park; BMPs within the state highway rights-of-way; and BMPs on properties that contribute stormwater to the Delaware Canal. The City of Philadelphia has adopted stormwater management as a utility function of its municipal water department, and this model may have applicability for managing the Delaware Canal stormwatershed. Further study will be required with DCNR partnership.

- Future Stormwater Management initiatives – partners involved in the Preliminary stormwater study need to be the catalysts to advance the opportunities identified in that study – including: additional planning; partner negotiations; funding development; and execution of model BMPs.
# 2.7 Quality

## Context

Water quality is not a major issue in a dry canal, but becomes a critical component in a DCNR Watered Canal Policy for Delaware Canal State Park. Operation of the Delaware Canal as a reliable waterway in modern times demands that systematic monitoring of its water quality begin for multiple current and potential purposes, including recreation, aquatic habitat, and possible future potable water supply.

## Challenges

A free flowing Canal faces turbidity, temperature, and water chemistry challenges. A stagnant canal creates anaerobic conditions that are an immediate threat to fish.

In April 2016, the PA DEP was called out to determine why fish were dying in the Canal south of Morrisville. It was discovered that there was zero oxygen in the water where a large railroad grade was constructed as a dam across the Delaware Canal, prohibiting free water flow. DEP findings were inconclusive to the cause(s) of the oxygen depletion.

The recent fish kill in the Delaware Canal adds water quality and aquatic habitat to the list of public safety, stormwater, and recreation as additional imperatives to improve the flow through the culverts and bulkheads along the entire length of the Canal and to remove waterway obstructions such as the CSX/Conrail railroad spur obstruction – to protect the Borough of Morrisville, northern neighbors, and non-human species that rely on DCNR to manage water safely in the Delaware Canal.

## Partnership Opportunities

- Water Quality Monitoring – DCNR can foster and embrace water quality partnerships with credible environmental “NGOs” (non-governmental partners) to establish a scientific and defensible water quality monitoring and recordkeeping system for the entire Delaware Canal. Efforts such as this are underway across the entire Delaware River watershed thanks to many projects funded through the leadership of the William Penn Foundation.
Context

The Delaware and Raritan (D&R) Canal is local example of a historic transportation canal that was adapted to serve as a modern public water supply system. The D&R flows along its full original length on the New Jersey side of the Delaware River from the Byram intake to Trenton (across the Delaware River running parallel to the Delaware Canal between Point Pleasant and Morrisville) where water is pumped into the Raritan section to flow to New Brunswick.

Both canals are state parks, but the D&R Canal maintenance is funded from water sales revenue by a companion water authority with an allocation for diverting up to 90 million gallons per day of Delaware River to provide potable water to eastern New Jersey consumers. The New Jersey Water Supply Authority, along with the D&R Canal State Park, manages the D&R Canal, and they also own heavy machinery that they use on the Canal.

Challenges

The Delaware Canal may offer similar future potential as a public infrastructure asset that could hold and convey a public potable water supply between Easton and Bristol, Pennsylvania for either emergency uses or as a future drinking water supply if there were a viable customer.

The watering of the Delaware Canal predates the creation of the Delaware River Basin Commission, and consequently, the Commonwealth may be able to claim that it has sovereign, grandfathered rights to a certain amount of Delaware River water, free of DRBC’s jurisdiction. DCNR’s attorneys should take steps to assert and protect these rights so that Canal water could possibly serve as a potable supply, either under emergency or permanent conditions.

DC21 contacted the Philadelphia Water Department during the Vision Study process and found that the agency was conducting a study of alternative water sources that potentially could be accessed 30 years from now, under the assumption that existing sources may be stressed due to climate change’s impact on the salinity of aquifers and reaches of the Delaware River below the fall line.

Partnership Opportunities

- Water Supply Feasibility – A feasibility study is needed to identify the issues, opportunities and costs to adapt the Delaware Canal to serve water supply purposes. The study would also address the alternative management structures to operate a water supply system similar to the D&R Canal system.
2.9 Hydropower

Context

The extant power house at Raubsville is a former hydro-generating facility that once dropped water from the Delaware Canal into the Delaware River to produce electricity to power a trolley system between Doylestown and Easton.

Over its course of its 60 mile length, the Delaware Canal changes 165 feet vertically. This elevation change represents a potential power source for "low-head" hydroelectric generation as a means to produce a consistent source of income that could be dedicated toward operations and maintenance of the Delaware Canal.

Challenges

Releasing water from within the Delaware Canal to the Delaware River for hydro-electric generation needs to be compatible with the priority goal of maintaining a watered Canal. A retrofit of the Raubsville generating station will need to reroute the hydropower tailrace back into the Canal. Additionally, unless the Canal is reliably watered, it would not be able to release sufficient volumes of water for predictable hydroelectric purposes.

The potential productivity of installing low-head hydro-electric generating facilities within the Delaware Canal – such capturing power within the grade changes of existing locks – and the potential impacts to the National Landmark will need to be assessed within a feasibility study.

The Lehigh River Dam / Fish ladder at Easton is also a potential location for a low-head hydro-electric generator that might expend Lehigh River water into the Delaware River, before it enters the Delaware Canal.

Partnership Opportunities

- Low-head Hydro Feasibility – A feasibility study is needed to determine the potential benefits and challenges to incorporating low-head hydroelectric generating facilities within the Delaware Canal. Raubsville and Easton are obvious locations to begin study. PEC has offered to assist partners in this process.
3 STRUCTURES

The Delaware Canal was created as a system of intercepted natural waterways and man-made structures to manage water as a transportation system. Many stone, earthen and iron structures that were originally built between 1827 and 1832 remain. Most gates are still hand-operated. The age and complexity of Delaware Canal structures make it the most technically intricate and costly Pennsylvania state park to maintain and operate safely and efficiently. A watered Delaware Canal is dependent on the structural integrity and operation of these structures.

A Feasibility Study will be needed as a next step to identify options, costs, historic character-defining features and a negotiating of priorities for how best to maintain a watered Canal. In taking this next step it will be important to understand that even the original 1832 Canal was adaptively reused and modified over time, and since 1932 the Canal has been adaptively re-used as part of the state park for recreational purposes. When the D&L Trail was developed and later the Circuit Trail concept, it became clear that the towpath of the Canal was again being used as a land transportation facility.

One of the challenges in developing a watered Canal Feasibility study is to reconcile that historic materials and components necessary for an interpreted historic transportation canal, may not be the same as those of a recreational park feature, or a water supply channel.

The challenge to DCNR and its partners is to acknowledge the multiple reasons to maintain a watered Canal, and to re-envision current planning, funding, maintenance and operational protocols to evolve beyond reactionary responses to weather and structural failures – toward proactive management for all Canal issues.

This level of stewardship will require a comprehensive partnership approach to future structural treatments that will balance modern demands with the important preservation considerations of the National Historic Landmark designation and National Register of Historic Places status of the Delaware Canal.

Aspects of the Delaware Canal related to structures include:

3.1 Dams
3.2 Prism
3.3 Towpath
3.4 River walls / Canal walls
3.5 Roadway walls
3.6 Locks
3.7 Bridges
3.8 Aqueducts
3.9 Culverts
3.10 Waste gates
3.11 Overflows
3.12 Stopgates
3.13 Locktenders houses
3.1 Dams

The dams are under the jurisdiction of ACOE as structures within the navigable waters of the United States. There is also a wing dam in the Delaware River across from Point Pleasant, which is owned by New Jersey and feeds the D&R Canal.

Challenges

The Lehigh Dam is located entirely within Pennsylvania and is owned by the Commonwealth and managed by DCNR as part of the resources of the Delaware Canal State Park. The Delaware River Dam at New Hope is in bi-state jurisdiction shared with the State of New Jersey. The dams are under the jurisdiction of the Army Corps of Engineers as structures within the navigable waters of the United States. There is also a wing dam in the Delaware River between Point Pleasant and Lambertville that is owned by New Jersey and feeds the D&R Canal.

In the early 1990’s DCNR and DEP cooperated to construct a fish ladder at the Lehigh Dam – as a concrete chamber of water steps that would allow shad to climb from the Delaware to the Lehigh in the Spring to spawn upriver. The Lehigh fish ladder did not function as well as intended and in 2013 a study by environmental groups recommended removal of the Lehigh Dam. That report recommended an alternate solution to watering the Delaware Canal State Park as a series of new pumps from the Delaware River – to be operated at the expense of DCNR. The City of Easton opposed the dam removal.

The issue of migratory fish habitat in the Delaware Valley is very important and needs to be solved in a way that does not result in de-watering of the Delaware Canal, a naturalized waterway that runs through 18 communities and serves hundreds of thousand residents and visitors each year. It is strongly recommended that the agencies involved with management/inspection/operation of the dams (the Army Corps of Engineers, DEP and other state and federal officials) move beyond the current periodic engineering inspections of the dam structures and begin a proactive program for the ultimate repair/replacement of both dams as future multiuse structures, ASAP.

Administrative challenges include assessment, redesign, and escrowing funds to repair or replace both structures – before a need becomes urgent. Without a proactive repair or replacement program in place, a future weather event or structural failure of one of those dams could easily result in a decade or more of an un-watered Delaware Canal. Future dam modifications should integrate waterway stewardship with modern recreation, economic and ecological priorities.

Partnership Opportunities

- Lehigh Dam Replacement Study – The City of Easton, Lehigh Valley Planning Commission, and D&L, Inc. are all essential partners in a study for the Lehigh Dam replacement. Engineering analyses of the existing structure and surveys and calculations of the project area conditions are the first data-gathering steps. The City of Easton has a waterfront plan and continued public involvement to advance the Easton’s waterfront development needs to include the dam issues. A concept to replace the existing structure emerged from the Vision Study process to envision a modern hybrid wing dam that maintains water supply to the Delaware Canal, provides for fish migration, and integrates community needs for cultural, recreation, environmental, and sustainability features in the design. A study would assess this alternative and other options. The Army Corps will be an important partner to DNCR in this study.

- Delaware Wing Dam Replacement Study – The New Hope-Lambertville wing dam is larger than the Lehigh Dam and more complex geographically and politically – located on a falls between Pennsylvania and New Jersey. The Army Corps will be instrumental in this study and may be an essential funding and technical partner to DCNR in the assessment and construction phases. A repair or reconstruction project needs to assess options for maintaining water supply to the Delaware Canal during construction, as well as if and how a future backup pump might be integrated into the project.

Context

The full dam across the Lehigh at its confluence with the Delaware River in Easton, and the “wing” dam across the Delaware between New Hope and Lambertville were both originally built to raise river pool levels for water diversions into the Delaware Canal. Both dams remain essential today to deliver the two primary water sources into the Delaware Canal.

The Lehigh River Dam is a full dam spillway that blocks fish migration from the Delaware River up that tributary and is also essential to the watering of the Lehigh Canal. The Delaware River Dam is a wing dam with two structural wings and an open, free flowing channel through the center that allows open river navigation and anadromous fish migration, including shad and herring.
3.2 Prism

Context
The Delaware Canal waterway is a trapezoid-shaped channel, historically lined with clay that must be kept saturated to remain expanded and able to hold water. Although other modern technologies have been tested by DCNR in the past, clay is the original and still most reliable construction material to waterproof the Delaware Canal.

A continually watered canal requires less prism maintenance than an intermittently watered canal – a fact that is demonstrated each time a segment of canal that is re-watered after being emptied for a prolonged local repair springs a new leak.

Keeping the clay liner continuous, saturated, and expanded is what prevents animals and plants from burrowing through the towpath side of the prism – creating fissures that cause leaks, structural weaknesses, future erosion, and catastrophic failures. Muskrats, for example, have no problem with water and burrowing through clay.

Challenges
A major challenge for DCNR is to adopt Bypass and Backup Watering Policies for all future canal repairs – to prevent draining sections of the prism above and below the construction site.

The need for bypass and temporary backup watering features in the planning, budgeting and construction specifications of each project is a necessary policy shift for DCNR. The practice of consistent watering above and below construction sites will prevent the unpredictable and regular secondary prism repair costs that always happen after a dry canal section is re-watered. Net cost savings from dewatering Canal sections during construction are highly questionable when compared with the predictable “extra” maintenance costs that DCNR staff faces after each dewatered section is re-watered and leaks occur where the clay liner has been allowed dry out. Capital and repair projects need to be programmed by DCNR to protect against broader maintenance, safety, ecological, and economic costs of dewatering the Canal – including backup and bypass provisions in every project.

Preventative maintenance of the Delaware Canal begins with a DCNR policy that requires a fully-watered prism upstream and downstream during each construction project. Canal repair projects will likely need supplemental funding to cover the costs of bypass and backup watering systems. This policy shift requires a conceptual shift by DCNR, state legislators, allied state agencies, both counties and local municipalities to address the previously unacknowledged costs of an un-watered canal and develop cooperative strategies to fund the investment in maintaining a watered Delaware Canal.

Partnership Opportunities
- Retaining Wall Waterproof Testing – Keeping a physically continuous prism lining means that the clay liner material needs to seal against canal structures to prevent leakage at those seams. Clay is difficult to use vertically as a sealing material, such as behind berm side retaining walls. Areas behind River Road retaining walls must be considered potential sieves in terms of effective waterproofing – until proven otherwise by testing. DCNR, PennDOT, and partners can conduct testing and develop a technology and specifications to ensure that miles of porous retaining walls are not defeating waterproofing efforts along the clay prism and at waste gates and other structures. In the process, new specifications for waterproofing berm-side retaining walls might also serve as mitigation to the visual impacts of modern segmental concrete replacement retaining walls. Leak testing would require isolating watered sections of the prism adjacent to berm side retaining walls and measuring subsidence of water levels. Since many of the bermside retaining walls are PennDOT structures, leak testing should be developed and conducted by a dual agency partnership – possibly as an impact mitigation to the historic resource.
A D&L, Inc. goal is for the Delaware Canal to be free of obstructions and serve as a completely continuous trail for hikers, bikers and horseback riders between Easton and Bristol. Mile 1 in Bristol was altered and filled in after World War II, but the right-of-way remains generally not built upon. This towpath segment could and should be re-established as thru-trail at some point. This step can be in partnership by Bristol Borough, catalyst partners and DCNR.

Challenges

DCNR responded to past public requests to improve the towpath surface for biking by experimenting with a different specification for the towpath surface. Unfortunately, the system of shallow excavation with a new surface of compacted gravel fines, did not withstand flooding or protect the structure below. Since that time, DCNR engineers have modified the towpath trail specification to re-employ stabilized turf surface materials with a hidden geogrid growing matrix and mix of surface stone fines. Some sections of the towpath remain modified as red stone wearing surfaces, instead of the historic grassed travel surface. DCNR will need to continue monitoring heavily-used sections of the towpath to determine if the new structurally modified grass towpath surface holds up under increasing modern traffic volumes.

The substructure of the towpath was constructed with mixed rubble and covered with a friable soil skin to grow grass. Where the towpath is adjacent to the Delaware River, the structure is either a graded embankment or a wall down to bedrock below the waterline. Towpath breaches can result from river side or canal side damages. In places where the towpath structure becomes damaged, a future repair program needs to continue to include provisions to invest in DCNR-specified gabions or concrete walls constructed within the finished towpath structure – as a hidden structural “backbone.” This investment will prevent future repeated damage in the same location.

The Delaware Canal works as a living structural system. A watered prism and a grassed towpath protect the integrity of the towpath structure below – that in many places is the first line of defense against Delaware River flooding doing damage to the adjacent River Road state highway. The importance of the Delaware Canal towpath as the structure of the D&L Trail and a cultural amenity is addressed in element 4.5 Access – Pedestrian and Bicycle.

Each attempt to improve the usability and longevity of the towpath system needs to address National Historic Landmark concerns and must include a period of monitoring – with the most stringent tests occurring during unpredictable flooding events.

Partnership Opportunities

- Towpath Expedited Repair Strategy – Breaches in the towpath occur periodically due to aging structures, but the likelihood of failures is increased by not maintaining a watered Canal prism. Towpath failure needs to be addressed by DCNR as an inevitable contingency – and DCNR response to towpath and river wall breaches can capitalize on these adverse opportunities to repair the damaged sections with greater built-in resiliency in the new sections of structure. An upgraded, hidden structural backbone beneath the towpath should be installed incrementally with each breach repair. This is a prudent investment while crews are on the job and reduces the chance of future disruptions in the most vulnerable stretches of towpath.

A DCNR contingency plan for towpath repairs should include construction-ready standard designs; escrow funding in place: backup or bypass water provisioning; and emergency repair response teams under pre-approved contracts so that DCNR can respond with expediency to towpath failures. These critical strategies may require DCNR policy changes and in some cases require state legislators to take actions to fund such investments that may exceed a minimum project program – that would not typically include smart structural improvements.

Memoranda of Agreements should be developed between DCNR and partner agencies so that permitting, execution, and monitoring of emergency repairs can be expedited when an inevitable event occurs. Previous memoranda exist for the Delaware Canal. Without such a proactive “expedited repair” program, future failures to the Delaware Canal towpath will continue to result in costly delays and avoidable direct costs, including: increased DCNR maintenance and the impact on safety, transportation, economic development, tourism and historically inconsistent repairs.
### 3.4 River Walls / Canal Walls

#### Context
Stone walls originally built between 1827 and 1832 still support the Delaware Canal above the Delaware River for approximately 18 miles. These walls are generally located at bends of the Delaware River where the bedrock prevented digging a canal, so the builders constructed walls from the riverbed to support the canal waterway and towpath structures. These walls tend to be located where geologic features force the river to turn and cause the flows to strike the walls most directly.

#### Challenges
These river wall / canal wall structures are historic engineering marvels that must be proactively monitored and appropriately maintained to reduce the potential for their collapse; for towpath trail interruptions, and the devastating loss of canal water downstream. The roots of vegetation that volunteer within the historic river walls / canal walls may initially help bind the wall stonework, but eventually it will help tear it apart. DCNR specifications include provisions for internal structural cores of concrete or gabions to be built within the towpath structure that are not visible. An alternative to installing the structural spines at river wall / canal wall locations is to build a new structural concrete wall. Visually, the original structural stone materials should be reinstalled on the new wall structure as a historically appropriate façade material. PHMC will review all proposed construction interventions to the Delaware Canal.

#### Partnership Opportunities
- River Wall / Canal Wall Conservation Program – A strategy for river wall / canal wall conservation must begin with DCNR policy decisions and include funding or technical partnerships, regular inspections, standard specifications, and a rapid reconstruction process.
- Periodic failures of the historic river walls / canal walls and the towpaths behind them must be anticipated, including DCNR contingency preparedness budgets that accrue and remain dedicated for this purpose if they are not expended in any given year. DCNR can create a rapid response process that includes pre-qualified contractors who must respond when called to make repairs. Standard construction specifications need to be ready that include acceptable structural options for river wall / canal wall replacement and repairs. River wall / canal wall repair or replacement projects need to be meet modern engineered standards to ensure that the repaired sections are no longer at risk. Multiple mitigation techniques might be utilized to reduce impacts of modern structures. PHMC review will be required. Provisions can be incorporated in each repair to help support the adjacent sections of wall and allow future sections to tie structurally when needed. Much of this structural work can be accomplished below the historically exposed surfaces – of stone and grass and clay. Aesthetics of the new structures is a consideration of the Wild and Scenic River perspective.
- DCNR-ACOE partnership – A partnership between DCNR and the Army Corps of Engineers began in 2015 to assess the conditions of the Delaware Canal river walls. This project can be expanded to include other river-related elements of the Delaware Canal, including river dams. The potential for future partnerships should be explored beyond assessment and planning to include repair and reconstruction projects. PennDOT is involved with canal wall assessment. ACOE and PHMC are also potential partners.
3.5 Roadway Walls

Context

In many locations, retaining walls support the state highways directly above the Delaware Canal waterway. These roadway walls were not built as part of the canal, but were built later as sections of the road needed to be shored up. These historic stone walls are in various states of repair and several sections have been replaced with modern concrete segmental retaining wall structures that were funded as flood response projects for the state highways.

Challenges

Unfortunately, the urgency to build “flood response” walls did not address historic considerations and there are no assurances that those sections of walls were built to be watertight. Impacts from these new concrete walls include: disposal – not reuse or conservation of the historic stone wall materials; unmitigated visual impacts; and most importantly, the imposition of modern repairs that did not ensure the integrity of the Delaware Canal to hold water in these sections.

Stormwater BMPs that can be linked to structural repairs may increase opportunities to engage additional funding partners in highway projects.

Partnership Opportunities

- Stone Wall Conservation – The existing stone parapet walls on both sides of Route 32 / 611, just below Raubsville, is a unique defining feature of Route 23/611 as designated Pennsylvania Scenic Road. These stone walls warrants special proactive conservation by PennDOT and partners – and must not be left to deteriorate beyond repair.

- Important scenic locations and cultural resources such as stone walls require partnership approaches where various jurisdictions overlap between DCNR, PennDOT, PHMC and both counties – to ensure that the character-defining features and materials that represent the historic fabric of the Delaware Canal cultural landscape are recognized and properly treated.

- Local partners can assist DCNR and PennDOT by providing professional mason recommendations for conserving historic stone structures. These supplemental consulting services are valuable during project planning and programming as well as during construction phases.
3.6 Locks

Context

Most original locks remain in their original locations and serve now as picturesque and readily interpretive artifacts of the historic Delaware Canal system. Locks were used to raise and lower canal boats to navigate between sections of the canal upstream and downstream. Many of the locks are associated with locktender houses for employees who operated the structures. Each lock was constructed as a chamber of two stone walls with a pair of wooden mitered gates at each end. During the peak years of canal commerce some of the locks were converted to double wide locks with drop gates on the northern end and mitre gates on the southern end. Housed within all gates were mechanical wicket gates that drop gates on the northern end and mitre gates on the southern end. Physically, lock walls are inherently weak against the back-pressure from the grades behind them, and tend to lean into the lock over time. Deteriorated timbercourses in lock walls are a concern as well, and FODC replaced the timber courses in Lock 7 and Lock 15 from the grades behind them, and tend to lean into the lock over time. Deteriorated timbercourses in lock walls are a concern as well, and FODC replaced the timber courses in Lock 7 and Lock 15 from the grades behind them, and tend to lean into the lock over time.

Lock gates were constructed of wood, and are similar to the clay prism liner, in that they have a longer operating life when they remained submerged. Replacement locks gates have been constructed for the Lehigh Canal, the Maumee Canal (Toledo) and other US canals, but the real value of operational canal locks today is for tourism navigation. Investments in lock rehabilitation demands faithful DCNR commitment to a Watered Canal Policy and regular maintenance to justify operable lock reconstruction in strategic locations. Otherwise, DCNR has replaced the functions of canal lock gates with bulkhead walls to control water levels between chamber elevations. Except for possible aesthetic treatments of these bulkheads to simulate lock gates, there are few other alternative treatments that can effectively serve the needed purpose to hold water at the locks.

Challenges

Some locks have been filled, such as Lock 1 in Bristol to construct a roadway that now includes a modest interpretation of the lock shape within the paving. Other locks, such as those in Lumberville and Point Pleasant retain a degree of historic integrity. In Point Pleasant and Lumberville, non-original hardware was unfortunately mounted to Delaware Canal locks and should be removed.

The Point Pleasant to Virginia Forrest rest area represents an opportunity for locks (and one aqueduct structure) to be rehabilitated to historic working conditions so that Canal boat navigation from New Hope to Centre Bridge may someday be extended to reach Point Pleasant. Changes would have to be made to the stop gate at Virginia Forrest in order to navigate a Canal boat ride vessel north. Other sections of the Delaware Canal may also hold the potential to be rehabilitated for tour boat excursions in the future, possibly including the section between Green Lane and the Bristol lagoon.

In New Hope, DCNR has begun negotiating an agreement with the private owners of the former Odette’s restaurant that includes provisions to dismantle the remaining stone walls of Lock 8; build new structural concrete walls, and face them with the original stone materials. This project should include authentic reconstructed lock gates at each end. At such locations, where new uses are being considered, it is important not to impact the locks structurally, visually, or hydraulically with modern utility structures such as industrial stormwater outfalls. Lock 11 in New Hope was restored in 2003 and is capable of being operable. Reconstructed lock gates such as those suggested for the Odette’s project should be constructed to historic specifications in accordance with the National Park Service’s Secretary of Interior’s Standards for the Treatment of Historic Properties and be considered as significant new interpretive features – including materials, joinery, and hardware. All concepts to modernize the canal industrial landscape, such as adding lighting to a lock structure must be rejected.

Partnership Opportunities

- Lock Restoration Feasibility – The feasibility of restoring specific sections of the watered Delaware Canal for tour boat navigation should be studied by DCNR partners. Many sections have modern bridges that do not allow headroom underneath for canal boats and practically foreclose navigation options. In those sections, aging locks should continue to be stabilized to prevent wall collapse and to display the original stone artifacts – including the original recessed walls for lock gates, hardware, and other historic features.

Other sections of the Canal in Easton, and in the Bristol area may hold potential to serve expanded tour boating navigation in the future. The section of Delaware Canal between Virginia Forrest Recreation Area and Point Pleasant is not pre-empted by any low highway bridges and holds the potential to extend the length of commercial tours from New Hope. The feasibility study would assess the opportunities and issues in raising the deck level of the Virginia Forrest access bridge; the rehabilitation of the Lumberville aqueduct; and restoration of operable locks in Lumberville and Point Pleasant to re-open navigation from Centre Bridge, across the Tohickon Aqueduct to reach the canoe livery in Tinicum.

Please tell us how you see it.
3.7 Bridges

Context

The landscape of crossings has changed dramatically since 1931. Only 6 original bridges remain. Originally the Commonwealth built 47 private road bridges, 49 public road bridges, 3 toll road bridges and three footbridges. As of 2014 there were 32 private road bridges, 32 public road bridges, 31 culverts, and 12 footbridges. The scale and design of bridges has also changed dramatically. There are now at least five major highway crossings. The width, grading, and paving materials of roadways has also been altered. The six bridges that remain are not original, but they do retain their authentic configuration and materials. The County of Bucks owns several bridges over the Canal.

At least six levels of jurisdictions exist for bridges that span the Delaware Canal – DCNR, PennDOT, PA Turnpike Commission, Delaware River Joint Toll Bridge Commission, Conrail, and local governments. DCNR owns more than 50 bridges over the Delaware Canal that provide public access to the state park and to private properties on the opposite sides. Some DCNR bridges are vehicular and some are for pedestrian-bicycle uses only. The original bridges spanning the waterway were called “Camelback” truss bridges due to the hump-shaped deck, and featured an engineering design unique to the Delaware Canal system. Six restored authentic camelbacks remain. The original camelback structural materials were stone, timber, wrought and cast iron. The bridges do not carry vehicular loads.

Challenges

Camelback Bridges are an iconic symbol of the Delaware Canal that can help brand the Canal crossing, in many cases where bridges over the Canal are replaced, repaired, or when new bridges are added.

The PHMC view of “Camelback” truss bridges is that they should only be used when it is documented that a Camelback bridge was there historically, to avoid creating a false sense of history. In other locations, a bridge that is compatible in massing, size, scale, materials, etc. should be used, perhaps one that employs the substructure of the bridge and a simple railing. This interpretation needs to be vetted.

DCNR and FODC have reused the historic metal materials in rebuilding several non-vehicular camelbacks and this tradition should continue an important interpretation of the original artifacts and the craftsmanship of bridge building. Many engineering techniques exist to conserve and adaptively reuse original stone abutments, and these priorities should continue for all Delaware Canal replacement bridges – even when the original stone may only be reused as a façade surface treatment in new abutments.

DCNR through extensive collaboration with FODC and input from PHMC, has worked with a consulting engineer to create the design/prototype of the Camelback truss design – to be used where appropriate.

In recent years, PennDOT has demonstrated sensitivity to the Delaware Canal cultural landscape with several replacement bridge design decisions that reflect the cultural landscape, including: perpendicular bridge alignments; adaptive reuse of existing stone abutments; design exceptions for new deck widths; member design details, scale, color, details, and mounting façade Camelback trusses on modern highway bridges over the Delaware Canal.

Non-camelback bridges that span the Delaware Canal may not be appropriate for façade Camelback treatments, due to scale, skewed alignments, or superstructure types. The Pennsylvania Avenue Bridge in Morrisville is a PennDOT-owned steel stringer system on a skewed alignment and not appropriate for a faux Camelback truss façade. Other mitigation treatments will be needed for the upcoming replacement span at Pennsylvania Avenue.
3.7 Bridges (cont)

The Trenton Avenue Bridge in Morrisville is a deteriorating, concrete arch bridge that spans the Delaware Canal at the northern gateway into Morrisville, and presents a graceful structural form that should be replicated in its eventual replacement by PennDOT. The Bridge Street Bridge over the Delaware Canal in Morrisville is an example of an undersized culvert that spans the canal and should be opened horizontally and vertically to increase the waterway when it is eventually replaced.

PennDOT has begun initial redesign for the Golden Pheasant Bridge over the Delaware Canal in Tinicum Township, in a location that deserves a Camelback façade treatment on a sympathetic new structure.

Local bridges over the Canal occur in multiple places, including Riegelsville and Morrisville. It is unclear under what legal agreements exist to grandfather these low elevation bridges – that sometimes create obstructions to waterway travel.

New pedestrian bridges over the Delaware Canal have been constructed in recent years by Solebury Township and Riegelsville Borough in cooperation with DCNR and the DRJTBC. Both structures are modern echoes of the traditional Camelback form. For future pedestrian spans over the Delaware Canal, the Solebury structure can set the standard for replication for non-original Camelback bridge locations.

Partnership Opportunities

- Camelback Structural Guidelines – The recent history of bridge design for spans over the Delaware Canal has been to reinvent the wheel every time for interpretation of the original Camelback bridge design. Versions range from weathering steel to oversized caricatured facades. DCNR partners can review and seek updates to existing design guidelines for authentic Camelback bridges, and these guidelines can also be used to help DCNR deliver basic design standards for façade Camelback trusses to future canal bridge designers. A successful Camelback façade design was first achieved on the PennDOT highway bridge over the Canal in Upper Black Eddy, and that design was originally used as a model for the PennDOT Rabbit Run replacement span. The preferred Camelback façade truss design has since evolved. The most recent specifications for those trusses should be incorporated into the DCNR Camelback Guidelines for all future Canal bridge projects.
3.8 Aqueducts

Context

According to the original National Register of Historic Places document there were nine original aqueducts constructed to carry the Delaware Canal waterway and towpath over the largest tributaries along its 60-mile parallel course with the Delaware River. Ten aqueducts exist today. Aqueduct construction materials in 1831 were the same as for Camelback bridges – stone, timber, wrought and cast iron. Over time, the Lehigh Canal NC replaced aqueducts with concrete and steel structures; the critical design feature was the ability to accommodate a canal boat.

Challenges

Creating a completely watertight structure was not originally possible and historic images show supercharged Delaware Canal aqueducts overflowing with water.

Since state acquisition of the Delaware Canal before the start of the Second World War, many types of structure have been employed for system aqueducts – ranging from a steel stringer trough over Tinicum Creek to a traditional Burr arch truss structure over the Tohickon Creek.

Before the Tohickon Aqueduct was constructed in 2001, the default structural material was concrete with wood façade. The difference in bids between the timber and concrete versions of the Tohickon Aqueduct was $2.1M and $1.8M respectively in 2000. DCNR elected the timber version for multiple reasons, including sustainability factors. The Tohickon Aqueduct became the standard of design for context sensitive Delaware Canal Landmark structures.

Since construction, the Tohickon Aqueduct has remained largely unloaded due to multiple Canal failures upstream and a dry Canal prism. The challenge for DCNR is how to assess effectiveness of the Tohickon Aqueduct to help determine future aqueduct replacement designs.

Several aqueduct rehabilitation projects planned by DCNR include: Tinicum Creek, Lumberville-Paunnacussing; Yardley-Brock Creek, and Kleinhan’s over Fry’s Run – each with different conditions, demands and opportunities. Tinicum Aqueduct offers the chance to replace a trough created by two I-beam stringers with a full-depth waterway that will reduce existing constriction and foster recreation navigation. The future Lumberville Aqueduct replacement includes a potential opportunity to remediate perpetual sedimentation issues of the Paunnacussing Creek that flows below it. DCNR can use its CAC process to increase meaningful public involvement in its design process for aqueducts and other major structures.

Partnership Opportunities

- Tohickon Aqueduct Assessment – because of the significant state and federal investment into a different and modern structural system for the Tohickon Aqueduct, the structure deserves an assessment of its conditions, maintenance requirements and service after 15 years since its completion in 2001. Maintenance requirements and the ability to replace structural members should be assessed as lifecycle benefits to investing in future modern timber aqueduct structures. The value of investing in innovative structures like the Tohickon Aqueduct as tourism attractions needs to be considered within the assessment. This assessment should address potential alternative funding sources for future DCNR aqueducts that might provide partnerships similar to the assistance provided by the USDA Forest Service to design and construct the Tohickon Aqueduct. Given the structural demands of designing the Tohickon Aqueduct to carry the water load; and the absence of historic drawings, a period Burr truss was selected to be structurally capable to carry the load using timber as traditional superstructure materials. The findings should guide DCNR future decisions on aqueducts and other structures – since no new reconstruction project will be able match the historic original designs. Defining features need to be determined per structure type and then each structural repair / replacement needs to interpret those features as sympathetically as possible – and show justification how the design addresses the Secretary’s Standards for historic preservation. Local partners in the Tohickon Aqueduct are available to assist DCNR with this assessment.
3.9 Culverts

Context

Culverts are generally arch structures of stone, concrete or corrugated metal pipe that were used to convey smaller local creeks under the Delaware Canal prism or convey the Canal waters under roads and railroads.

Challenges

The High Falls Culvert in Bridgeton Township collapsed in 2015 and was reconstructed by DCNR without provisions for a bypass or backup watering systems as part of the emergency construction program. This decision resulted in a dewatering of the Delaware Canal from Easton to New Hope for more than 9 months, while the emergency repair was made. The High Falls culvert collapse was unanticipated by DCNR, and occurred shortly after water was restored to the Delaware Canal northern section in 2015.

In 2016, DCNR issued a call for concessionaires to operate the New Hope Canal Boat, with no success. The location of Rabbit Run Culvert and its potential structural vulnerability have direct bearing on the timing and reliability of DCNR delivering water to New Hope. If the restoration of active service of the New Hope Canal Boat Concession is a DCNR priority, restoration of the Rabbit Run Culvert should be coordinated to support such a public-private partnership.

Partnership Opportunities

- Rabbit Run Culvert Priority – Since the High Falls culvert collapse, DCNR has begun an inspection program for its culverts that is similar to its bridge inspection program. The Rabbit Run Culvert in Solebury Township has been identified as vulnerable and the condition calls for a proactive strategy by DCNR and partners to anticipate its potential failure or inevitable repair, to advance its schedule for rehabilitation, related to other DCNR priorities; and to ensure a watered canal above and below the Rabbit Run site during construction. Partnership priorities should be determined by DCNR’s inspection and assessment process.
3.10 Waste Gates

Context

Waste gates are used to drain the waterway or relieve canal surplus flows back in the Delaware River, and are generally located on the river side of the waterway prism, often opposite from local tributaries flowing directly into the Delaware Canal. The original structures include stone headwall and wing walls that house timber frames and operable gate structures. All waste gates on the Delaware Canal are manually operated.

Challenges

Waste gates are generally vulnerable structures that require maintenance, and are considered by DCNR as sources of significant water losses in the Canal. The structures are generally small in size, but their reconstruction is made complex due to their drainage location.

Some of these structural elements have been replaced with concrete; towpath bridges at the waste gates are either steel or timber beams with timber decking. At least one gate lacks mechanisms. The operability of all the waste gates needs to be addressed comprehensively as a major part of a DCNR Watering Policy.

Operation of waste gates is still performed by hand by DCNR staff at each location, which presents significant issues during off-hour storm events over the 60-mile state park. Since the floods of the early 2004, 2005, and 2006, DCNR has modified its operation of waste gates to maintain water in the canal during river high flows, rather than releasing canal water in anticipation of high river flows.

Partnership Opportunities

- Hydraulic Operations Assessment – The waste gates that exist today are leaky structures and, after achieving a consistent prism watering program, a comprehensive DCNR program for waste gate rehabilitation represents perhaps the single most effective infrastructure investment to maintain consistent water flows in the Delaware Canal. Only roadside retaining walls represent a source of water loss with the potential equivalence to waste gates. During the public visioning meetings the idea was suggested to modernize Delaware Canal waste gates so that they could be remotely monitored and operated from a single location during severe weather events. The operational feasibility and integration of modern hydraulic structures, similar to the stainless steel waste gates in the Tohickon Aqueduct are all within the National Landmark, and represent two aspects of this idea that need to be determined by this study. Like all potential interventions, potential impacts on historic integrity of Canal must be addressed as part of the next phase Feasibility Study.
3.11 Overflows

Context

Overflow structures are depressions built into the surface of the towpath where high flows of the Delaware Canal can be released back into the Delaware River. These overflows, as well as waste gates, can also allow high river flows into the canal waterway. DCNR records indicate an example of their frequency – with 25 overflow structures in the towpath north of Mile 24 in New Hope.

There were 27 overflows in 1950. Some overflows are simply depressions in the towpath, some are paved depressions in the towpath, some have concrete spillways. The overflow at mile 54 is deep enough to require a towpath bridge.

Challenges

In some cases, such as Pidcock Creek in Solebury Township, the overflow is buffered by distance from the river edge. In some cases overflows are constructed into an exposed river wall. During river flood events overflows help equalize the head pressures between canal and the river, as well as directing flow and reducing the velocity and the erosive potential of river water spilling over sections of unarmored towpath. A topographic survey of the canal prism, towpath and other features does not currently exist as the basis to create accurate engineering hydraulic models for general operations and flooding conditions – including modeling the effectiveness of the existing overflows.

A towpath bridge should be considered for the overflow north of Wy-Hit-Tuk Park in order to supply sufficient volume as well as for the Pidcock Creek.

Partnership Opportunities

- Geometric / topographic survey – A survey of the Delaware Canal landscape is needed for planning and design purposes by DCNR and its consultants. This work can be the first stage of a hydraulic Operations Study to establish baseline water flow data. The elevations of the canal features will be essential for the next stages of stormwater assessment and planning for the Delaware Canal. Overflows are components of the hydraulic system and should be assessed as part of a Hydraulic Operations Assessment for the entire Delaware Canal. The feasibility and effectiveness of adding additional overflow structures deserves engineering assessment as a potential retrofit for infrastructure resiliency.
3.12 Stopgates

Context
Stopgates were wooden structures that, when closed, maintained a preferred water elevation behind them. When dropped to the bottom of the canal, the gates opened along a hinge line at the base. Stopgates conserved water behind and allowed the equalization of canal water elevations on both sides when canal boats passage was needed. Dropgates are the northern gates on double locks.

Challenges
Original stopgates have been replaced by solid wood or concrete headwalls. Retrofitting operable stopgates is important where it is determined to be feasible to restore canal boat navigation along segments of the canal.

Partnership Opportunities
The issues with stopgates and an evaluation of ways they can be used during different conditions should be included as part of the Hydraulic Assessment Study.
3.13 Locktenders Houses

Context

Locktenders houses were the residences for people who operated the 23 Canal locks on the Delaware Canal.

The state acquired no lockhouses as part of the transfer in 1931 but an offer was made. The LCNC offered most of them for sale to the former lock keepers. Of the two toll houses, the one in Bristol is gone, but the one in New Hope remains. The historic integrity of most of the privately owned lockkeepers houses has been compromised.

Today, most of the original locktenders houses have become private residences, but their locations, scale, and features help sustain the context of the original Delaware Canal cultural landscape. DCNR owns five original locktenders houses:

- New Hope (Friends of Delaware Canal operates from this building)
- Smithtown (unoccupied)
- Uhlerstown (leased to occupant)
- Upper Black Eddy (Park office)
- Raubsville (unoccupied)

Challenges

Acquisition and local zoning are primary tools that can help conserve the attributes of locktenders houses and their immediate landscape features. The locktenders house at Lock 11 in New Hope is owned by DCNR and is leased as a cooperative partnership to the Friends of the Delaware Canal for use as an office, interpretive and public information site.

Careful considerations need to be made, in general, with the introduction of new features adjacent to canal resources, including the locktenders houses owned and maintained by DCNR, while enforcing local zoning ordinances as a primary tool to ensure preservation of privately-owned locktenders houses.

Partnership Opportunities

- Historic District Mapping / Assessment – Locktenders houses are one of many elements that help establish the historic character along the Delaware Canal corridor. The various local historic districts that overlap the Delaware Canal should be mapped as a unified GIS layer; assessed for consistency; and added to the catalogue of maps developed for the Vision Study. Opportunities for preservation and adaptive reuses should be identified for these resources.

DCNR owns five original locktenders houses:

- New Hope (Friends of Delaware Canal operates from this building)
- Smithtown (unoccupied)
- Uhlerstown (leased to occupant)
- Upper Black Eddy (Park office)
- Raubsville (unoccupied)
4. ACCESS

The Delaware Canal is a national, regional, and local asset that attracts users from diverse locations and from a broad demographic. Modes of travel opportunities and types of access sites vary greatly along the 60-mile linear corridor.

D&L Inc. PEC and multiple other partners consider opening the missing “gaps” in the D&L National Heritage Corridor to be a high priority goal for the Delaware Canal. DCNR supports this initiative with the collective goal of opening all gaps by year 2020.

During the Vision Study process, previous ideas were echoed of the Delaware Canal as a singular amenity within a larger context of a cluster of significant public assets on both sides of the Delaware River.

Opportunities were envisioned to integrate planning, development, and marketing of the Delaware Canal with parallel initiatives, including: the D&R Canal State Park in New Jersey; PA Route 32/611 Scenic Highway; NJ Route 29 Scenic Highway; the Delaware River Wild and Scenic river system; the Delaware River Water Trail; and continued collaboration with the D&L National Heritage Corridor.

Beyond the official state park access sites, many partnerships already exist at physical locations where access to the Delaware Canal State Park is provided by county and municipal partners. Other ideas to grow existing or new “access partnerships” beyond traditional automobile facilities include opportunities to reach the Delaware Canal by: regional public transit; interstate bus and rail; intersecting regional trails; Uber cars and taxis; shuttles; bike rentals; and local sidewalks. Bristol Borough is currently developing Delaware Riverfront boat access near the Delaware Canal turning basin.

A preliminary hierarchy of access locations to the Delaware Canal are conceptualized to include: “Portals,” “Landings,” and “Linkages.” An idea was expressed for DCNR to develop a standard offering of basic services that are essential, needed, expected, and possible at each of these types of access site.

These concepts can serve as an organizing principle for partners to comprehensively consider access improvements to the Delaware Canal within each community. DC21, D&L, Inc. and other catalytic partners can assist the negotiations between the local municipalities, DCNR, and other essential partners.

After the Vision Study, the catalytic partners can begin to engage communities individually to understand local issues more deeply, identify opportunities, and find ways to cooperate that improve local access to the Delaware Canal. These partnership contacts can be renewed annually with a meeting or conference call to consistently advance local goals. The CAC is the primary DCNR forum for local communications.

Aspects of the Delaware Canal related to public access include:

4.1 Portals
4.2 Landings
4.3 Linkages
4.4 Gaps
4.5 Upgrades to Existing Areas
4.6 Pedestrian and Bicycle
4.7 Waterway
4.8 Transit
4.9 Parking
4.1 Portals

Context

Portals are considered as primary entry sites into the Delaware Canal that are located at each end of the 60-mile Delaware Canal; or can be reached via interstate highways; or where significant intersections with the D&L Trail already exist or are planned.

Portal sites should offer basic necessities for state park visitors, but also enable today’s recreational users to access the amenities they seek near their preferred recreation locations – such as dramatic visual environments, convenient access, parking, information directories, bike rentals, food, coffee and sundries, rest rooms, gasoline, transit access, nearby lodging, and associated recreation and cultural attractions.

Challenges

Easton is the northern portal for the Delaware Canal. Easton has undergone significant planning and redevelopment of its downtown waterfront on the north side of the Lehigh River. Yet to be created, in Easton is a safe, universally accessible and attractive public pedestrian-bicycle route between Easton Downtown and the head of the Delaware Canal. With significant future improvements, people in Easton will be able to access the D&L Trail as a cherished asset, by easily walking between downtown Easton and the Easton waterfront. Existing parking at the Easton Portal site is currently constrained and cannot be expanded, however the City recently built a new intermodal bus center and parking structure one block from the riverfront that can directly serve peak and off-peak visitors to the Delaware Canal. The challenge is creating an attractive local connection between downtown Easton and the head of the Delaware Canal that visitors and residents will feel is safe and attractive to use.

Bristol is the southern portal of the Delaware Canal – a revitalizing borough that is seeking to feature the Delaware Canal as one of its primary cultural assets. With significant future improvements, the sense of entry into Bristol can be enhanced at the historic Holding Basin – as the portal entry. Removing major existing obstacles in the first mile of the historic Canal right of way that will create a clear, accessible, and attractive D&L Trail connection to the Bristol Portal area as a cherished asset to residents and visitors.

Between the two termini, I-95 Scudder’s Falls, and Morrisville are considered locations that both need strategic partnerships to evolve as significant Delaware Canal portals.

Partnership Opportunities

- Bristol Partnership – The Turning Basin at the Delaware River port in Bristol Borough is the southern terminus of the Delaware Canal. Work has been done over the years to recover, repair, and attempt to interpret the original configuration of the Canal system in Bristol Borough after community “modernization” efforts in the 1950’s eliminated the first mile of the Canal waterway and towpath. The Borough has worked diligently to stimulate a downtown revitalization. However these earlier interpretations of the Delaware Canal as a cultural landscape along Mile 1 are deteriorating, disjointed, or missing – and they do not feature the Delaware Canal as a cohesive attraction or present the D&L Trail as the major amenity that it can be. In 2016, Bristol Borough began seeking funding partnerships to address the revitalization of the Turning Basin area as a primary civic site – that will physically link the new river wharf with the Delaware Canal.

- The Bristol Turning Basin offers the potential to become a major Delaware Canal portal where the East Coast Greenway Trail and the Philadelphia Circuit Trail are...
4.1 Portals (cont)

planned to meet the D&L Trail. Several obstacles to the towpath trail physically block users in Mile 1, and present opportunities for partners to collaborate to clear the obstructions. Approximately one mile north of the Turning Basin a major SEPTA regional rail station that serves Philadelphia and Trenton offers great potential as a “landing” for train riders to disembark at Bristol to use the D&L Trail.

• To take advantage of these opportunities, Bristol Borough can engage with partners to catalyze the latent opportunities that the Delaware Canal offers to help generate additional community and economic development. A comprehensive rehabilitation program of the physical needs, opportunities, and funding partnerships that relate to Delaware Canal rehabilitation is the first step to establishing Bristol Borough as a Delaware Canal Portal town with potential similar to that in Easton at the northern terminus of the canal.

• Morrisville Partnership – The Calhoun Street Bridge is a historic Phoenix Iron Pratt truss structure that spans the Delaware River between Morrisville, PA and Trenton New Jersey, and serves as the route for the interstate East Coast Greenway trail to enter Pennsylvania from the north.

• The site needs to serve as the portal at the intersection where the joint alignment of the East Coast Greenway splits off from the D&L to run north into New Jersey and the D&L Trail continues north along the Delaware Canal. The public parking area is on public site of the former Morrisville waterworks – directly across from the riverfront and approximately ¼ mile north of the US Route 1 interchange in downtown Morrisville. The site has been partially conceived as an entry location to the D&L trail and currently includes a public restroom structure. Public parking is available across the road to serve Delaware Canal users and walkers on the riverside levee trail.

• Major infrastructure improvements are needed on-site as well as to state and local infrastructure surrounding this portal site, including: roadway, bridge, sidewalk, crosswalk, stormwater, signage and other repairs and reconstruction to upgrade functions and improve the overall fatigued appearance at this location. Morrisville can work in partnership with PennDOT, DCNR, DRJTBC, D&C21, D&L, Inc. and others to re-envision and realize the full potential of this site as a portal to the D&L trail.

• DRJTBC Partnership – A new I-95 / Scudders Falls Bridge will replace the existing interstate span over the Delaware River, directly north of Yardley, PA. Full construction is anticipated to begin early in 2017. The new bridge will be completed by DRJTBC to include a separate pedestrian-bicycle facility that will connect by ramps directly to the towpaths of the Delaware Canal and the D&R Canal in NJ.

• In Pennsylvania, an existing public park & ride lot directly north of the I-95 bridge alignment is owned by Lower Makefield Township and is used actively by both weekday commuters and off-peak recreation users to access the adjacent Delaware Canal and D&L trail. This site deserves consideration to become a portal to the Delaware Canal – a concept that will require cooperation between DCNR, DRJTBC, PennDOT, Lower Makefield Township, and other strategic partners. DRJTBC can be a potential partner in this effort.

• Easton Partnership – refer to Details – Location – Easton section for a description of opportunities.
4.2 Landings

Context

Landing sites generally provide vehicular access and parking. Existing “landings” for Delaware Canal parking may be considered to include: Riverfront Park lot (Bristol Borough), Community Park (Falst), Black Rock Road (Lower Makefield), Lower (Upper Makefield) and Upper (Solebury) sections of Washington Crossing State Park, Canal Park and Virginia Forrest Access (Solebury), Tinicum Park and Giving Pond (Tinicum), Durham Access (Durham), Rauville Access (Theodore Roosevelt Recreation Area), Wy-Hil-Tuk Park (Williams) and the Forks of the Delaware (Easton).

Challenges

A site such as the Bucks County Park at Bridge 2 (Ticinum Township) is a public parking location with access from Route 32 to the Delaware River and Canal, but it is not identified/siged from River Road and is not generally known or used as a landing.

The Mountainside Inn Property (Plumstead Township) is a privately-owned access and parking site for the Delaware Canal that has been used informally for decades but is not legally a public parking site. Similarly, a lot at Mt. Eyre Road in Lower Makefield is used, but is not a public lot.

Both SEPTA stations in Yardley and Bristol should be considered as potential landing sites for the Delaware Canal. There is currently no clear, direct, and publicly-accessible connection between the Yardley Station and the Delaware Canal, but the physical distance between the two is within commuter walking distance. The Bristol Borough SEPTA Station has the potential to become a transit-oriented development (TOD) node within the Borough – conceptually part of future mixed-use community improvement with the Borough.

SEPTA currently has an agreement with Whitemarsh Township to enable the Spring Mill station to be used as a trailhead for the Schuykill River Trail. This model might be applicable to potential D&L SEPTA station-area partnerships.

Other sites may be considered as potential landings, and all landing sites should be improved with a minimum of signage, parking and access, rest facilities and public information. Partnerships to formalize landing sites can be pursued by local and catalytic partners with support from DCNR.

The definitions and characteristics of portal and landing sites may need to be formalized in the future.

Partnership Opportunities

- Washington Crossing State Park Partnership – Washington Crossing State Park was transferred to DCNR stewardship in 2016 and it abuts the Delaware Canal, including several existing landing sites that can be used to access both parks. The parks are managed by two different local DCNR staffs, but cooperation is very close within the Department. Opportunities exist for DCNR to revisit elements of the recently completed master plan for Washington Crossing Park and to determine what recommendations remain relevant under the new DCNR jurisdiction. Local Washington Crossing community organizations can work with Delaware Canal partners to help integrate access improvements at Washington Crossing that work for both parks – physically, programmatically and thematically.

- Bucks County Partnership – At least two Bucks County parks provide direct access to the Delaware Canal, in Tinicum and Bridgeton Townships. Strategic partners can help negotiate access and service improvements between Bucks County and DCNR for all adjacent county park sites.

- Mountainside Partnership – Strategic partners can seek to formalize an agreement for the longstanding informal use of this parking area to conserve the historic public use of this site as a landing for the Delaware Canal.

- SEPTA Partnership – The SEPTA stations at Bristol and Yardley may be negotiated and marketed as D&L Trail landings, given their physical proximity to the Delaware Canal; the availability of public (fee) parking; and the potential to access nearby services and amenities. Strategic partners can open a formal negotiation with SEPTA to explore access and marketing opportunities that feature alternative public access – by train and bus to the D&L Circuit trail system. The re-establishment of SEPTA regional rail service in Morrisville needs to be explored.

Arriving by train: The SEPTA West Trenton Line stops at Yardley.
4.3 Linkages

Context

Numerous local walkways, trails and parks link directly to the Delaware Canal and serve as important community connections to the state park and help integrate it physically and culturally within the fabric of adjacent neighborhoods. The frequency of these linkages increases with the size of the communities they serve, especially from New Hope south through Bristol. User services are not generally provided at linkage locations, however in appropriate locations signage, benches, trees, waste containers, and shade trees can help establish the intersection of canal and roadway as a public place.

Challenges

In places like Yardley, Morrisville, New Hope, Bristol and Falls Township the Canal and towpath intersect regularly with local streets and state highways, and the conditions and treatments at these intersections vary widely based on the ownership jurisdiction at each location.

PennDOT standards control the geometric, signage and signalization requirements on state highways. State and federally-funded highway projects require environmental reviews including potential impacts on cultural resources. Sometimes roadway improvements cause negative impacts to the Delaware Canal National Historic Landmark that must be mitigated. Mitigation can take many forms, including public access improvements for pedestrian and bicyclist mobility linking the public ROW to the D&L Trail. Every Canal host municipality addresses Canal access from local streets differently.

Partnership Opportunities

- Canal-Roadway Intersection Program – DCNR has basic requirements for public access to the Delaware Canal within its jurisdiction. Directly outside the park boundary are areas where DCNR can cooperate with local municipalities to make access improvements as a support partner. Municipalities and strategic partners can work together to document the conditions of existing roadway and trail linkage locations and create a comprehensive Canal-Roadway Intersection Program, including both the minimum and the optional features that should be considered at each location – such as D&L, Inc. branding signage, directional signage, improved crosswalks and curb cuts to suggest a few typical examples of improvements. Development costs can be assigned to typical improvements as a tool for securing funding and constructing the local linkage improvements to the Delaware Canal and D&L Trail. The program can be implemented by various local and catalytic partners by targeting recreation, community development, and transportation programs to help fund planning and design of Canal linkage improvements that lie outside state park jurisdiction.

- The D&L Corridor offers a partnership program for signage that is available to municipal partners to create identity, direct users and interpret the Delaware Canal cultural landscape and improve public access where it passes through local communities.
4.4 Gaps

Context

Gaps block access on the Delaware Canal towpath and D&L Trail. (Obstructions are described as total blockages of the Delaware Canal waterway that pose flooding / safety threats.) Gaps pose safety threats to state park users where they prevent through travel on the D&L Trail – and may provoke users to risk traveling unsafe routes, such as intersections where the D&L Trail is not accommodated as a recognized transportation mode. D&L, Inc. and partners have set a strategic goal with DCNR to open all missing trail gaps on the D&L Trail by year 2020.

Challenges

D&L Trail gaps include physical barricades such as the Conrail spur embankment directly south of Morrisville; the PennDOT Tyburn Road embankment in Falls Township; and the PennDOT Bridge Street bridge over the Canal in Morrisville. The Route 32 crossing in New Hope is not physically obstructed, but visually and measured by highway engineering standards – the existing towpath crossing may seem like a gap to many. The D&L Corridor goal is to remove all physical gaps on the D&L Trail by 2020. Each location poses unique challenges to trail access, engages different partners, and requires creative solutions.

Partnership Opportunities

- Trail Gap Clearance 2020 – D&L, Inc. and PEC have cooperated with DCNR to find alternative funding and to advance design and construction of remedies to several trail gaps in the southern end of the Delaware Canal. In the case of the Bridge Street gap in Morrisville, funding was released in 2016 to design and construct ramps from the towpath to the bridge sidewalks and create a mid-block pedestrian highway crossing. It is imperative that future projects are programmed comprehensively from the planning stages to ensure that all final design address clearing gaps to both the towpath trail and the water trail of the Delaware Canal. The Bridge Street crossing project should include sidewalk “bumpouts” to calm vehicular traffic on the state highway and reduce the length of the crosswalk. Within its jurisdiction, PennDOT should take a “complete streets” approach to the Bridge Street project to ensure the new facility addresses multiple connectivity, mobility, identity, and public amenity opportunities that are unique to this site.
4.5 Upgrades to Existing Areas

Context

Upgrades are considered improvements that are needed for trails or access facilities. These can be general, such as ADA-accessibility improvements and standard signage — or can be site specific such as special paving treatments in high priority or intensively-used locations. Generally, access and trail upgrades are addressed within the DCNR lists of its priority capital and maintenance projects.

Challenges

Programming and budget priorities are perennial challenges for DCNR upgrade projects. After priority safety projects are funded, upgrade projects must be equitably apportioned geographically and by feature type. Sometimes upgrade designs are performed in-house by the DCNR Bureau of Facility Design and Construction. Large upgrade projects are managed by the PA Department of General Services (DGS) with DCNR as its client. Each project can assume various shapes, depending upon its location and the lead development partner. DCNR has some standard specifications that it uses or requires, but there are aspects of prominent visual features, such as the Camelback Bridge truss facades; public restroom structures; and replacement retaining walls that should have specification standards that are consistently employed for all upgrade projects. Standardized specifications should be considered but cannot be applied indiscriminately to historic rehabilitation projects, because the original materials and structural details vary greatly within the 60-mile canal corridor.

Partnership Opportunities

- Standard Upgrade Specifications – Strategic partners can initiate an assessment of existing facilities in partnership with DCNR, ACOE, PennDOT, and PHMC that can serve as a baseline for recommendations for future facility upgrades. A review of existing DCNR specifications and past DGS Canal project specifications would be the first step. Preference criteria can be developed in a rational vetting process with DCNR for use by in-house engineers, and used to inform DGS contractors at the commencement of each Delaware Canal capital project. A technical subcommittee of the Canal Advisory Committee may be a good forum to perform this work.
4.6 Pedestrian and Bicycle

Context

Pedestrian and bicycle (ped-bike) uses coexist on the D&L Trail. The geometry, surface conditions and absence of motor vehicles make the towpath especially suited to recreation trail uses of all ages, including occasional horseback riding. The towpath may be used as a “transportation” trail, however many serious cyclists prefer the narrow, on-road conditions of the adjacent River Road to the grass covered canal path – even in segments where the compacted stone dust trail surface remains.

The Vision Study process revealed that some ardent recreation cyclists (and walkers) prefer to use the Delaware Canal as one leg of a Delaware River “loop” ride – with a specific preference for the slower leg on the Delaware Canal in the morning and the faster return ride on the D&R towpath in New Jersey in the afternoon. The current northern limit of the river trail loop options is the Erwinna-Frenchtown Bridge. The current southern limit may be considered the Calhoun Street bridge, between Morrisville and Trenton.

The Delaware River bridges are owned and managed by the DRJTBC and all bridges between Easton and Morrisville include pedestrian facilities on deck where cyclists can dismount and walk bikes across the spans. The Lumberville Bridge is a pedestrian-only span that connects to Bulls Island State Park in New Jersey at the head of the D&R Canal.

The Friends of the Delaware Canal recently published a “Bridge Loop” brochure promoting the use of the Delaware River bridges and the D&R Canal for Delaware Canal users to customize their own Delaware Canal loop trail routes.

Challenges

Ped-bike access to the Delaware Canal occurs at portal, landing and linkage locations. Every type of entry facility should be expected to be ADA-accessible, unless those features are provided by other nearby access locations. “Sharing the trail” issues must be resolved. Ideal capacity must be defined, and improvements tailored to meet that ideal capacity. Landings such as the Virginia Forrest and Raubsville access areas should include: parking, restrooms, maps, park information, and bike racks for all user types – but generally other visitor amenities or support services may not be found nearby. In some cases along the Delaware Canal cell phone service may be difficult. Easton, New Hope, Lower Makefield, Yardley and Morrisville all currently have commercial bike shops that can assist D&L trail users at various levels of support.

Significant pedestrian and bicycle issues remain to be solved in key areas of the Delaware Canal – especially at the two terminal portals of Easton and Bristol – each currently with substandard alignment to reach the D&L Trail via walking and bicycle. Both municipalities can work proactively with DCNR and other partners to re-envision their future D&L Trail connections as essential features for national destinations that will attract and serve Delaware Canal users in their civic centers.

The short stretch of Route 32 between the Roebling Pedestrian Bridge and the Delaware Canal access bridge inLumberville is a narrow segment of the state highway with no shoulder, that is heavily used by visitors and residents on foot and on bikes within the vehicular carway.

Partnership Opportunities

• PA / NJ Trail Loops – Strategic partners can expand on the interstate trail loop concept to engage DRJTBC and PennDOT and NJ partners in the river loop marketing and improvement projects.

• Lumberville Bridge-Delaware Canal Linkage – This missing trail link on the Canal side of River Road in Lumberville will become increasingly acute as commercial and state improvements in this area make it more attractive to ped-bike users and increase traffic volumes on Route 32. The abutting jurisdictions of DRTBC, PennDOT and DCNR in this location make this project administratively challenging but not physically impossible. Solebury Township and local businesses can work with strategic partners to create a safe, accessible and aesthetic trail loop connection at this high-use, scenic pinch point. The first step is public involvement in Solebury Township.
The Delaware Canal State Park is both a land and water trail – Although with past state practices of dewatering the Canal during construction – the unreliability of the Canal as a watered system has severely reduced its use as a water trail and recreation resource. Boating needs to be considered a priority recreation use that most natural water trails do not enable without motorized crafts. When watered, the Delaware Canal creates "loop" excursion options, including canoeing downstream and paddling the canal back upstream to the start – an excursion that also reduces the need for vehicular shuttling of users. When the canal is not watered, this opportunity / public service is lost.

Hybrid water-land trail loop excursions include canoeing the Canal in one direction and biking or hiking the return trip on the towpath. Local users are most familiar with the recreation opportunities of a watered Delaware Canal, but these options can be easily marketed as attractions by private canoe outfitters, chambers of commerce, canal supporters, and even DCNR itself – if the Canal remains consistently watered.

A well-maintained system of waterway access features is important to serve this type of low-impact, ecotourism attraction. In multiple lock locations, DCNR has constructed and maintained ramps and platforms in the canal, above and below locks, to provide ADA-accessibility to portage around the historic structures. The primary challenge to capitalize on these investments is to maintain water in the canal. A secondary challenge is to address the potential NR/NHL impacts form such new structures.

Solebury Township designed, but never constructed, one of the boat launch structures for users to embark and disembark the waterway at its Canal Park. A public commitment to a watered canal will increase the effectiveness of these important access water facilities.

The Vision Study process also revealed the need to identify existing public access locations where water trail users can connect between the Delaware River and the Delaware Canal. Locations where the public has direct access between the Canal and River include: Wy Hit Tuk Park, Giving Pond; Tinicum Park; Golden Pheasant Bridge; Bucks County parks property at Bridge 2 in Point Pleasant; Virginia Forest access area; Roosevelt Recreation Area; the Delaware River intake in New Hope; and Washington Crossing State Park. River access from Lambertville is much preferable and more accessible than the New Hope intake, particularly when the Gateway to New Hope project is completed.

The Vision Study process also identified the need to increase river-canal access locations where possible. In 2009, the Delaware River Greenway Partnership (DRGP) completed a Trails Signage plan for the Delaware River from Hancock, NY to Trenton, NJ – including the entire parallel alignment of the Delaware Canal. This plan includes signage recommendations for multiple jurisdictional public access partners and may be updated and modified to support the Delaware Canal water trail.

One prominent private location that has been used informally but not officially by the public to access the Delaware Canal and River is the Mountainside Inn at Mile 30 in Point Pleasant. DCNR and partners should consider securing a public easement to the canal and river at this location a priority.

Partnership Opportunities

- Water Trail Loops – The concept for canal-river loop land trails can be similar to the bi-state loop trail routes on both sides of the Delaware River. Water loop trails using the Delaware Canal and Delaware River can be developed an promoted – only if the Canal is consistently watered, and loops will only be viable if easy ways to portage are provided. An assessment of existing and potential water trail loops can be developed by strategic partners working with DCNR. The assessment can identify possible locations where access to the water trail can be expanded by agreement, acquisition, or easement with public and private owners. The execution of access improvements can be accomplished by DCNR or in partnership with county and local governments and or with strategic NGO partners.
4.8 Transit

Context

The Delaware Canal intersects with public rail and bus transportation lines in multiple locations along its entire 60-mile length — including within suburban villages. SEPTA Regional Rail stations in Bristol and Yardley are each located within a block from the Delaware Canal. Public transit access locations along the Delaware Canal were mapped during the Vision Study process.

Challenges

The SEPTA Regional Rail station in Bristol is located directly across from the historic Grundy Mill factory, with the Delaware Canal and a gracious public green located in between the factory and the canal. Public Vision Study comments included the opportunity for Bristol Borough to become a major destination for cyclists traveling from Philadelphia and New York to embark on D&L trail rides.

SEPTA buses make stops near the Delaware Canal in Bristol, Tullytown and Morrisville. The interstate Transbridge buses between NYC make stops in Frenchtown and Lambertville (New Hope) — directly across the Delaware River bridges at Erwinnna and New Hope, respectively. Transbridge also runs up to 20 buses per day that serve the new Easton Intermodal Center. The Easton bus transit station is located within walking distance of city center food, lodging, entertainment, and services, including a bike rental shop. Easton riverfront development initiatives are located within one block from the Intermodal Center. Currently missing is a safe, attractive and direct ped-bike route across the Lehigh River to reach the Delaware Canal trailhead and portal to the D&L Trail.

SEPTA trains and buses accommodate bikes, but this service is not yet available on Transbridge buses. For public transportation access options to become more attractive and popular as a means to reach the Delaware Canal, the transit communities need to take the lead in planning and developing the services and amenities that transit riders need to make them feel safe and excited to use the Delaware Canal and D&L Trail.

Partnership Opportunities

- Interstate Bus Connections – The City of Easton is strategically positioned along the Delaware Canal to negotiate marketing strategies with the Transbridge carrier to increase visitation from the NYC region to the Delaware Canal corridor. Multiple partners can cooperate to negotiate marketing and service improvements in communities that host the Delaware Canal and have Transbridge bus stops — including Frenchtown and New Hope. SEPTA Regional rail service does not stop at Morrisville, but passes through the Borough to a terminal stop in Trenton. Public comments during the Delaware Canal Vision Study process included the desire by Morrisville to have SEPTA reinstitute passenger rail service in Morrisville. The SEPTA 127 Bus Line travels through Morrisville en route to Trenton. Both SEPTA rail and bus services can be promoted as Delaware Canal transit linkages.
Context

DCNR provides and maintains public access and parking areas for the Delaware Canal in multiple locations and in various configurations – ranging from formalized parking at areas such as Virginia Forrest Access in Solebury Township, to unsigned, informal parking at its maintenance shops in Yardley and Lodi.

Each Delaware Canal destination or access location differs. The Borough of Bristol maintains the Turning Basin public parking area at the southern portal of the Delaware Canal. Bristol also has metered street parking. DCNR leases the small public parking area at the head of the Delaware Canal from the City of Easton. The City of Easton constructed its new Intermodal Transportation Center within its new Easton City Hall and an integrated car parking structure for public (fee) parking. The FODC Landmarks and Mileage chart, available online, includes parking locations.

Challenges

The recent transfer of Washington Crossing State Park operations from PHMC to DCNR will afford new partnership opportunities, and inevitably attract people to also access and use the adjacent Delaware Canal along its western edge. A recently-completed master plan for Washington Crossing Park should be revisited in terms of its recommendations for improving shared parking between the two state parks.

High volume visitation areas like New Hope have no free public parking dedicated to the Delaware Canal State Park. Much of the DCNR-owned parking area adjacent to Odette’s will likely be leased to support the new private commercial uses. A for-fee parking lot opposite the Canal from the Locktenders House in New Hope is owned by the American Legion and operated by the Eagle Fire Company to raise funds. Free on-street parking remains available in Bristol, Morrisville and Yardley, but most other Canal towns have metered street parking with limited terms.

Municipal parks such as Tincum and Canal Park in Solebury Township offer free public parking with direct access to the Delaware Canal and D&L Trail. The Vision Study recommends updates to the public parking locations By DCNR for all sites along the canal. No quantifications for public or private parking capacities were calculated as part of the Vision Study.

Partnership Opportunities

• Delaware Canal Parking Assessment – One of the suggestions from the Visioning Study process was to improve the DCNR park map; the online information; and the on-location signage to include all DCNR, public partner, and private parking opportunities within a single unified information system. This assessment can be performed by strategic partners in partnership with DCNR. Mapping data developed for the Vision Study is available to be supplemented by this effort.
The availability of visitor services varies significantly along the 60-mile Delaware Canal State Park. Beyond the most basic public access challenges of parking and ADA compliance—providing for immediate and essential human needs of local users and visitors is a constant challenge for DCNR and its partners. Public rest room facilities remain a priority. Basic signage—directional, informational, and interpretive—are all within public expectations of basic services at access locations on the Canal. Amenities may include benches, waste receptacles, bike racks, shelter, and environmental landscaping. Potable water is an expensive service, but may be justifiable at portals and some landing sites. The dedicated basic landscape maintenance services that DCNR provides are described in Element 2.3 Administrative. County and local partners work cooperatively with DCNR to provide many services along the 60-mile state park corridor. ADA accessibility issues should be clearly explained at each access location.

Aspects of the Delaware Canal related to services and amenities include:

5.1 **Toilets**
5.2 **Waste**
5.3 **Potable water**
5.4 **Recreation**
5.5 **Signage**
5.6 **Information**
5.7 **Interpretation / Education**
5.8 **Concessions / Vending**
5.9 **Visitor Centers**
5.10 **Associated DCNR Assets**

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5.10 **Associated DCNR Assets**
5.1 Toilets

Context

Public toilets and information about their locations and availability are priorities for Delaware Canal park users. Public comments during the Vision Study indicate that public restroom facilities appear to be insufficient in quantity and distribution—however, a systematic analysis has not been conducted to determine overall availability, conditions, and needs for public toilets based on quantified or projected visitation records within various segments of the Canal.

Challenges

DCNR operates modern public rest facilities at Virginia Forrest and Raubsville access areas. In other locations such as the Easton portal, DCNR provides an ADA-rated portable toilet.

Tinicum Park offers seasonal restrooms adjacent to the Canal, but there is no signage or information that directs Canal users to them. A similar condition exists where Washington Crossing State Park abuts the Delaware Canal. Morrisville Borough operates modern public restroom facilities at the Trenton street portal location, but the structure design creates poor visibility and indefensible space issues—and hours of accessibility are uncertain.

New Hope is a location where modern public toilets are needed, and the high level of potential canal users may justify a DCNR investment.

Partnership Opportunities

• Comprehensive Public Services Assessment—An assessment is needed to quantify the locations and conditions of essential public services—both inside the state park, and adjacent directly to it. Toilets, water, shelter, benches, information, waste receptacles, bike racks, and shade are all basic components of public services at or adjacent to Delaware Canal Access sites. The analysis can be conducted by DCNR partners in cooperation with Delaware Canal State Park, and should include all public facilities within ¼ mile of all DCNR access locations—including portals, landings, and linkages.

LOCATIONS
Bristol Borough
Bristol
Tullytown
Falls
Morrisonville
Lower Makefield
Yardley
Upper Makefield
Solebury
New Hope
Point Pleasant
Tinicum
Bridgeton
Nockamixon
Durham
Riegelsville
Williams
Easton

ELEMENTS
Safety
Water
Structures
Access

ADMINISTRATIVE
Physical Plant
Maintenance
Management
Planning

Partnership Opportunities

• Comprehensive Public Services Assessment—An assessment is needed to quantify the locations and conditions of essential public services—both inside the state park, and adjacent directly to it. Toilets, water, shelter, benches, information, waste receptacles, bike racks, and shade are all basic components of public services at or adjacent to Delaware Canal Access sites. The analysis can be conducted by DCNR partners in cooperation with Delaware Canal State Park, and should include all public facilities within ¼ mile of all DCNR access locations—including portals, landings, and linkages.
5.2 Waste

Context

Trash / recycling receptacles are provided by DCNR at select locations, such as Virginia Forrest Access area. Otherwise the D&L trail operates on the "Leave No Trace" principles.

Challenges

Areas that are not owned by DCNR, but are used culturally by Canal and River recreation users – such as the Mountainside in Plumstead, suffer from not having trash facilities, signage, maintenance or enforcement of standard DCNR regulations. Trash tends to accumulate in these "undefined" areas.

Partnership Opportunities

Refer to 5.1 for Partnership Opportunities.
5.3 Potable water

Context

Public drinking water facilities are capital and maintenance-intensive services. The public restroom building at Morrisville Portal near Trenton Avenue includes a public water fountain that may or may not operate due to seasonal conditions and occasional vandalism. Other locations of public drinking water along the 60-mile Canal corridor are rare. Three are available at Virginia Forrest, Roosevelt Recreation Area and Lodi access.

Challenges

Within the Public Services Assessment, portal locations at Bristol, Morrisville, I-95 Scudder’s Falls, and Easton should be priority sites considered for providing drinking water service, especially considering the propensity for many users to carry their own water bottles. New Hope should also be considered based on its concentrated and historic volume of visitation. Other sites may be considered based on non-DCNR partner involvement.

Delivery of potable water to primary Canal access sites needs to be evaluated, and may be considered a service provided by DCNR partners.

Partnership Opportunities

Refer to 5.1 for Partnership Opportunities.
5.4 Recreation

Context

Traditional recreation uses of the Delaware Canal include: walking, running, canoeing, kayaking, water boat paddling, wildlife observation, fishing, ice skating, and horseback riding. Modern recreation uses include biking, dog walking and cross country skiing.

Challenges

The multi-use service program for Delaware Canal State Park presents challenges for DCNR and sometimes for user expectations. One example may be the towpath trail surface. Some users prefer a grassed towpath and some prefer the compacted stone dust surface that is more bicycle-friendly. If use of the D&L Trail and the Delaware Canal continues to increase, there will be a point where a “carrying capacity” of the resource may be reached. These future demands can be estimated as soon as possible for the various “high use” areas first, and then projected more broadly for future demand forecasting.

Partnership Opportunities

- Carrying Capacity Estimates – DCNR and partners can project future demand and estimate the carrying capacity of the park for various recreational uses along the 60-mile state park. The existence of visitation history data could inform this estimating process. The estimates should project a tipping point for peak recreation uses along various segments of the Canal. This information is valuable to DCNR and partners in planning future facilities, marketing the Canal, and in efforts to encourage future visitation more broadly across the lesser-frequented segments of the Canal. A proactive Estimating Process will help advise policy, budgeting, and construction decisions by DCNR. NPS may provide a model for estimating park users and its carrying capacity.

The primary challenge to provide recreation services within Delaware Canal State Park is to maintain a watered prism for reliable boating services in the Canal. User data collection is a challenge for any park, trail, or public facility that needs to justify its funding by demonstrating values of its services. Accurate user counts are considered essential to help make the case for public funding of trails.

PEC is installing two permanent counters on the southern end of the D&L trail – one in Upper Makefield Township and another in Tullytown Borough. Additionally DVRPC has temporary counters available for placement on the trail which can be used by partners to understand seasonal adjustment factors. DCNR also has an attendance methodology using four traffic counters and four trail counters which are movable.

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5.5 Signage

Context

The standard adopted by DCNR for signage along the Delaware Canal, is the D&L Signage Specifications described in the D&L’s design manual “Visually Speaking.” The system has been broadly implemented along the corridor and includes: entry, directional, informational and interpretive fixtures. The system should be adopted and proliferated as a component of every Delaware Canal-related project. Every new project should be considered for how one or more of the signage types might be incorporated to provide better services at that location.

Challenges

In some locations, such as Bristol, the D&L signage fixtures have suffered damage from vandalism.

Over time, the fiberglass D&L interpretive panels degrade in the sunlight and become illegible. An upgrade to porcelain enamel signage or other improved technology should be considered a prudent investment in interpretive features for all future Delaware Canal-related projects.

Partnership Opportunities

- Expand / proliferate D&L, Inc. Identity signage network

LOCATIONS
- Bristol Borough
- Bristol
- Tullytown
- Falls
- Morrisville
- Lower Makefield
- Yardley
- Upper Makefield
- Solebury
- New Hope
- Point Pleasant
- Tinicum
- Bridgeton
- Nockamixon
- Durham
- Riegelsville
- Williams
- Easton
Context

Information as a public service still exists in the form of on-site features and printed materials, but web-based information sources enable people to access the full array of current information from almost any location, when they need it – while reducing printing and solid waste.

Challenges

A central clearinghouse site for the Delaware Canal on the web could serve as a directory to help people understand and access the various sources of information available – including links to sites maintained by DCNR, D&L, Inc., DC21, FODC, and others. This service might include essential user data such as: real time or at least up-to-date canal condition reports; where is there water; where is it dry; why is it dry; status of repairs, etc.

The existing DCNR map for the Delaware Canal State Park can be updated for paper and digital formats – using the graphic base mapping that was created for the Vision Study.

Partnership Opportunities

- Web-based Information Directory – Strategic partners can cooperate with DCNR to create a web-based information directory site that facilitates access to the voluminous information available at multiple websites.
- DCNR Park Map update – DC21 and D&L, Inc. can assist DCNR to update the Delaware Canal State Park user map – to improve content and graphic presentation, based on new information and the Vision Study base map system.
5.7 Interpretation / Education

Context

The Delaware Canal presents opportunities for historic and environmental interpretation that reach beyond on-site signage and web-based educational resources. The standard for identity and interpretive signage along the Delaware Canal corridor is the system developed by the D&L, Inc. with the National Park Service called “Visually Speaking.”

Challenges

Telling the stories of the Delaware Canal is challenging in terms of relevance and depth of information presented for each topic – as well as using new media that is not static. A challenge for catalytic partners is to envision and develop an interpretive audio program that is georeferenced for people traveling along the Delaware Canal.

Partnership Opportunities

- D&L, Inc. Delaware Canal Interpretive Partnerships – The original interpretive system developed by D&L, Inc. for the Delaware Canal remains valid, with new opportunities expressed during the Vision Study process. In light of the aging of early exhibits, D&L, Inc. and partners can revisit the Delaware Canal interpretive strategy to: expand editorial content, upgrade fixtures, improve siting specifications, and identify geographic gaps in the system. A GIS database of all D&L signage should be created.

- Georeferenced Audio Tour – D&L, Inc., NCM, FODC, DC21, and HC all have information and resources that could help advance the development and marketing of georeferenced audio tour of the Delaware Canal that could be accessed by users with mobile phones. Other advanced interpretive devices should be explored.
5.8 Concessions / Vending

Context

The Canal boat ride in New Hope is perhaps the most well-known privately-operated concession on the Delaware Canal. Other concession and vending opportunities may be possible that would be both appropriate to the National Historic Landmark resource and also generate income dedicated to maintaining the Delaware Canal. Concessions can be considered as one form of public-private partnerships.

Challenges

Understandable public concerns exist about “commercializing” the Delaware Canal. At one end of the spectrum may be corporate branding and the other extreme is not allowing private services. Reasonable opportunities need to be identified, assessed and if appropriate, pursued.

The DCNR solicitation for a new Canal Boat Tour operator was not successful in Spring of 2016, but should be reassessed and reissued.

Ideas from the Vision Study include: food service, inns, bed & breakfasts, bike rentals, and boat rentals as potential concession and vending partnerships with DCNR at Delaware Canal State Park. Each possibility needs assessment to determine appropriateness and potential viability. These tasks can be performed as elements of an economic study for the Delaware Canal.

Partnership Opportunities

- Canal Boat Tour – DCNR can re-envision its scope and terms in the original solicitation for a vendor after discussions with potential vendors to help address issues faced by the private sector to deliver this recreation service.
- Odette’s – DCNR can negotiate a partnership with Odette’s that balances the loss of public parking spaces in New Hope and the relocation of the Landmark structure with historic resource rehabilitation benefits from the developer. DCNR can negotiate safety, environmental, historic restoration, aesthetic, and public access improvements within this agreement.
5.9 Visitor Centers

Context

There has never been an official visitor center for Delaware Canal State Park. In 2015, DCNR and DGS conducted an investigation of a site in New Hope for development as a visitor center and park office and determined the site was not suitable for that use based on multiple issues. In 2016, DCNR announced that it was abandoning the New Hope location as a park office site and would conduct a corridor-wide assessment of potential park office sites, including the possibility of creating more than one smaller satellite facility.

Challenges

DCNR has developed some preliminary Visitor Center program, but that definition remains internal. Typical public visitor centers include: a central location, with parking, interpretation, education, materials, restroom facilities, etc. Each potential site needs to address a preliminary program differently.

The 60-mile Delaware Canal corridor makes it difficult for one visitor center site to serve a majority of park users. Portal locations including Bristol, I-95 Scudder’s Falls, and Easton are potential visitor center sites. Washington Crossing Historic Park (WCHP) already has a visitor center and the possibility of a combined Visitor Center with Delaware Canal State Park has been ruled out. The concept of expanding / adapting the Giving Pond in Tinicum was identified as a potential visitor center site but is not near any major highways. Currently, the Park Office is the official Visitor Center and is located off Route 32 on Lodi Road, which is a major route for visitors.

Partnership Opportunities

- Site Selection / Development Process – The new direction for determining a Delaware Canal Visitor Center strategy gives DCNR the opportunity to improve its public participation process at all stages – from assessment, through planning, and design. A committee of the CAC should be formed to engage with DCNR and its consultants on a more regular basis than just receiving quarterly updates at CAC meetings.
5.10 Associated DCNR Assets (related holdings)

Context

DCNR is the steward for other park resources that are within the Delaware Canal State Park boundary, such as Hendricks Island in the Delaware River (near Virginia Forrest access area). Giving Pond in Tinicum Township, ten other Delaware River Islands and the Nockamixon Cliffs are also under DCNR stewardship and are within the Delaware Canal State Park boundary. Delaware Canal and Ralph Stover State Park are administratively linked.

Challenges

The levels of public accessibility between these sites vary significantly. Some areas have restricted uses. Consistent information through all types of media about the recreational opportunities between these resources should be established as a marketing priority for DCNR.

Partnership Opportunities

- Adjacent Asset Integration – DCNR can consider refining its concept of managing its assets that abut the Delaware Canal as a “string of pearls” connected by the canal “thread.” A CAC committee might be formed by host communities such as Tinicum (Giving Pond), Solebury (Hendricks Island), and Upper Makefield (Washington Crossing) that helps guide a comprehensive DCNR framework for linking its local resource to the canal – physically, educationally, and for using the Delaware Canal to help market its lesser known assets.
The Delaware Canal, like the neighboring D&R Canal, is one of the last of the original US towpath canals that remains capable of being fully watered. Changes have been continually made to the Delaware Canal during its one hundred years of commercial operation, and changes must continue to occur for inevitable maintenance needs and modified uses. But despite well over a century of modernity advancing all around it, the original essence and possibilities of the Delaware Canal have not been lost. The primary goal must be to conserve its essential “character-defining features.” Maintaining a watered canal has been identified by this study as a primary character-defining feature of the Delaware Canal. Accomplishing this goal will be an evolving process. Other character-defining features have been identified during this study process, and the process of evaluating and listing character-defining features is underway, led by PHMC. This list should be vetted by strategic partners with DCNR, and used as the principles for making treatment decisions for every intervention to the resource in the future.

This process will present many complexities, for instance, before the late 1990s little to none of the work done on the canal met the Secretary of Interior’s Standards for the treatment of Historic Properties.

Aspects of the Delaware Canal related to historic resources include:

6.1 National Register of Historic Places
6.2 National Historic Landmark
6.3 Local Historic Districts
6.4 Cultural Landscape
6.5 Conservation Options
6.6 Education
6.1 National Register of Historic Places (NRHP)

Context

The National Register of Historic Places (NRHP) is the United States federal government's official list of districts, sites, buildings, and objects deemed worthy of preservation. The Delaware Canal has been listed as a resource in the National Register of Historic Places since 1974 and is eligible for consideration under the National Historic Preservation Act of 1966, as well as the Pennsylvania History Code of 1988. These laws require consultation with the Pennsylvania Historical and Museum Commission’s Pennsylvania State Historic Preservation Office (PHMC-PASHPO). In the case of federally or state funded or permitted projects, Section 106 of the National Historic Preservation Act of 1966 as amended and the Pennsylvania History Code may apply. Potential impacts to the historic resource are assessed according to federal criteria set forth by the National Park Service’s “Secretary of the Interior’s Standards for the Treatment of Historic Properties” and the implementing regulations (36 CFR Part 800) of the Advisory Council on Historic Preservation.

Under Section 106, federal agencies that fund, permit and/or license a project are required to consult with the PHMC-PASHPO and other consulting parties. DCNR as a state agency is not required to consult with the PHMC-PASHPO under Section 106 if it is not using federal funds or permits. If there are federal funds or a federal permit or license required, then the pertinent federal agency is required to consult. DCNR may do the footwork, but the federal agency is the responsible agency. Under Chapter 5 of the Pennsylvania History Code, state agencies are required to seek the comment and advice of the PHMC-PASHPO regarding projects receiving Commonwealth funds, conducted on Commonwealth land, and/or projects requiring Commonwealth permits or licenses and their potential effects on historic properties. The PHMC-PASHPO uses the implementing regulations (36 CFR Part 800) of the Advisory Council on Historic Preservation to determine effects. The concepts of Context, Significance, and Integrity as developed by the National Park Service (NPS) are the three standards of NRHP eligibility.

Challenges

The Delaware Canal is a sophisticated landscape machine, built in 1831 to create a water road for commerce by manipulating natural rivers and creeks. Its primary incentive was economic development. Its legacy is one of the industrialization of the United States. As it was cut through existing settlements, various civic, social and business enterprises were affected and adapted to benefit and serve it. In the 21st Century, what industries does or might the Delaware Canal serve?

The Delaware Canal passes through eleven villages with historic districts individually listed in the National Register of Historic Places. The Delaware Canal may contribute as an element of those historic districts where in turn, some historic districts may contribute to the Delaware Canal.

Projects that are federally or state funded and/or require a federal or state permit or license that may potentially affect the Delaware Canal require consultation with the PHMC-PASHPO. Locally or privately-funded public projects do not require consultation. Effects of projects on historic properties can be determined to be beneficial or adverse.

Every project along the Delaware Canal changes the historic property in some way. Many projects outside the Delaware Canal boundaries also affect its context and its integrity. As such, state and federal agencies and organizations are striving to understand the evolving history of the canal and its contributing resources. For example, in 2016, PennDOT is currently undertaking their own inventory for the Delaware Canal NRHP documentation, which requires review and concurrence by the PHMC-PASHPO as well as review by other stakeholders. FODC has been a participant in this inventory process.
For specific projects, Section 106 is inherently a consultative process. Thus, the best preservation outcomes often include ongoing conversations, early on in the project planning process, between the responsible agencies (for example, DCNR or PennDOT), PHMC-PASHPO, and other consulting parties. Programmatic Agreements, such as the Ten-Year Maintenance Programmatic Agreement (PA) between the U.S. Army Corps of Engineers, DCNR, PHMC-PASHPO, and D&L, Inc., assist in balancing the needs of the agencies with preservation concerns. Opportunities may exist for other similar agencies and actions but would require continued consultation between the various agencies and stakeholders with regards to preservation concerns and interest. This method enlists a broad expertise to participate in the process and enables the partners the opportunity to bring other resources to the project, such as design alternatives and supplemental funding. Section 106 requires a public participation process. The Pennsylvania History Code does not.

All properties keep changing, even with the best preservation stewardship or benign neglect. The simple cleaning of historic properties is considered a mild intervention. Ultimately, the concept of “preservation” has evolved into a “conservation” approach that accepts inevitable change to historic properties, while attempting to preserve and retain those character-defining features that make a property eligible for the NRHP.

The Secretary of the Interior’s Standards for the Treatment of Historic Properties provide four distinct approaches to the treatment of historic properties: preservation, rehabilitation, restoration, and reconstruction – in a descending order of preference. Restoration and rehabilitation are the likely treatments used for most Delaware Canal projects. Daylighting filled-in sections of the prism is one example that would likely be considered reconstruction.

It is important to remember that the visual quaintness of the Delaware Canal today belies its original essence as a working landscape of the Industrial Revolution. Treatments to the resource cannot be proposed that adversely alter its essence or add foreign elements to the landscape that ultimately do not ensure its preservation.

Several partnership opportunities can help protect the NRHP status of the Delaware Canal.

**Partnership Opportunities**

- **Programmatic Agreement** - A potential partnership opportunity could include the creation of a Programmatic Agreement to ensure adequate protection and consideration of alternatives as well as prevent delays on future projects involving the Delaware Canal, that would involve extensive coordination with DCNR, PennDOT, FHWA, DCNR, FODC, ACOE, DEP, and the NPS as well as any necessary local entities to develop guidelines for conducting work at locations along the Canal – inclusive of design guidelines. These guidelines could include a protocol for decision making to ensure that all interests are represented in future undertakings that involve potential effects to the Delaware Canal. The creation of such would ensure preservation outcomes, while prioritizing project planning and would involve consultation with other consulting parties and interested stakeholders.

- **PennDOT National Historic Resource Documentation** – Concurrent with the Vision Study process, PennDOT began an update to the National Register documentation for the entire Delaware Canal (in both Districts 5 and 6). This effort is an example of a collaborative inter-agency process that seeks to update the National Register documentation. The final assessment report must be reviewed by PHMC-PASHPO and the NPS since it is an update to the existing National Register documentation. Any PA initiated by a state or federal agency will identify public consulting parties.
6.2 National Historic Landmark (NHL)

Context

The intent of the NRHP listing was to list only the Delaware Canal features owned by the Commonwealth. The NHL implied, but did not document, a broader Delaware Canal-related historic district. The Delaware Canal became a National Historic Landmark in 1976, long after multiple modern "improvements" had already impacted its integrity. Yet, even with those impacts, the National Historic Landmark designation describes the value of the Delaware Canal as a landmark because it retained most of its original integrity from 1831, and possesses the ability to demonstrate an intact original waterway of that era. The NHL Nomination states "On no other canal in the United States can one walk its towpath through a setting that is as little changed from its historic period as is the Delaware Canal."

Challenges

The NHL description for the Delaware Canal is generally broad and non-specific in areas. The designation includes both the Canal as a resource and twelve other structures outside the Delaware Canal boundary that were considered by the author and the NPS at the time to be closely associated with the Canal’s history - including Chez Odette Restaurant in New Hope, the Mountainside Restaurant in Point Pleasant, and the entire village of Uhlerstown. The NHL inventory was a general list. It did not establish the benchmarks for inclusion as contributing features. Any future amendment of the NHL will need to do this.

A NHL designation affords another level of review of potential effects in addition to the National Register designation, but neither can prevent all potential adverse effects. The intent of Section 106 of the NHPA is for the lead federal agency to consult and consider the effects of an undertaking on historic properties in consultation with other stakeholders. The law only mandates the process through which those decisions are made; it does not mandate nor does it dictate a preservation outcome in regard to historic properties. The federal agency is responsible for the final Section 106 decisions.

In addition, consideration of potential effects to historic properties is not mandated if there is no federal and/or state involvement. If activities are occurring on private land without the use of state and/or federal funds and/or permitting, the private property owner is not required to consult with any agency or stakeholder regarding the potential effect of their project on the Canal. This presents a serious challenge when publicly owned land is bound for a large extent of its 60-mile length on at least one, if not both sides by privately owned land.

The NHL designation for the Delaware Canal begins to describe its “character-defining features” that contribute to determining the areas of significance and integrity of a resource. The public Vision Study process began to describe specific elements of an initial list of those features, including:

- Extant structures – as the artifacts of early hydraulic engineering
- Scale – as the visible frame of reference for the original construction period
- Materials – as the structural palette and craftsmanship of the industrial revolution
- Others to be determined

The character-defining features are essential to developing a guidelines manual for the treatment of each element of the Canal resource – as a fundamental, system-wide conservation tool for DCNR staff and partners that seek to protect the integrity of the elements that contribute to the NRHP and NHL eligibility.

Partnership Opportunities

- Character-Defining Features – The draft list of character-defining features should be formalized and vetted by DCNR partners – in cooperation with the agency, PHMC-PASHPO, and with input from NPS and the FODC. This may be accomplished by convening a short-term committee of the CAC with the task of creating a list that describes the essential resources that define the Delaware Canal. Identifying character-defining features is important, and will be based on the NRHP/NHL properties inventory underway in 2016.
- Treatment Guidelines – The list of character-defining features is needed to inform the next task of developing treatment guidelines. This is a technical task that requires more in-depth analysis of existing conditions, restoration history, and potential options. For instance, if water is considered a primary character-defining priority to maintain the Landmark integrity, then all options for supplying and retaining water would need to be carefully assessed to draft treatment guidelines that serve all DCNR conservation decisions for the Canal. DCNR strategic partners can extend the CAC committee that developed the list of Character-Defining features to continue to work with technical experts to create a Treatment Guidelines Manual in cooperation with DCNR.
6.3 Local Historic Districts

Context

In 2016, there were 11 local historic districts listed in the National Register that overlapped or abutted the Delaware Canal, including:

- Bristol Borough
- Bristol Borough Industrial
- Yardley
- Brownsburg Village
- New Hope Village
- Phillips’ Mill
- Center Bridge
- Cuttalossa
- Lumberville
- Point Pleasant
- Uhlerstown

The resources within each district and the characters of each, help support the local context of the Delaware Canal, especially where there are shared areas of significance.

Challenges

Except for projects requiring consultation under Section 106 or the Pennsylvania History Code, a National Register historic district designation does not protect the asset from impact by private owners on their own individual resources. Impacts to individual contributing resources may also negatively impact the district collectively. Historic property owners can make any modification to their resources that are permitted by municipal ordinances. Zoning ordinances can vary greatly between the 18 municipalities that host the Delaware Canal. The historic districts of each village and local zoning within each municipality can be analyzed to assess the issues and opportunities that municipalities might encounter by approaching canal-area zoning collectively.

In a broader and more proactive context, the historic districts offer the potential to inform public understanding of the history of the canal and canal landscape – beyond the regulatory issues.

Partnership Opportunities

- Historic District Zoning Comparison – Strategic partners can work with DCNR, D&L, Inc. and local communities to conduct an assessment of existing zoning ordinances for the 18 municipalities that host the Delaware Canal – that identifies provisions that help protect or fail to protect the Delaware Canal. A multi-municipal approach to planning can attract additional partners, and offers the possibility of yielding multi-municipal actions such as establishing a Canal-wide “overlay district” that could help coordinate ordinance provisions for the Delaware Canal as a corridor.
6.4 Cultural Landscape

The NPS cultural landscape strategy originated upriver in the Delaware Water Gap National Recreation Area as a means to manage the historic Delaware River villages that had been acquired and razed to build the Tocks Island Dam. When the project was halted and the remaining landscapes were transferred to the NPS to manage as a land-based park, the NPS developed its Cultural Landscape approach to conserve remaining historic fabric and to interpret history without the full integrity of the original resources.

The cultural landscape also focuses on the broader context of places, rather than relying on a single or clusters of artifacts or areas of significance— as described in a NRHP. A cultural landscape may resemble a historic district in some ways, and is especially versatile for presenting multiple layers or periods of significance for a site or a region.

The Delaware Canal is a cultural landscape that within its boundaries and multiple layers of overlapping cultural uses surrounding it—such as the local villages, mills and early industry, the river road, river ferry crossings, and early recreation uses to name just a few.

Challenges

Cultural landscapes typically begin by acknowledging that there is a collection of resources—physical and human, that are important to conserve. The first step is to use the NPS process to conduct a Cultural Landscape Assessment (CLA) that can identify, quantify, and assess elements that contribute to the cultural landscape. The second phase of cultural landscape planning is a Cultural Landscape Report (CLR) that is used to develop and set forth a strategy for conserving the elements of the cultural landscape. A cultural landscape does not equate to a NRHP or NHL designation, but may very well include resources of either within its geographic boundaries.

The Delaware Canal deserves a CLA as an organizing tool that can identify, quantify, and create a database of visual “values” that is quantifiable, represents a rationalized assessment of aesthetic values; and identifies the contributing resources that need to be actively conserved or restored to maintain the visual integrity of the corridor. Partners with interests in maintaining the visual integrity along the Delaware Canal corridor include: tourist promotion agencies in two states, the counties, local municipalities, D&L, Inc., NPS, and economic development partners at all levels.

Partnership Opportunities

- Cultural Landscape Assessment—DCNR and strategic partners can conduct a Delaware Canal CLA as a logical next stage of planning following the Vision Study. DC21 and D&L, Inc. can continue the successful public process by focusing the region-wide outreach process at the municipal level. The CLA will address the Delaware Canal itself, but will probe deeper into the historic and current social and economic aspects of the communities directly outside the state park jurisdiction. The visual values survey and the preliminary stormwater studies are examples of two related resources that will inform a CLA for the Delaware Canal.

- Visual Values Survey—A visual values survey is a rationalized process that uses criteria developed by NPS to set values and identify resources of positive and negative visual quality for a given area. The highly scenic visual quality along much of the Delaware Canal has never been assessed, nor have the values of contributing visual elements been quantified as a tool for helping to conserve them. A Visual Values Survey for the Delaware Canal could be designed by adapting NPS criteria for a corridor assessment between Bristol and Easton. The NPS process enables visual surveyors to minimize subjectivity and create a database of visual “values” that is quantifiable; represents a rationalized assessment of aesthetic values; and identifies the contributing resources that need to be actively conserved or restored to maintain the visual integrity of the corridor. Partners with interests in maintaining the visual integrity along the Delaware Canal corridor include: tourist promotion agencies in two states, the counties, local municipalities, D&L, Inc., NPS, and economic development partners at all levels.

Context

The NPS defines a “cultural landscape” as: “…a geographic area, including both cultural and natural resources and the wildlife or domestic animals therein, associated with an historic event, activity, or person, or exhibiting other cultural or aesthetic values.

The Delaware Canal is a cultural landscape in addition to its National Register of Historic Places and National Historic Landmark designations. Cultural landscapes are a tool created by NPS to assess and manage heritage landscapes that were too large for individual NRHP designation, or locations that remained culturally important, but had lost the level of historic integrity needed to qualify for the NRHP. Cultural landscapes are not designations, and do not need to meet NRHP/NHL criteria.
6.5 Conservation Options

Context

Conservation is a broader approach to stewardship historic resources than “preservation” which implies that artifacts can be stopped from deteriorating. A Conservation strategy acknowledges that all resources will deteriorate over time and the treatment plan evolves over time. Decisions for the Delaware Canal need to result from clear policies that include input from the public, agency and technical professionals. The need for early clear, rational, and consistent communications are is the key to achieving the preferred conservation treatments for the Delaware Canal. Treatments must meet the Secretary of the Interior’s Standards for the Delaware Canal to retain NRHP and NHL eligibility.

Challenges

Treatment options must address the loss of canal fabric and features over time, not only those caused by previous owners and DCNR actions, but also by private property owners along the canal.

As state administrations change over time,

Delaware Canal supporters need to continually adapt with partnership strategies that supplement the budget and technical capabilities of DCNR. Without this proactive process, conservation policies are likely to default to DCNR budget-driven decision-making only.

Treatment Priorities are policies that DCNR can craft with its partners as a set of principles for conservation for Delaware Canal resources. The priorities should be based on specific conditions, such as supplemental funding, management, and service partnerships. Specific conditions should be those related to the material situation of the canal feature, not particular agendas of partners,

Partnership Opportunities

- Treatment Priorities – Identifying preferred treatment priorities can begin before a Treatment Guidelines manual is completed. Treatment priorities would represent fundamental DCNR policies – such as a Watered Canal Policy; a Constriction Elimination Program; modernization of hydraulic structures; and/or specific levels of aesthetic treatment for all projects. Strategic partners can assist DCNR to develop a Treatment Priority statement to be used as the framework to determine schedule, budgeting, and treatment decisions for all proposed projects within the Delaware Canal.
6.6 Education

Context

Education opportunities about the Delaware Canal already exist within DCNR and its partner organizations. DCNR staff conduct outreach education programs at more than 25 schools in the Delaware Canal region. D&L, Inc. has merged with the National Canal Museum and they share a joint office and interpretive center in Easton. FODC conducts regular public education sessions including guided walks along the Delaware Canal.

Challenges

Various education challenges are addressed in sections:

- 5.4 Signage - Delaware Canal Interpretive Strategy
- 5.6 Interpretation / Education - Georeferenced Audio Tour

Partnership Opportunities

- DCNR School Outreach – The DCNR school outreach program is a critical public sector element in a strategy to foster a culture of future Delaware Canal stewards within the younger generations of the region. Funding for this program staffing and presentation development needs to be protected within the state budget. DCNR seeks student interns for summer service support positions, and this practice might include future GIS data processing assistance.
7. CIVIC

The Delaware Canal is intimately connected to its local communities at multiple levels and the resource serves important civic functions that often overlap the jurisdictions of various agencies and social organizations; including: recreation; social, economic; education; environmental; public safety; and transportation.

The Vision Study process also identified many opportunities to broaden existing and create new social partnerships between private, county, state and federal partners to help integrate the Delaware Canal into the fabric of the local communities.

Aspects of the Delaware Canal related to community development include:

7.1 Park-Community Integration

7.2 Economic Development

7.3 Transportation

7.4 National Heritage Area / Wild and Scenic River
7.1 Park-Community Integration

Context
The geographic and social networks within each community determine the opportunities to incorporate the Delaware Canal into the network of local cultural places and events. The Delaware Canal cleanups and walking tours organized for decades by the FODC are community-building events that also benefit the Delaware Canal State Park, including public education and annual maintenance services provided by volunteers along the 60-mile corridor. Many developments use proximity to the Delaware Canal as a marketing tool. Many commercial establishments orient and feature the nearby Delaware Canal. A watered Delaware Canal as a firefighting resource is a major element of community safety and preparedness.

Challenges
The linear nature of the Delaware Canal generally makes the state park challenging as a place for large public gatherings, although there are probably locations, such as Washington Crossing State Park, where those resources can be used to support community events that feature the Delaware Canal.

The Delaware Canal State Park requires use permits and insurance coverage by partners to use the Park facilities for public / charitable purposes. These events are limited by space and times.

Partnership Opportunities
- Events Integration – The Delaware Canal is used by non-profits to sponsor marathons as fundraising events for charitable causes. Social events might be also adapted to specific locations along the Delaware Canal – perhaps at the portal locations, as they are developed with basic public services.
7.2 Economic Development

Challenges

The Canal Boat tour on the Delaware Canal in New Hope has been a traditional recreation opportunity that DCNR seeks to continue through a new concessionaire agreement. By negotiating a modern public-private partnership model to restart the Canal Boat operations, DCNR may begin to foster other similar opportunities along other sections of the Delaware Canal.

Business advocacy organizations can serve as strategic partners that may feature the Delaware Canal in their marketing and business strategies – and generate increased public awareness and help to supplement funding as benefits to the Delaware Canal. Care needs to be taken regarding commercialization of the Canal.

The D&L Economic Impact Analysis identified the benefits of the Delaware Canal as an economic attraction and generator, but to date, no study has been conducted for the Canal as a comprehensive economic asset – including its value to: area real estate; public safety, stormwater management, the sports recreation sector, and other economic factors.

Partnership Opportunities

- Canal-River Promotion – Business interests in New Hope, PA and Lambertville, NJ created a bi-state Chamber of Commerce in 2015 to jointly market the complementary river communities. Both towns cultivate tourism economies and both host historic-recreation canal trails. The joint chamber decided that the Delaware River is a common bond, not a barrier, and have begun to envision cooperative efforts at regional marketing of the two towns within the Delaware River valley. Bucks County Visitors Bureau and the Lehigh Valley Visitors and Convention Bureau each have different regional agendas, but the Delaware Canal traverses both, and may present similar opportunities to work jointly. All these possibilities depend upon a reliable product that can be marketed with confidence – specifically a watered Canal. The difference between a Canal emptied for a month-long repair project during peak visitation season or a watered canal with all its recreation potential and aesthetics, can profoundly affect user satisfaction and make the difference in real economic terms between visitors choosing to return and recommend the experience to friends, or not. The Vision Study findings present the reasons for business and tourism partners to expect and actively request DCNR to adopt a Watered Canal Policy.

- Economic Benefits Analysis – D&L, Inc. commissioned the D&L Trail Economic Impact Analysis to assess the benefits of the D&C corridor as a regional tourism income generator. The D&L analysis is specifically geared to the tourism economy and presents the findings by corridor segment. Not surprising, the segment of the Delaware Canal between New Hope and Washington Crossing shows high returns from tourism. The D&L, Inc. study does not assess or quantify comprehensive economic benefits of the Delaware Canal – which include, but are not limited to: real estate values; stormwater management values, firefighting safety infrastructure values; fishing and birding conservation and ecotourism values; potential values from hydro-electric generation or potable water supply. The D&L, Inc. study also did not project the potential increases in the tourism economy if specific investments were made in the Delaware Canal. A comprehensive Economic Benefits Analysis should be supported by DCNR and DCED, and could be managed by DCNR strategic partners. The effort should enlist all levels of the regional civic and business communities and investigate more deeply into the tourism potential of the Delaware Canal specifically. The analysis could begin where the Return on Investment canal trails. The joint chamber decided that the Delaware River is a common bond, not a barrier, and have begun to envision cooperative efforts at regional marketing of the two towns within the Delaware River valley. Bucks County Visitors Bureau and the Lehigh Valley Visitors and Convention Bureau each have different regional agendas, but the Delaware Canal traverses both, and may present similar opportunities to work jointly. All these possibilities depend upon a reliable product that can be marketed with confidence – specifically a watered Canal. The difference between a Canal emptied for a month-long repair project during peak visitation season or a watered canal with all its recreation potential and aesthetics, can profoundly affect user satisfaction and make the difference in real economic terms between visitors choosing to return and recommend the experience to friends, or not. The Vision Study findings present the reasons for business and tourism partners to expect and actively request DCNR to adopt a Watered Canal Policy.

Context

The value of the Delaware Canal to local, regional and state economies is documented in the previously published D&L Economic Impact Analysis. Participants in the Vision Study supported the public consensus that a fully watered Delaware Canal is more valuable to tourism, real estate values, and other economic factors than a dry Canal.

The business sector has opportunities, similar to the charitable communities, to partner with DCNR on many levels to utilize and support the Delaware Canal – such as municipal park improvements that support public use of the Delaware Canal and result in recreation service improvements.
7.3 Transportation

Challenges

River Road in Bucks and Northampton Counties evolved from Native American trails that predated the Delaware Canal. The 1831 construction of the Delaware Canal predated modern improvements of the river trail into a road. Well into the 20th century, sections of the adjacent River Road remained unpaved. When paved as a state highway, geology, topography, the River, the Canal, and pre-existing structures all impacted its alignment and scale to this day.

Those physical constraints have produced one of the most dramatically scenic drives on the East Coast. They have also resulted in an organically developed infrastructure that is most challenging to reconstruct, repair, and maintain.

River Road can be conceived as a national attraction in itself. Coupled inseparably with the Delaware Canal and Delaware River in many places, together they become a multi-jurisdictional resource management challenge in the places of highest scenic values.

River Road was individually evaluated for eligibility for listing in the NRHP and was determined not eligible, with PHMC concurrence. Current partnership efforts such as the PennDOT NRHP inventory assessment is a start toward documenting resources and planning treatment programs for a portion of River Road where it may impact the Delaware Canal historic resources. Stormwater management issues from River Road runoff is not included in the PennDOT cultural resources inventory process, nor are areas of River Road that do not impact the Delaware Canal. These and other issues require an independent assessment of River Road as a scenic resource in itself.

Routes 32 and 611 that run parallel to the Delaware Canal are designated as a Pennsylvania Scenic Road but a case can be made to designate them as a Pennsylvania Scenic Highway, as is the Blue Route (the Mid-County Expressway between Plymouth Meeting and Chester, PA). The case for River Road is obvious, but what the "scenic" designation means to conserving the resource is not defined, and should be.

A Visual Values Survey of River Road is inseparable from the aesthetic survey of the Delaware Canal in many locations – both as vista and vantage locations. Both share and are each other’s visual resources, including surrounding cultural improvements, the vegetated mountainside, the river, and New Jersey vista.

Partnership Opportunities

• Scenic Highway Designation – Defining the visual values of River Road as a state scenic highway is an essential step toward creating a mutual operations link between the Canal and the Highway. The river walls of the Delaware Canal are the first line of defense for River Road from river flooding. River Road is an intervention device for stormwater impacts to the Canal in many places where the palisades of the mountainside funnel local drainage through the River Road right of way, before depositing stormwater in the Canal. The common needs of PennDOT and DCNR as stewards of these resources can also be articulated as common goals in a Visual Values Survey.

• The survey can explore the following questions: Why can’t transportation funding to repair River Road retaining walls include aesthetic provisions? Why can’t stormwater funding be integrated into PennDOT River Road projects to the benefit of both resources? Given the significance of the landscape, all projects along most of River Road have the high potential to produce significant visual impacts. River Road is critical to the long-term sustainability of the Delaware Canal. Delaware Canal advocates can be central to a coalition of government, civic and advocacy organizations that work with the Delaware Canal Caucus (at the State House in Harrisburg) to create a template that gives a meaningful purpose to the River Road State Scenic Highway designation. The Scenic Byways program is a good model to begin with, whether or not a “Scenic Byway” designation is ultimately pursued. PennDOT can be a partner in funding this work.

Context

The Delaware Canal was once the primary transportation corridor for the region, an alternative to overland or river travel. Today, residents and visitors use multiple roadways and trails to reach the Delaware Canal as an alternative transportation route and recreation destination. Portals suggested for the Delaware Canal are located based on intersections with major trails, roadways and population centers. Unless walking or biking locally or arriving by transit, most Delaware Canal users arrive via River Road – also known as PA Routes 32 and 611.
Context

The federal Wild and Scenic River program is administered by the NPS under Department of the Interior regulations. The National Wild and Scenic Rivers System was created by Congress in 1968 to preserve certain rivers with outstanding natural, cultural, and recreational values in a free-flowing condition for the enjoyment of present and future generations. The Lower Delaware River was included in the program in 2000 as a "recreational" river. The Lower Delaware River Wild and Scenic (LDRW&S) designation runs generally concurrent with the Delaware Canal between Easton and Washington Crossing – with some segments of the Delaware River that are not included in the designation as a concession to pre-existing industrial uses on the River. Other segments of this corridor are not included in the designation because municipalities on opposite sides of the River did not adopt the original designation. The Delaware Canal and several of the tributaries that flow under it are included as resources in the Wild and Scenic designation for the Lower Delaware River.

Challenges

The Wild and Scenic Rivers program represents an organizing opportunity for local municipalities on both sides of the Delaware to combine efforts to conserve the quality of the Delaware River and the contributing natural and cultural resources that define this section of the river valley.

Partnership Opportunities

- Expand NGO partnerships – Delaware Canal strategic partners can reach out to LDRW&S partners to begin discussions of potential partnership opportunities. This fertile ground can be worked as a subcommittee to the LDRW&S program or some other mutually beneficial mechanism.
- Expand D&L, Inc. programs and partnerships - that support the Delaware Canal reach of the Delaware & Lehigh National Heritage Corridor, including the Landmark Towns Program, which has been incorporated into the Trails Program to improve connections between the different Landmark Towns.

Recent 2016 changes in the LDRW&S organization – administered by NPS, include; elections of new local leadership; revisions to the bylaws; and official commitments by local municipalities. The Delaware River Greenway Partnership and the Natural Lands Trust are key organizational partners that have provided organizational and management support to this volunteer program.

There appear to be mutually-beneficial opportunities for the members of the LDRW&S program to cooperate with DCNR strategic partners on common goals, such as scenic and water quality in the Delaware Canal; protection of Delaware Canal resources from impacts resulting from proposed gas pipelines; River management of the Lehigh and Delaware by the DRBC; and water trail recreation – to begin the potential list of collaborative opportunities.
8. ENVIRONMENT

The Delaware Canal environment is a narrow green and blue ribbon that winds through the geological river landscape of Northampton and Bucks Counties. Over its 60-mile path, the canal shape changes little as a man-made micro-environment within its evolving surroundings. The watered canal creates a habitat for aquatic species along its entire length. The trail and waterway support terrestrial and bird species as a habitat, even within the most densely populated southern reach. Managing the Delaware Canal environment as an independent, yet integrated system within the greater ecosystems surrounding it is the largest environmental challenge that DCNR faces.

Aspects of the Delaware Canal related to the environment include:

8.1 Habitat
8.2 Vegetation
8.1 Habitat

Context

The naturalized, human-made watered environment of the Delaware Canal is of greatest concern. Terrestrial and many bird species use the Delaware Canal corridor regardless of its watered status. The same is not possible for aquatic species. Portions of the Canal are habitat to red-bellied turtles.

Challenges

Over the decades, there have been many fish kills in the Delaware Canal due to unanticipated breaches in the prism or structural failures. DCNR and volunteers attempt to rescue and migrate fish to other sections or to the Delaware River when breaches or dewatering for construction has occurred in the past. These emergency interventions are not always completely successful. The loss of aquatic habitat limits the viability of aquatic species in the Canal, which affects other species that use the Delaware Canal as habitat and food source.

Since the floods of 2004, 5, and 6, the stocking of trout in the Delaware Canal was stopped for years by PA F&BC because the Delaware Canal was an unreliable watered habitat. Fish stocking resumed in sections in 2010. In April 2016, DCNR had completed repairs from the three floods, plus repairs of issues caused by the extended period of a dewatered Canal. Water began to fill the northern section of the Canal.

In 2016, there was a fish kill below and above the Conrail obstruction, just south of Morrisville in Falls Township. DEP responded and determined that there was almost no dissolved oxygen in the Canal water. Reasons for the lack of dissolved oxygen were not given, but the location is where the Conrail obstruction restricts water flow in the Canal.

The incident illuminates the multiple demands on DCNR – not to just keep the Canal filled with water, but to ensure its flow and water quality for all species.

Partnership Opportunities

- Fish Stocking – DCNR, Delaware Canal supporters and sports fishing organizations should meet with representatives of PA F&BC to seek partnership from the agency with DCNR for maintaining a watered Canal. A DCNR Watered Canal Policy is needed to reduce the risks and emergency staff response costs to fish kills in the Canal.
- Red Bellied Turtles – DCNR and partners can work to ensure the survival and protection of red bellied turtle habitats and nesting areas within the Canal. This threatened species makes its home in the Canal waters and can hibernate here in the winter months. If water levels drop due to Canal projects or low rainfall, they and their nests are at risk. Partners and community groups can help DCNR by relocating the turtles to habitation in overlapping watersheds when these events occur.
8.2 Vegetation

Context

Vegetation on elements of the Delaware Canal is an early bioengineering technology that remains an epitome of green infrastructure. Grass roots have historically anchored the clay soils of the towpath and prism from flood erosion, as the grass leaves lay flat to create a living armor against erosive currents. During commercial operations, the company maintained the waterway clear on the berm side.

Challenges

DCNR regularly mows the towpath and exposed surfaces of the prism when the Canal is watered. Dewatered sections of the Canal are left unmaintained by DCNR until ready to be re-watered, and usually must be cleared of woody volunteer species growth.

Maintenance of the inland berm side vegetation is usually beyond DCNR capability for regular maintenance and the tasks are often assumed by adjacent property owners or left unmaintained until a tree falls to block the waterway.

The volunteer woody vegetation that has seized a foothold in the stone river walls is ultimately destructive as the tree roots expand to displace stones. But attempts to remove the living roots completely pose the real risk of weakening the wall structure. The program to solve river wall vegetation issues will evolve as part of the DCNR-ACOE cooperative efforts to manage the River walls.

During the Vision Study process, the concern emerged that grass and invasive plants were not native species and that the Canal should be planted with low maintenance indigenous species. Due to the biomechanical functions of the grass vegetation, it is not recommended to modify the historic green infrastructure on the towpath and prism surfaces.

Partnership Opportunities

- Invasives / Maintenance – A Watered Canal Policy eliminates the periodic demands of clearing opportunistic vegetation in the Canal prism. A watered canal also reduces the risks of prism failures due to drying and shrinking of the clay liner – that leads directly to increased vegetation maintenance. One opportunity to maintain vegetation and reduce the incidence of invasive plants is for volunteers to form a partnership with DCNR to clear different sections of the berm and land adjoining the towpath every spring or fall. Coordination of DCNR staff and volunteers, equipment and insurances will be required to conduct this program. An alternative to trained volunteer support has not yet been identified.
DCNR administrative tasks of managing the Delaware Canal waterway are complex and challenging. The Vision Study did not delve into a deep analysis of DCNR administrative procedures, however ideas did emerge during the public process that were not project-specific, but managerial in nature and functions.

The broad spectrum of administrative tasks for the Delaware Canal were distilled into four basic categories:

1. Physical Plant – Inspections, Records, Operations (hydraulic)
2. Maintenance – Preventative, Annual, Periodic, Capital
3. Management – Staff, Training, Programs, Budgets, Compliance
4. Planning – Economic, Strategic, Partnerships, Marketing

This categorization may not be the way that DCNR conceives the organization of its stewardship, but for the purposes of the Vision Study, it provides an understandable framework of responsibilities. A brief discussion of each administrative category is provided, including partnership opportunities that may not have been identified in other sections.
1. **Physical Plant**

The "physical plant" addressed stewardship of the canal and ancillary structures.

1.1 Inspections

DCNR performs all levels of facilities inspections to maintain the Delaware Canal State Park. The most critical are safety inspections of structures.

Canal bridges are inspected every two years by DCNR.

Since the High Falls Culvert failure in 2015, DCNR has added culverts under the Canal to its inspections protocol. DCNR is in the process of developing a culvert location plan – which can be added to the GIS database that was developed during the Vision Study. The DCNR inspection schedule of its culverts under the Canal needs to be expedited, for safety, proactive maintenance and water management.

River walls pose safety and capital maintenance issues similar to Delaware Canal culverts. The river wall inspection and assessment process began in 2015 between DCNR and ACOE. The ACOE has identified funding to advance the partnership to the next stage. This DCNR-ACOE partnership needs to be fully realized, since river issues are fundamental determinants of Canal operations, maintenance and safety. State and federal legislators can actively position the Delaware Canal as critical public infrastructure on the Delaware Canal State Park.

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1.2 Records

Careful and accessible record-keeping is a due diligence responsibility of DCNR that would be best performed at the state park and regional engineering levels – to be most useful and accessible.

Good record keeping is an administrative cost that must be methodically maintained, and it is absolutely essential to manage a hydraulic system of this size and complexity under a modern stewardship program. The business of maintaining 19th Century resources can be improved by employing 21st Century information technologies. DCNR can work with its strategic partners to enlist legislators to deliver the support needed to improve Delaware Canal recordkeeping.

Refer to partnership opportunity 1.2 - GIS Recordkeeping under the Elements Section.

1.3 Operations (hydraulic)

Public Vision Study responses were clearly in favor of maintaining a watered Canal for its entire length. Maintaining consistent water flow is the primary water stewardship responsibility of DCNR. Managing the hydraulics of the Delaware Canal begins with proactive monitoring, management and upkeep of the two river dams.

Inlet and waste gates have always been operated by hand at each location, using the anecdotal history of the Park staff and judgment of the superintendent and regional engineers under each unique weather and construction scenario. There have never been monitoring devices within the Canal to capture data about the relationships between flood levels, Canal flows and releases. The structures elevations, prism capacities between locks; varying flow rates; are now beginning to be investigated in 2016 as basic engineering data that are essential to operate the historic waterway using smart modern methods. The 2016 Preliminary Stormwater Study has begun to quantify preliminary engineering data based on local watershed and generalized Canal dimensions. Subsequent work will be needed.

In the near term, DCNR staff needs to be debriefed and their collective institutional knowledge compiled into an operations history document. This work should capture the knowledge of former staff who have retired or transferred from Delaware Canal State Park.

DCNR needs to adopt a Watered Canal Policy to help protect its hydraulic operations investments. Engineering budgets can no longer be the default determinate of watering policies. Without a full commitment to a watered Canal, each new remedy is undermined by the many detrimental structural effects of a dry canal. DCNR needs to rely on its strategic partners to engage legislators to revisit budget and policy assumptions that have never succeeded in watering the Delaware Canal.

Temporary pumps are emergency augmentation water sources in the overall hydraulic operation of the Delaware Canal and are a cornerstone of a Watered Canal Policy. Strategic partners need to engage legislators to revisit policies and budgets to find ways to ensure that temporary watering measures are required and funded for all non-disaster issues on the Canal.
2 Maintenance

There are at least four types of maintenance operations required for the Delaware Canal, including: preventative, annual, periodic, and capital.

2.1 Preventative

Preventative maintenance is work performed to pre-empt emergency maintenance. In the best case scenarios, these actions reoccur on a regular basis for many operational items. Clearing berm side vegetation and invasive species might be one example of preventative maintenance. Plugging leaks in waste gate walls are preventative actions that can help prevent wall breaches. Generally staff and budget limitations and a high occurrence of emergency structural breaches all contribute as constraints to the ability of DCNR to perform systematic preventative maintenance. Contributing to the difficulty of creating a proactive preventive maintenance program is the missing recordkeeping data base system that could help DCNR and partners to analyze and prioritize needs and locations.

2.2 Annual

Annual maintenance is performing regular services, such as mowing grass, maintaining restrooms, and general facilities upkeep. These maintenance tasks and costs are important fundamental budget items of any state park. They cannot be cut without immediate public reaction to the curtailing of services. It is difficult for DCNR to justify expanding types of services or geographically within state park budgets that have been generally capped at the rate of inflation for the past decade. Investigation of economic development partnerships might include appropriate concessions where a lessee assumes some annual maintenance costs – such as restroom maintenance or mowing in those sections.

2.3 Periodic

Periodic maintenance includes upkeep such as tree maintenance, painting, plumbing upgrades, roadway repairs, etc. These costs are funded as part of the annual Delaware Canal operating budget, but only priorities are completed within the line item budget for each year. Sustainable design is now a mandate for DCNR design projects – both in-house and for its local clients funded by DCNR. In every case, the value of upgrading materials for increased service life needs to be continued to be assessed by DCNR and partners. One example of conscious life-cycle investments into higher grade materials on the Delaware Canal is the Tohickon Aqueduct, which in 2001 upgraded galvanized hardware for stainless, steel roofing for copper; and cedar siding for lower species. If DCNR partners are aware of the projected DCNR maintenance priorities, there may be ways for partners to supplement the DCNR budget to enable specific projects to afford material upgrades that increase service life.

2.4 Capital

Capital maintenance projects are major improvements, often structural that are required due to weather damage, fatigue, and/or end of useful life replacements. All bridges, aqueducts, locks and major wall projects are normally considered capital budget projects that are funded separately from the state park operations budgets. DCNR maintains its own list of capital projects within a general priority order. The most recent version was published as a Master Project List by DCNR in June 2015. The list of priority projects remains flexible for DCNR to be able to respond to inevitable issues that have not been predicted – such as flooding and structural failures. The Vision Study identified a range of partnership opportunities, including capital maintenance needs that are not yet on the DCNR Master Project List.
3 Management

There are at least five major management responsibilities for DCNR. Some are standard for all state parks. Some are unique to the Delaware Canal.

3.1 Staff

DCNR staff are required to perform multiple functions, including: administration, community liaison, policy interpretation, agency coordination budgeting, record-keeping, environmental education, policing, site maintenance and “minor” repairs.

The DCNR staff hierarchy for Delaware Canal State Park at the time of the Vision Study includes the DCNR Secretary, Bureau of State Parks Director, Regional Director, and Delaware Canal State Park Superintendent and assistant Superintendent.

DCNR also has an in-house design section called the Bureau of Facilities Design and Construction, with staff of engineers, architects and technicians that operate at the Central Office and regional levels. At the time of the Vision Study, the BFD&C Director, and the regional engineer were overseeing Delaware Canal projects. Within the recent past, DCNR has added a full-time engineering staff position dedicated to the Delaware Canal State Park under its regional BFD&C office. The importance of this DCNR decision deserves recognition.

For some Delaware Canal capital projects, the design and construction is administered by the PA Department of General Services (DGS) and DCNR acts at the client agency. An example of this interagency collaboration was the Delaware Canal Visitor Center Study for New Hope in which DGS ultimately recommended to search for other sites that were more suitable.

3.2 Training

Delaware Canal State Park staff are trained under the DCNR system to serve as stewards for the broadest variety of conservation and recreation services across the Commonwealth. With this training DCNR staff are exceptionally qualified to perform most park stewardship tasks in the Commonwealth – except for perhaps the Delaware Canal – which presents the most unique management challenges and requires on-the-ground training to manage an active historic waterway.

During the Vision Study process the Superintendent and the Assistant Superintendent both left the Delaware Canal for assignments in other state parks. Earlier in 2015, the new engineer assigned specifically to the Delaware Canal State Park passed away suddenly. These examples demonstrate the fragility of the institutional knowledge about operating the extraordinarily complex Delaware Canal hydraulic system.

The Vision Study identified at least two partnership opportunities that can help codify all the institutional knowledge with DCNR, as well as share operation experiences with other canal experts in North America. Establishing and maintaining a modern record-keeping system is essential for documenting conditions, assessing challenges and requires on-the-ground training to manage an active historic waterway.

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3.3 Programs

DCNR staff provide a range of educational, historical and recreational programming for community members and schools as a means to foster an understanding and appreciation of the natural and cultural resources present at the Canal. Programming for school-age children is especially essential as it cultivates an early sense of stewardship that can carry forward to adulthood.

Programs:

Environmental

- Birds and Boats
- Birds / Raptors
- Boating Water Safety Awareness
- Ecosystems / Trophic Pyramids
- Forest Values
- Introduction to Watersheds
- Orienteering
- Problem Solving / Team Building
- Signs of a Healthy Environment
- Survival
- Wildlife Populations
- Water Ecology and Monitoring
- Watershed Field Study
- Bus Tour, River Tour and Shad Ladder Tour
**Historical**
- Lock Tender’s House and Canal Boat Ride
- Life on the Canal
- Historic Bus Tour
- History Hikes
- Location-Based Programs
  - Innovation and Industry along the Canal
  - Flat-Bottomed Boats and Iron Furnaces
  - Mystery of the Vanishing Canal

**Recreational**
- Hikes
- Canoeing and Kayaking
- Rock Climbing
- Digital Photography
- Wildlife and Plant Identification
- Fishing

**Teacher Workshops**

### 3.4 Budgets

The two major sources of state funding from which allocations for state park operations are obtained are the General Fund and the Oil and Gas Lease Fund. The General Fund is the state’s largest fund and is comprised of tax revenue, non-tax revenue and federal grants and entitlements not placed elsewhere. Ninety-seven percent of the revenue in the General Fund is made up of tax revenue. The Oil and Gas Lease Fund is made up of revenues from rents and royalties from oil and gas leases of state-owned lands. Since 2010, the share of state park appropriations from the Oil and Gas Lease Fund has been steadily increasing as an act passed in 2009 provides for $50 million in yearly appropriations from this fund to DCNR.

<table>
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<th>Year</th>
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<th>Delaware Canal State Park Appropriation (in millions)</th>
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Source: Pennsylvania Office of the Budget

### 3.5 Compliance

Below is an outline of general compliance regulations from jurisdictional state and regional agencies that DCNR has to meet for Delaware Canal State Park:

- DRBC - Water withdrawals
- ACOE – Various structures, river walls
- FBC - Fishing and boating regulations, endangered species regulations, construction in waterways
- PA Game Commission - Hunting regulations, endangered species regulations
- DEP - Water quality in regards to sewage treatment, erosion and sedimentation regulations, construction in waterways
- County Conservation Districts - Erosion and sedimentation regulations, habitat quality
- NPS - National Register of Historic Places regulations, Wild & Scenic River Program regulations
- PHMC - Historic preservation regulations
- PennDOT - Right-of-way and public access, roadway construction regulations
4 Planning

A master plan document for the Delaware Canal was created in the 1980s by the Bureau of State Parks under the DCNR predecessor, PA Department of Environmental Resources – carried out by the Friends of the Delaware Canal. The 2016 DCNR Master Project List identifies a $90M budget for capital improvements. The Delaware Canal Vision Study 2016 represents the next phase of planning that has enabled the public to think creatively and not necessarily be encumbered by past practices. The Vision process was carefully planned, openly developed, and respectfully negotiated between partners and DCNR to ensure that innovative ideas could be expressed and discussed in an open forum without necessarily advancing to future stages. The Vision Study will serve as a model of planning that can inform subsequent initiatives between partners and DCNR.

There are at least four general categories of planning functions needed for the Delaware Canal, including: economic, strategic, partnerships, and marketing.

4.1 Economic

Economic planning for the Delaware Canal needs to expand beyond Commonwealth budget negotiations and state park allocation planning. This process can happen through partnerships. The Vision Study articulates a consensus that acknowledges partnerships as the primary strategic method to planning a sustainable economic matrix for the Delaware Canal. Strategic partners are essential to formulate new strategies and help negotiate those partnerships – from conceptual discussions to legislative and executive actions.

The economic sustainability ideas that have emerged from the Vision Study include:

- Government partner funding (non-DCNR sources) – county, state, regional, federal

These supplemental sources might fund multiple forms from capital projects; water bills on tourism imperatives or public safety, or acquisition of new access sites. Options need to be explored. Strategic partners can take the lead with DCNR and legislators

- Public-private partnerships (Odette’s, Outfitter/service concessions)

The Odette’s rehabilitation project is an example of a public-private partnership where capital improvements to critical historic infrastructure are funded by the private sector in exchange for concession rights to parking from the Commonwealth. The formula for each potential partnership will be unique, DCNR will be the arbiter to ensure that partnerships directly benefit the public.

- Public Bank financing (eg: Public Bank of North Dakota)

The Bank of North Dakota is a publicly-owned bank that deposits public funds (tax revenues, pension funds, etc) into its own reserve that is used to guarantee small private banks loans to public and private projects that are determined to be in the best economic interest of the people of North Dakota. The interest paid on the loans goes back into the loan pool or used to fund public needs. In January 2016, the Philadelphia City Council held a public hearing on Public Banking to investigate the North Dakota public banking system as a possible model for funding sustainable public infrastructure investments that pay returns, such as stormwater management and photovoltaic solar. A public bank can be created at a county or state level, with investment goals that include repairing public infrastructure, such as the Delaware Canal. Strategic partners can help advance the county and state investigation of this alternative to paying high fees and interest costs for private bonds to fund public infrastructure – with public money.

4.2 Strategic

Strategic planning begins at the conceptual level – such as the 2016 Vision Study, and can extend deeper into the details of operating the Delaware Canal. The Canal Advisory Committee (CAC) was formed by DCNR as forum for the agency to interact with its local constituents is one of two such local-state park councils in the Commonwealth. (The other is Presque Isle State Park.) The CAC convenes quarterly and communication extends in both directions. However the current capacity of the CAC does not include committees to actually conduct strategic planning work. The opportunity exists to re-envision the capacity of the CAC to include working committees – such as a strategic planning committee that can coordinate the efforts of various catalyst partners with DCNR and deliver completed committee work to DCNR. A strategic planning committee of the CAC would need to understand the details of DCNR annual plans for Delaware Canal State Park and perform work in advance that can contribute in a timely manner.

There are likely other opportunities that should be explored for partners to plan strategically together with DCNR.

4.3 Partnerships

Partnership building is an element of strategic and economic planning, but may be considered more of the outreach / ambassador planning functions. Each partner organization to DCNR has specific strategies to engage partners into active stewardship commitment to the Delaware Canal. There is an opportunity for strategic partners to coordinate their annual partnership strategies to maximize efficiency of efforts and results. D&L, Inc., DC21 and FODC, the three state partners to coordinate their annual partnership strategies to maximize efficiency of efforts and results.

The project partners identified ways that partnerships might be expanded in the future, including:

* Create / strengthen CAC subcommittees for trail, improvements, watering (existing), history, and nominations.
* Enlist greater municipal involvement in the CAC.
* Seek successful elements from the Presque Isle CAC to envigorate the Delaware Canal CAC.
* Continue to seek ways to partner with PennDOT.
4.4 Marketing

Past marketing actions regarding the Delaware Canal appear to be incidental and tangential to the primary marketing emphases within the two-county region. The reasons may be understandable due to damage/repair issues and previous networking policies by DCNR.

A Watered Canal Policy is an essential basis of a primary marketing campaign for a restored Delaware Canal system. An obstruction-free towpath is essential to a primary marketing campaign for the D&L Trail. These two objectives are not the same, but can both support a comprehensive marketing campaign for the Delaware Canal State Park. A Watered Canal Policy is needed because of the direction beyond the D&L Trail can be realistically discussed between DCNR, local, county and state visitor and tourism promoters.

The 2020 goal of an obstruction-free D&L trail has been negotiated with D&L, Inc., DCNR, PEC, and DVRPC as a critical goal to complete this major spine of the greater Philadelphia Circuit Trail system.

The Convention & Visitor Bureaus (formerly known as Tourist Promotion Agencies) representing the Delaware & Lehigh National Heritage Corridor (Bucks County, Lehigh Valley, Pocono and Luzerne County) have been meeting and financially contributing to a marketing consortium since the early 2000s. These partners are currently engaged in planning for the full connectivity of the D&L Trail and have met twice in 2016. The Delaware Canal region of the D&L Trail makes up 36% of the Trail and National Heritage Corridor.

This same consortium can help raise the profile of a watered Delaware Canal and all the associated amenities. CVBs seek to promote attractions that can deliver hospitality oriented features (parking, restrooms, amenities, lodging, etc.) The planned transition of the D&L Landmark Towns program to a more inclusive Heritage Towns platform would also help to improve the level of visitor services and connectivity to such services for the visiting public; increase the regional recreation and tourism economy; and generate income dedicated to the Delaware Canal.
This section lists the maps, graphics, data sources, public participation feedback, reference documents and other support materials that were used in the generation of this Vision Study.

1. Maps & Graphics – The following is a listing of maps and graphical displays produced for the Vision Study.

1.1. Vision Study Project Area Map - Our project base map which displays the Delaware Canal and its infrastructure within the context of its surrounding municipalities as well as the elevation changes at the locks from north to south. http://delawarecanalvision.org/wp-content/uploads/2015/06/150731_WaterSystemsMap.jpg


1.11. The Public Idea Process – A graphic that illustrates how public ideas were used to derive the study themes, principles and recommendations. http://delawarecanalvision.org/wp-content/uploads/2015/06/151117_Needed-ProjectsWeb.pdf


1.15. Backup Pump Watering Map – A map that displays the locations of 4 proposed pumps and the extent of the water flow for each pump from Easton to New Hope along with locations of future concepts to water the southern stretch. http://delawarecanalvision.org/wp-content/uploads/2015/06/160223_DC21MetEdGrant.pdf

2. Data Sources – The following is a listing of organizations that contributed GIS data files used to develop the mapping and graphical materials for the Vision Study.

2.1. Bucks County Planning Commission (www.buckscounty.org/government/CommunityServices/PlanningCommission)

2.2. Delaware Valley Regional Planning Commission (www.dvrcp.org)

2.3. Department of Conservation and Natural Resources (www.dcnr.state.pa.us)

2.4. Federal Emergency Management Agency (www.fema.gov)

2.5. Lehigh Valley Planning Commission (www.lvpc.org)

2.6. New Jersey Geographic Information Network (njgin.state.nj.us)

2.7. Pennsylvania Spatial Data Access (www.pasda.psu.edu)

2.8. U.S. Census Bureau (factfinder.census.gov/faces/nav/jsf/pages/index.xhtml)

3. Meetings – The following is a listing of meetings that were held to gather public and stakeholder feedback along with links to meeting notes and distilled ideas.


4. Findings – The following are the themes and principles that were developed from an analysis of the public participation feedback and which laid the groundwork for the Study recommendations.


5. Images – The following is a list of sources for the images used throughout the Study

5.1. Simone Collins Landscape Architecture
5.2. Delaware & Lehigh National Heritage Corridor, Inc.
5.3. Delaware Canal 21
5.4. Google

6. Reference Documents – The following is a list of previously published documents that were used for background research and analysis.


end of report