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Division of Water Supply Protection
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Archival Survival

DCR/MWRA Historic Record Now Available Online

Sean Fisher, DCR Archivist with Joel Zimmerman, DCR Regional Planner

Sylvio Casparis, president of one of the several construction companies hired to build the Wachusett Aqueduct, poses on horseback in 1897 at the mouth of the newly completed water conduit. This is just one of thousands of high-resolution historic images now available online depicting the life and times surrounding the building of the Wachusett Reservoir as well as construction and operation of other Boston area water supply infrastructure. More images are shown in the pages of this expanded edition of *Downstream*.



Cell phones are everywhere today, but one hundred and twenty years ago the folks building Boston's drinking water system could not take a selfie or a quick video to document their work. The Metropolitan Water Works (MWW) – predecessor to the Department of Conservation and Recreation (DCR) and the Massachusetts Water Resources Authority (MWRA) (see page 2) – relied on that era's state of the art technology, dry plate glass negative cameras, to take more than 6,000 photographs from 1895 to 1906.

They were documenting the expansion of Boston's water distribution system through the construction of the Wachusett Reservoir/Dam/Aqueduct, Sudbury Reservoir/Dam, and Weston Aqueduct/Reservoir. An additional 2,000 images were captured between 1907 and 1926 showcasing both buildings and operations. The 6.5" x 8.5" fragile negatives are similar to another technology that has been supplanted by the digital age: vinyl records. Like LPs, the negatives are bulky and difficult to store, but are a superior product for capturing detailed information (at least to many audiophiles).

DCR has collaborated with several partners to both safeguard

these notable images as well as making them available for public viewing in the internet age. This edition of *Downstream* provides some background to the multi-generational archival effort, teasing the reader with few of the pictures so that you will want to go on-line and explore the wealth of information now available at the click of a mouse or the swipe of a fingertip.

Early Storage

Nearly the entire collection of approximately 8,000 glass plate negatives (numbered sequentially from 1 through 7672, plus unnumbered and rejected negatives) had been moved to two Chestnut Hill Pumping Stations in Brighton by the 1920s. While not an optimal storage

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DCR and MWRA - Clean water partners

By Joel Zimmerman, DCR Regional Planner
Editors note: This article is reprinted from the Winter 2015 issues of 'Watershed Currents', the DCR/DWSP newsletter for Watershed Preservation Restriction (WPR) holders.

Over the past 175 years, there have been a dozen different names of government organizations responsible for the Boston area drinking water supply. Today, the Office of Watershed Management within DCR's Division of Water Supply Protection (DWSP) and the Massachusetts Water Resources Authority (MWRA) manage this vast resource. Why two agencies?

The MWRA's 1985 enabling legislation mandated the new independent authority to finance and repair the Boston region's water and sewer infrastructure, and act as the wholesale distributor of these utilities to the local

Metropolitan Water Works System Agency Names 1846 - Present	
Agency Name	Years
Boston Water Commissioners	1846-1850
Cochituate Water Board	1850-1875
Water Commissioners of the City of Charlestown Water Works	1862-1865
Mystic Water Board	1865-1875
Boston Water Board	1875-1895
Metropolitan Water Board	1895-1901
Metropolitan Water and Sewerage Board	1901-1919
Metropolitan District Commission (MDC), Water Division	1919-1985
Metropolitan District Water Supply Commission	1926-1947
<i>for construction of the Quabbin Reservoir</i>	
Massachusetts Water Resources Authority (MWRA)	1985-Present
<i>for supply aqueducts and distribution system (from the MDC Water Division)</i>	
MDC Division of Watershed Management	1985-2003
<i>for the Quabbin Reservoir, Ware River, Wachusett Reservoir, and Sudbury Reservoir watersheds</i>	
Department of Conservation and Recreation, Division of Water Supply Protection	2003-Present

There has been a succession of agency names that have managed the construction and management of the greater Boston drinking water supply. Across the generations, no matter the name, there has been a commitment to providing ample clean water to the citizens of the Commonwealth. Photograph of Sudbury Reservoir, 1898.

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Photo/Image Credits
 All pictures, unless noted otherwise, are from the Metropolitan Water Works Photograph Collection, available through Digital Commonwealth (www.digitalcommonwealth.org).

Page 3 DCR
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 Page 12 Top: DCR
 Bottom: Diane Petit, NRCS



MWW Truck #3, 1920

cities and towns. While MWRA got all the pipes and treatment facilities, the legislature maintained state control of the land and reservoirs, creating a Division of Watershed Management within the Metropolitan District Commission (MDC), DCR's predecessor agency (MDC and the Department of Environmental Management were merged in 2003 to become DCR). DWSP is required to provide "a sufficient supply of pure water to the [MWRA], and shall utilize and conserve said water and other natural resources in order to protect, preserve and enhance the environment of the commonwealth and to assure the availability of pure water for future generations."

In simple terms, DWSP handles watershed management, while MWRA takes over when the water enters the Quabbin and Wachusett Reservoirs' intakes. Reservoir management is a

joint responsibility. The inter-agency relationship, of course, is much more complicated. In reality, DWSP and MWRA work closely together to provide 2.5 million people some of the best drinking water in the world.

The functions of each agency are spelled out in a Memorandum of Understanding. Most importantly, MWRA – and its ratepayers – entirely fund DWSP's operating budget through the Water Supply Protection Trust. This financing also includes land acquisition and Payments in Lieu of Taxes (PILOT). The DCR/MWRA watershed system is a partnership that makes both short- and long-term investments from the system's users in the permanent protection and management of the source water supply.

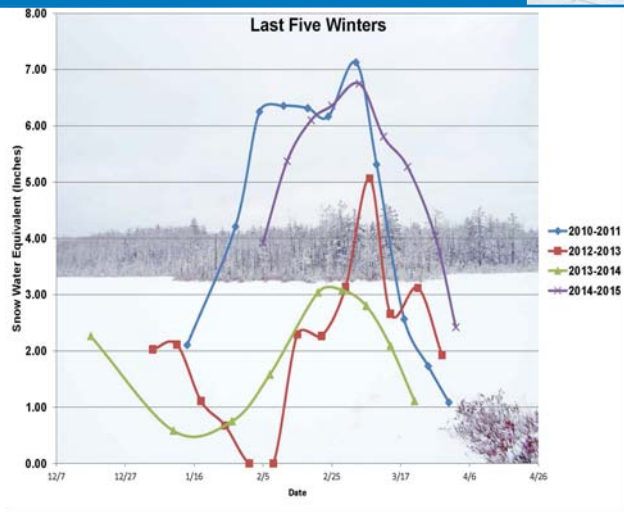
The cooperation between the two agencies, and their ability to maintain a successful watershed management

The Water Supply Natural Record

The Wachusett Snow Survey Program By Steve Sulprizio, DCR Environmental Analyst

Remember last winter? While measuring snow depth may not seem all that complicated, at right is a photograph of a training session that was conducted for snow depth and water content analysis outside the Wachusett Field Headquarters last winter in order to ensure consistent and accurate results from the staff involved in the survey.

Below is a chart that shows the rate of snow pack build up and decline for the past 5 years, from 2010-2015



tube. A snow core is pulled out and is weighed to determine the snow water equivalent.

The scale is calibrated to translate the weight of the snow to a water equivalent in inches. A

rough estimation is that a quarter of a pound of snow equals about an inch of water. This data is shared with the National Weather Service and provides valuable ground truth data for flood

forecasting. The data is also beneficial to engineers who can use the snow weight to estimate stress on roofs from the snow.

The winter of 2014-2015 proved to be particularly harsh, especially from late January through the month of February. Record cold and snow battered the area for about six weeks. Worcester broke its greatest one-day snowfall record with 31.9 inches of snow on January 27, 2015. Snow depth peaked

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Environmental Quality staff at the Wachusett Reservoir conduct weekly snow measurements at six locations within the watershed during the snow survey season. A typical survey season goes from about December 1 through April 1. These measurements are made to quantify the amount of water that is locked up in the snowpack. Each location is measured five times for snow depth and snow water equivalent, or SWE for short. These five results are averaged together to come up with a single snow depth and snow water equivalent for the site.

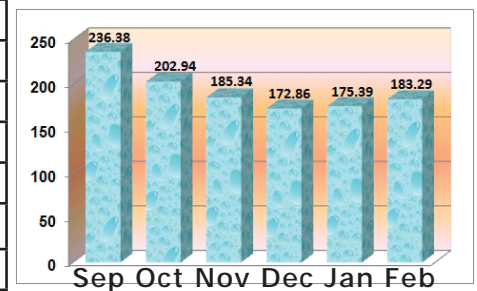
The surveys are done using an Adirondack snow tube which is pushed into the snow until it reaches the ground. The snow depth is recorded by reading the marked depths, by one inch increments, on the side of the

- Reservoir Watch -

Reservoir levels and 6-month precipitation

Reservoir	Quabbin	Wachusett
Minimum	524.86'	387.08'
% Full	90.5%	84.4%
Date(s)	11/23/14	2/27/15
Maximum	527.61'	391.80'
% Full	95.5%	93.6%
Date(s)	2/26/15	12/12/14
Precipitation	22.17"	21.00"
Seasonal Avg	23.12"	22.08"

System-wide Water Usage Sept 2014 to Feb 2015 (million gallons per day)



Archival Record From Page 1

Land Surveys and Reservoir Construction



W. RES. - CLINTON
LONG & LITTLE'S HOIST.
MAY 18, 1900



W.RES.CLINTON.NORTH DIKE, EASTERLY PORTION, FEB. 6,-1903.

4860.

Clockwise from above: The "Long and Little Hoist," 1900, was one of several locations where removed material was lifted out of the reservoir bed. Work crews install heavy rip-rap on the North Dike in 1903. Final clearing of the Wachusett reservoir floor, 1903. Bottom left: The form used to construct the stone arch bridge on the Sterling Street (Route 140) causeway. Bottom right: The completed arch bridge framing a view of the Old Stone Church.



W. RES.-W. BOYLSTON FINAL CLEANING OF RESERVOIR BOTTOM, SEC. 6.

OCT. 15 '03 8314

environment, the negatives remained there for forty years.

In 1964, however, the glass plate collection caught the eye of a representative from the Division of Mechanical and Civil Engineering of the Smithsonian Institution's National Museum of American History who was visiting the pumping stations. Immediately understanding their value, the Smithsonian Institution requested a loan of the negatives for further examination and preservation. The entire set was shipped to Washington, D.C., minus approximately 800 negatives that were kept at the pumping stations. The Smithsonian re-housed and re-boxed the negatives that were entrusted to them. The collection was returned 25 years later.

I began working as the Archivist for the Metropolitan District Commission, DCR's predecessor (see p. 2) in August 1992. This treasure trove was

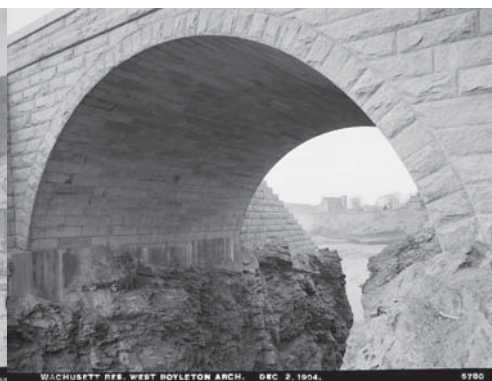
one of the first things I noticed in the MDC archives. I was fascinated by this collection; I set out to discover as much as possible about the glass plate negatives, ensure that the now 100 year old collection was as complete as possible, and preserve these pieces of our history.

The negatives numbers in the col-

lection range from 1 through 7,672. The MDC Archives, however, was holding only approximately 6,000. Throughout the 1990s, I tracked down several locations where other pieces of the collection had been dispersed. Negatives from the series were at the Massachusetts Water Resources Authority (MWRA) Records Center



W.RES. CENTERS & FALSE WORK W.BOYLSTON ARCH. JULY 18-04.



WACHUSETT RES. WEST BOYLSTON ARCH. DEC. 2, 1904.

5750

Construction of the Wachusett Dam



(those left behind at Chestnut Hill Pumping Stations in 1964), the West Boylston Historical Society (from a MDC 1970s loan), and the Boylston Historical Society (from a 1970s MDC loan). Furthermore, bound volumes of photographic prints of the collection were held by the Massachusetts State Archives (from a 1980 transfer from MDC), the MWRA Library, Boylston Historical Society (from a 1970s MDC loan), and West Boylston's Beaman Memorial Public Library (from a 1976 MDC loan); loose prints were also in the possession of the Clinton Historical Society.

The ultimate goal of this plan was to sequentially merge the negatives and consolidate the complete collection at the State Archives for future generations. All of the various repositories agreed to participate in this project.

Above left: An 1897 view of the Nashua River Valley at the dam site before construction.
 Above right: Boring machines and work crews on rafts drilling to bedrock through the floor of the Nashua River at the Wachusett Dam site in 1895.

Right: A detail of work crews fitting stone at the eastern end of the dam in 1904.
 Below Left: An over view of dam construction from the east taken in 1904.
 Below Right: A view of the completed dam and gatehouse taken in 1906, with yearly construction progress noted on the image.



Current Archiving

A plan was drafted in the winter of 2000 to gather all of the disparate pieces together to archivally preserve the complete MWW negative collection, create a database to catalog this vast portfolio, and reformat the images for multiple repository research use.



Equipment and Heavy Machinery



Properly preserving the negatives was a vital initial step in this effort. The MDC and MWRA made a significant investment in the necessary archival supplies. A system was developed using methods recommended in the archival preservation literature to clean the non-emulsion side of the glass plate negatives in order to improve image quality for future reformatting (basically, why put dirty plates in clean enclosures).

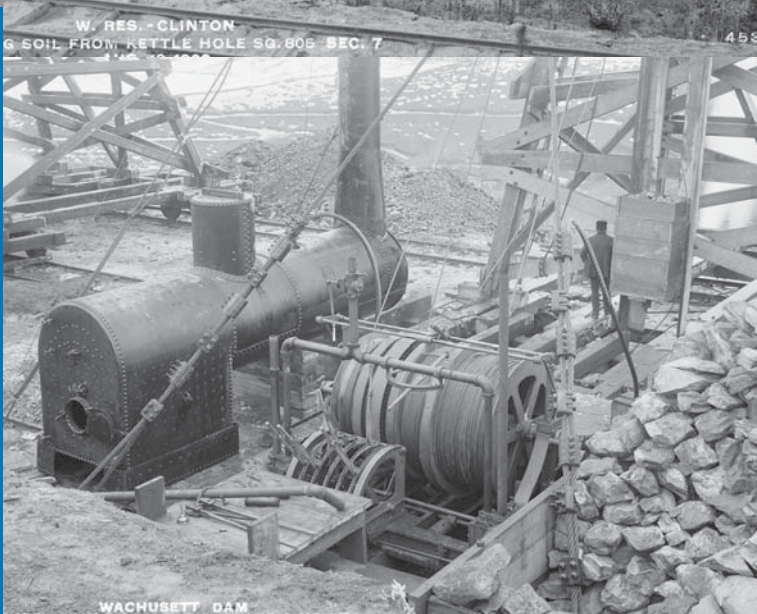
The next step was the actual cleaning of the 8,000 pieces. A troop of 120 volunteers from 31 cities and towns was assembled in the fall of 2000 at the gymnasium in John Augustus Hall, MDC's West Boylston Regional Headquarters. Over the span of two Saturdays, 3,950 glass plate negatives were archivally cleaned and re-housed. The remaining negatives were com-

Top Left: In 1900, "The Jessie" was one of several small steam engines used to haul soil from the reservoir.

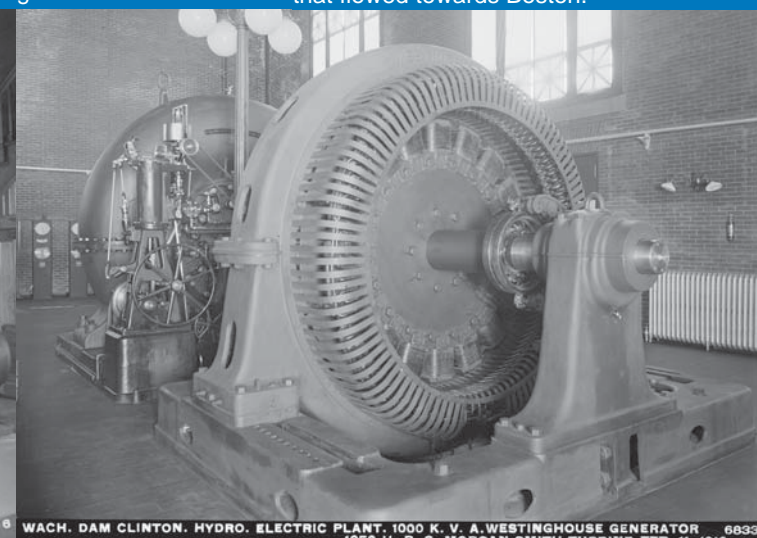
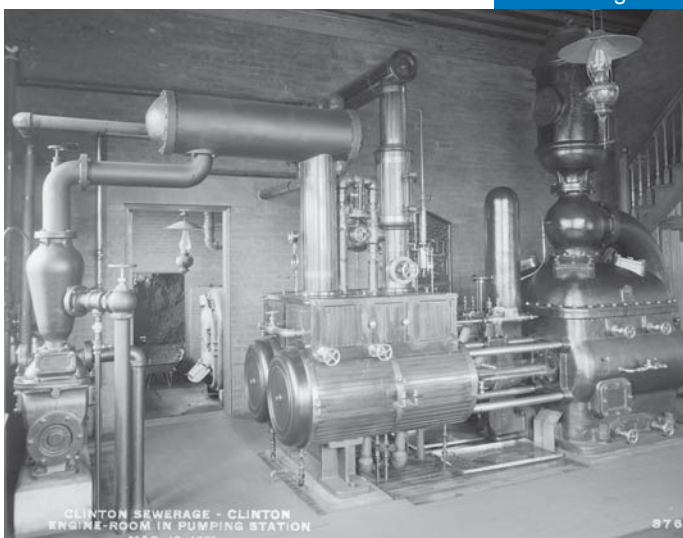
Top Right: Three steam engines ganged together in 1902 for added tractive power.

Right: Hoisting machinery of the Lidgerwood Cableway, used for heavy lifting in 1901 while building the Wachusett dam.

Below Left: A 1901 view in the engine house of the Clinton pumping station. The fine detail shown in these machine photographs are of particular interest to mechanical and engineering historians.



Below Right: The 1,250 hp Westinghouse hydroelectric generator located in the gatehouse at the Wachusett Dam. These turbines were moved by 240 million gallons a day of water released to the aqueduct that flowed towards Boston.



Builders of the Dam and Reservoir



Above left: The last stone of the Wachusett Dam was fitted into place in June of 1905. While an entire work crew shown here was on hand for the momentous occasion, stone worker John Mercer was credited for the final fitment.



Above right: This 1918 image shows 10 electrical transmission laborers working on the Wachusett to Sudbury power lines, posed around a contractor's truck.

pleted over time by additional volunteers, graduate student interns, MWRA staff, and myself. Throughout 2002, the descriptive information for each image was entered into a database. The sequentially merged negatives were ultimately relocated to the State Archives between 2001 and 2005.

Digital Access

The successful preservation of the delicate negatives that occurred over the first decade of the 21st century was possible due to thousands of volunteer hours and funding from the water supply agencies. Tight budgets, however, did not allow for the expensive digital transformation of the MWW photograph collection that would facilitate internet access to this



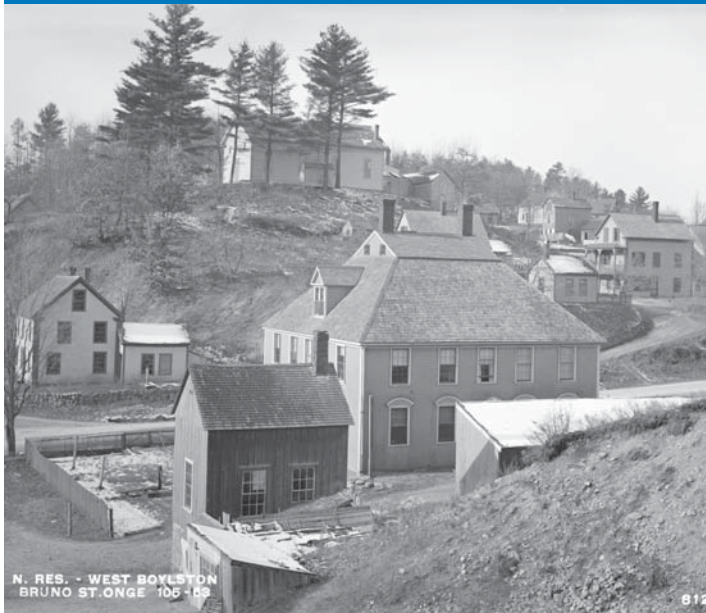
This set of images to the left and below, taken in 1896-7, documents the life of the Italian immigrant laborers, who built the dam and reservoir, in their Patrone village of sod huts. At left is a shoemakers shack as evidenced by the small wordless sign on top. Below left is a typical sod hut where laborers lived and directly below is a view of a main path through the makeshift village. For more information see *Downstream* #29.



N. A. BERLIN
ITALIAN CAMP SEC. 4
OCT. 19, 1906

707

Real Estate, Homes, and Businesses



Area homes and businesses were documented early in the process of dam and reservoir construction. Some homes remained, but 360 were raised to make way for the reservoir. Clockwise from the bottom left: the West Boylston Mfg. Company Store, George Tatro's West Boylston blacksmith shop, the Beaman Street neighborhood, and the intersection of Prospect and East Main St. at the west end of West Boylston Common. Close study of these 1896 images reveal details of daily life at the turn of the 20th century.



historic record.

A solution to this last piece of the restoration and archival plan was found in 2012. DCR and the MWRA joined together to have the MWW Photograph Collection digitally scanned through the relatively newly formed partnership between “Digital Commonwealth,” a web portal established in 2007, and the Boston Public Library (BPL) Digital Services Unit. DCR and the MWRA submitted an application in the summer of 2012 to take advantage of the free digital services offered by Digital Commonwealth/BPL. All participants saw the potential value and use from the proposal to transform the glass plate negatives into high resolution digital files. Federal and state grants, including Institute of Museum and Library Services/Library Services and Technology Act (LSTA) federal funds administered through the Massachusetts Board of Library of Commissioners support this free service.

It took BPL Digital Services two years to digitally scan the Boston Water Works/Metropolitan Water Works photographic images held by DCR, MWRA, and the MA State Archives. Many people were instrumental in this effort. It was led by

Churches and Cemeteries

MWRA Librarian Rebecca Kenney and myself, as we managed logistics and metadata creation. We also were supported by MWRA Communications Officer Barbara Allen and MA State Archives Quality Control Archivist Wallace Dailey.

The plan developed fifteen years ago to archive this invaluable set of pictures has been completed and the public can now explore the wealth of historic information buried in these pictures. The Digital Commonwealth website launched the MWW Photograph Collection, encompassing more than 8,800 images, in September 2014.

The original and complete MWW photographic negative and print collection created by the Commonwealth is safely preserved and organized at the Massachusetts State Archives. It is cataloged through a national library/archives bibliographic database, called OCLC WorldCat, which is also available online. Everyone is encouraged to explore the details of the people, places, machines, and infrastructure that created the metropolitan Boston drinking water supply.

To access the Metropolitan Water Works Collection from Digital Commonwealth, go to <https://www.digitalcommonwealth.org/collections/commonwealth:g732dh56k>.



Detailed photographs, such as these taken between 1896 and 1897, also included churches, memorials, and cemeteries.

Top: The newly constructed Baptist Church, now known as *The Old Stone Church* that currently stands sentinel over Thomas Basin.

Above and below center: Memorial markers at the Catholic cemetery near Sandy Pond, Clinton.

Bottom right: The Patrick T. O'Riely Catholic Church, West Boylston.

Bottom left: The First Congregational Church (and Thomas Hall) of West Boylston.



Navigating the Digital Commonwealth

To access the entire MWW photograph collection, go to <https://www.digitalcommonwealth.org/collections/commonwealth:g732dh56k>. If you find yourself on the Digital Commonwealth home page, click on "Institutions" and then scroll down to Massachusetts Archives, where you will find a link to the MWW collection.



Once you are on the MWW Photo Collection page, there are a various ways to search the files:

- Browse by topic or by place (city/town) from the right.
- Search by a word, or phrase. Be creative! Many more words are searchable than in browse by topic.
- After results appear, you can sort by date; and, if needed, change number of images per page.
- Clicking on a single result, the top portion of the page will be the image and bottom portion the catalog record of the image. Click on the image, and a scale-able image appears.

Associated with the MWW Photo Collection is a set of 72 Wachusett Reservoir land survey blueprints. These blueprints were annotated by the MWW engineers with the photo number of 1,432 real estate images. There are links on the survey page and the photo collection page to connect to each other. You can find the place of a picture from the photo collection on the survey, or vice versa:

- Search by MWW image number. That number can be found in the catalog record obtained by the instructions above. Look for either the accession number or identifier. The image number is the digits that follows "EN4.05/2630X" in the accession field; it is the same number, without the leading zeros and without the leading MWW, in the identifier field.
- Click on the image result, and in the catalog record below, verify that the image number is located on that blueprint sheet (image numbers are listed in the notes field).
- Click the blueprint image to enlarge. Scroll around to locate the image number, which are annotated in red ink.

Utilize two separate windows – one for the blueprints and the other for the photos – to compare the image to its location on the map!

Snow Survey Program - from Page 3

on February 19 at 27.3 inches. The snow water equivalent peaked at 6.75 inches on March 5, 2015; this was equivalent to about 13 billion gallons of water spread throughout the watershed.

The graph on page 3 shows the last five years of snow survey results. The only missing year was the winter 2011-2012 when barely any snow fell and the surveys were not conducted. Surveys are typically only taken when there is more than two inches of snow on the ground for at least a week. The other standout year was the winter of 2010-2011. That year snow depth peaked at 28.25 inches on February 4 and snow water equivalent peaked at 7.13 inches on March 4, which was equivalent to 13.76 billion gallons of water within the watershed boundaries.

Snow melt rapidly accelerates through March, typically due to less snowfall and warming temperatures. Spring stream flows were impacted by the higher than normal snowpack; higher flows were present for much of April as the snow melted. The slow melt prevented any flooding from occurring and helped to alleviate the effects of a very dry spring. These drastic changes in the snowpack from year to year will likely continue due to climate change. DCR will continue to collect snow pack data to diagnose and mitigate stream flow impacts to the water supply system. 💧

DCR and MWRA

- from Page 2
program, was a critical component to a federal judge's ruling that allows the system to be one of the few unfiltered water supplies in the country. DCR and MWRA staff will continue to collaborate on a wide range of issues – such as water quality, reservoir operations, dam maintenance, sewers, and other watershed issues – in order to quench the thirst of a third of the state. 💧

Preserving Glass Plate Negatives



The glass plate negatives of the MWW collection have had a long and arduous journey to archival preservation. Early record keeping at top shows three boxes of the 6.5" x 8.5" negatives and the log books that kept track of the 8,000 images. Volunteers helped clean many of the negatives in 2000. Many had been damaged and required more extensive restoration (see this image on page 9). Digital Commonwealth provided the equipment and expertise to make the collection available online.

Kids Corner

The Historic Jumble

The jumbled words in this puzzle are found in the articles in this newsletter and relate to the history of the Wachusett Dam and Wachusett Reservoir. Unscramble them and find the letters to answer the question posed regarding the historic photograph described below. Good luck!

(the answers are printed at the bottom of this page)

odolf ○ ○ □ □ ○

arshec □ ○ □ □ □ □

virache ○ □ □ □ ○ □ ○

ishorty □ □ □ ○ □ □ □

apwoncks □ ○ □ □ □ □ □ □



What did the operator of this 75 horsepower hoist have to say to his fellow workers during the construction of the Wachusett Reservoir?

“ _____ ? ”

And another thing...

by J. Taylor



This 1918 photograph shows workers installing line and insulators on an electric power transmission pole that will carry power between Wachusett and Sudbury Reservoirs.

“Who said it was lonely at the top?”

For more information about...

The Digital Commonwealth:

Digital Commonwealth

<https://www.digitalcommonwealth.org>

Metropolitan Water Works Collection

<https://www.digitalcommonwealth.org/collections/commonwealth:g732dh56k>

DCR Archives:

DCR Archive Management

<http://www.mass.gov/eea/agencies/dcr/conservation/cultural-resources/archives-management.html>

Water Quality and Quantity:

DCR Division of Water Supply Protection Water Quality

<http://www.mass.gov/eea/agencies/dcr/water-res-protection/water-quality-monitoring/>

DCR Water Data Tracking

<http://www.mass.gov/eea/agencies/dcr/water-res-protection/water-data-tracking/>

MWRA Monthly Water Quality Reports

<http://www.mwra.com/monthly/wqupdate/qual3wq.htm>

Then and Now

Massachusetts Envirothon

By Joel Zimmerman, DCR Regional Planner

The Mass Envirothon, a state-wide, natural resource based environmental education program, returned to Quabbin Reservoir in 2015 after a twenty year hiatus from the picturesque location.

As described in *Downstream* #29, the Mass Envirothon holds an annual competition that brings teams of students together to test their knowledge and skills in a variety of natural resource topics, including water, forests, wildlife, and soils. There is also a current topic that the students research and make a presentation; this year's topic was the climate crisis.

Thirty teams ventured to Quabbin on a picture perfect day in May. Newton North emerged as the over-all winner and will represent the state in the North American Envirothon later

this summer in Missouri. Hometown participants Quabbin Regional High School won the Current Topics section of the competition. Congratulations to all the students who took the time from their busy schedules to explore the many facets of the environment.

The connection between DCR – as well as its sister agencies within the Executive Office of Energy and Environmental Affairs – and the Mass Envirothon is a natural link. The program encourages environmental stewardship and protection while supporting community service among our youth. Everyone who participates in the Mass Envirothon comes out a winner! We look forward to another twenty years of pictures and memories.💧



MA Envirothon at Quabbin Reservoir in 1996 and 2015. Styles may have changed, but the students' grasp of environmental science and policy concepts have remained strong over twenty years.

downstream

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Downstream is produced twice a year by the Massachusetts Department of Conservation and Recreation, Division of Water Supply Protection. It includes articles of interest to the Watershed System communities. Our goal is to inform the public about watershed protection issues and activities, provide a conduit for public input and promote environmentally responsible land management practices.

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EOEEA Secretary: Matthew A. Beaton
DCR Commissioner: Carol I. Sanchez
DWSP Director: Jonathan L. Yeo
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