1. Type of Area Form
   - Town-wide: ☐
   - Historic District: ☒
   - Project Area: ☐

2. Name of area: Dover Water Works

3. Location: Lowell Avenue, Dover, Tax Map/Lot 37-40

4. City or town: Dover

5. County: Strafford

6. USGS quadrangle name(s): Dover West

7. USGS scale: 7.5 minute

8. UTM reference: 19.347368.4786118

9. Inventory numbers in this area:

10. Setting: Industrial storage-yard landscape (former City Water Works site) now partly wooded on perimeter. Site immediately surrounded by dense suburban residential development.

11. Acreage: 6.3 acres

12. Preparer(s): Richard M. Casella


14. Date(s) of field survey: 1 June 2011

15. Location map
15a. Street level location of Dover Water Works property (Parcel 37-40) on Dover Tax Map 37.
16a. Aerial Photo of Property (resources identified on previous figure) (Microsoft Corp 2010)
17. Purpose and Methods

[From:"Project Summary, Berry Brook Watershed Restoration Project, " UNH Stormwater Center, April 2011.]

A partnership of the University of New Hampshire Stormwater Center; The City of Dover; New Hampshire Department of Environmental Services (NHDES); Cocheco River Watershed Coalition; the New Hampshire Fish and Game Department; and American Rivers Restoration Program intends to conduct water quality and stream restoration improvements in the Berry Brook Watershed from 2011-2013. Berry Brook, a tributary to the Cocheco River, is a 0.9-mile long stream in a 164-acre watershed in downtown Dover. The brook is impaired for aquatic habitat and primary contact recreation. Through a series of three grants and matching funding from the City of Dover, this project will implement some of the major recommendations from the 2008 Watershed Management Plan for Berry Brook.

The project will significantly restore and reconnect the urban stream, wetland complexes, and watershed through two efforts: 1) Wetland and stream restoration, removal of fish passage barriers, and buffer development, and 2) Base flow and water quality improvements. Wetland and stream restoration will occur at the existing open channel portions at both the headwaters and tailwaters of Berry Brook. The stream restoration will restore much of the continuity of aquatic habitat for the Brook from the main stem to its headwaters. Water quality will be improved to Berry Brook and consequently the Cocheco River by implementing low impact development stormwater treatment strategies to filter, infiltrate, and reduce stormwater runoff from impervious cover as a means for managing pollutant loading and controlling runoff volumes. Water quality improvements will include installation of raingardens and other treatment mechanisms throughout the watershed and at the Home Street School. Upper watershed improvements are scheduled for year 1 (2011-2012). Lower watershed improvements are scheduled for year 2 (2012-2013). A Community kick-off meeting was scheduled for May 2011 to introduce project to community and solicit input. Watershed improvements will begin at Home Street Elementary School in the spring of 2011. The success of the project relies on the on-going support of the Community within the Berry Brook Watershed.

In In April 2011 the City of Dover and the UNH Stormwater Center submitted a Request for Project Review Form (RPR Form) to the New Hampshire Division of Historical Resources (NHDHR) for the project (RPR 2946). On 16 May 2011 NHDHR responded by letter requesting this Historic District Area Form be prepared to "investigate the entire property (both above and below ground components) and analyze the historical, architectural and engineering significance of the property."

In preparation of the RPR Form, UNH Stormwater Center Project Manager Melinda Bubier conducted a file review to gather information on already-identified historic properties within or adjacent to the project area that may be affected by this project was conducted at the Division of Historic Resources (DHR) in Concord, New Hampshire on May 2, 2011. Files reviewed included the general project files for Dover and files for streets surrounding the site (Glenwood, Lowell, Roosevelt, Central and Crescent). Three sites (856 Central Avenue and 3 and 36 Glenwood Avenue) were identified adjacent, or proximate to the site; however, these were deemed not eligible for listing on the historic register.

On May 23 and 31, background research was conducted at the libraries of UMASS Dartmouth, Brown University and Worcester Polytechnic Institute to gather engineering literature on the specialized buildings and structures that remain at the former Dover Water Works property. On 1 June 2011 a site investigation of the property including field measurements and photography was conducted. Background research at Dover Department of Public Works and the Dover Public Library was also conducted on 1 June 2011.

[See following section for additional project description taken from the RPR Form]

18. Geographical Context

The Berry Brook Restoration project is located on Lowell Avenue in Dover, New Hampshire and is depicted as Map 37, Lot 40 on the City of Dover tax map. The Property is currently used as a staging/storage area for construction projects and construction material (pipe, stockpiled soil, etc.). Three buildings and an underground
structure are currently located at the Property including: an existing brick Pumping Station (1955) utilized by the City of Dover; the original brick Pumping Station constructed 1888 which is vacant; a metal Garage and storage building (ca. 1980) utilized by the Department of Public Works and the underground concrete Filter Bed, abandoned and buried. The buildings are outside of the project area and will not be impacted by this project; the Filter Bed is in the path of the project and must be removed.

The wetland pond system headwaters of Berry Brook are located on the northern portion of the Property and are currently disconnected by portions of the WTP, which have been out of service since the mid-1950s. The Berry Brook Restoration project will expand the existing on-site wetland into disturbed portions of the Property and reestablish an open channel, floodplain, and wetland pond system. This project requires the daylighting and reconstruction of approximately 960 feet of stream channel (which is currently a network of underground piping) and creating a forested floodplain and wetland. The work will require the removal of several drainage structures within the property, and the remains of an abandoned slow sand filter.

A review of historic aerial photos and historic USGS topographic maps indicate various changes in site topography and development within the project area including alterations to the historic stream channel. This area was developed in 1888 as the City’s WTP which eventually consisted of an aerator, a settling tank, two sections of a slow sand filter, and a 1.0 million gallon clear water reservoir (see Site Sketch). The slow sand filter remains and consists of a 100' x 200' concrete structure approximately 15' in depth. The exterior portion of this structure is primarily covered by fill piles and the structure itself is not visible from the outside. It is likely that the other components of the historic water treatment operation were removed, filled, or demolished over time, as test pits conducted did not indicate the presence of the clear water reservoir; however, if they are located during stream reconstruction, they may also need to be removed.

19. Historical Background

A special meeting of the Dover City Council was held on 28 June 1887 to consider the building of a public water works system for the City. The public favored the undertaking and on 9 September 1887 the City Council authorized Mayor B. Frank Nealley to "secure and employ a competent and experienced engineer to ascertain water supply and cost of constructing water works." ¹ The Mayor's friend, John Holland, Agent of the Cocheco Manufacturing Company, a primary employer in the City, recommended Percy M. Blake, a civil; engineer based in Hyde Park, Massachusetts. Blake conducted a preliminary assessment of the available water supplies within the City and on November 14, 1887 reported them to be sufficient to support a population of 25,000.

On 30 November 1887 the voters approved in a special election the construction of municipal water works in a vote of 1326 in favor to 346, opposed. Percy Blake was hired by the City on 8 May 1888 to prepare the plans and specifications. In the first months of 1888 the City negotiated with the three existing aqueduct companies operating in the City for the rights to their water supplies, property and equipment, which were purchased for the following amounts: Cocheco Aqueduct Co., $67,500; Dover Aqueduct Co., $20,000; Dover Landing Aqueduct Co., $13,000.²

The City Council passed an ordinance on 7 June 1888 creating the Board of Water Commissioners "for the purpose of constructing, managing and maintaining the system of water works."³ Groundbreaking was done by Mayor George G. Lowell on 11 June 1888 with a shovel on a pipe trench on Hough Street.⁴ The main components of the system included two deep collecting wells known as the Hussey and Page wells (not extant), a stone-lined clear-water receiving basin (not extant), a pumping system housed in a brick Pumping Station building (extant), an open reservoir atop Garrison Hill (not extant) and a system of piping for the transport of the water between the wells, pumping station and reservoir and then through the city to fire hydrants, mills and businesses and eventually residences (some abandoned original piping may be extant). Several contracts were let in June and by July 1888 construction had begun on the reservoir, the wells and piping systems. Construction of

¹ Dover Annual Report, 1889, p. 12.
² Water Commissioners' Report for 1889, p. 49-50.
⁴ Water Commissioners' Report for 1889, p. 51.
the Pumping Station was begun 30 August 1888 and was completed and accepted on 8 October 1889. A detailed report by the engineer of the building of the water works is contained in the First and Second Annual Reports of the Water Commissioners for the year 1888 and 1889. The Second Annual Water Commissioners Report for 1889 gives further details on the operation and initial performance of the system.

By the first years of the 20th century the City's demand for water began to outstrip the supplies. The City's yearly average water consumption rose from 0.44 million gallons per day (mgd) in 1890 to 0.77 gpd in 1905.\(^5\) In 1904-1905 a new well was drilled in the vicinity Hussey Springs "at considerable expense" but although high in output it was so contaminated with iron that it was unsuitable for domestic use and could not be added to the system.\(^6\)

The City hired William S. Johnson, "an expert sanitary and hydraulic engineer" from Boston, to assist in solving the diminishing water supply and iron contamination problems. Johnson built an experimental sand filter bed and aerator at Hussey Springs in 1907, which proved successful in removing the iron.\(^7\) Johnson was then "engaged to make plans, prepare specifications and estimates for a filter plant of sufficient capacity to filter all the water required by the city."\(^8\)

Construction of the filter plant was approved by the City Council on 25 April 1908 and the contract awarded on 20 June 1908 to the Ryan Unmack Co. of New Haven, Conn. for the bid of $22,000. Excavation began July 14th and the first concrete was placed on August 14th. "The construction work was done under the supervision of Mr. William T. Ryan for the contractors, and the engineering work under that of Mr. Gould, from the office of Mr. Johnson."\(^9\) The filter plant was completed and put into operation 12 February 1909 and consisted of a underground sand filter structure of concrete construction, approximately 100' by 200' by 15' high (extant but abandoned), an adjacent underground settling basin of concrete, approximately 40' x 60' (not extant – filled-in foundation ruins); and a brick above-ground aerator building, approximately 20'x25' (not extant). Water from the Hussey well field flowed by gravity through a sixteen-mile vitrified pipeline to the filter plant.

Our new water purification plant, completed early in the year, was placed in service February 12th and has been in constant use since. It is giving good satisfaction. Two small leaks were discovered in the southerly wall of one of the filter beds and promptly remedied. At first it was found necessary, in order that the water might pass through the sand regularly, to clean each bed at least once in two weeks. This required the setting apart one day each week, and the expense incident thereto was about $12.00 per week. In July we Constructed an implement with which one man rakes each bed once a week, this rendering it unnecessary to clean them oftener than once in about eight weeks. This method effects quite a saving in expense of maintenance. In August grading the grounds about the filter-beds and receiving basin was begun, all spare time being devoted to the purpose. On account of the deep ravine near the beds it was found necessary to fill, in some places, at least fifteen feet. Nearly 8,000 cubic yards of earth was moved during the progress of the work. The grading can be resumed early in the spring and, when completed, the approach to, as well as the grounds surrounding, this part of our system, will be greatly improved.\(^10\)

During the 20th century the demand for water grew while the original sources diminished in productivity and could not meet demand during dry seasons. New wells were drilled in "Pages Pasture" in 1931 and 1941, and near Barbadoes Pond in 1947, but the system as a whole was suffering from a increasing number of age related problems. The water mains and distribution piping were no longer of sufficient capacity to meet flow requirements, a problem compounded by the reduced flow caused by corrosion and deposits in the pipes.\(^11\) The Boston consulting firm of Chas. T. Main, Inc. (Main) was hired by the City in 1949 to conduct a "comprehensive investigation of the water supply sources, water treatment facilities and distribution system." Main found the slow sand filter system in need of extensive maintenance and recommended repairs to the concrete, complete replacement of the sand and gravel filter medium, cleaning and repair of the underdrains, and installation of a pre-

\(^5\) Chas. T. Main, Inc. 1950, p. 6.
\(^6\) Water Commissioners' Report for 1907, p. 240. [Bound in Dover Annual Report for 1907].
\(^7\) Ibid. p. 252.
\(^8\) Water Commissioners' Report for 1908, p. 203.
\(^9\) Ibid., p. 214.
\(^10\) Water Commissioners' Report for 1909, p. 199.
\(^11\) Chas. T. Main, Inc. 1950, p. 1.
chlorination system to assist in iron removal and prevent "iron bacterial slimes clogging the sand bed." The work was one item in a comprehensive program of overhaul and new-construction for the water system that was summarized in ten proposed improvement programs totaling $252,800.

Main conducted two more studies, in 1951 and 1954 that further examined the water system and treatment needs. The second study addressed the sudden and severe contamination of the clear-water receiving basin in late 1953 with iron and highly acidic water. It was concluded the pollutants infiltrated as a result of the cleaning of the sand filters (ca. 1952) and the dumping of the iron-laden sand in the swamp above the clear-water receiving basin. Recommended improvements included the construction of a new chlorine treatment facilities, a new pump station building, covered steel tank reservoir, wells and piping network. The improvements were undertaken in the following years, resulting in the abandonment of the slow sand filter system and discontinued use of the Pumping Station building as a functioning component of the water system.

20. Applicable NHDHR Historic Context(s):
86. Water supply and distribution in New Hampshire, 1850-present.

21. Architectural Description and Comparative Evaluation
The site conditions of the former Dover Water Works property is described in Section 18 above. The buildings and structures on the property are tabulated below:

Table of Extant and Non-Extant Buildings and Structures
(Refer to Site Plan (Item 16) and & Aerial Photo (Item 16a) above).

<table>
<thead>
<tr>
<th>Building Number</th>
<th>Year Built</th>
<th>Name Original</th>
<th>Name Current</th>
<th>Photo Numbers</th>
<th>NR Eligibility [contributes to District]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1888</td>
<td>Dover Water Works Pumping Station</td>
<td>Former or Old Dover Water Works Pumping Station</td>
<td>1-6</td>
<td>YES</td>
</tr>
<tr>
<td>2</td>
<td>1908</td>
<td>Slow Sand Filter Beds</td>
<td>Same</td>
<td>8, 10-14</td>
<td>YES</td>
</tr>
<tr>
<td>3</td>
<td>1955</td>
<td>Pumping Station</td>
<td>Same</td>
<td>15</td>
<td>NO</td>
</tr>
<tr>
<td>4</td>
<td>ca 1980</td>
<td>Garage</td>
<td>Same</td>
<td>16</td>
<td>NO</td>
</tr>
<tr>
<td>A</td>
<td>1888</td>
<td>Clear Water Basin</td>
<td>NOT EXTANT</td>
<td>-</td>
<td>n/a</td>
</tr>
<tr>
<td>B</td>
<td>1908</td>
<td>Settling Basin</td>
<td>NOT EXTANT</td>
<td>-</td>
<td>n/a</td>
</tr>
<tr>
<td>C</td>
<td>1908</td>
<td>Aerator Building</td>
<td>NOT EXTANT</td>
<td>-</td>
<td>n/a</td>
</tr>
</tbody>
</table>

1. Dover Water Works Pumping Station [refer to Item 16, 16a; Figures 1-5; Photos 1-6]
Plans for the building were not located; the following information is derived from a site inspection and from the Water Commissioners reports for 1888 and 1889. The Pumping Station building was built in 1888 and the mechanical equipment it housed completed in 1889. Its purpose was to house a large steam powered water pump and the coal-fired boilers that powered it. It pumped water gathered in the clear water receiving basin from ponds and wells by gravity, up into an open reservoir on top of Garrison Hill (none of these built resources other than the Pumping Station are extant). It was built by the contracting firm of Tuttle, Brown & Bishop on property of the Dover Landing Aqueduct Co. known as Page's Field, which included a spring and was bought by the City as part of the Dover Water Works development project. The exterior of the building as originally built is partly depicted in a woodcut in Figure 1; a diagram of the original steam pump is shown in Figure 2; the interior of the engine room after electrification ca. 1908 is shown in Figure 3; the building sketch and key to photos, Figure 4. The Manchester NH Pumping Station, built 1874, is shown for comparison purposes in Figure 5.

The Pumping Station building is brick, rectangular 60' x 36', with a complex hip and gable-on-hip roof with slate shingles. It is a true and exceptional example of the Queen Anne style, combining a variety of pronounced architectural features representing several styles. The main entrance is set in a large Romanesque semi-circular keyhole arch, under a projecting roof-gable supported on wall brackets and infilled with an open timber screen. In

---

12 Ibid., pp.33, 60.
13 Chas. T. Main, Inc. 1954, pp. 1, 9.
the arch above the door is a huge fixed transom with divided lights of stained glass. A grand secondary entrance on the east side is also under a projecting gable supported on paired columns, forming a small entrance porch with Eastlake-type decorative features like the spindled valance. Window sizes vary in flat and arched openings and include pairs of small square openings typical of the Queen Anne period. A centered brick chimney vents a fireplace in the center partition wall, but the tall brick stack that exhausted the two coal fired boilers (see Figure 1) is gone along with all evidence of the steam plant. All of the principal original doors and windows have been replaced, several opening have been bricked-in, but the arched window openings retain their lattice-light transoms. The interior is partitioned by a brick firewall into two equal rooms, 36 feet wide by 30 feet deep; the north Engine Room housed the pump and valves, the south Boiler Room housed two boilers manufactured by Whittier manufacturing Co. of Boston. A brick fireplace with decorative tile inlay that is built into the brick partition wall remains intact. The exposed-brick on the (inside of the) exterior walls appear to be the original finish (not originally plastered). The interior of the Engine Room has been later subdivided with wood-framed, sheet-paneled partition walls but these are easily removable. All of the original equipment has been removed, although the piping originally entered a well or basement area under the valve bay and this area could not be accessed to see if any original piping or valves might remain abandoned under the floor.

2. Slow Sand Filter Beds [refer to Item 16, 16a; Figures 6, 7, 9; Photos 8, 10-14]
Plans for the structure were not located; the following information is derived from a site inspection and from the Water Commissioner's reports for 1908 and 1909. Figure 6 provides a plan of the Somersworth (NH) Covered Filter Bed, which predates the Dover beds by ten years, and although not identical, it is so similar in design as to give a very clear picture of the Dover beds. The Dover Filter Bed is a large rectangular underground concrete reservoir structure that has been abandoned since 1955. A plan drawing from 1955 (see Item 16, Site Sketch) shows the structure and the attached associated structures that are no longer extant. The filter structure measures overall approximately 100' by 200' with an estimated height of 15'. It is divided with a concrete partition wall into two filter chambers 95' square. The concrete roof is supported by square columns joined in each direction by low-rise arches, all of which were cast together as an integral plain concrete (unreinforced) unit. Six manholes are located in the roof of each chamber (see Photo 11). The concrete floor is buried under a 9" layer of gravel followed by a 26" layer of sand (revealed by digging), which served as the water-filtering medium. The floor is understood to be equipped with drainage channels that gather the filtered water and direct it to collection piping but that was not confirmed by the limited excavation. The height from floor to ceiling at the top of the arches was measured at 14'-2" (assuming a 6" roof thickness and 4" floor thickness gives an overall height of 15'). The arched columns are 20" square, spaced 13'-9" on center; the arches rise 32 inches.

An arched opening on the east side of the north chamber was uncovered by backhoe excavation. This was a service or "clean-out" door used for maintaining the filter medium (see Photo 10). An "operating chamber" sheltered by a narrow brick structure was located midpoint of the east side, serving both chambers but physical remains of this feature were not found. The photo in Figure 5 shows the operating chamber building and cleanout door (now buried).

The principal of operation according to historical information on similar structures: the filter was loaded with gravel and sand to a height of perhaps 3 feet; raw water was flooded onto the top of the sand to percolate down to the floor where it was gathered into the water distribution system. The top layer of sand was periodically removed and replaced with clean sand as previously described.

3. Modern Pumping Station [Photo 15]
This is a square brick industrial building with a flat roof, metal tilt-sash windows, and solid metal doors. Built in 1955, it is utilitarian in design and devoid of stylistic features giving it an obvious Modern appearance. A concrete loading dock serving wide paired entrance doors provides the primary access for people and equipment. The building houses operating pumping machinery for the City water supply, which replaced the machinery originally housed in the historic pumping station. The interior was not accessed.

4. Garage [Photos 16]
This is a standard prefab metal building, rectangular with a gable sheet metal roof and sheet metal sidewalls, built circa 1980.
Non-Extant Features, A, B, C [refer to Item 16, 16a; Figures 6, 9; Photos 7, 9]
Information on the non-extant features, the Clear Water Basin (A) 1888, the Settling Tank (B) 1908, and the Aerator Building (C) are limited to the 1955 site plan which depicts them, and very limited description in the Water Commissioner's Reports.

A. Clear Water Basin. Also called the Receiving Basin, it was built in 1888 over Page Spring, the main water source of the Dover Landing Aqueduct Co., purchased by the City. It was roughly 150 feet square, constructed with earth walls paved inside with gravel and granite blocks. The bottom was lined with course gravel to allow the upward percolation of spring water. It had a capacity of 1 million gallons and was fenced to prevent swimming. Photo No. 7 looks toward the former site of the Basin, now stockpiled with earth fill; no evidence of the Basin remains today.

B. Settling Tank. This structure is believed to have been an appurtenance of the Filter beds and also underground as indicated on the 1955 site sketch, which locates it at the north end of the beds. It is estimated to have been approximately 40' by 60' and of unknown height. A portion of the wall of the tank, recently excavated as part of the site investigation, is shown in Photo 9. The purpose of the Tank was to allow heavy particulate matter to settle out of the raw water before introducing the water into the filter beds. It acted as a pre-filter, extending the life of the sand filter medium.

C. Aerator Building. This was a small brick building with a hip roof, measuring perhaps 16 by 32 feet. It would have housed equipment for introducing air into the water for the purpose of reducing iron and anaerobic bacteria. The nature of aeration equipment typically in use in 1908 was not determined for this report but is undoubtedly available in the engineering literature.

Comparative Evaluation

The Dover Water Works property is a representative example of a late 19th early 20th century municipal water supply facility built for small cities with a population in the range of 15,000 to 25,000, making it a relatively rare property type in New Hampshire. The Pumping Station building is an exceptional and well-preserved example of the Queen Anne style as applied to commercial or industrial buildings. An inventory of similar buildings in NH was not possible within the scope of this report, but it is assumed to be an uncommon property type, particularly as a municipal utility building.

The Slow Sand Filter Bed is a specialized engineering structure of which an unknown number survive in the US that date from the early 20th century. Remarkably, in Somersworth, the state possesses the second oldest covered slow sand filter bed in the country; it remains intact and in use as a covered reservoir and is a candidate for recognition as an environmental engineering landmark. It was not determined if the first filter bed of the type in the US, built one year before Somersworth in Ashland, Wisconsin, is still in existence. The Ashland, Wisconsin, Somersworth, and Dover sand filters are all covered with groined arch roofs. The type was introduced by William Wheeler, a Boston engineer, in 1895 at Ashland, followed by Somersworth in 1896. Figure 7 provides a list of the groined arch reservoirs and sand filters built as of 1903.14 The Dover Filter bed compares closely with Somersworth, but is entirely of concrete construction, as opposed to the granite piers of Somersworth and brick piers of many other early examples. The third example, at Wellesley, Mass., with brick piers and plain concrete arches, collapsed during construction, killing a worker. The cause was determined to be the use of new "quick-setting Alsen Portland Cement" that was not given sufficient time to set before removing the forms.15 The method of construction was to pour a section of the groin roof, let it harden sufficiently to stand on its own, then remove the groin forms and move them forward for the next section to be poured. The date and location of the first all-concrete groin arch structure was not determined, but based on Metcalf's data appears to date ca. 1900, making Dover's Filter Beds among the early examples.16

15 Engineering News, 1897, p. 223.
16 Groined arch reservoir and filter beds structures were built at least into the 1930s; the first such slow sand filter structure in Maine built in 1917.
22. Statement of Significance

The Dover Water Works property is associated with the important water supply history of the City of Dover and New Hampshire. The Pump Station building housed the primary pumping and valve equipment of the first municipal Water Works for the City and is representative of the late 19th century movement in the US to bring safe drinking water to the populace under the auspices of a public rather than private utility. The building exhibits a high degree of integrity, architectural quality and workmanship, representative of the importance placed on the mission of the building. It survives as an outstanding example of a rare property type.

The Slow Sand Filter Bed is an early and rare surviving example of a unique civil engineering property type, the masonry covered water supply reservoir or filter bed. It is also and rare and early example of a sub-type with a groined arch roof structure, and further specialized by its all-concrete construction.

23. Periods(s) of Significance

1888-1908. The period of significance is based on the dates of the surviving historic resources, which date to 1888 and 1908. The integrity of the property as an operating late 19th, early 20th century municipal water works was destroyed by the 1955 construction and subsequent abandonment and/or partial or full demolition of the historic buildings and structures thereby excluding extension of the period of significance to 1955 to include the new Pump Station (1955) or to 1961, the 50 year cutoff date.

24. Statement of Integrity

The historic Dover Water Works property, as developed in 1888 and expanded with a slow sand filtration plant in 1908, retains sufficient integrity of original location, setting, design, materials, workmanship, feeling and association to be eligible for the National Register. The loss of the Clear Water Basin, Aerator Building and Settling Tanks has diminished the integrity of the district, but not to a degree that outweighs the high degree of integrity of the two primary components of the works, the Pump Station and the Slow Sand Filter Bed, and the important historical, architectural and engineering significance they possess.

25. Boundary Justification

The district boundary represents the original parcel boundary of the Dover Water Works property.

26. Boundary Description

The boundary is described as the property boundary for Dover Tax Parcel # 37-40 comprising 6.3 acres, as delineated on Figure 1.
27. Bibliography and/or References


City of Dover. Annual Report of the Receipts and Expenditures and of the Several Departments for the Municipal Year 1889. Dover, NH: Scales and Quimby, Printers, 1889. [this and later volumes cited as cited as Dover Annual Reports, (date)].

———. First Annual Report of the Water Commissioners for the Municipal Year 1888. Dover, NH: Scales and Quimby, Printers, 1889. [this and later volumes cited as Water Commissioners' Report, (date)].


O'Connell, John F. "The collapse of concrete roof arches at the Lawrence Filter." Engineering Record, April 27, 1907.


### 28. Surveyor’s Evaluation

<table>
<thead>
<tr>
<th>NR listed:</th>
<th>district</th>
<th>individuals</th>
<th>within district</th>
<th>NR eligible:</th>
<th>district</th>
<th>not eligible</th>
<th>NR Criteria:</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>×</td>
<td></td>
<td></td>
<td></td>
<td>×</td>
<td></td>
<td>A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Yes or no information needed?</td>
</tr>
</tbody>
</table>

If this Area Form is for a Historic District:

- # of contributing resources: 2
- # of noncontributing resources: 2

**Photography Statement:** I, the undersigned, confirm that the photos in this inventory form have not been digitally manipulated and that they conform to the standards set forth in the NHDHR Digital Policy. These photos were printed with HP Photosmart 7850 Printer, HP Vivera 100 Gray Photo Ink, HP Premium-Plus Photopaper. The digital files are housed at Historic Documentation Company, Inc., Portsmouth, RI.
FIGURE 1: The Pumping Station. Woodcut included as frontispiece in 2nd Annual Water Commissioner's Report for 1889.

1888 WATER WORKS
PUMP STATION BUILDING

BOILER ROOM
30' x 36'
NOW GARAGE & STORAGE

ORIGINAL INTERIOR BRICK WALL WITH FIREPLACE

ADDED INTERIOR WALLS

ENGINE ROOM
30' x 36'
NOW STORAGE

VALVE BAY

SIDE ENTRANCE

MAIN ENTRANCE

FIGURE 4: KEY TO PHOTOS 1 THRU 6.
FIGURE 5: Manchester NH Pumping Station, built 1874. (Source: Fanning, 1886, p. 213.

FIGURE 6: View of narrow brick building sheltering the "operating chamber" (left) and arched cleanout door (right) of Slow Sand Filter Beds underground structure. (Source: *Fosters Daily Democrat*, 23 June 1973, p. 57).
FIGURE 7: Somersworth covered filter beds, 1898, second groined arch covered structure of its type built in the U.S. by engineer William Wheeler of Boston, originator of system. The structure is still in use as a covered reservoir. (Source: Engineering News, December 8, 1898, p. 358.)
### E N G I N E E R I N G  N E W S.

**FACTS RELATING TO GROINED ARCHES COVERING RESERVOIRS AND FILTER BEDS IN THE UNITED STATES.**

(Compiled by Leonard Metcalf, Assoc. M. Am. Soc. C. E., Boston, Mass.)

<table>
<thead>
<tr>
<th>Date</th>
<th>Location</th>
<th>Engineer</th>
<th>Description</th>
<th>Depth in feet</th>
<th>Concrete</th>
<th>Mixed</th>
<th>Spec. Grav.</th>
<th>Max. Size</th>
<th>Min:Max</th>
<th>Min. Size</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1895</td>
<td>Ashland, Wis.</td>
<td>Wm. Wheeler</td>
<td>Filters for water &amp; sewerage, brick, coated w/ asphalt, covered brick.</td>
<td>5' 0&quot;</td>
<td>11' 6&quot;</td>
<td>15' 6&quot;</td>
<td>2'-6&quot;</td>
<td>5'-0&quot;</td>
<td>13</td>
<td>4'-10&quot;</td>
<td></td>
</tr>
<tr>
<td>1894</td>
<td>Seminole in</td>
<td>Wm. Wheeler</td>
<td>Filters for water &amp; sewerage, brick, coated w/ asphalt, covered brick.</td>
<td>5' 0&quot;</td>
<td>11' 6&quot;</td>
<td>15' 6&quot;</td>
<td>2'-6&quot;</td>
<td>5'-0&quot;</td>
<td>13</td>
<td>4'-10&quot;</td>
<td></td>
</tr>
<tr>
<td>1897</td>
<td>Wisconsin</td>
<td>Freeman, Coffin</td>
<td>Filters for water &amp; sewerage, brick, coated w/ asphalt, covered brick.</td>
<td>5' 0&quot;</td>
<td>11' 6&quot;</td>
<td>15' 6&quot;</td>
<td>2'-6&quot;</td>
<td>5'-0&quot;</td>
<td>13</td>
<td>4'-10&quot;</td>
<td></td>
</tr>
<tr>
<td>1898</td>
<td>Louisville, Ky.</td>
<td>G. H. Knepper</td>
<td>Filters for water &amp; sewerage, brick, coated w/ asphalt, covered brick.</td>
<td>5' 0&quot;</td>
<td>11' 6&quot;</td>
<td>15' 6&quot;</td>
<td>2'-6&quot;</td>
<td>5'-0&quot;</td>
<td>13</td>
<td>4'-10&quot;</td>
<td></td>
</tr>
<tr>
<td>1899</td>
<td>Concord, Mass.</td>
<td>Leonard Metcalf</td>
<td>Filters for water &amp; sewerage, brick, coated w/ asphalt, covered brick.</td>
<td>5' 0&quot;</td>
<td>11' 6&quot;</td>
<td>15' 6&quot;</td>
<td>2'-6&quot;</td>
<td>5'-0&quot;</td>
<td>13</td>
<td>4'-10&quot;</td>
<td></td>
</tr>
<tr>
<td>1899</td>
<td>Albany, N.Y.</td>
<td>Allen Hazen</td>
<td>Filters for water &amp; sewerage, brick, coated w/ asphalt, covered brick.</td>
<td>5' 0&quot;</td>
<td>11' 6&quot;</td>
<td>15' 6&quot;</td>
<td>2'-6&quot;</td>
<td>5'-0&quot;</td>
<td>13</td>
<td>4'-10&quot;</td>
<td></td>
</tr>
<tr>
<td>1899</td>
<td>Clinton, Mass.</td>
<td>F. P. Stearns</td>
<td>Filters for water &amp; sewerage, brick, coated w/ asphalt, covered brick.</td>
<td>5' 0&quot;</td>
<td>11' 6&quot;</td>
<td>15' 6&quot;</td>
<td>2'-6&quot;</td>
<td>5'-0&quot;</td>
<td>13</td>
<td>4'-10&quot;</td>
<td></td>
</tr>
<tr>
<td>1900</td>
<td>Superior, Wis.</td>
<td>Allen Hazen</td>
<td>Filters for water &amp; sewerage, brick, coated w/ asphalt, covered brick.</td>
<td>5' 0&quot;</td>
<td>11' 6&quot;</td>
<td>15' 6&quot;</td>
<td>2'-6&quot;</td>
<td>5'-0&quot;</td>
<td>13</td>
<td>4'-10&quot;</td>
<td></td>
</tr>
<tr>
<td>1901</td>
<td>Philadelphia</td>
<td>John W. Hill</td>
<td>Filters for water &amp; sewerage, brick, coated w/ asphalt, covered brick.</td>
<td>5' 0&quot;</td>
<td>11' 6&quot;</td>
<td>15' 6&quot;</td>
<td>2'-6&quot;</td>
<td>5'-0&quot;</td>
<td>13</td>
<td>4'-10&quot;</td>
<td></td>
</tr>
<tr>
<td>1902</td>
<td>Milwaukee, Wis.</td>
<td>Leonard Metcalf</td>
<td>Filters for water &amp; sewerage, brick, coated w/ asphalt, covered brick.</td>
<td>5' 0&quot;</td>
<td>11' 6&quot;</td>
<td>15' 6&quot;</td>
<td>2'-6&quot;</td>
<td>5'-0&quot;</td>
<td>13</td>
<td>4'-10&quot;</td>
<td></td>
</tr>
<tr>
<td>1902</td>
<td>Philadelphia</td>
<td>John W. Hill</td>
<td>Filters for water &amp; sewerage, brick, coated w/ asphalt, covered brick.</td>
<td>5' 0&quot;</td>
<td>11' 6&quot;</td>
<td>15' 6&quot;</td>
<td>2'-6&quot;</td>
<td>5'-0&quot;</td>
<td>13</td>
<td>4'-10&quot;</td>
<td></td>
</tr>
<tr>
<td>1902</td>
<td>Philadelphia</td>
<td>Frank L. Fuller</td>
<td>Filters for water &amp; sewerage, brick, coated w/ asphalt, covered brick.</td>
<td>5' 0&quot;</td>
<td>11' 6&quot;</td>
<td>15' 6&quot;</td>
<td>2'-6&quot;</td>
<td>5'-0&quot;</td>
<td>13</td>
<td>4'-10&quot;</td>
<td></td>
</tr>
<tr>
<td>1903</td>
<td>Ithaca, N.Y.</td>
<td>Allen Hazen</td>
<td>Filters for water &amp; sewerage, brick, coated w/ asphalt, covered brick.</td>
<td>5' 0&quot;</td>
<td>11' 6&quot;</td>
<td>15' 6&quot;</td>
<td>2'-6&quot;</td>
<td>5'-0&quot;</td>
<td>13</td>
<td>4'-10&quot;</td>
<td></td>
</tr>
<tr>
<td>1903</td>
<td>Proposed for</td>
<td>Morris Konkel</td>
<td>Filters for water &amp; sewerage, brick, coated w/ asphalt, covered brick.</td>
<td>5' 0&quot;</td>
<td>11' 6&quot;</td>
<td>15' 6&quot;</td>
<td>2'-6&quot;</td>
<td>5'-0&quot;</td>
<td>13</td>
<td>4'-10&quot;</td>
<td></td>
</tr>
<tr>
<td>1903</td>
<td>Yonkers, N.Y.</td>
<td>Allen Hazen</td>
<td>Filters for water &amp; sewerage, brick, coated w/ asphalt, covered brick.</td>
<td>5' 0&quot;</td>
<td>11' 6&quot;</td>
<td>15' 6&quot;</td>
<td>2'-6&quot;</td>
<td>5'-0&quot;</td>
<td>13</td>
<td>4'-10&quot;</td>
<td></td>
</tr>
<tr>
<td>1903</td>
<td>Watertown, N.Y.</td>
<td>Allen Hazen</td>
<td>Filters for water &amp; sewerage, brick, coated w/ asphalt, covered brick.</td>
<td>5' 0&quot;</td>
<td>11' 6&quot;</td>
<td>15' 6&quot;</td>
<td>2'-6&quot;</td>
<td>5'-0&quot;</td>
<td>13</td>
<td>4'-10&quot;</td>
<td></td>
</tr>
<tr>
<td>1903</td>
<td>Brooklyn, N.Y.</td>
<td>F. F. Forbes</td>
<td>Filters for water &amp; sewerage, brick, coated w/ asphalt, covered brick.</td>
<td>5' 0&quot;</td>
<td>11' 6&quot;</td>
<td>15' 6&quot;</td>
<td>2'-6&quot;</td>
<td>5'-0&quot;</td>
<td>13</td>
<td>4'-10&quot;</td>
<td></td>
</tr>
<tr>
<td>1903</td>
<td>Proposed for</td>
<td>John W. Hill</td>
<td>Filters for water &amp; sewerage, brick, coated w/ asphalt, covered brick.</td>
<td>5' 0&quot;</td>
<td>11' 6&quot;</td>
<td>15' 6&quot;</td>
<td>2'-6&quot;</td>
<td>5'-0&quot;</td>
<td>13</td>
<td>4'-10&quot;</td>
<td></td>
</tr>
<tr>
<td>1903</td>
<td>Proposed for</td>
<td>John W. Hill</td>
<td>Filters for water &amp; sewerage, brick, coated w/ asphalt, covered brick.</td>
<td>5' 0&quot;</td>
<td>11' 6&quot;</td>
<td>15' 6&quot;</td>
<td>2'-6&quot;</td>
<td>5'-0&quot;</td>
<td>13</td>
<td>4'-10&quot;</td>
<td></td>
</tr>
<tr>
<td>1903</td>
<td>Proposed for</td>
<td>John W. Hill</td>
<td>Filters for water &amp; sewerage, brick, coated w/ asphalt, covered brick.</td>
<td>5' 0&quot;</td>
<td>11' 6&quot;</td>
<td>15' 6&quot;</td>
<td>2'-6&quot;</td>
<td>5'-0&quot;</td>
<td>13</td>
<td>4'-10&quot;</td>
<td></td>
</tr>
<tr>
<td>1903</td>
<td>Proposed for</td>
<td>John W. Hill</td>
<td>Filters for water &amp; sewerage, brick, coated w/ asphalt, covered brick.</td>
<td>5' 0&quot;</td>
<td>11' 6&quot;</td>
<td>15' 6&quot;</td>
<td>2'-6&quot;</td>
<td>5'-0&quot;</td>
<td>13</td>
<td>4'-10&quot;</td>
<td></td>
</tr>
<tr>
<td>1903</td>
<td>Proposed for</td>
<td>John W. Hill</td>
<td>Filters for water &amp; sewerage, brick, coated w/ asphalt, covered brick.</td>
<td>5' 0&quot;</td>
<td>11' 6&quot;</td>
<td>15' 6&quot;</td>
<td>2'-6&quot;</td>
<td>5'-0&quot;</td>
<td>13</td>
<td>4'-10&quot;</td>
<td></td>
</tr>
<tr>
<td>1903</td>
<td>Proposed for</td>
<td>John W. Hill</td>
<td>Filters for water &amp; sewerage, brick, coated w/ asphalt, covered brick.</td>
<td>5' 0&quot;</td>
<td>11' 6&quot;</td>
<td>15' 6&quot;</td>
<td>2'-6&quot;</td>
<td>5'-0&quot;</td>
<td>13</td>
<td>4'-10&quot;</td>
<td></td>
</tr>
<tr>
<td>1903</td>
<td>Proposed for</td>
<td>John W. Hill</td>
<td>Filters for water &amp; sewerage, brick, coated w/ asphalt, covered brick.</td>
<td>5' 0&quot;</td>
<td>11' 6&quot;</td>
<td>15' 6&quot;</td>
<td>2'-6&quot;</td>
<td>5'-0&quot;</td>
<td>13</td>
<td>4'-10&quot;</td>
<td></td>
</tr>
</tbody>
</table>

**FIGURE 8:** Data on groined arch roof structures built in the United States as of December 1903 compiled by Leonard Metcalf. Metcalf co-founded the water and wastewater consulting firm of Metcalf & Eddy in 1907 and is considered the father of environmental engineering. (Source: Metcalf, 1903, p. 565).
Photo # 1 description: Pump Station, main entrance, north elevation
Photo ID #: DWW_001  Direction: S  Date: 1 June 2011  Image stored at: HDC, Inc. Portsmouth, RI

Photo # 2 description: Pump Station, west elevation, showing circular bay for operating valves.
Photo ID #: DWW_002  Direction: SE  Date: 1 June 2011  Image stored at: HDC, Inc. Portsmouth, RI
Photo # 3 description: Pump Station, south and east elevations
Photo ID #: DWW_003  Direction: NW  Date: 1 June 2011  Image stored at: HDC, Inc. Portsmouth, RI

Photo # 4 description: Pump Station, east side entrance
Photo ID #: DWW_004  Direction: W  Date: 1 June 2011  Image stored at: HDC, Inc. Portsmouth, RI
<table>
<thead>
<tr>
<th>Photo #</th>
<th>Description</th>
<th>Photo ID</th>
<th>Direction</th>
<th>Date</th>
<th>Image Stored At</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Pump Station, interior of Engine Room showing valve bay</td>
<td>DWW_005</td>
<td>W</td>
<td>1 June 2011</td>
<td>HDC, Inc. Portsmouth, RI</td>
</tr>
<tr>
<td>6</td>
<td>Pump Station, interior of Engine Room showing partition wall with fireplace</td>
<td>DWW_006</td>
<td>W</td>
<td>1 June 2011</td>
<td>HDC, Inc. Portsmouth, RI</td>
</tr>
</tbody>
</table>
FIGURE 9: KEY TO PHOTOS 7 THRU 16.
Photo # 7 description: Former location of Clear Water Basin, Pump Station in background.

Photo ID #: DWW_007  Direction: S  Date: 1 June 2011  Image stored at: HDC, Inc. Portsmouth, RI

Photo # 8 description: View toward location of buried Slow Sand Filter Bed

Photo ID #: DWW_008  Direction: N  Date: 1 June 2011  Image stored at: HDC, Inc. Portsmouth, RI
Photo # 9 description: Portion of wall or foundation of Aerator or Settling Tank
Photo ID #: DWW_009  Direction: W  Date: 1 June 2011  Image stored at: HDC, Inc. Portsmouth, RI

Photo # 10 description: Portion of Filter Bed access door, exposed by excavation
Photo ID #: DWW_010  Direction: W  Date: 1 June 2011  Image stored at: HDC, Inc. Portsmouth, RI
Photo # 11 description: Manhole in roof of Filter Bed structure
Photo ID #: DWW_011 Direction: W Date: 1 June 2011 Image stored at: HDC, Inc. Portsmouth, RI

Photo # 12 description: View of interior of Filter Bed, looking in thru cleanout door shown in Photo 10
Photo ID #: DWW_012 Direction: W Date: 1 June 2011 Image stored at: HDC, Inc. Portsmouth, RI
Photo # 13 description: Interior of Filter Bed showing concrete groined arch construction, manhole in roof
Photo ID #: DWW_013   Direction: S   Date: 1 June 2011   Image stored at: HDC, Inc. Portsmouth, RI

Photo # 14 description: Interior of Filter Bed showing detail of groined arch construction, concrete form marks
Photo ID #: DWW_014   Direction: S   Date: 1 June 2011   Image stored at: HDC, Inc. Portsmouth, RI
<table>
<thead>
<tr>
<th>Photo #</th>
<th>Description</th>
<th>Photo ID</th>
<th>Direction</th>
<th>Date</th>
<th>Image Stored At</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>New Pump Station, south and west elevations</td>
<td>DWW_015</td>
<td>NE</td>
<td>1 June 2011</td>
<td>HDC, Inc. Portsmouth, RI</td>
</tr>
<tr>
<td>16</td>
<td>Garage, north and east elevations</td>
<td>DWW_016</td>
<td>SW</td>
<td>1 June 2011</td>
<td>HDC, Inc. Portsmouth, RI</td>
</tr>
</tbody>
</table>