Town of Dover Hydrology Study

Board of Health, Water Resource Committee Meeting
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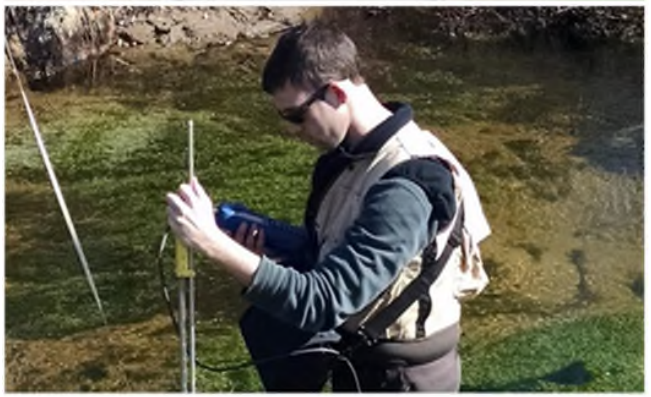
Introduction

Why a hydrology study in Dover?

- Private wells supply drinking water for the majority of Dover residents
- Board of Health noted increasing problems with private wells
- 2015-2016 drought intensified concerns
- 2015: Dover Board of Selectmen established a Water Resources Study Committee (WRSC) to address water resources concerns
- 2017: Committee transferred to Dover Board of Health responsibility
- 2018: Town authorized funding for this hydrology study.

Presentation Overview

1. Project Purpose
2. Project Scope
3. Dover Water Resources & Challenges
4. Monitoring Network
5. Field Monitoring Program
6. Key Findings
   - Water use records
   - Water level monitoring
   - Water quality testing
7. Discussion & Recommendations
8. Questions



Project Purpose

Project Purpose:

- Identify and map water resources in Town
- Gather data on water use
- Install a long-term monitoring network
- Monitoring of stream and groundwater levels over time will identify seasonal trends and year to year changes
- Data will provide information for informed decision making to mitigate risks to Town aquifers

Project Scope

- Task 1: Research and Data Review; Monitoring Network Design
  - Research and compilation of available data; design a monitoring network
- Task 2: GIS Layer Development
  - Develop a Dover Water GIS layer to include public water supply wells, piping, and private wells and incorporating the new monitoring network points
- Task 3: Installation of Monitoring Network
  - Groundwater monitoring wells and stream monitoring
- Task 4: Monitor and Test Groundwater
  - Monitor groundwater and stream levels; collect water quality samples
- Task 5: Report
  - Report deliverable

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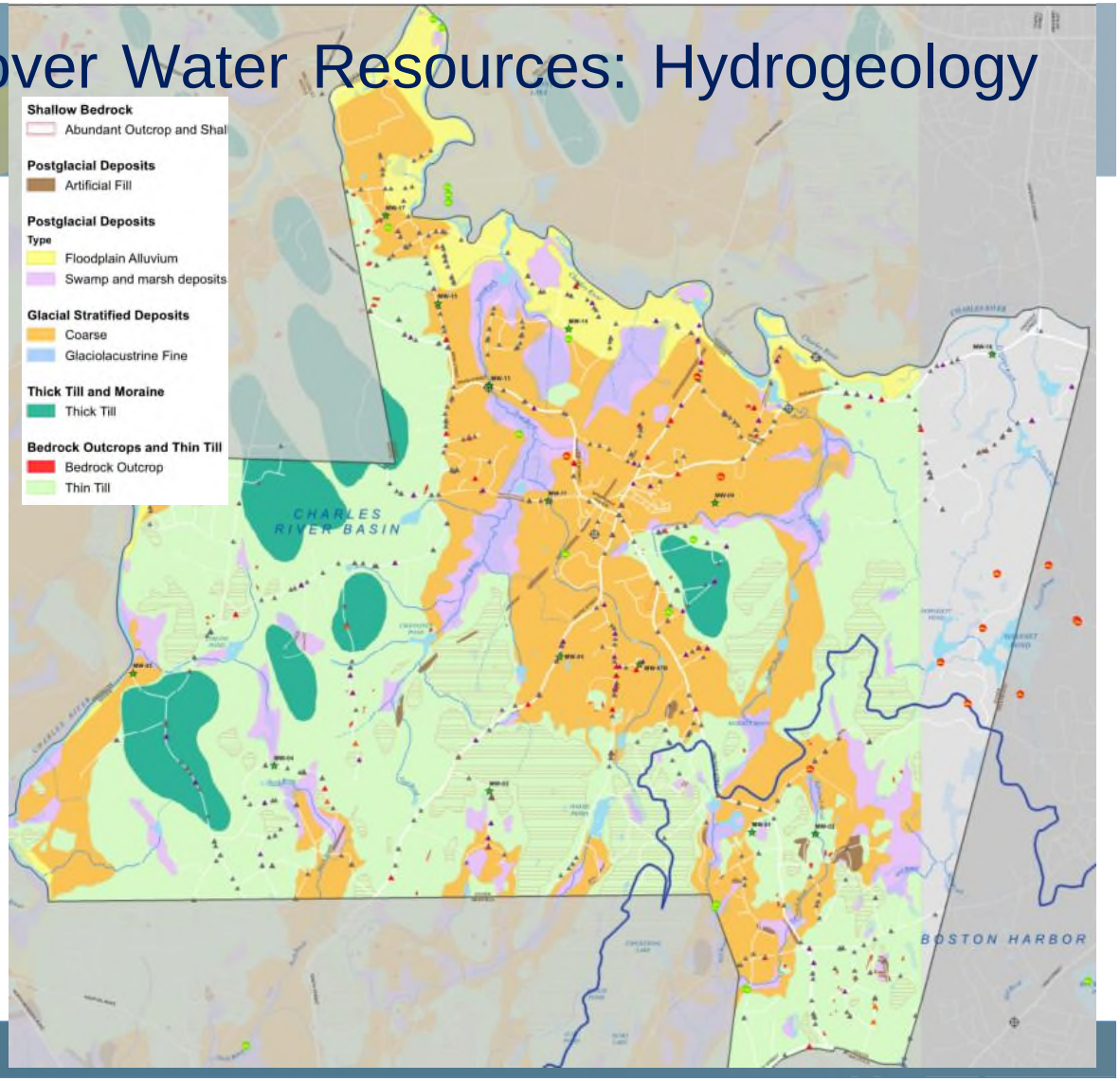
Dover Water Resources: Hydrogeology

Drainage basins:

- Charles River Basin
  - *Trout Brook, Noanet Brook, North*
- Boston Harbor Basin
  - *Tubwreck Brook, Mill Brook*

Geology:

- Extensive till; bedrock deposits
- Valley sand & gravel
- Floodplain alluvium



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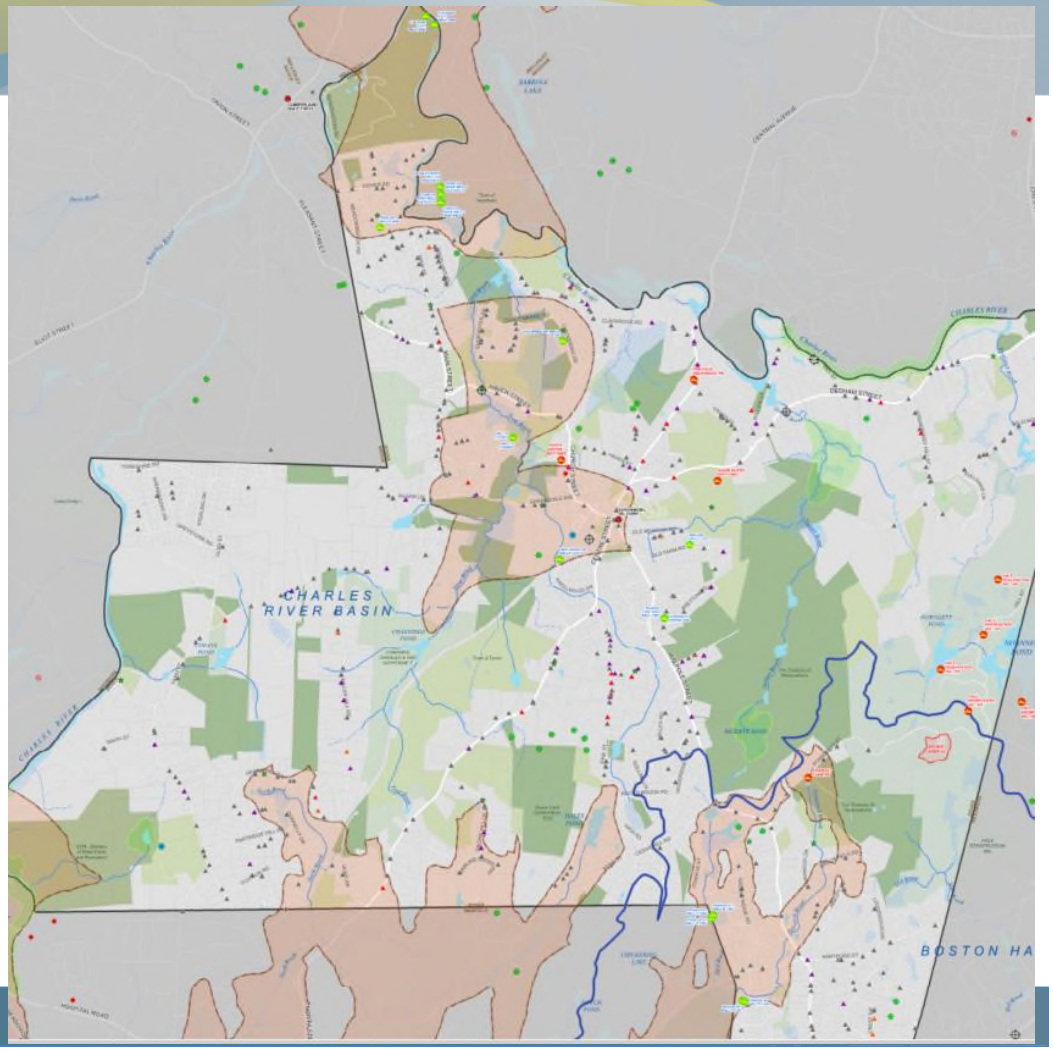
Dover Water Resources: Water Supply

Dover residents Water supply:

- 63% private wells
  - Most are installed in bedrock, hundreds of feet deep
- 37% Public Water Systems (PWS)
  - Installed in shallow sand/gravel aquifers
  - Most are 50 feet deep or less
  - Governed by MassDEP Permit
  - Protected Zone II recharge areas based on permitted pumping rates



Dover Water Resources: Water Supply

Dover residents Water supply:

- 63% have a private well
  - 2007-2017: at least 134 private wells decommissioned, drilled deeper, or hydrofractured (a method to increase yield).
- 37% served by privately owned Public Water Systems (PWS)
- 3% supplied by Towns of Natick or Walpole
- Largest PWS- Colonial Water (formerly Dover Water Co.)

Table 2-1: Public Water Systems Supplied by Wells in Dover

System Name	PWS ID#	Dover Population Served(1)	System Type	Notes	Average Daily Pumping (2) (gal/d)
Colonial Water	3078006	1,674	Community	7 active gravel wells	146,284
Springdale Farms Trust (Colonial Water purchased 2018)	3078008	150	Community	2 gravel wells	18,987
Town of Dover Water Dept	3078000	500	Non-Transient-Non-Community (school)	Caryl Park Well (gravel)	1,795
Old Farm Rd. Water Trust	3078001	40	Community	Bedrock Well	3,410
Glen Ridge Trust	3078002	122	Community	Purchases water from Natick	12,042
Meadowbrook Water Trust	3078005	57	Community	Purchased water from Natick	5,031
Precious Beginnings	3078010	44	Transient Non-Community (day care)	Day care center	80

(1)Service population is from MassDEP ASR
(2) Average Daily Pumping from MassDEP ASR 2009 - 2017

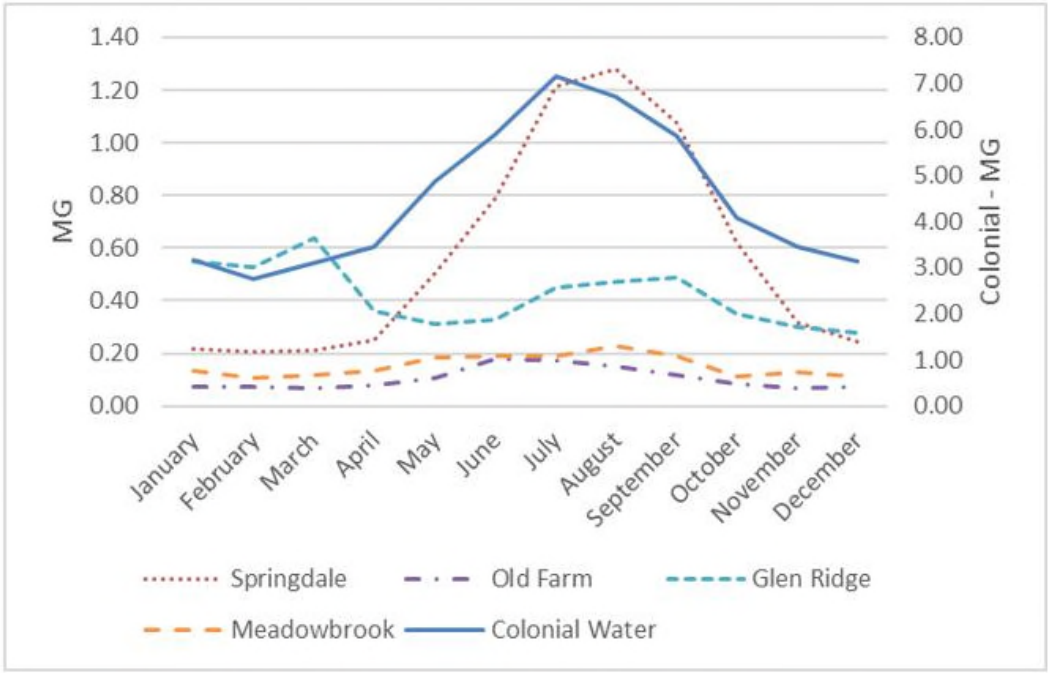
Dover Water Resources: Public Supplier Water Usage

Review of PWS records:

- Significantly higher usage in summer
- Colonial: Summer usage doubled
- Springdale Farms: Summer use 6x higher

Note: no data available for Dover private well users

Figure 2-4: Monthly Average Usage for PWSs (2009-2017)



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Dover Water Resources: Public Supplier Water Usage

Review of PWS records:

- Pumping in exceedance of Permit (Colonial)
- Water use exceeding MassDEP conservation standard of 65 gallons per person per day (all PWS)

Note: no data available for Dover private well users

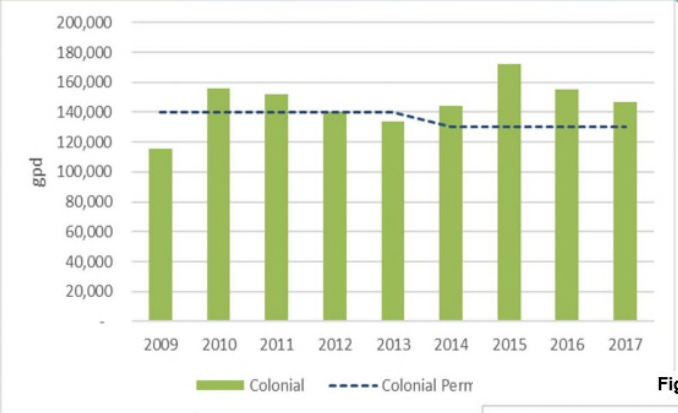
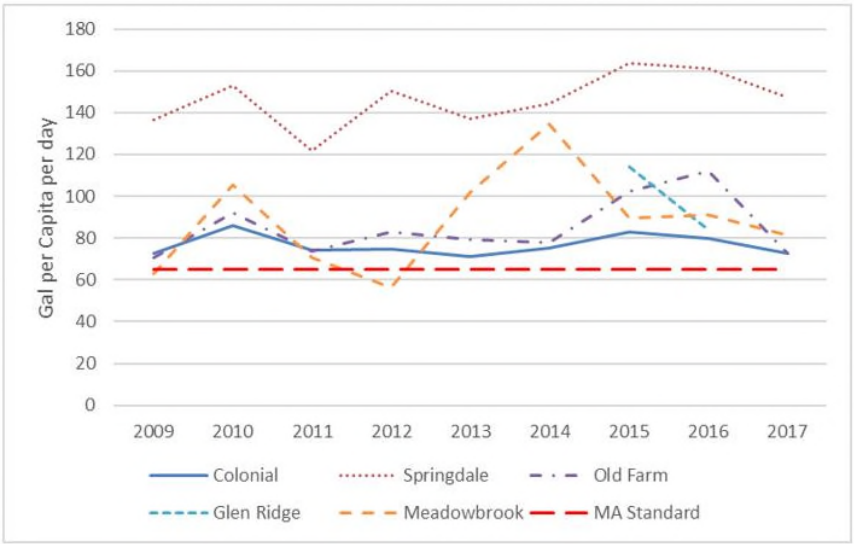


Figure 2-3: Residential Gallons per Capita per Day (2009-2017)



Dover Water Quality Concerns

Dover has significant areas of protected open space, which helps protect groundwater, streams, and wetlands

- Potential water quality threats do exist:
  - Commercial / municipal property in Town center
  - Septic systems
  - Agricultural land use
  - Roads
- In 1986 a fuel spill at the Mobil station contaminated the Town Church Street Well (now abandoned)

Monitoring Network

Existing data sources:

- USGS Dover monitoring well (monthly groundwater level)
- USGS stream gauges (daily flow)
- Regional weather stations (daily precipitation)

New data sources installed during study:

- Groundwater monitoring wells
- Piezometers
- Stream gauges

New monitoring location goals:

- Locate on Town land or road right of way
- Install in shallow overburden sand /gravel aquifers
- Monitor near streams / wetlands reported drying
- Locate near areas of potential contamination
- Locate near areas of concern for private wells
- Locate in each area supplying public wells
- Provide geographic coverage across Town if possible

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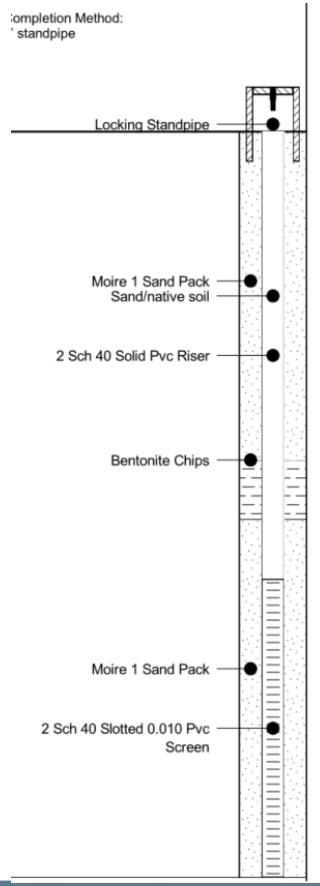
Field Monitoring Program

Monitoring Well Installation

- December 2018 and February 2019
- Drilling of shallow 2-inch diameter monitoring wells
- 16 locations, installed in sand/gravel
- 3 well locations subsequently went dry
- 1 additional well installed in bedrock



Field Monitoring Program

Groundwater & Stream Monitoring Network

- Data logging water level sensors installed in 14 monitoring wells and 5 stream locations
- Sensors are suspended inside the well, under the water and record changes in pressure and temperature
- Pressure is converted to water level with computer software.
- Manual readings are collected to verify sensor operation.

Field Monitoring Program

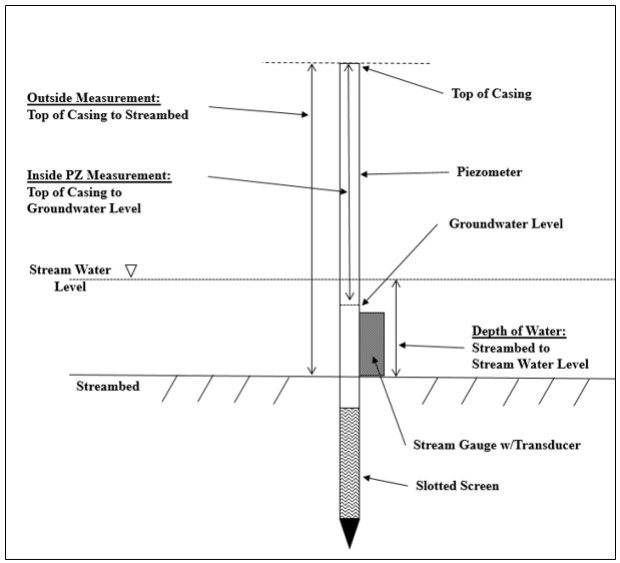


Figure 4-2: Piezometer and Stream Gauge Measurements

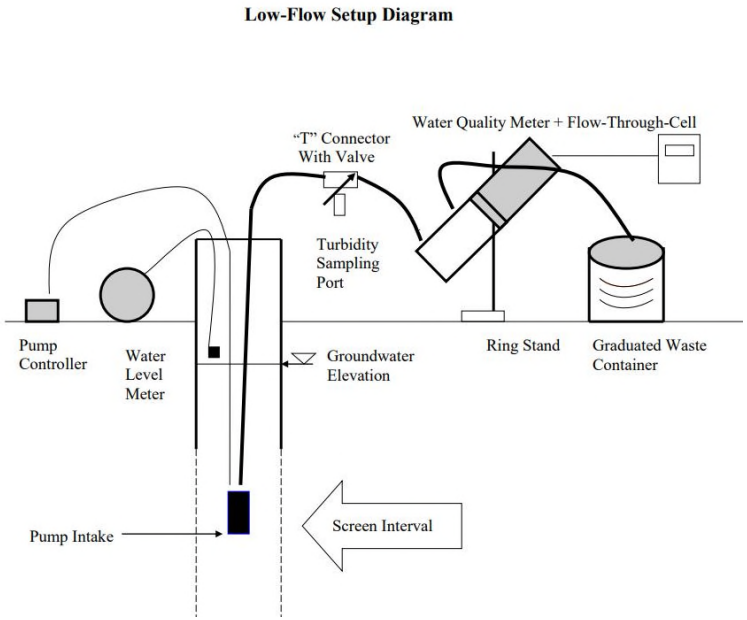
Streambed piezometers

- Piezometers measure if a stream is 'gaining' water from the aquifer or 'losing' it to the aquifer
- 6 PZ's installed (same location as MW's)
- Periodic manual measurements inside the pipe determine gradient between groundwater and the stream
- Stream data logging sensor is mounted to the piezometer pipe to continuously measure stream height

Field Monitoring Program

Groundwater Quality Testing

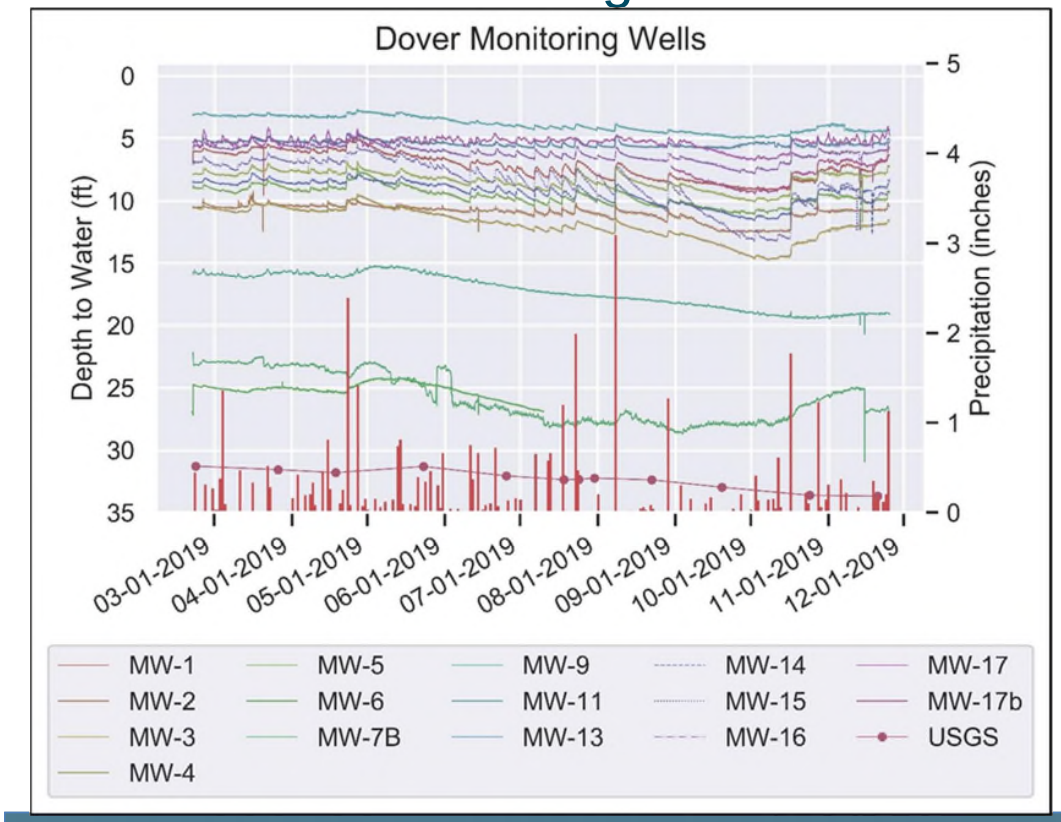
- 13 of the 14 monitoring wells were sampled November 13 -15, 2019
- MW-6 was planned for sampling, but was dry at the time of sampling
- All wells were analyzed for pH, manganese, sodium, chloride, nitrate and nitrite, and volatile organic compounds (VOCs).
- A minimum of one field blank per day was collected and trip blanks accompanied all sample shipments.



Source: EPA Low Flow Sampling Manual

Key Findings

Water Level Monitoring – Groundwater:



- Typical seasonal trends were reflected in most monitoring wells
- Increase in the groundwater table observed during the cooler months and a decrease following summer months, particularly during September and October.
- Consistent with regional trends in temperature and precipitation.
- Several monitoring wells had relatively larger seasonal drawdowns which could potentially be related to the pumping of nearby public and / or private supply wells.

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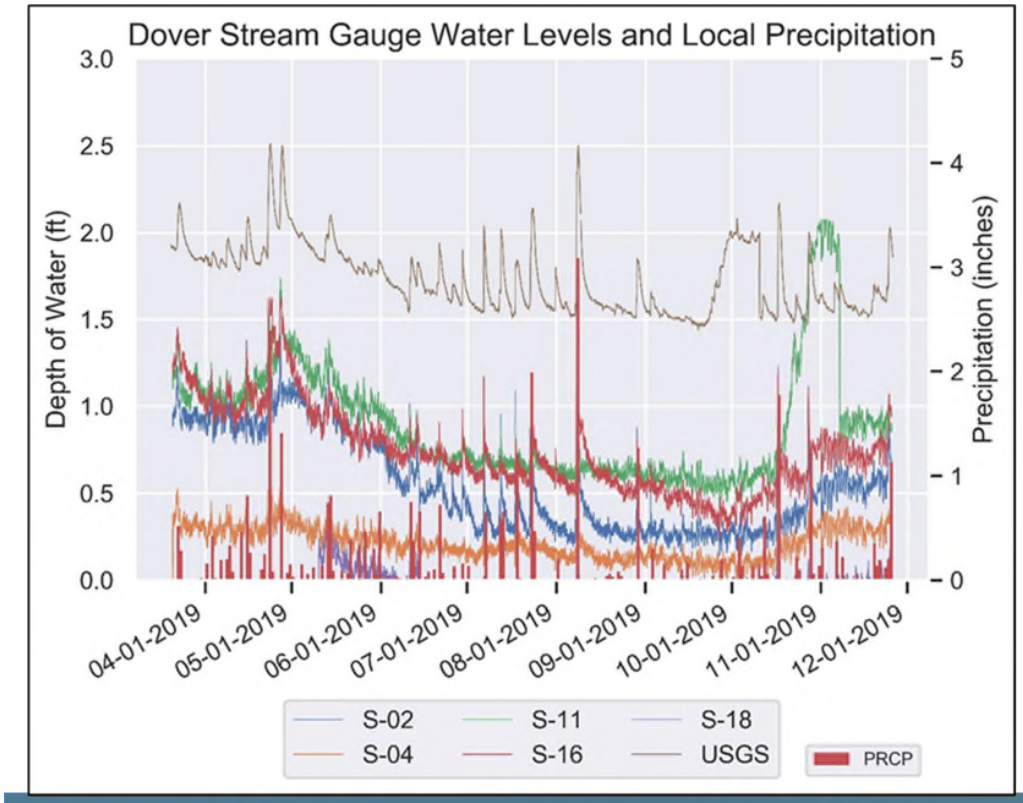
Key Findings

Water Level Monitoring – Streamflow :



- Stream gauges also followed these general trends with higher stream levels in the cooler months and lower levels in the warmer months.
- Stream gauges responded rapidly to precipitation events

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Key Findings

Water Quality Testing:

- Nitrate, manganese, volatile organic compounds (VOCs), sodium and chloride.
- No VOCs were detected
- All wells: low pH, typical of regional acidic natural groundwater
- All wells: elevated Mn typical of the regional groundwater (naturally occurring)
- Nitrate indicative of septic system influence (over 1 mg/L, but below 10 mg/L limit) was observed in 7 wells; generally in more densely developed areas.
- One well had nitrate in excess of the Dover Board of Health Well Regulation limit of 5 mg/L.
- Many of the wells also had elevated levels of sodium and chlorides indicating that road de-icing salt is influencing the water quality.

Well ID#		MW-1	MW-2	MW-3	MW-4	MW-5	MW-7B
Well Location		Hunter's Path	Tubwreck Dr.	Snow's Hill Rd	Grand Hill Rd	Bridge St	Ben Arthur's Way
Lab Work Order #	---	19K0918-01	19K0914-01	19K0912-01	19K0913-01	19K0907-01	19K0933-01
Sampling Date	---	11/13/19	11/13/19	11/13/19	11/14/19	11/14/19	11/15/19
Analysis Parameter	Unit						
pH	s.u.	5.7	5.6	5.7	5.7	5.8	5.5
Manganese	mg/L	0.3	0.1	ND	0.34	0.24	0.11
Sodium	mg/L	97	70	26	110	58	65
Chloride	mg/L	170	100	58	140	160	110
Nitrate as N	mg/L	2.06	0.26	6.69	3.05	ND	0.66
Nitrite as N	mg/L	ND	ND	ND	0.017	ND	ND
VOCs	ug/L	ND	ND	ND	ND	ND	ND

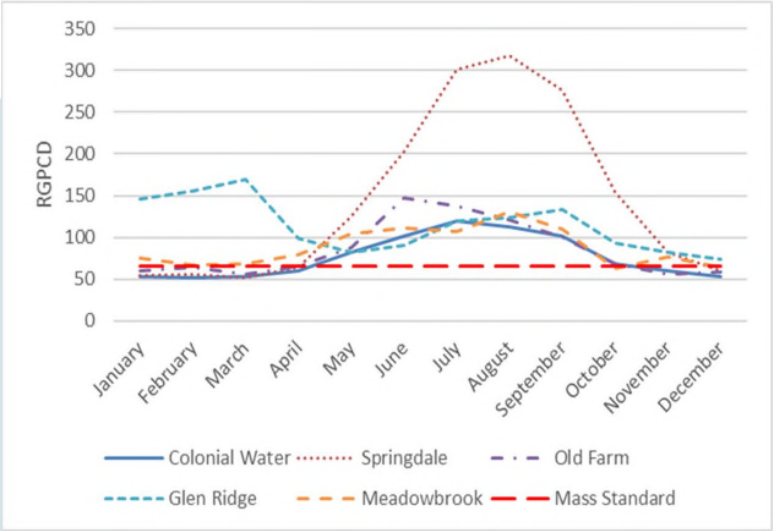
Well ID#		MW-9	MW-11	MW-13	MW-14	MW-15	MW-16	MW-17
Well Location		Caryl Park	Springdale Ave.	Haven St.	Chickering Dr.	Main St.	Dedham St.	Brook St.
Lab Work Order #	---	19K0936-01	19K0935-01	19K0856-01	19K1087-01	19K0857-01	19K0912-01	19K1086-01
Sampling Date	---	11/15/19	11/15/19	11/12/19	11/18/19	11/12/19	11/13/19	11/18/19
Analysis Parameter	Unit							
pH	s.u.	5.6	6.6	6.3	6.2	5.4	6.7	6
Manganese	mg/L	0	0.12	0.03	1.3	0.083	3.2	ND
Sodium	mg/L	5	17	76	27	290	7.9	59
Chloride	mg/L	ND	52	190	110	480	23	85
Nitrate as N	mg/L	ND	1.5	4.2	0.18	1.1	ND	4.8
Nitrite as N	mg/L	ND	ND	ND	ND	ND	0.025	ND
VOCs	ug/L	ND	ND	ND	ND	ND	ND	ND

ND: Not detected

Key Findings

Water Use Records:

- PWS: highest usage July through September, during the time of year that groundwater levels are often lowest.
- This indicates excessive household seasonal non-essential outdoor water use (e.g. lawn watering; pool filling).
- Residential usage consistently exceeds Massachusetts Conservation standard of 65, in some cases by more than double.
- Largest supplier exceeded withdrawal Permit in 7 of the past 9 years for which data were reviewed.
- Over pumping that significantly exceeds permit limits has the potential to negatively impact water availability in Dover aquifers, and to mobilize contamination sources, particularly during droughts such as the severe drought of 2016



Key Findings

Water Use Management:

- Strategies for preventing negative impacts of excessive groundwater use can include:
  - MassDEP enforcement of existing regulations and restrictions on PWSs
  - Town establishing new regulations for private well use
  - Promoting good water stewardship through education of Town private well users
  - Working with PWS to help them comply with Permit requirements which mandate conservation measures and seasonal water use restrictions

Discussion & Recommendations

1. Monitoring Network:
   - Continue to collect data; fill data gaps; explore partnership with USGS
2. Review PWS water use records annually; compare with network trends
3. Evaluate water conservation strategies:
   - Explore outdoor water use bylaw; regulations
   - Implement Town-wide water conservation campaign
   - Work with PWS on conservation efforts required by their Permits – pursue available MassDEP grant funding
   - Install high efficiency fixtures in Town facilities

Questions?

Acknowledgements:

Water Resource Committee Members:

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Dover Town Staff:

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