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Support of Persistent Data Service for the Cape Cod Aquifer

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Support of Persistent Data Service for the Cape Cod Aquifer

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Title: Support of Persistent Data Service for the Cape Cod Aquifer

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Description of work done to support NGWMN as a data provider

The Cape Cod Commission (and its predecessor the Cape Cod Planning and Economic Development Commission) has been measuring water levels within the Cape Cod network for many decades. The work performed under this grant further supports the Commission's contribution to the National Groundwater Monitoring Network from those ongoing water level measurement activities.

Each month, Commission staff measures water levels in groundwater observation wells in over 30 locations distributed across Cape Cod, including eight NGWMN wells, compiling that information and providing it to the USGS New England Water Science Center. The information is made available to the public via the Groundwater Watch web site administered by the USGS, and the National Water Information System. To inform high-water estimates, water levels from a subset of wells (index wells) are made available to the public each month via the Commission's web site (https://www.capecodcommission.org/our-work/cape-cod-groundwater-levels/). This information is used by contractors, health departments and others doing work on Cape Cod. The Commission frequently fields questions from contractors and the general public regarding the well network and applications of the water-level information ranging from septic system installations to basement flooding.

Data collection, well maintenance, well-drilling activities

During the project period, Commission staff continued to collect and report water level information as described above. This effort has been complicated by the replacement of seven wells, six of which are used as index wells to estimate seasonal high groundwater levels.

The Commission was asked by the USGS to measure concurrent water levels in both replaced and replacement wells for up to 18 months to allow water levels in replaced and replacement wells to be correlated over time. Correlation of water levels is critical to the high-groundwater calculation because reference elevations (measurement points and land surfaces) for each well are specific to each location. To address these changes, the Commission performed surveys to obtain or verify reference elevations at replaced and replacement well where access was possible. Results of surveying activities are shown in Table 1. Commission staff performed surveys at A1W247, SDW253, CGW138, and WNW17. Staff from the Town of Sandwich performed the survey at SDW252.

Table 1: Well survey data

Well ID	Measurement Date	Measuring Point Elevation (ft AMSL)	Casing Stick Up Height (ft)	Land Surface Elevation (ft AMSL)	Adjustment factor required for high water level estimation (ft)
A1W247	10/23/2018	46.5	2.0	44.5	
A1W247R		48.4	2.87	45.6	1.87
SDW253	10/31/2018	113.9	2.7	111.2	
SDW253R		111.9	3.2	108.7	5.8
SDW252	1/2/2019	54.64	0.89	53.75	
SDW252R		46.43	2.64	43.79	7.06
CGW138	11/26/2018	39.3	4.0	35.3	
CGW138R		37.8	2.71	35.1	2.9
WNW17	11/26/2018	21.96	3.0	19.0	
WNW17R		22.0	2.5	19.5	2.0

Commission staff was informed by USGS staff that the USGS intends to conduct a professional survey of Cape Cod wells and that water-level measurements from replacement wells should not be used until the USGS establishes elevation control on the wells. For the purpose of high-groundwater estimations, Commission staff resumed reporting water levels measured in replaced wells, with the exceptions of SDW252, where site access has been denied, and CGW138, where elevation control of the replaced well needs to be re-established.

Commission staff was informed by USGS staff that updates of the USGS Database Portal would be performed by USGS staff using the information collected and submitted by Commission staff. Commission staff recorded information regarding well dimensions (well depths, diameters and heights of measurement points above ground surface) on field sheets for January, February and March 2019 that were included in the monthly data submissions to USGS. A summary of the well construction data collected is also provided in Table 2.

Table 2: Well construction data

Well ID	Total Depth (ft below MP)	Casing diameter (in)	Casing height (ft ALS)
A1W 247	51.20	1.25	2.00
A1W 247R	56.23	2	2.87
A1W 307	35.05	1.25	0.08
MIW 29	40.70	2	-0.19
SDW 263	108.30	2	0.25
CGW 138	34.25	2.5	3.83
CGW 138R	N/A*	2	2.75
WNW 17	43.10	3	3.13
WNW 17R	N/A*	2	2.52
SDW 253	59.78	1	2.70
SDW 253R	N/A*	2	3.20

*USGS requested that total depth measurements not be recorded in wells with pressure transducers

Well maintenance

The Commission participated in the siting of replacement wells constructed within the USGS Climate Response Network. With the exception of well SDW252R, all replacement wells were installed adjacent to their corresponding replaced wells. Before SDW252R can be used to estimate high groundwater, measured water levels from SDW252R will require further adjustment to address the difference between water table elevations at SDW252 and SDW252R. The further adjustment will require contemporary measurements at SDW252 and SDW252R, which have not been possible to date because access to SDW252 has been denied by the property owner.

Aquifer responsiveness tests of wells A1W307 and SDW263 were conducted in May 2019 as detailed in Table 3 and in the methods section below. Well SDW263 demonstrated good to excellent recovery, with the water level recovering to its original value in slightly more than two minutes following the addition of a five-gallon slug to the well. Only fair recovery was observed in Well A1W307, as the water level never reached its initial value but recovered at a rate of approximately 0.47 ft/s. USGS may want to prioritize A1W307 during future well replacement activities. Commission staff measured the depth to bottom in network wells as part of the August water level measurements.

Table 3: Results of aquifer response tests in wells A1W307 and SDW263

Well ID	Casing Diameter (in)	Initial DTW (ft bmp)	Approximate Slug Volume (gal)	Final DTW (ft bmp)	Time of recovery (s)
SDW263	2	91.52	5	91.48	126
A1W307	1.25	24.74	3	4.76	600

The Commission continues to monitor the condition of wells throughout the network and identify those in need of maintenance. Concerns are reported to USGS staff in conjunction with the monthly data submissions.

Methods used for data collection

Survey data was gathered using a Lietz C40 / Sokkia B40 autolevel and standard surveying techniques. At wells A1W307 and SDW263, slug tests were performed by measuring the initial water level, adding a volume of potable water to the well, and measuring the time required for the water level to recover to its initial level (SDW263) or measuring the final water level after a set period of time (10 minutes, A1W307).