New Hampshire Geological Survey
New Hampshire Department of Environmental Services
National Ground-Water Monitoring Network Project
(Cooperative Grant Agreement No. G19AC00190)
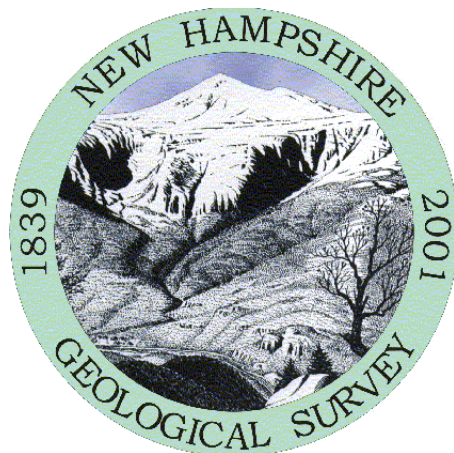# 7/15/2019 – 7/14/2021
Final Grant Report

By

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Introduction

The New Hampshire Geological Survey (NHGS) began participation in the National Groundwater Monitoring Network (NGWMN) in June of 2016. This document is meant to fulfill our obligation of a final report for our 2019 grant, Cooperative Grant Agreement No. G19AC00190.

In our proposal, NHGS proposed the following tasks:

- Maintenance of current web services (Objective 2 activities),
- Expansion of the network by one additional well (LCW-01), under Objective 1 activities,
- Data gap filling for the newly added well (Objective 3 activities), and
- Well maintenance at LCW-01 and three additional network wells NPW-03, NPW-06 (both located in Newport, NH) and DDW-46 (Deerfield, NH), under Objective 4 activities.

Network Expansion

In 2019, NHGS began monitoring LCW-01 in Lancaster, NH (see Figure 1) following the USGS Pembroke NH Water Science center discontinuing monitoring this well. Under this project, NHGS collected metadata, classified this well and entered it into the NGWMN portal for inclusion in the network. Much of the metadata collected are discussed below in the Network Data Gap Filling section. The well is classified as a background, trend well. The classification is based on a review of the well hydrograph which spans from 1966 to present day. Additional factors reviewed included surrounding development, well withdrawals proximal to the LCW-01 and statistical correlation analysis with a local Lancaster weather station precipitation record. Development around the well is primarily agricultural and no water withdrawals were documented in the vicinity of LCW-01. The raw monthly correlation of groundwater levels and precipitation yielded little correlation (-0.035). However, comparison of each monthly average over the period of record yielded a more promising correlation score of 0.66. Based upon these factors, NHGS concluded that we could classify the well as background monitoring location.

Network Data Gap Filling

NHGS proposed to perform an optical and GPS survey to evaluate the well construction conditions and improve the vertical and horizontal accuracies of the well LCW-01. These activities were completed during the fall of 2020. The optical survey, conducted using a downhole camera, indicated the well was approximately 30 feet deep and constructed of galvanized piping and appeared to have a short, less than 1-foot, PVC screen. Based upon this new information, NHGS updated the construction information found in our web services. Newly derived coordinates and vertical elevation were updated in the portal and web services.

Network Well Maintenance Activities

NHGS proposed to perform slug testing and redevelopment of well LCW-01 and replacement of protective well casings for wells in Newport, NH (NPW-03 and NPW-06) and Deerfield, NH (DDW-46), see Figure 1. These activities were completed in the fall of 2020. The casing replacements occurred without difficulty. Similarly, redevelopment and slug testing of LCW-01 was completed without issue. The slug test was conducted commensurate with USGS protocols laid out in Cunningham & Schalk, 2011, and the slug test data was analyzed using methods from Bouwer, H. and R.C. Rice, 1976. Purge water from the well development indicated the well is likely screened in a silty, fine sand consistent with the mapped glacial meltwater deposited delta, Thompson 2019. Similarly, the slug test results of $1.568\text{x}10^{-8}$ ft/sec is commensurate with a silty, fine sand aquifer. These observations and results would fit with the NGWMN classification of N100GLCIAL Sand and gravel aquifers (glaciated regions).

Data and Web Service Management

NHGS continues to collect, curate and store groundwater level data from our network of monitoring wells. These data are then shared with the NGWMN through our web services, for public and stakeholder access. This data has proven critical to a wide variety of stakeholders at the federal, state and local levels who have been responding to and managing a multi-year drought during 2020 and 2021 in New Hampshire and surrounding states. Over the grant period, we have been engaged with USGS to ensure our web services are operating and providing data to the network.
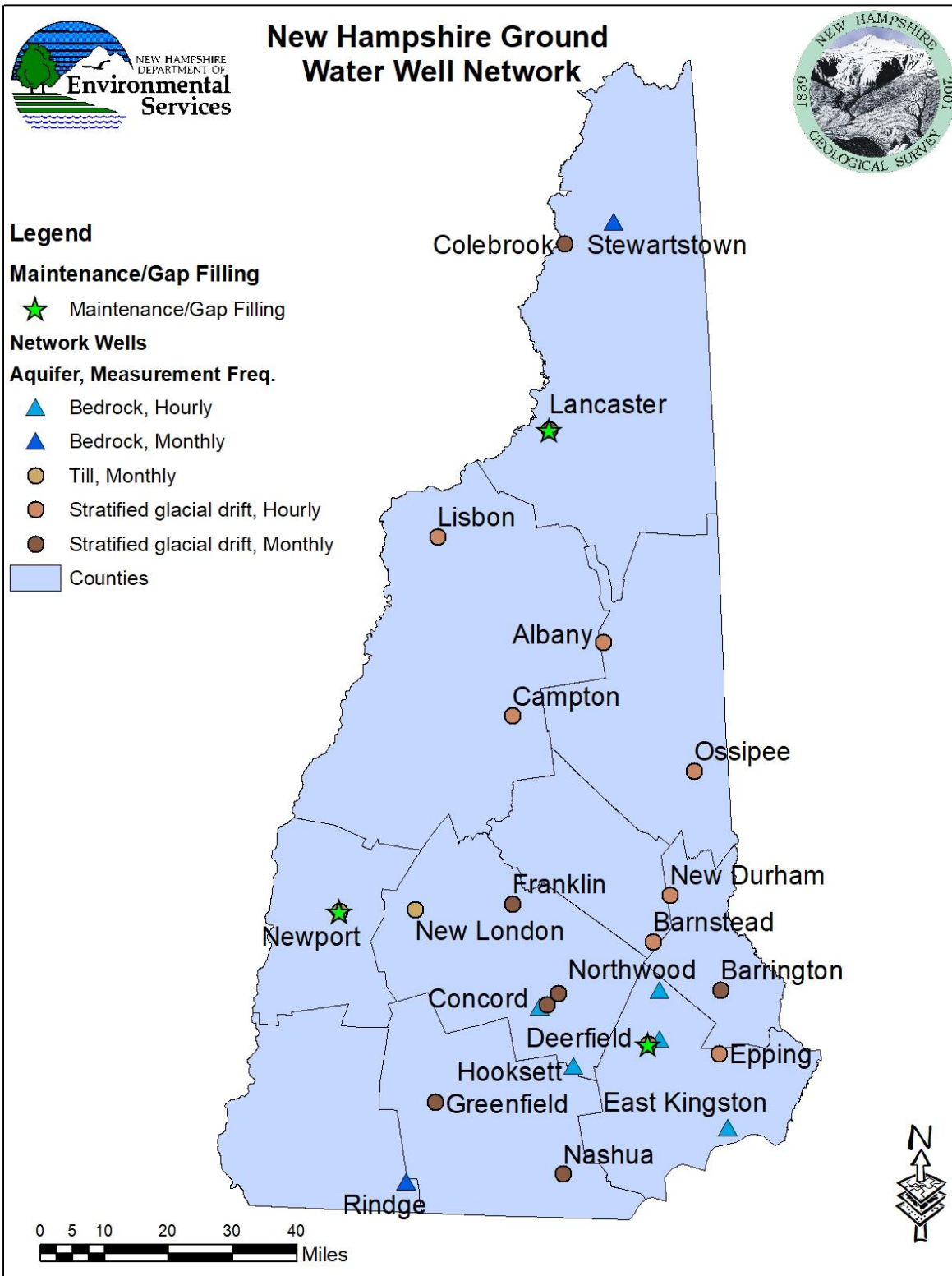
Figure 1 - Current NHGS Monitoring Network with expansion well LCW-01 (Lancaster) and maintenance activities at the two Newport wells and at one Deerfield well, DDW-46

References

Bouwer, H. and R.C. Rice, 1976. A slug test method for determining hydraulic conductivity of unconfined aquifers with completely or partially penetrating wells, Water Resources Research, vol. 12, no. 3, pp. 423-428.

Cunningham, W.L., and Schalk, C.W., comps., 2011, Groundwater technical procedures of the U.S. Geological Survey: U.S. Geological Survey Techniques and Methods 1–A1, 151 p. (https://pubs.usgs.gov/tm/1a1/)

Thompson, W.B., 2019, Surficial Geological Map of the Lancaster 7.5 minute quadrangle: New Hampshire Geological Survey, Open-File Reports Geo-035-024000-SMOF, scale 1:24,000.