



The
NEW HAMPSHIRE DEPARTMENT OF ENVIRONMENTAL SERVICES
hereby issues
LARGE GROUNDWATER WITHDRAWAL PERMIT

NO. LGWP-2018-0001

to the permittee

BERLIN WATER WORKS
55 WILLOW STREET
BERLIN, NH 03570
(603-752-1677)

for the withdrawal of the following volume of groundwater from the following wells for the purpose of community water supply:

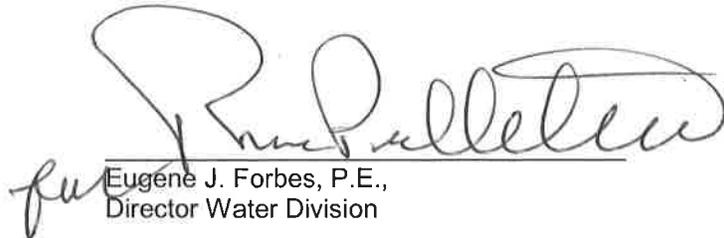
Brown Farm Well 2 (BFW2): 1,008,000 gallons over any 24-hour period
Brown Farm Well Field (BFW1 and BFW2 combined): 1,584,000 gallons over any 24-hour period

Date of Issuance: May 3, 2018
Date of Expiration (if the withdrawal is not activated): May 3, 2023
Date of Expiration (if the withdrawal is activated): May 3, 2028

Pursuant to authority in N.H. RSA 485-C:21, the New Hampshire Department of Environmental Services (NHDES), hereby grants this permit to withdraw groundwater from the Brown Farm Well Field (BFW1 and BFW2) subject to the following conditions:

1. The permittee shall comply with the requirements of this permit, Env-Wq 403 and RSA 485-C at all times.
2. Water Conservation: The permittee shall implement the approved Water Conservation Plan, received March 2, 2018, in accordance with Env-Wq 2101 and NHDES' approval dated March 13, 2018.
3. Metering Requirements: Withdrawals from the source must be metered at all times. All meters must be selected, installed, tested, and maintained in accordance with Env-Wq 2101. The permittee shall read source water meters to adequately report the following volumes to the reporting program referenced in condition No. 6 of this permit:
 - a) The 24-hour peak day volume withdrawn from the well field (BFW1 and BFW2 combined) during each month and the date the water use occurred; and
 - b) The cumulative volume withdrawn from the well field during each month.
4. Pump Runtime Monitoring: The permittee shall record the pump runtimes on BFW1 and BFW2 through the SCADA system in the treatment building and report them to NHDES as requested.
5. Mitigation Requirements
 - a) In the event that an adverse impact occurs, the permittee shall comply with all of the requirements below and with the impact mitigation and source replacement requirements of Env-Wq 403.
 - b) Where the status of an unanticipated impact is not clear, the permittee shall gather information needed to quantify the impact and determine its status relative to the adverse impact criteria defined under RSA 485-C:21, V-c and provide this information to NHDES within 48 hours of being notified by NHDES. A verified adverse impact shall be mitigated in accordance with Env-Wq 403.
6. The permittee shall register BFW2 with the NHDES Water Use Registration and Reporting Program and maintain the water use reporting requirements of BFW1 and BFW2 established by RSA 488, Env-Wq 2102 and this permit.
7. The permittee shall apply for renewal of this permit no more than 6 months prior to its expiration date in accordance with Env-Wq 403. The permittee shall continue to comply with all conditions in this permit until the permit is renewed or the facility is closed in accordance with all applicable requirements, regardless of whether a renewal application is filed.

Any person aggrieved by any terms or conditions of this permit may appeal in accordance with RSA 21-O:7, IV within 30 days.


Eugene J. Forbes, P.E.,
Director Water Division

PROJECT NARRATIVE

**Large Community Well Siting Approval/Large Groundwater Withdrawal Permit LGWP-2018-0001
Berlin Water Works, PWS ID 0231010
Brown Farm Well Field
Berlin, New Hampshire**

May 3, 2018

BACKGROUND

Berlin Water Works (BWW) submitted an application to the New Hampshire Department of Environmental Services (NHDES) requesting approval for one large community production well and issuance of a large groundwater withdrawal permit for the withdrawal of up to 1,008,000 gallons per day (gpd) or 700 gallons per minute (gpm) over a 24-hour period from the Brown Farm Well 2 (BFW2). BWW is also requesting approval for a permitted withdrawal volume of 1,584,000 gpd, or 1,100 gpm over a 24-hour period, for the Brown Farm Well Field, which consists of the original Brown Farm Well, referred to as BFW1, and BFW2. BWW is requesting approval for the Brown Farm Wells to be used in combination with its existing surface water treatment plan for Berlin's municipal water supply.

The purpose of developing BFW2 is to:

- Increase the overall capacity of the Brown Farm Well Field;
- Decrease the pumping rate and reliance on BFW1; and
- Allow BWW to operate the Brown Farm Well Field as a backup for the Ammonoosuc Water Treatment Plant in the event that it had to be shut down or flow was reduced.

The Ammonoosuc Water Treatment Plant is the main source of water for BWW and can yield around 2.1 million gallons per day (Mgd). Currently, BFW1 is the only other groundwater source for BWW, and it has the capacity to provide up to 1,000 gpm or 1.44 Mgd. BFW1 was installed in 1981 and rehabilitated by BWW and GeoInsight, Inc. (GeoInsight) in 2013. Since 2013, BWW and GeoInsight have been working to develop a second well at the Brown Farm site to provide additional capacity and redundancy to BFW1. BWW has been reliant on BFW1 to meet the increased municipal water demands in Berlin due to water use at the Burgess Biomass Energy Plant and state and federal prisons. When pumped together, BFW1 and BFW2 will act as a backup source of water for the Ammonoosuc Water Treatment Plant.

BFW1 and BFW2 are similarly constructed 24x36-inch gravel pack wells installed to depths of 46 and 50 feet, respectively. BFW2 was installed by Layne Christensen Company, Inc., a NH licensed water well contractor, in September 2017. The well is located approximately 50 feet south of BFW1 and was constructed with a stainless steel screen that is 10-ft in length and 24-inches in diameter. Water from BFW1 is pumped into a nearby treatment building for treatment and distribution into the BWW system and BFW2 will be connected into the same treatment building using the existing inlet pipe for BFW. Due to this connection requirement, the combined flow from the well field will be metered inside the treatment building, rather than metering BFW1 and BFW2 individually.

The Brown Farm wells are located approximately 200 feet east of the Androscoggin River and are screened in a highly transmissive portion of the stratified drift aquifer within the river valley. This portion of the aquifer is in middle of a north-south oriented esker deposit consisting of mostly coarse sand and gravel. The aquifer is unconfined, around 60 feet deep and limited to the relatively narrow river valley at this location. While much of the aquifer is sand and gravel, it is not homogenous and contains lenses of silt and sand that can limit the hydraulic conductivity of the formation.

The already established Wellhead Protection Area for BFW1 will be carried forward for both wells. The relatively limited increase in withdrawal rates (from 1,000 gpm previously to 1,100 gpm) did not increase the radius of influence (ROI) based on the withdrawal testing results by GeoInsight.

WITHDRAWAL TESTING AND CONCLUSIONS

A withdrawal testing program was conducted by GeoInsight from December 1, 2017 through December 21, 2017. The purpose of withdrawal testing was to:

- Provide data to estimate long-term sustainable water quantity and quality of BFW1 and BFW2;
- Observe the response of the aquifer to pumping;
- Evaluate the degree of hydraulic connection between BFW1 and BFW2, the overlying deposits and the Androscoggin River; and
- Assess the potential for adverse impacts to water resources and users that may result from the proposed withdrawal.

The withdrawal testing program began with a seven day antecedent monitoring period with no pumping from either wells BFW1 and BFW2. Pumping began in well BFW2 on December 8, 2017 at 900 gpm. Due to excessive drawdown at this rate, the pumping rate of BFW2 was reduced over several days in 50 gpm increments to 700 gpm. On December 14, 2017, the second phase of the test began where BFW1 and BFW2 pumped at 450 gpm and 750 gpm, respectively. Due to excessive drawdown, the flow rate was eventually reduced from 750 to 650 gpm in BFW1 and the final combined flow rate was 1,100 gpm. Pumping at both wells ended on December 18, 2017 and the recovery period began. Water levels were monitored for three days until 95% recovery had been achieved in the production wells.

During the testing program, water levels were recorded in six onsite monitoring wells screened in the overburden, one background monitoring well, and two piezometers. Properties within the potential impact area of the withdrawal are served by BWW; as such, no private wells were included in the monitoring network. Streamflow records at two USGS stream gauges on the Androscoggin River, one upstream of the production wells and one downstream, were tracked along with the groundwater levels during the pumping test.

Discharge water from BFW1 was sent into the water system and discharge water from BFW2 was sent into the Androscoggin River. Flow from BRW1 was controlled with the SCADA system in the treatment building. BFW2 had not been fully wired into the SCADA system in the treatment building, so flow rates were measured with an orifice plate and piezometer near the discharge location and the flow rate was controlled with a valve.

Water quality samples were collected during the beginning, middle and end of pumping period to characterize the quality of the water derived from the well. Results of the water quality sampling conducted during the withdrawal testing program indicate that each parameter was below the applicable Maximum Contaminant Level (MCL) or Secondary Maximum Contaminant Level (SMCL) in water derived from BFW2. Per- and polyfluoroalkyl substances (PFAS) were not detected above the laboratory reporting limits. The microscopic particulate analysis was performed due to the well's proximity to surface water and the results indicate the well is low risk of being influenced by surface water.

Groundwater level measurements collected during the pumping of BFW1 and BFW2 indicate that the six on-site monitoring wells responded to pumping. Pumping-induced drawdown of water levels in the monitoring wells ranged from approximately 5 and 18 feet and was greatest in wells located closest to BFW1 and BFW2. There is a clear hydraulic connection between the two production wells; the water level in BFW1 dropped approximately 10 feet during the portion of the BFW2 only pumping test. There

appears to be limited connection between the production wells and the Androscoggin River and the withdrawal of water will not have a significant effect on the flow in the river. Due to the large size of watershed and river, adverse impacts to surface water and wetlands are not anticipated.

Based on the conceptual hydrologic model of the withdrawal and pumping test data, the cone of depression of BFW1 and BFW2 is elongated in the north-south direction (parallel to the river) within the most transmissive portion of the sand and gravel deposits; however, insufficient data exists to estimate its extent to the west of the wells and river. Based on an analysis of graphical projections of water level responses in the monitored wells that assume 180 days of continuous pumping with no net recharge to the aquifer, pumping-induced drawdown is estimated to extend approximately 500 feet from the well.

PUBLIC INVOLVEMENT

Pursuant to RSA 485-C:21, II through V-a, materials submitted in support of the large groundwater withdrawal permit (the preliminary application, final report, and supplemental materials) are required to be sent (via certified mail) to municipalities and public water suppliers in the potential impact area of the withdrawal. In the case of this application, the Town of Berlin is the only municipality and public water supplier in the potential impact area of the withdrawal. No public hearings were requested, and no public meetings were held regarding the application for this large groundwater withdrawal permit.

LARGE GROUNDWATER WITHDRAWAL PERMIT MONITORING, REPORTING AND WITHDRAWAL REQUIREMENTS

No initial monitoring of water users or water-related natural resources is incorporated into the permit due to the lack of substantial influence of BFW2 on these entities. In the event that an adverse impact is reported and verified, an impact mitigation program would be implemented in accordance with conditions of the large groundwater withdrawal permit and Env-Wq 403. The program would implement actions necessary to mitigate the impact including reducing the withdrawal volume, establishing water use restrictions for customers of the water system, modifying or replacing an impacted source at no initial capital cost to the user, and establishing a monitoring network to assess the effectiveness of the mitigation program. More information concerning these requirements is provided in the large groundwater withdrawal permit under condition No. 5.