



The

NEW HAMPSHIRE DEPARTMENT OF ENVIRONMENTAL SERVICES

hereby issues

LARGE GROUNDWATER WITHDRAWAL PERMIT

NO. LGWP-2010-0003

to the permittee

TOWN OF BOW  
10 GRANDVIEW ROAD  
BOW, NH 03304  
(603-228-1187)

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

PW-1            1,008,000 gallons over any 24-hour period;

Date of Issuance:    April 15, 2010

Date of Expiration:    April 16, 2020

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 well PW-1 subject to the following conditions:

1. The permittee shall comply with the requirements of Env-Wq 403 and RSA 485-C at all times.
2. Water Conservation: The permittee shall implement the approved Water Conservation Plan, dated September 29, 2009, in accordance with Env-Wq 2101 and NHDES' conditional approval dated May 6, 2010.
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 the AWWA M6 manual as referenced in Env-Wq 2101. The permittee shall provide NHDES with a certificate of calibration and performance specifications for each meter. The permittee shall document and maintain records of all meter maintenance and calibration activities and submit this information to NHDES in an annual report by January 31 of each year. 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  - a) The 24-hour peak day volume withdrawn from the source during each month; and
  - b) The cumulative total volume withdrawn from the source during each month.
4. Monitoring and Reporting Requirements: The permittee shall establish and maintain the monitoring and reporting program as described below.
  - a) Groundwater Level Monitoring : The permittee shall use electronic water level meters or install pressure transducers and data loggers and measure water levels at a frequency of at least twice per week at on-site overburden monitoring wells OW-6, OW-8 and OW-9 [new well] starting one month prior to initiating the withdrawal from PW-1.

The installation of well OW-9 shall be performed as described in a letter dated March 2, 2010 submitted by Stantec to NHDES and incorporated herein by reference. If OW-9 can not be located at its target location due to site constraints, the permittee must seek prior approval from NHDES for an alternative location. The permittee shall provide NHDES with soil boring data, monitoring well construction details, and a well completion report within 30 days following the installation of OW-9.

All water level monitoring shall be completed by a person who can demonstrate, by education or experience, competency in collecting and reporting hydrogeologic measurements.

Monitoring well locations and frequency may be added or changed if the water level data obtained as part of the monitoring program contradicts the information in the permittee's application, or if additional data points are required to assess the potential for adverse impacts to occur.

- b) Water Quality Monitoring: The permittee shall collect water quality samples from on-site overburden monitoring wells OW-6, OW-8 and OW-9 [new well] at the following frequency:

- i. Within the month prior to initiating the withdrawal from production well PW-1; and
- ii. Quarterly (four times per year in the months of February, May, August and November) after start-up of production well PW-1.

All samples collected shall be analyzed for volatile organic compounds (VOCs by method 524), sodium and chloride, and field measured for specific conductance, temperature and pH. The sampling methodology for all samples collected shall conform to standard low-flow sampling techniques or an equivalent method.

All water quality sampling shall be completed by a person who can demonstrate, by education or experience, competency in collecting and recording water quality samples.

Water quality sampling frequency, parameters and locations may be added or changed if the water quality results contradict the information in the permittee's application, or if additional sampling is required to assess the potential for adverse impacts to occur.

In the event that results from quarterly VOC sampling of the monitoring wells indicate the presence of a compound that exceeds New Hampshire Ambient Groundwater Quality Standards, the permittee shall notify NHDES within two weeks of receipt of the water quality results.

- c) Reporting Requirements: A monitoring report and all monitoring data shall be submitted to NHDES annually by January 31 of each year. The annual monitoring report shall note any relevant observations that may affect the water level measurements or water quality results and include all field notes documenting the monitoring activities for the preceding year. All field notes shall be signed and dated by the personnel responsible for collecting measurements. The annual report shall include all analytical laboratory results.

The annual monitoring report and all monitoring data collected per this section shall be submitted in an electronic format and hard copy format. All water level monitoring data collected per section 4a above shall be submitted in an electronic format only.

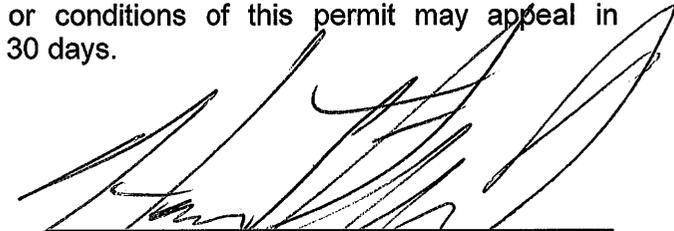
## 5. Mitigation Requirements

- a) In the event that adverse impacts occur, the permittee shall comply with all of the requirements below and with the impact mitigation and source replacement requirements of Env-Wq 403.
- b) Prior to initiating the large groundwater withdrawal, the permittee shall notify any lot owner with a private or public well within the area identified as the influence area of well PW-1 on Figure 10, titled "Projected Water Level Elevation Contour at 180-Days", included in the Final Report Addendum titled "Response to Final Report – Large Groundwater Withdrawal Permit Application. Town of Bow Proposed Municipal Water Supply Well, Anderson Property, New System Bow,

New Hampshire” prepared by Stantec dated March 2, 2010. The permittee shall provide a copy of the notification letter and copies of certified return mail receipts to NHDES. The permittee shall explain to lot owners with wells in the identified area that their well may be influenced by the withdrawal at well PW-1. The permittee shall provide these owners with contact information for both the permittee and NHDES in the event they believe they may be adversely impacted by the withdrawal.

- c) 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 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 its new source of water with the Water Use Registration and Reporting Program and maintain the water use reporting requirements established by RSA 488 and this permit.
7. The permittee shall apply for renewal of this permit at least 365 days prior to its expiration date. 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 485-C:21, VI within 30 days.



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Harry T. Stewart, P.E.,  
Director Water Division

## PROJECT NARRATIVE

### Large Well Siting Approval/Large Groundwater Withdrawal Permit LGWP-2010-0003

Town of Bow, New System,  
River Road Well (PW-1)  
Bow, New Hampshire

May 7, 2010

#### BACKGROUND

The Town of Bow, NH, has submitted an application to the New Hampshire Department of Environmental Services (NHDES) requesting approval of a 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.

The purpose of the new community production well (designated PW-1) is to provide a long-term water source for a new community water system. When PW-1 is brought online, it will operate as the primary source for the water system.

PW-1 is located approximately one mile south of Bow Junction in Bow, within a sparsely forested area that, from west to east, has a terrace-like topography that alternates between flat- and steep-slopes to a low-lying area along the western bank of the Merrimack River. PW-1 is located approximately 800 feet west of the Merrimack River and is about 1,000 feet east of an industrial/commercial development corridor located along I-93, Route 3/3A and River Road in Bow. Little surface water other than the river is located within close proximity to the well, some sparse wetlands however are located west of PW-1, in low-lying areas (on the lowest terrace) near the river. One small stream, named Bow Bog Brook, is located south of the well site (over 2,000 feet away) and drains to the Merrimack River; a substantial portion of the drainage area for the north branch of this brook makes up the wellhead protection area for PW-1. The potential impact area for the withdrawal from PW-1 encompasses much of the Bow Bog Brook watershed.

The overburden unit encountered at the PW-1 well site is comprised of materials originating from glacial, lacustrine and alluvial environments. In the low-lying areas east of PW-1, the upper 5 to 10 feet of soil consists of a combination of silt, sand and occasional gravel that is interpreted as a mixture of over bank (flood plain) deposits and reworked (eroded) materials from the bordering hillsides. Both below these near surface deposits, and at the ground surface in higher terrace areas, are deposits with varying proportions of silt, fine to coarse sand, occasional clay lenses and gravel seams. Collectively, these deposits vary greatly in thickness and are interpreted as lacustrine deposits that developed both on the margin of and within Glacial Lake Hooksett which, itself, is believed to have occupied much of the Merrimack River valley in the area. Underlying these deposits is a coarse-grained sand and gravel, cobbly deposit that occupies a north-south trending trough in the bedrock surface below the site. This deposit is interpreted as an esker and appears to have originated as outwash from fast-moving glacial meltwater present at the base or terminus of an actively receding glacier. This gravel layer is the water bearing zone screened by PW-1 where approximately 50 feet of the unit was encountered at about 80 feet below the ground surface.

## WITHDRAWAL TESTING AND CONCLUSIONS

A withdrawal testing program was conducted by Jacques Whitford (now Stantec) from March 17, 2006 through April 17, 2006. The purpose of withdrawal testing is to provide data to estimate long-term sustainable water quantity and quality; observe the response of the aquifer to pumping; evaluate the degree of hydraulic connection with overlying deposits; and assess the potential for adverse impacts to water resources and users that may result from the proposed withdrawal. The withdrawal testing program included monitoring during pre-pumping, pumping, and water level recovery periods, where PW-1 was pumped at 700 gpm between March 31 and April 6, 2006.

Water level measurements were collected during the withdrawal testing program at eleven on-site overburden well locations, two off-site overburden wells, three private wells, three on-site shallow groundwater piezometers (in wetlands), two surface water staff gages, and three river monitoring stations that had both a staff gage and shallow riverbank piezometer. Shallow piezometer and surface water measurements were recorded to assess the degree of hydraulic connection between the well, the bordering wetlands area, Bow Bog Brook, and the Merrimack River. The private domestic wells monitored during the pumping test are located off of River Road to the west and south of the well site, at distances ranging between 1,500 feet and 3,500 feet from PW-1, respectively. Based on records at NHDES, review of drilling records and interaction with private wells owners by Stantec, two of the private wells are dug wells and one is a bedrock well. Discharge was metered during the withdrawal testing program to maintain a constant rate, and water quality samples were collected during the pumping period to characterize the quality of the water derived from the well.

Water level measurements collected during the withdrawal testing program indicate that most of the on-site wells responded to pumping of PW-1. The pumping-induced drawdown of water levels ranged from 0.2 feet to 6.4 feet in these wells and was greatest in wells located closest to the production well. Based on a graphical projection of water level response that assumes 180-days with no net recharge to the aquifer, pumping-induced drawdown in the esker unit is estimated to extend on the order of 800 feet from the well and is limited by leakage from the river. Although substantially less, production from PW-1 also caused some drawdown (induced recharge/leakage) in wells screened within the overlying, less permeable units that is estimated to extend on the order of 1,400 feet from the well. In contrast, a lack of water level response in near ground surface, shallow piezometers, staff gages and river bank stations installed around/in surface water and wetlands areas (relative to nearby deeper monitoring points) indicates that the full sequence of overlying units is an effective confining unit that restricts direct hydraulic connection between the esker deposit and shallow soils. No drawdown was observed in the private wells monitored during the test implying that production from PW-1 would not pose an impact to these locations. Overall, based on monitoring results presented in the final report, a production rate of 1,008,000 gpd (700 gpm) is a production rate that the well and geologic formation can sustain.

Historically, substantial characterization of water quality has occurred at the PW-1 well site and surrounding formation; in general, water quality characterization efforts were driven by the widespread occurrence of the former gasoline additive methyl tert-butyl ether (MTBE) at low concentrations in groundwater within the shallow sand and gravel unit at the site and its prevalence was noted early in the well siting and testing process. Prior to the pumping test, the relatively ubiquitous and low concentration of MTBE throughout the formation was believed to be atmospherically sourced. Additional water quality sampling done during and subsequent to

well testing however, have shown sporadic detections of MTBE in various on-site monitoring wells at concentrations which are sufficiently high (occasionally exceeding drinking water standards) to dispute the idea that the contaminant is atmospherically sourced. Observation of higher concentrations of MTBE resulted in additional investigation and reconnaissance for point locations for a potential contaminant source in the capture zone for PW-1. Given the range of locations, observations and sporadic presence of MTBE in wells at the site, and the fact that no point location was found for the contaminant, the general conclusion from the water quality monitoring completed to-date is that groundwater contamination may not be attributable to a discrete point source or plume, rather, it may be sourced by a broader, more diffuse area potentially related to the River Road, Route 3, 3A and I-93 development corridor upgradient of the well field and in its source area. In addition, generally persistent and elevated concentrations of sodium and chloride observed in groundwater sampled from the monitoring well network (and production well) over time further substantiates some degree of influence of road-related constituents on groundwater quality.

Results of water quality sampling conducted during the withdrawal testing program indicate elevated concentrations of sodium and chloride, and the presence of MTBE at concentrations less than 1 part per billion in the well water. In addition, the concentration of manganese and pH of the water produced by PW-1 exceed secondary Maximum Contaminant Levels (SMCLs) and may require treatment.

## **PUBLIC INVOLVEMENT**

Pursuant to RSA 485-C:21-II through V-a, materials submitted in support of the large groundwater withdrawal permit (the preliminary permit application, final report, supplemental materials, etc.) were sent (via certified mail) to municipalities and public water suppliers in the potential impact area of the withdrawal including the Town of Bow, Town of Pembroke and the Meeting House Water Company. No public hearings were requested, and no public meetings were held regarding the application for this large groundwater withdrawal permit.

## **LARGE GROUNDWATER WITHDRAWAL PERMIT PUBLIC NOTIFICATION, MONITORING, REPORTING AND WITHDRAWAL REQUIREMENTS**

The permit requires pre-start up and ongoing monitoring of water levels and water quality at monitoring locations upgradient of PW-1. The intent of the monitoring is to track the regional water quality issues, monitor for a potential adverse impact and gauge the effectiveness of the water system's source water protection efforts. In order to provide a means for notification in the event of an unforeseen impact, Bow is required to notify and provide contact information to all public and private water users within the potential zone of influence of PW-1 once the water system brings the well online. 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 reduction of the withdrawal volume, implementation of water use limitations, replacement of impacted sources with an alternative water supply at no initial capital cost to the user, and revision of the monitoring network to assess performance of the mitigation program. More information concerning these requirements is provided in the large groundwater withdrawal permit (LGWP-2010-0003) under condition No. 5.