NEW HAMPSHIRE DEPARTMENT OF
Environmental Services

The

NEW HAMPSHIRE DEPARTMENT OF ENVIRONMENTAL SERVICES

hereby issues

LARGE GROUNDWATER WITHDRAWAL PERMIT

NO. LGWP-2008-0001

to the permittee

ROCHESTER DEPARTMENT OF PUBLIC WORKS
45 OLD DOVER ROAD
ROCHESTER, NH 03867
(603-332-4096)

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

RCH-1C	864,000 gallons over any 24-hour period
RCH-2A1	864,000 gallons over any 24-hour period

Date of Issuance: April 4, 2008
Date of Expiration: April 4, 2018

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 RCH-1C and RCH-2A1 subject to the following conditions:

1. The permittee shall comply with the requirements of Env-Ws 388 and RSA 485-C at all times.

2. Metering Requirements: Withdrawals from all sources must be metered at all times. The permittee shall comply with the metering requirements of RSA 488, Env-Ws 390, and Env-Ws 374.

3. Monitoring and Reporting Requirements: The permittee shall establish and maintain the monitoring and reporting program as described below.

   a) Protecting Low Flows in the Cocheco River: The permittee shall implement a low-flow pumping restriction program to protect low flows in the Cocheco River whereby withdrawals from RCH-1C and RCH-2A1 are limited to times when flow in the Cocheco River exceeds a minimum flow threshold of 23 cubic feet per second (cfs) measured at U.S. Geological Survey (USGS) Stream Gage. No. 01072800 (Cocheco River Near Rochester, NH). The low-flow pumping restriction program shall be as described below and as described in Response 8 of the final report addendum titled "Addendum to the Final Hydrogeologic Investigation, City of Rochester, Groundwater Development, Production Wells RCH-1C and RCH-2A1," prepared for Rochester Department of Public Works (Rochester) by Emery & Garrett Groundwater, Inc. (EGGI), dated March 13, 2007.

      Stream flow shall be monitored on a daily basis using stream flow measurements reported by the above-referenced USGS stream gaging station. RCH-1C and RCH-2A1 shall not be operated when the reported stream flow is equal to or less than the minimum flow threshold of 23 cfs. If the well(s) are shutdown as a result of the minimum flow threshold being met, the operation of RCH-1C and RCH-2A1 shall resume only when the reported stream flow is at least 26 cfs, i.e. the minimum flow threshold of 23 cfs plus the production rate of both wells (2.67 cfs).

      Stream flow monitoring shall commence when a withdrawal is initiated from RCH-1C or RCH-2A1 and shall continue indefinitely as a condition of this permit when RCH-1C and RCH-2A1 are in use.

      If stream flow measurements cannot be acquired from the above-referenced USGS stream gaging station, then the permittee shall propose an alternative stream flow monitoring location and method to NHDES for approval. Upon receiving approval from NHDES, the permittee shall install the monitoring station, if not already available and after acquiring all other necessary permits, and monitor stream flow at the alternative location at the same frequency as at the USGS stream gaging station originally proposed.

      The permittee shall maintain records of the daily stream flow measurements and the operation schedules and total daily withdrawal volumes of RCH-1C and RCH-2A1. The operation schedules shall indicate when RCH-1C and RCH-2A1 are shutdown due to the minimum flow threshold being met, and when operation of RCH-1C and RCH-2A1 is resumed. The withdrawal volumes shall be recorded as total daily flow using a flow meter installed at each well. The permittee shall submit this information to NHDES in the annual monitoring report.

   b) Water Level Monitoring: The permittee shall complete the following water level monitoring and reporting program for the RCH-2A1 well location.

i) Off-site Private Dug Well: The permittee shall install a pressure transducer and data logger and measure water levels at a frequency of at least once every four hours in the following private dug well. Water level monitoring shall commence six months prior to initiating a withdrawal from RCH-2A1 and shall continue indefinitely as a condition of this permit.

Property Identification Number	Property Address
18167	

ii) On-site Overburden Monitoring Wells: 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 once every four hours in monitoring wells MW2-2, MW2-6, and MW2-5s. The locations of these wells are illustrated on the map titled "Figure 7 – Groundwater Monitoring Well Locations Located Near Production Wells RCH-1C and RCH-2A1, Topographic Map" included in the final report titled "Final Hydrogeologic Investigation, City of Rochester, Groundwater Development, Production Wells RCH-1C and RCH-2A1, Volume I," prepared for Rochester by EGGI, dated March 30, 2005. Water level monitoring shall commence six months prior to initiating a withdrawal from RCH-2A1 and shall continue indefinitely as a condition of this permit.

If a private well owner denies permission to monitor water levels or if the identified well cannot be monitored due to a structural limitation, then the permittee shall propose an alternative monitoring location to NHDES for approval. Upon receiving approval from NHDES, the permittee shall install the monitoring well, if not already available, and monitor water levels at the alternative location at the same frequency as the original monitoring well proposed.

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 frequencies may be added or changed if the water level data obtained contradict the information provided in the permittee's application, or if additional data points are required to assess the potential for adverse impacts to occur.

c) Wetland Monitoring: The permittee shall implement the wetland monitoring program as described in the report titled "Proposed Wetland Monitoring Program, Public Water Supply Project, Production Well RCH-1C, Rochester, NH" prepared for EGGI by NHSC, Inc., dated January 2008. Monitoring shall occur at the proposed on-site wetland monitoring station in the wetland east of RCH-1C and the proposed control site located south of the Cocheco River outside the zone of contribution of RCH-1C. The wetland monitoring program shall commence one year prior to initiating a withdrawal from RCH-1C and continue indefinitely as a condition of this permit. All work shall be conducted under the direct oversight of a New Hampshire Certified Wetland Scientist. The tri-annual wetland surveys must provide a clear determination as to whether or not an adverse impact has occurred, may occur, or has not occurred over the monitoring period.

All monitoring data shall be submitted to NHDES annually by January 31 of each year. The annual monitoring report and all monitoring data collected per sections 3a) and 3c) above shall be submitted in an electronic format and hard copy format. All water level monitoring data collected per section 3b) above shall be submitted in an electronic format only.

The annual monitoring report shall note any relevant observations that may affect the stream flow measurements, water level measurements, or wetland plot observations 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 results of the tri-annual wetland surveys and associated impact assessment shall be included in the annual monitoring report unless requested sooner by NHDES.

4. 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-Ws 388.

   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 "Estimated 180-Day Zone of Influence around each production well" as illustrated on Figure 1 titled "Estimated 180-Day Zone of Influence around Production Wells RCH-1C and RCH-2A1 Color-Infrared Aerial Photograph" dated March 21, 2008. The permittee shall provide copies of certified returned 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 wells RCH-1C and RCH-2A1. 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) The permittee shall notify NHDES of any adverse impact within 12-hours of receiving such information. Furthermore, the permittee shall provide potable water for drinking and cooking purposes to a well owner that NHDES has determined to be adversely impacted. The permittee shall have 12 hours to provide drinking and cooking water after being notified of an occurrence of an adverse impact. The permittee shall provide potable water for other domestic uses within 36 hours of being notified of an adverse impact (e.g., lower well pump, install higher capacity well pump, drill a new well, or truck bulk water to the property). A permanent alternative water supply that produces water quality that complies with Federal and State drinking water quality requirements and a quantity of water that complies with the requirements of RSA 485-C:21 V-c, shall be provided to an adversely impacted water user within 30 days of NHDES determining that a water user had been adversely impacted.

      Contracts with companies capable of providing water and well services (including drilling of new wells) must be developed and maintained prior to and after initiating the withdrawal such that in the event that impacts are noted at private

wells, mitigation steps can be undertaken expeditiously. Copies of these contracts shall be provided to NHDES prior to initiating the large groundwater withdrawal.

d) 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 as described in paragraph c), above.

e) NHDES will routinely review the results of all monitoring data, and if water level monitoring data indicates that groundwater is being extracted at a rate that exceeds natural recharge on average, then NHDES will modify the permit in accordance with Env-Ws 388 in order to prevent adverse impacts from occurring.

5. The permittee shall register its new sources of water under the Registered Water User Program and maintain the water use reporting requirements established by RSA 488.

6. 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 21-O:7,IV within 30 days.

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

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PROJECT NARRATIVE

Large Well Siting Approval/Large Groundwater Withdrawal Permit LGWP-2008-0001
Rochester Department of Public Works, EPA ID 2001010
Wells RCH-1C and RCH-2A1
Rochester, New Hampshire

April 4, 2008

BACKGROUND

The City of Rochester (Rochester) has submitted documentation to the New Hampshire Department of Environmental Services (NHDES) requesting approval of two new large community production wells and issuance of a large groundwater withdrawal permit for the withdrawal of up to 864,000 gallons per day (gpd) or 600 gallons per minute (gpm) over a 24-hour period from RCH-1C and 864,000 gpd or 600 gpm over a 24-hour period from RCH-2A1 for a total additional supply capacity of 1,728,000 gpd. Rochester is requesting that these two new overburden wells be used in combination with its existing source of water for the municipal water system.

The purpose of the two new community production wells is to supplement the potable water needs of Rochester and prepare for future population growth which poses an estimated water supply demand in excess of 4.7 million gallons per day (MGD). Currently, Rochester's sole source of water supply is the Berry River, and it obtains all of its water via intakes at Rochester Reservoir and Round Pond. Based on current operational practices, the safe yield of Berry River is estimated to be approximately 2.8 MGD.

RCH-1C and RCH-2A1 are located in the Cocheco River valley within the northwestern portion of the City of Rochester, east of NH Rte. 11 between the Spaulding Turnpike and the City boundary. The Cocheco River watershed upgradient of the new wells covers an area of approximately 59 square miles; the wells are located in the eastern flank of the watershed, near the boundary with the Salmon Falls River watershed.

Installed approximately 400 feet and 60 feet from the Cocheco River respectively, wells RCH-1C and RCH-2A1 are located in topographically flat areas that border the river and are dominated by silty sand deposits generally interpreted to be material that has been reworked by the river, possibly during overbank flooding events. At depth, however, the production wells are installed in a fine- to coarse-grained sand unit that contains varying amounts of cobbles and/or boulders; this unit is laterally extensive and constitutes the primary water-bearing unit in this section of the Cocheco River valley. Finer grained deposits made of organic-rich clay and silt are common in the unit and, where encountered at the RCH-1C site, exhibit the characteristics of a semi-confining unit within a restricted area near this well. Well RCH-1C was installed to a depth of 66 feet and well RCH-2A1 was installed to a depth of 70 feet.

WITHDRAWAL TESTING AND CONCLUSIONS

A withdrawal test program was conducted by Emery & Garrett Groundwater, Inc. (EGGI) from January 28, 2004 to February 19, 2004. 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 private water supply wells and the Cocheco River; and assess the potential for adverse impacts to water resources and users that may

result from the proposed withdrawal. The withdrawal test program included monitoring during pre-pumping, pumping, and water level recovery periods, where RCH-1C and RCH-2A1 started pumping on February 4th and 6th, respectively, at a continuous rate of 700 gpm each for an equivalent combined rate of 2,016,000 gpd. Pumping of each well ceased on February 11, 2004.

For the RCH-1C well site, water level measurements were collected during the withdrawal test program at on-site locations including 21 shallow overburden wells and piezometers; and off-site locations consisting of two private water supply wells (one bedrock and one sand & gravel). For the RCH-2A1 well site, on-site water level measurements were collected at 14 shallow overburden wells and piezometers; and off-site water levels were collected at four private water supply wells (three assumed bedrock and one sand & gravel) and two public water supply wells (one bedrock and one sand & gravel). The degree of interaction with the Cocheco River was assessed via monitoring of numerous riverbank piezometers and monitoring of the level of surface water at two staff gauges located proximal to the well sites; in addition, river flow measurements were coincidently recorded at a USGS stream gaging station (#01072800) located in Rochester, south of the well sites.

In addition to water level measurements, each of the wells was metered to maintain a constant pumping rate during the testing program, and three water quality samples were collected from each production well during the pumping period in accordance with the community production well testing requirements. In excess of 20 additional water quality samples were also collected from the wells during the pumping test and analyzed for various parameters to assess the variability in well water quality and assist Rochester in planning for any long-term water treatment needs.

For the RCH-1C site, the water level measurements collected during the withdrawal test program indicate that most of the on-site monitoring wells and piezometers, as well as the off-site, private sand & gravel well responded to the pumping of the production well. The pumping-induced drawdown of water levels ranged from approximately 0.2 to 8.5 feet across the site, and was generally greater in those monitoring wells screened at greater depths. Based on a graphical projection of the water level in the private sand & gravel well, pumping-induced drawdown of the water level assuming 180 days of continuously pumping RCH-1C at 700 gpm with no net recharge to the aquifer is estimated to be approximately 1.3 feet. Under the same projected conditions (i.e., 180-days of continuous pumping with no recharge), the pumping-induced drawdown of the shallow water table in the vicinity of a wetland east of RCH-1C is estimated to be approximately 6.5 feet.

For the RCH-2A1 site, all of the on-site monitoring wells and piezometers, and three of the private water supply wells responded to the pumping of the production well. Pumping-induced water level drawdown was generally less than that observed at the RCH-1C site and ranged from approximately 0.1 to 2.6 feet, where the drawdown observed at the subset of private water supply wells monitored during the test was less than one foot. Projections of pumping-induced drawdown of the water levels in the private water supply wells assuming 180 days of continuously pumping RCH-2A1 at 700 gpm with no net recharge to the aquifer is estimated to range from approximately 0.9 to 2.5 feet.

To assess if adverse impacts potentially might occur as a result of pumping RCH-1C and RCH-2A1, and to mitigate adverse impacts (if observed and verified), Rochester is required to implement an impact monitoring and reporting program and an impact mitigation program per the conditions of the large groundwater withdrawal permit and as summarized below.

Although staff gauge records did not reflect changes in river stage, drawdown observed in riverbank piezometers installed along the bank of the Cocheco River indicates that significant induced infiltration from the river occurred as a result of pumping and implies a direct hydraulic connection between the wells and the river. Estimates from numerical modeling performed subsequent to the pumping tests indicate that river flows reduced by approximately 350 to 700 gpm during the pumping test as a result of both induced infiltration and captured discharge to the river from the surrounding aquifer.

Results of the water quality sampling program conducted during the withdrawal test program indicate acceptable water quality, with all parameters below applicable Maximum Contaminant Levels (MCL). Secondary Maximum Contaminant Levels (SMCLs) for iron and manganese were exceeded in water samples collected from well RCH-2A1 at concentrations that range from 0.36 to 0.49 milligrams per liter (mg/L) and 0.06 to 0.07 mg/L, respectively, and may require treatment to reduce the concentrations of these constituents. In addition, the pH of water from both wells was recorded below the SMCL range of 6.5 to 8.5 which may necessitate treatment of the water prior to its use in the system.

Although tested at a withdrawal rate of 700 gpm each, Rochester is requesting each well be permitted at 600 gpm (for a combined volume of 1,728,000 gpd); which, based on withdrawal test monitoring results presented in the final report, is a production rate that the wells and geologic formation can sustain. Given observations relating well production rate to river flow, production from the wells at the rate indicated above will be restricted to periods when flow in the Cocheco River is above low threshold levels.

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 the City of Rochester and to the municipalities and public water suppliers in the potential impact area. The entities that were sent copies of the above-referenced materials are the City of Dover, the Town of Farmington, West Wind Mobile Home Park, and the Dustin Homestead Condo Association. No public meetings were requested by any of the entities notified, 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 large groundwater withdrawal permit requires Rochester to notify any lot owner with a private or public well within an area surrounding RCH-1C and RCH-2A1 identified as the zone of influence after 180 days of pumping at 1,200 gpm with no recharge. As part of this notification, Rochester must explain to the lot owners within the area that their well may be influenced by the withdrawal at the production wells and provide them with contact information at Rochester and NHDES in the event they believe their well may be impacted by the withdrawal. More information concerning this requirement is provided in the large groundwater withdrawal permit (LGWP-2008-0001) under condition No. 4b).

The large groundwater withdrawal permit requires Rochester to conduct a water level monitoring program that includes monitoring of an off-site residential well, on-site overburden monitoring wells, an off-site stream flow gaging station, and on-site wetlands. General monitoring requirements are summarized below.

- Off-site wells – The permit requires that water levels in one residential well east of the RCH-2A1 site be monitored to assess the potential for and/or detect the occurrence of an adverse impact.

- On-site wells – The permit requires that water levels in three overburden monitoring wells at the RCH-2A1 site be monitored to assess the potential for and/or detect the occurrence of an adverse impact.

- Wetlands - The permit requires the permittee to establish a wetland monitoring and reporting program to assess the potential for and/or detect the occurrence of adverse impacts in a wetland mapped east of the RCH-1C site via observation of two wetland plots, one on-site wetland plot and one off-site control plot located south of the Cocheco River outside the zone of contribution of RCH-1C.

- Stream Flow - The large groundwater withdrawal permit requires cessation of pumping from the wells if the flow in the Cocheco River measured at a stream gaging station downstream of the well sites meets a low flow threshold of 23 cubic feet per second (cfs) or less.

An impact mitigation program would be implemented in accordance with conditions of the large groundwater withdrawal permit and Env-Ws 388 if an adverse impact is observed and verified. 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 increases in the monitoring frequency of the withdrawal monitoring network to assess performance of the mitigation program.

Rochester is required to submit an annual monitoring report in hard copy and electronic format to NHDES by January 31st of each year. As stipulated in the permit, the annual report will include a summary of trends and variability observed in the site monitoring network, all monitoring data and records required by the permit, and an assessment of the potential impacts associated with the withdrawal. The annual report will be available to the public for review. A complete description of monitoring and reporting requirements is presented in more detail in the large groundwater withdrawal permit (LGWP-2008-0001) under condition No. 3.