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Water Conservation Plan
Irrigation Wells Source of Supply
Sports Complex Building Water Usage

Granite Fields Golf Club
Kingston, New Hampshire

The following documentation presents the Water Conservation Plan for the water used in relation to the irrigation groundwater source of supply and sports complex building groundwater source of supply for the Granite Fields Golf Club property located at 7 Route 125 in Kingston, New Hampshire. This Water Conservation Plan has been prepared in accordance with the New Hampshire Department of Environmental Services (NH DES) water conservation administrative rules as defined in Env-Wq 2101, more specifically Env-Wq 2010.08.

Introduction

This Water Conservation Plan has been prepared for the existing water uses associated with the golf course located at 7 Route 125 in Kingston, New Hampshire. Currently, Diamond Oaks Golf Club, LLC, owns the site and the Granite Fields Golf Club is operated on the property. The existing irrigation system consists of two sand and gravel irrigation wells (PW-2 and PW-3). The sports complex building source of supply is from a bedrock well (BRW-1). This Water Conservation Plan has been prepared on behalf of the following applicant:

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This Water Conservation Plan has been prepared by the following:

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Currently, GFGC holds a Large Groundwater Withdrawal Permit (LWGP-2004-0001) dated April 20, 2004, amended May 15, 2009, permitting the irrigation wells to withdrawal a combined total of 131,040 gallons per day. More specifically, the LGWP permits irrigation well PW-2 to withdrawal up to 48,960 gallons of groundwater over any 24-hour period and permits irrigation well PW-3 to withdrawal up to 82,080 gallons of groundwater over any 24-hour period.

Groundwater from the irrigation wells is discharged to a man-made lined irrigation pond that is connect to two additional man-made lined irrigation ponds. The pond that the groundwater is discharged to is located approximately 300 feet from PW-2 and 450 feet from PW-3. This irrigation pond has drainage overflow that leads to another irrigation pond with an outlet pipe to the main holding pond (Holding Pond 3). In addition, the first irrigation pond is connected to Holding Pond 3 through an outlet pipe. The water level in Holding Pond 3 is controlled primarily through the outlet pipes in the other two ponds. The golf course irrigation system source water is fed by pumps that withdraw from Holding Pond 3. GFGC operates the irrigation wells to maintain a water level in Holding Pond 3 that is suitable for irrigation needs as well as aesthetic needs of the golf course.

In addition to the irrigation wells, GFGC withdrawals groundwater for sanitary uses inside the on-site sports complex building. Groundwater for this use is withdrawn from bedrock well BRW-1, water use registration identification 20787-S04, which is located approximately 40 feet of the northwest corner of the building and was installed and utilized beginning in 1997. This well was registered as a water supply source prior to the initiation of the NH DES Large Groundwater Withdrawal regulations in 1999, and therefore does not hold a groundwater withdrawal permit, only a water use registration status.

PROPOSED WATER CONSERVATION PLAN DETAILS

Env-Wq 2101.08 - Requirements for Industrial, Commercial, and Institutional Water Users (ICI).

A. ICI water users shall identify the location and amount of water used for existing and anticipated future uses of water associated with the following:

1. Heating;
2. Cooling;
3. Processing;
4. Product Ingredient;
5. Sanitary use; and
6. Outdoor water use.

Currently, GFGC withdrawals groundwater for irrigation use purposes (outdoor water use) only. Irrigation well PW-2 is permitted to withdrawal up to 48,960 gallons of groundwater over any 24-hour period and irrigation well PW-3 is permitted to withdrawal up to 82,080 gallons of groundwater over any 24-hour period. All groundwater pumped from the irrigation wells is stored in the man-made lined irrigation ponds prior to being pumped out of Holding Pond 3. All water pumped from Holding Pond 3 is distributed to

the golf course lawns, greens, and tees. The best management practices associated with irrigation uses are described in detail in this proposed water conservation plan.

In addition, GFGC withdrawals groundwater for sanitary uses inside the on-site sports complex building (bedrock well BRW-1, water use registration identification 20787-S04), which is located approximately 40 feet of the northwest corner of the building and was installed and utilized beginning in 1997. This supply well is connected to a holding tank, the pump operates on an as-need basis when the tank level drops. According to water usage rates submitted to NH DES, this source of supply withdrawals, on average, less than 100 gallons per day. The water use is higher in the winter months when indoor sports (primarily soccer) are occurring.

Water use for the sports complex building includes one set of bathrooms (men and women's with three toilets and two sinks each, no showers), a small kitchen sink associated with a snack bar/bottled drink cooler station, indoor cleaning of floors and equipment, and outdoor washing of equipment. Since the building was constructed in the late 1990's, the fixtures installed at the time of construction met all applicable water efficiency standards. As part of this proposed water conservation plan, if and when replacements of water fixtures are required, GFGC will upgrade those water fixtures with the currently available high water efficiency fixtures.

There is no future anticipated change in the current use activities for the golf course and the sports complex building.

B. ICI water users shall install and maintain water meters as described below prior to initiating a withdrawal from a new source of water:

1. Water meters shall be installed for each groundwater and surface water source; and
2. Water meters shall be maintained in accordance with "Manual of Water Supply Practices, Water Meters-Selection, Installation, Testing, and Maintenance," document identification number AWWA M6, American Water Works Association, 1999.

A source meter is installed at the wellhead of each irrigation well, inline with the irrigation piping from Holding Pond 3, and adjacent to the holding tank for the sports complex well BRW-1. All meters have been selected, installed, and maintained with the procedures and protocols described in "Manual of Water Supply Practices, Water Meters-Selection, Installation, Testing, and Maintenance" document identification number AWWA M6 American Water Works Association, 1999. GFGC tests and calibrates the source meters for the irrigation wells and the meter associated with Holding Pond 3 on an annual basis. When the irrigation meters have been found inoperable, maintenance has been performed in accordance with the specifications of the manufacturer. All future maintenance will be performed in accordance with the protocols described in AWWA M6.

C. If water is used in a single-pass cooling system, the water user shall replace or retrofit the process by using one or more of the following methods to achieve maximum water efficiency within 5 years of initiating a withdrawal from a new source of water:

1. Recirculation cooling techniques;
2. The use of sensors and automatic shut-off devices to reduce water used for cooling purposes;
3. Implementation of water treatment processes;
4. Air cooling techniques; or
5. Alternative technology that produces results equivalent to processes described in (1) through (4), above.

GFGC's water uses do not incorporate a cooling system. Therefore, compliance under Env-Wq 2101.08(c) is not applicable.

D. Processes that result in the discharge or disposal of unused water shall be identified and modified as described below:

1. Any processes where water is used to control temperature shall be identified; and
2. Any process where water within a given process may be discharged or otherwise disposed of unused through an overflow shall be identified.

GFGC's water use is not used to control temperatures. The water withdrawn from the two irrigation wells is discharged into a network of three on-site lined irrigation ponds. All water used for irrigational purposes is pumped from Holding Pond 3. There is an overflow discharge located off Holding Pond 3 to allow for overflow of precipitation during large rain events (typically only occurs during heavy spring rains and/or snow melt).

E. Processes identified in (d), above, shall be modified within 5 years of initiating a withdrawal from a new source of water by using one or more of the following methods:

1. Automatic shut-off devices preventing the discharge of water to waste shall be installed for all processes identified in (d), above; and
2. Sensors that optimize the use of water shall be installed for all processes identified in (d), above.

GFGC utilized the irrigation wells to maintain a level in Holding Pond 3 that is suitable for irrigation withdrawals. Overflow discharge would occur during and following large precipitation events only. Modifications to the discharge, that would control irrigation withdrawals, would not prevent overflow discharge and is therefore neither necessary nor applicable.

F. Water Conservation practices not described in paragraphs (a) through (e), above, shall be implemented and described below:

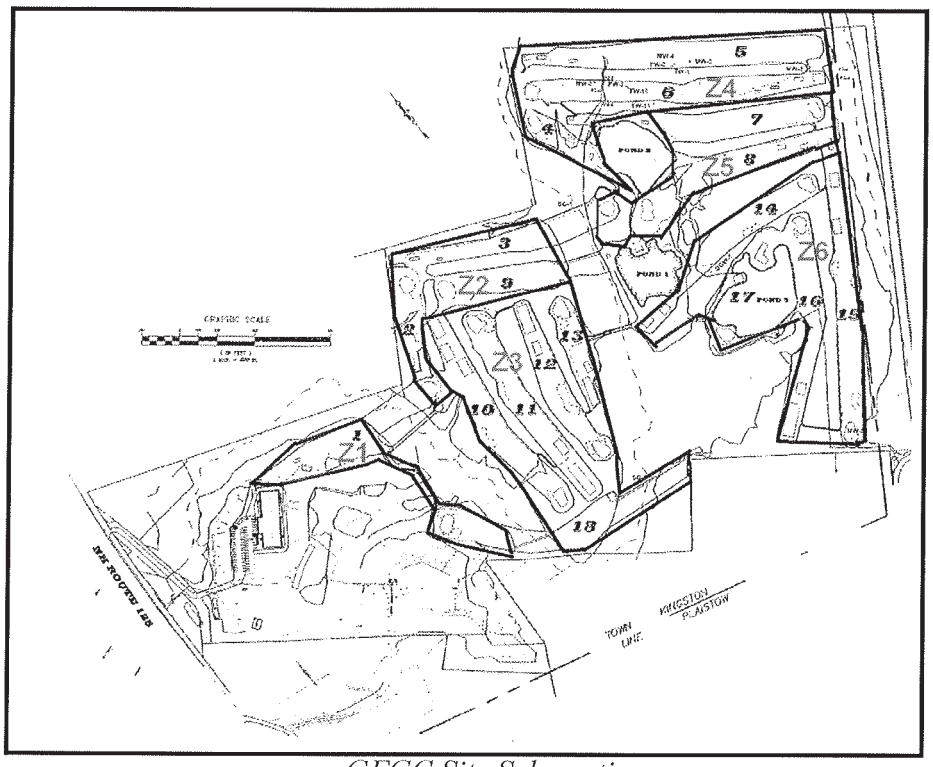
1. The water user shall provide the department a description of water conservation best management practices of best available technologies that might be applicable to the types of water-using processes at the facility;
2. The water user shall develop a plan and schedule to implement the plan that demonstrates these processes will be implemented within 5 years; and
3. The water user shall implement the plan according to the schedule upon obtaining approval from the department pursuant to Env-Wq 2101.12.

The following paragraphs present a description of the irrigation system, information pertaining to typical operational practices, and current and proposed water conservation best management practices in regard to the operation of the irrigation system.

Groundwater withdrawals from the irrigation wells are seasonal. Typically, withdrawals for irrigation purposes begin in the spring (late April) and end mid-fall (mid-October). GFGC utilizes the irrigation wells to maintain a level in Holding Pond 3 that is suitable for irrigation withdrawals. When water levels in the ponds are low, due to low precipitation recharge and/or decreased well production volumes, GFGC can adjust the irrigation pond transfer piping (outlet from the discharge pond to Holding Pond 3) to a lower elevation. This adjustment allows GFGC to withdrawal water from Holding Pond 3 for irrigation uses without having to fill all three ponds to higher elevations. GFGC will continue to perform these irrigation best management practices for all future irrigation seasons.

The irrigation system is comprised of a suction pump (which draws surface water from Holding Pond 3), a meter, a pressure vessel, and a control panel array located within a pump house adjacent to Holding Pond 3. The meter associated with Holding Pond 3 will be calibrated on an annual basis and the necessary maintenance will be performed. The results of the annual calibration activities will be provided to NH DES.

The pressurized irrigation system is comprised of six (6) zones throughout the golf course each on their own separate controllers. Each controller has setting options for the greens and approaches, tees, fairways, and tree groves within each zone. Approximately 90% of the irrigation system distributes water to the greens and approaches, tees, and fairways. Only 10% of the irrigation system distributes water to the tree groves (due to 360 degree rotation of irrigation heads in fairways). No other areas of the golf course are irrigated. A generalized depiction of the 6 irrigation zones is presented in the Site Schematic below.



GFGC Site Schematic

All of the greens, tees, and fairways are cultivated through aeration techniques once or twice per season. The following describes the types of grasses used in each area:

- Greens and Approaches: Creeping bent grass
- Tees and Fairways: Dwarf Kentucky bluegrass
- Roughs: Standard sun/shade mix of fescue grass, blue grass, and ryegrass blend
- Tree Groves: Fescue grass

The irrigation system operates automatically based upon the settings that are manually programmed. Personnel at GFGC manually set the controllers at least every three days, and at least daily during stresses periods (i.e. periods of heavy or very low rainfall) in order to implement water saving techniques. The controllers are manually set based upon personal judgment, which includes a review of recent precipitation, forecasted precipitation, and current ground conditions (i.e. wetness, vegetation/grass growth conditions). The irrigation system does incorporate a rain sensor that automatically shuts down the system during times of heavy rain events. Currently, there are no on-site weather stations, however, as part of this water conservation plan, GFGC will begin weekly monitoring of precipitation using a manually recorded and emptied rain gauge. At this time GFGC is not proposing to convert to a fully automated system. This proposed water conservation plan does include stipulations for an irrigation audit; at the time of the audit a more thorough feasibility study will take place if the auditor recommends converting to a fully automated system.

Currently, irrigation watering does not occur during daytime or afternoon hours when evaporation rates are the highest. The typical program settings (sub-zone, time of day, irrigation duration times) are described below.

Area of Irrigation	Time of Day when Irrigation Occurs	Duration of Irrigation per Zone
Greens and Approaches	4:30 am – 6:00 am	10 minutes
Tees	2:30 am – 4:30 am	12 minutes
Fairways	12:00 am – 2:00 am 1:00 am – 3:00 am	6-12 minutes 6-12 minutes

As mentioned previously, during dry periods, water conservation techniques such as reducing the irrigation timing on the fairways or turning them off completely are executed. Additional water saving measures that may be taken include a reduction in the duration of irrigation per sub-zone, physically removing irrigation heads within each sub-zone to reduce the total area irrigated, and/or reducing the per zone irrigation timing to every other or every few days (as appropriate).

Prior to activation of the irrigation system, on a yearly basis GFGC will perform a pressure test for each zone to ensure no leaks are present. In addition, at least twice a day during the irrigation season GFGC personnel inspect and audit the golf course grounds for signs of vandalism, surface erosion, required maintenance, broken irrigation head valves, and irrigation leaks. Since the irrigation system is pressurized, if a leak were to occur or had have occurred during times of irrigation (night or early morning hours), evidence of such a leak would be present through surface erosion or surface pooling. Typically leaks are created through broken or damaged irrigation valve heads. GFGC continually maintains and replaces the heads as needed and conducts performance testing on any replaced head. Patrons of the golf course often report any unusual conditions that are observed (i.e. wet areas, eroded areas, discolorations to greens, etc.). In response to these reports, GFGC personnel act quickly to make the appropriate corrections, if any. In addition to daily visual observations, the meter in the pump house is monitored at least every three days to program the controllers. In the event that there is an anomalously high flow meter reading, GFGC personnel would identify that there was a leak or a meter malfunction and take immediate appropriate actions to correct the issue.

The use of reclaimed wastewater for irrigation uses is not an option. Any wastewater generated on-site is considered to be very minor in volume. The irrigation system (and water used within it) is separate from any other on-site buildings or structures.

GFGC employs a landscape irrigation consultant who acts as the primary controller of the irrigation system. In addition, GFGC will employ only one or two additional personnel who are permitted to control the irrigation system. On an annual basis employees are briefed on any changes to the irrigation system and potential water use reduction options that are available. In regards to water conservation awareness and education for all persons utilizing the property (patrons and employees), GFGC proposes to post informative flyers (utilizing the NH DES Water Efficiency Factsheets and site specific

water use data over time graphs) in the clubhouse and pump house that outlines the benefits of water conservation and the actions GFGC takes to promote water conservation.

G. ICI water users shall not be required to implement a measure described in (c) through (f), above, if an economic analysis prepared by a person employed or contracted by the water system who has the training and experience in preparing economic analysis shows that the payback period for the measure is more than 4 years.

GFGC will follow the current and proposed irrigation conservation best management practices as described in this plan. It is not anticipated that an economic analysis will be performed in order to be exempt from the measures described in 2101.08 (c) through (f). However, an economic analysis may be performed based upon the results and recommendations of irrigation audits proposed to be performed as part of this proposed water conservation plan.

H. The economic analysis in (g), above, shall factor in the true cost of the water use, including:

1. The cost of energy to pump and transmit water;
2. The cost of treating pumped water;
3. Cost of disposal of wastewater;
4. Capital costs or fees associated with developing new sources of water; and
5. All other costs or fees associated with obtaining or disposing of the water.

GFGC will follow the current and proposed irrigation conservation best management practices as described in this plan. It is not anticipated that an economic analysis will be performed for the irrigation uses at GFGC. Therefore, item 2101.08(h) is not applicable.

I. The department shall approve the economic analysis in (g), above, if the analysis:

1. Contains all of the information required by (h), above; and
2. Is accurate.

GFGC will follow the current and proposed irrigation conservation best management practices as described in this plan. It is not anticipated that an economic analysis will be performed for the irrigation uses at GFGC. Therefore, item 2101.08(i) is not applicable.

J. If an ICI water user is establishing new lawns, it shall immediately implement the following water efficiency processes:

1. All new automatic watering devices used to irrigate the lawns, shall be equipped with technology that will prevent the systems from starting automatically and that will shut down the systems when not needed;
2. All automatic watering systems installed after the effective date of this document shall be audited at no less that once every three years to ensure the technology required by (1`), above, is functioning properly; and
3. All new lawn areas shall be underlain by 6 inches of loam.

The GFGC irrigation system has been in place since 2004 and is not equipped with a fully automated system. GFGC proposes to have a certified golf course irrigation auditor perform an irrigation audit at least every three years in order to monitor the irrigation system's distribution uniformity. The results of each irrigation audit will be forwarded to NH DES. In addition, GFGC will take all necessary and feasible actions to insure that the auditor's recommendations are implemented within 5 years of each audit.

K. The requirements of (j), above, shall not apply to lawns associated with golf courses or agriculture uses.

The requirement of immediately implementing the requirements of 2101.08(j) are not applicable since GFGC irrigation practices are in regards to existing lawns associated with a golf course [2101.08(k)]. However, as stated in 2101.08(j) above, irrigation audits will be performed and actions will be taken to implement ant auditor's recommendations.

Other – Water Use Monitoring and Reporting

The source meters installed at the wellhead of each irrigation well, the meter for Holding Pond 3, and the meter from BRW-1 are manually read on a weekly basis. Monthly water use from the two irrigation wells, withdrawal rates from Holding Pond 3, and usage from BRW-1 are reported to NH DES on a quarterly basis.

Other - Public Notification and Involvement

This Water Conservation Plan is being submitted in connection with a Large Groundwater Withdrawal Permit Application that includes a small community water system at the property. In accordance with Env-Wq 2101.11, GFGC provided a copy of the Proposed Water Conservation Plan and a copy of the NH DES administrative rules Env-Wq 2010 to the municipality (Town of Kingston) and regional planning board (Rockingham Regional Planning Commission) on April 4, 2012 in request of public comments. No comments were received by either entity. GFGC requests that the Town of Kingston continue to update local site planning requirements in order to promote water efficiency.

Certification

I certify that I have read this Water Conservation Plan, understand the responsibilities of the water system as referenced in the plan, and that all information provided is complete, accurate, and not misleading.

Signature Owner Name (print): Jim Dufrenge

System Owner Signature: _____ Date: 5-29-12