

Regency at Providence – Pond 1 Ancillary Equipment

Description, Operation, Maintenance & Troubleshooting

This is a write-up of the equipment located on community property to the northwest of Pond 1. It is intended to describe each system component and how those pieces interact to provide (1) make-up water to the pond, (2) water for the Sloan Road Clubhouse irrigation system and (3) aeration for the pond. The Community Association Board is assisted in the operation and maintenance of this equipment by the contracted Community Manager, the Ponds & Irrigation Committee volunteers, and by various local contractors and consultants. Photographs of the principal components can be found following the narrative portion of this document.

The Well

Pond 1 has a 305 foot deep, 6 inch diameter steel cased well installed by Bucks County Well Drilling in 2005 under contract to Toll Brothers; at that time the well yield was measured at 60 gpm by the driller. Its initial purpose was solely to provide make-up water to the pond. Since there are no community storm drains feeding Pond 1 the only inflows are direct precipitation and pumped well water.

The Well Pump and Drop Pipe

The Goulds model 25GS20412 is a 25 gpm, 10 stage pump powered by a Franklin Electric 2 HP, 230 volt, single phase motor and is suspended 240 feet deep in the well by schedule 120 (thick wall) PVC drop pipe. It was originally configured with a simple electro-mechanical timer to control how much time each day the well pump would provide make-up water in order to maintain the pond at an aesthetically pleasing level. The current pump, motor and drop pipe were installed in May 2021 by Powell Pump & Well Drilling to replace the original system which could no longer maintain adequate pressure; during the 2021 change-out it became evident that the pressure loss was caused by extensive corrosion leaks in the original galvanized steel drop pipe. A check valve at the new pump outlet, a second one near the top of the pipe string and a third in the horizontal above-ground section of pipe prevent water from flowing back down the drop pipe, which would cause the pump to spin backward when not in operation. The 20 foot sections of 1¼ inch PVC pipe are threaded together and each section is fitted with a plastic spacer to keep the pipe centered in the steel casing; a torque arrester is installed above the pump to minimize twisting of the pipe during the start/stop cycles of the suspended pump/motor. A drain-back valve near the top of the pipe string allows the upper portion of the pipe to flow back into the well to prevent freeze damage during winter months; this is accomplished by admitting air through the schrader valve located atop the pipe string. A pictorial description of the 2021 installation work can be found in the PONDS section of the RAP website. Technical details for the pump can be found at:

<https://www.xylem.com/siteassets/brand/goulds-water-technology/resources/technical-brochure/b5-25gs-r8.pdf>

The Aquavar Pump Controller

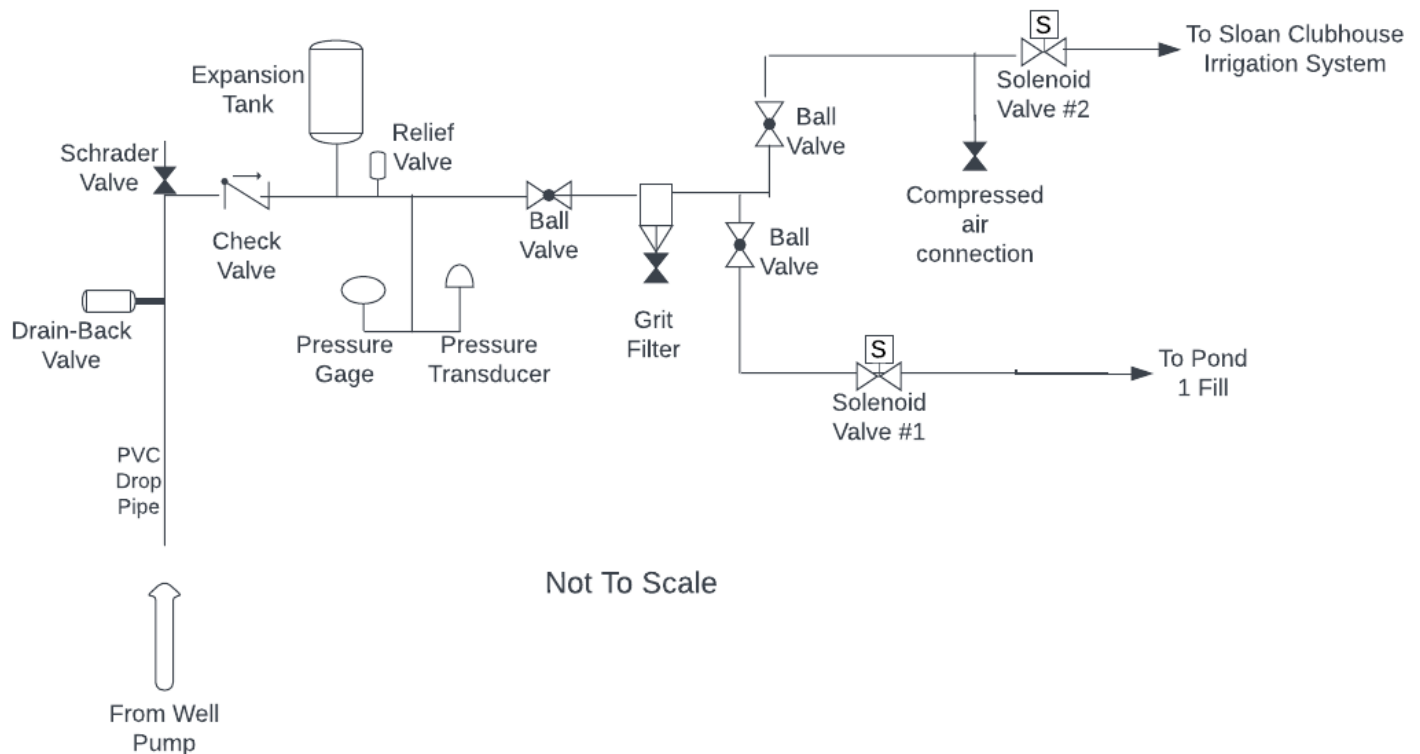
This controller is mounted in a weatherproof cabinet just south of the well. It was installed in 2016 when the system was converted by Hydroscares to provide irrigation water to the Sloan Road Clubhouse (in addition to make-up water for the pond). The HOA Board's justification for the conversion was to eliminate the cost of purchasing water from Pennsylvania American Water for irrigation as well as to reduce the sewage charge by Upper Providence Township (which is tied to the volume of metered water usage). The controller is a CentriPro model 1AS15 Solo 2 unit with a pressure transducer that senses water pressure at the pump discharge and varies the pump motor speed to maintain a set point of approximately 55 psi; the set point is adjustable. In a tight system with no leaks, the controller will shut down the pump once the set pressure is achieved. The Aquavar controller is powered from an adjacent electric distribution panel through a 30 amp

double-pole circuit breaker (labeled “WELL”) and, in turn, feeds power down to the well pump motor through submersible 4-conductor, #10 copper electric cable. An owners’ manual for the controller is kept in the cabinet and can also be found at:

https://s3.amazonaws.com/pumpproducts/pdf/539189_4_Goulds+Aquavar+Solo+Instruction+Manual.pdf

The Well Discharge Header

The discharge of the well feeds a horizontal, above-ground, carbon steel header which contains a check valve, expansion tank, relief valve, pressure gage, pressure transducer, three shutoff ball valves, a grit filter, compressed air hose connection and two solenoid valves. Several pipe unions in the header facilitate disassembly for maintenance. The following is a schematic diagram of the header components:



- The expansion tank (Amtrol model *WX-102*) protects against sudden pressure surges and the damage they can cause as a result of well pump start/stop cycles.
- The pressure gage provides a visual indication of line pressure in pounds per square inch (psi).
- The pressure transducer (CentriPro model *9K744*) is fed 5.0 volts from the Aquavar controller and returns a 0.5 to 4.5 volt signal corresponding to 0 to 100 psi line pressure. It failed in May 2022, preventing the well pump from operating, and was replaced in June 2022 at a cost of \$175.
- The three shutoff ball valves allow for system maintenance and are all normally in the open position.
- The grit filter (Rusco model *2" Spin-Down*) captures small particles from the flow stream, preventing them from flowing downstream and clogging the many spray heads in the Sloan Clubhouse irrigation system. Information for the filter can be found at: <https://www.rusco.com/products/2-spin-down>
- The threaded hose connection can be used to drain the header but is primarily utilized by the irrigation contractor in the late fall for admitting pressurized air to blow water out of the piping and each of the 23 irrigation zones to prevent freezing in the winter.
- The two solenoid valves direct the flow of well water either to the pond to maintain level or to the Sloan Clubhouse for irrigation purposes.

The Solenoid Valves and Toro Controller

Two Rain Bird DC latching solenoid valves direct the output of the well pump to either Pond 1's make-up water line or to the Sloan Clubhouse irrigation system. These valves are opened and closed by the battery-powered Toro programmable controller, model *DDCWP-2*. They can also be opened manually by turning their knurled control knobs in the counter-clockwise direction. As a precaution, the Toro controller senses battery voltage and will not open a solenoid unless there is sufficient voltage to close the valve; if this occurs the low battery icon will appear on the controller display. A copy of the Toro controller manual is kept in the large cabinet and can also be found at:

<https://media.toro.com/catalogdocuments/manual/ddcwp-20manual-20revised-2010-06.pdf>

Typical Operation of the Well Pump System

Program "A" of the Toro DC controller is set to operate solenoid valve #1, which opens to direct well water to the pond. When the valve opens water pressure drops, the Aquavar controller starts the well pump and a small geyser should be visible about 10 feet from shore in the northwest corner of the pond. The duration of the daily open time for this valve should be adjusted to maintain the pond level just below the overflow point of the concrete outlet structure. Program "A" is normally set for all days of the week.

The Toro controller needs to be time-synchronized with the Sloan Clubhouse irrigation controller located on the back interior wall of the pool shed. By use of the Toro "B" program, solenoid valve #2 will open at the same time as the first Sloan irrigation zone. When the first irrigation zone opens the water pressure drops in the system and the Aquavar controller starts the well pump to attempt to restore system pressure. After sequencing through all active irrigation zones and irrigation flow ceases, the system pressure will return to its set point and the Aquavar will shut the well pump down. The "B" program is utilized because irrigation is not needed every day of the week. The following table shows the settings for the summer of 2022.

	Start Time	Open time	Operating Days	Toro Program
Solenoid Valve #1 (pond fill)	10:00 AM	60 minutes*	Monday – Sunday	A
Solenoid Valve #2 (irrigation)	1:30 AM	4 hours	Mon, Wed, Fri	B

* Should be adjusted occasionally to maintain pond just below overflow level

Fine Bubble Aeration System

Pond 1 was initially equipped with an Otterbine fountain which aerated the pond water approximately 12 hours per day, April through November. The fountain design had its 230 volt motor submerged in the pond water and, on several occasions, electrical failures occurred which were caused by pond water leaking into the motor housing; similar failures were experienced with the three fountains in Pond 2 and the one in Pond 4. As a result of these costly failures the RAP Board approved the use of fine bubble aerator systems for our wet ponds and the system for Pond 1 was installed in June of 2020 by Coon Hollow Lawn & Pond Services.

The source of air is a Gast rotary vane air pump (model *AT05-101-G215DX*, 5 psi, 4.8 cfm) housed in a faux rock enclosure located near the well. The air pump motor is plugged into a 120 volt GFCI outlet in the site power panel and the compressor discharges into weighted tubing that feeds two air diffusers resting on the bottom of the pond; the tubing is routed through buried conduit that was originally used for the electric cable powering the fountain. The bubbler system operates around-the-clock, April through November. The air pump operation/maintenance manual can be found at:

<https://gastmfg.com/sites/default/files/2019-08/70-299-c.pdf>

Routine Maintenance & Troubleshooting

The components of this system are relatively trouble-free but some do require routine maintenance:

- The Rusco grit filter contains a polyester and stainless steel 250 mesh internal element (part number *FS2-250*) designed to capture solid particles as small as 50 microns. Opening the bottom flush valve when the filter is under pressure will blow the larger captured particles out of the filter. For smaller particles trapped in the mesh (characterized by a rust colored coating) it will be necessary to isolate and depressurize the filter, unscrew the clear plastic cover and then clean the outer portion of the filter element with water and a plastic brush [an automobile oil filter wrench is needed to loosen and unscrew the clear plastic cover from the body of the unit]. The community owns a spare filter element which will speed the process. Due to sunlight falling on the ancillary equipment site, the grit filter will breed algae and become clogged unless an opaque shade is placed over the clear plastic cover.
- The programmable Toro controller is powered by two 9 volt alkaline batteries that should be replaced every 18 to 24 months. The battery compartment can be accessed via the waterproof screwed cap at the lower right corner of the controller. If the batteries are replaced prior to the end of their life, a permanent internal battery will retain the controller's stored instructions, obviating the need for re-programming. Every effort should be made to keep moisture from entering the compartment during battery change. The programming dial can be "locked" by depressing the "+" and "-" buttons simultaneously and holding for 5 seconds; repeating this action unlocks the dial.
- The Gast air pump is maintained during the winter months by the pond contractor, Coon Hollow, at his storage facility. This mainly involves cleaning the inlet air filter and lubrication.

Observing well pump discharge pressure, as measured by the Aquavar controller, is a good way to judge the condition of the system:

- With both solenoid valves closed, the pressure shown on the controller digital display should be between 54 and 57 psi and should hold steady, indicating a tight system.
- With the pond fill solenoid valve #1 open and water flowing into the pond, the display should be approximately 5 – 8 psi; a pressure higher than 12 psi indicates a fouled grit filter, at which point the grit filter should be disassembled and the clean spare filter element installed.
- With the irrigation solenoid valve #2 open and no irrigation zones operating the pressure should be 53 – 57 psi and steady; a falling pressure indicates a leak somewhere in the Sloan Clubhouse irrigation piping. In the summer of 2022 it took slightly over 2 minutes for system pressure to reach 55 psi after solenoid #2 was opened; this indicates a leak (as yet unfound) in the clubhouse irrigation system.
- With solenoid valve #2 open and either Zone #1 or Zone #13 flowing (the two largest zones) the pressure was 44 psi at the Aquavar controller in October 2022; the grit filter was clean at the time.

Winter Shutdown Services

The community's irrigation contractor and pond contractor are responsible for performing the winter shutdown services, which are coordinated through the Community Manager. The irrigation contractor will de-energize the well pump, connect the threaded hose connection to a source of pressurized air, open solenoid valve #2, and blow all the irrigation piping and spray heads clear of water to avoid freeze damage. They will also drain the horizontal discharge header and, using the schrader valve, drain the upper portion of the well's drop pipe back into the well. The pond contractor will disconnect the electric and air connections to the bubbler system air pump, remove it from the site (along with the faux rock enclosure) and store it over the winter months at their facility. The weighted air tubing and the two air diffusers will remain in the pond.

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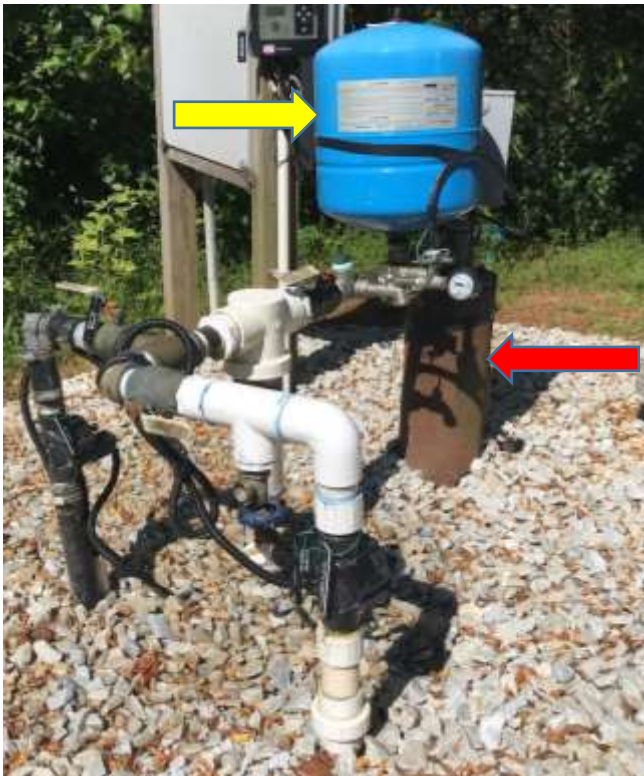
Photographs of Principal Components



The Goulds well pump (top) and 2 HP Franklin Electric motor (bottom) prior to installation in May 2021.



A plastic spacer placed on each 20' section of PVC drop pipe keeps the pipe string centered in the 6 inch diameter well casing.



View of the well discharge header. Yellow arrow denotes the expansion tank, red arrow the steel well casing.



The grit filter prevents particles from flowing downstream and plugging the sprinkler nozzles.



The Aquavar well pump controller is mounted in the upper left corner of this weatherproof cabinet.



The Toro controller is powered by two 9 volt alkaline batteries and, like the Aquavar unit, remains in place during the winter.



The two Rain Bird solenoid valves are controlled by the Toro unit but can also be operated manually using the knurled control knob (CCW to open).



Around-the-clock pond aeration is supplied by the Gast air pump, which is housed in a faux rock enclosure.