

Appendix K-5
Irrigation Well and Pond Overview
AASI



Paul Granger | President | Aqua Agronomic Solutions, Inc. | P.O. Box 5532 | Clinton | New Jersey | 08809 |
Office (908) 730-7887 | Cell (908) 391-9471 | Skype paul.granger2

The Preserve at Indian Hills Irrigation, Well and Pond Overview

July 14, 2019

The irrigation system for The Preserve at Indian Hills will be designed using the most up to date state of the art materials available today.

The system will be a full coverage system over the 88.95 acres of the developed golf course and will be designed to cover greens, tees, fairways and primary rough. It will be designed to confine irrigation to the grassed areas only.

The emphasis on irrigation system design today is for smaller sprinklers on tighter spacing with less g.p.m flow, therefore yielding lower precipitation rates. This gives today's golf course superintendent the ability to more efficiently distribute water to where it is needed, on a much smaller scale. This has been made possible by the advancement in sprinkler and nozzle technology, allowing us to utilize these smaller spacing and smaller sprinkler flows. This equates to lower energy cost due to the lower pump horsepower requirements. The newer sprinklers also perform better in the wind at lower pressures and produce more uniform coverage.

The fairway irrigation will be a minimum of triple row with ins and outs along the outer two rows to allow the roughs to be irrigated separate from the fairways. Rough irrigation should be added where not adequately covered by the outs along the fairway edges. Coverage will also include the roughs between the tees and fairway start. Tee boxes will be irrigated with smaller sprinklers to more efficiently irrigate the tee surface and the surrounds.

Two sets of sprinklers will be installed at each green complex. One set should be part circle sprinklers to irrigate the greens with the other set being part circle directed to irrigate the surrounds without irrigating the putting surface. Any sprinkler not part of the greens irrigation such as approaches and greens surrounds directed back towards the green, shall be positioned so as not to irrigate the putting surface

Additionally, The Preserve at Indian Hills control system will be based upon evapotranspiration (this is the amount of water lost during the day between the turf grass plant and the soil). In conjunction with an on-site weather station, the control system will determine how much water was lost from the plant and soil during the day, determine how long each individual station needs to run to replenish this amount, and then communicates this information to the satellite controller or sprinkler. This reduces the amount of excess irrigation that is done, shortens the water time window and reduces the cost of pumping.

The most critical feature that the control system offers however is flow management. These control systems monitor the amount of water running at any given moment and can turn on sprinklers to keep the pump station running at its maximum efficiency.

In addition to the weather station, soil moisture sensors will be installed in the ground over the golf course to more specifically monitor the moisture in the soil reservoir and allow the golf course superintendent to more accurately determine real-time turf grass needs and irrigate only as needed.

The piping network to be used is High Density Polyethylene which reduces the carbon footprint over other piping materials such as PVC piping.

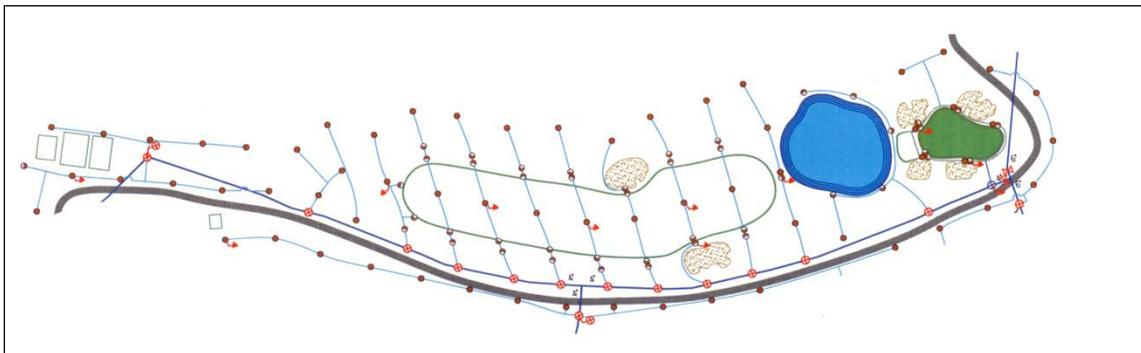


Figure 10: Sample modern irrigation layout giving golf course superintendent ability to water the fairways and rough separately. Notice how the irrigation more closely follows line of play.

The irrigation system for the irrigation of The Preserve at Indian Hills will be designed based on the attached document named "The Preserve at Indian Hills irrigation water use estimates based on 20 year evapotranspiration data from coastal New York, reference ET calculated using the FAO method with 75% rainfall based on historical data from Centerport, NY".

As seen in the document, the estimated total irrigation needed is 28,360,692 during the year. From this document you will note that the month of July shows the highest deficit between evapotranspiration and rainfall. That deficit is approximately 325,040 on a daily basis. The irrigation system will need to be run at approximately 1200 to 1500 g.p.m. to meet the six (6) hour water time window. Although, based on watering practices of the golf course, daily evapotranspiration and weather, daily irrigation could be as much as 600,000 gallons or 1700 g.p.m.

The combined lakes for irrigation are 14.6 acres with a combined storage of 640,000 cubic feet or 4,787,532 gallons. There are 4 ponds created for reuse on the golf course. The uppermost pond, next to hole 15 stores 173,000 cu. Ft. of water or 1,294,129 gallons. This pond is physically connected to the second pond on hole 14 thru a pipe. This pond stores 52,600 cu. ft. of water or 393,475 gallons at normal elevation. The pond at 14 is physically connected to the pond at hole 8 through a pipe. The pond at hole 8 will be the irrigation pond. At present, the difference between the bottom of the pond and normal water elevation is four feet (4'). At present, it will store 70,200 cu. Ft. of water or 525,132 gallons of water. We propose to deepen this pond by approximately six feet (6') which will double the storage in this pond to 140,400 cu. ft. or 1,050,264 gallons. A typical irrigation cycle will drawdown the pond on hole 8 approximately 30" during the night. The final pond in the series is the pond is the pond on Hole 2. It is capable of storing 270,000 cu. ft or 2,019,740 gallons. It is connected to hole 8 through and overflow and stream.

Presently the golf course has a permitted well capable of 500 g.p.m. with a permitted use of 32,000,000 g.p.y. The plan is to keep all ponds at their normal level at all times. There will be a SCADA-type system set up to monitor the water level in all ponds. A transfer system from the pond on hole 2 will automatically transfer water to the other ponds by priority to pond on 8 first, then pond 14, and finally pond 15 anytime it exceeds the normal water elevation of 12.0".

In addition to the above, the well will be set to refill all water levels in the same priority as the above. If the well is the primary source to fill the irrigation pond, it will take approximately 10.8 hours to bring the pond on Hole 8 back to its normal elevation.

The Preserve at Indian Hills

THE PRESERVE AT INDIAN HILLS IRRIGATION WATER USE ESTIMATES - BASED ON 20 YEAR EVAPOTRANSPIRATION DATA FROM COASTAL NY. REFERENCE ET CALCULATED USING THE FAO MODIFIED PENMAN METHOD With 75% RAINFALL BASED ON HISTORIC AVERAGE FROM CENTERPORT, NEW YORK

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Year
Estimated Evapotranspiration Rates (Inches) based on 75% Useful Rainfall	0.00	0.00	0.00	0.00	0.78	2.49	3.91	3.07	0.75	0.00	0.00	0.00	11.00

Description of Area	Area in Square Ft.	% Irrigated Area	Irrigated Area	Plant Factor	Irrigation Efficiency	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Year					
						Gals. / Mo.	Gals. / Mo.	Gals. / Mo.	Gals. / Mo.	Gals. / Mo.	Gals. / Mo.	Gals. / Mo.	Gals. / Mo.	Gals. / Mo.	Gals. / Mo.	Gals. / Mo.	Gals. / Mo.	Gals. / Mo.	Gals. / Mo.	Gals. / Mo.	Gals. / Mo.	Gals. / day	
The Preserve at Indian Hills																							
Fairways	898,207	1.0000	898,207	1.00	0.80	0	0	0	0	545,593	1,742,865	2,734,852	2,149,304	524,926	0	0	0	7,697,540					
	23.87	Acres	20.62			Gallons Per Day:					0	0	0	0	17,600	58,096	88,221	69,332	17,498	0	0	0	21,089
Primary Roughs	2,826,608	0.8000	2,261,286	1.00	0.80	0	0	0	0	1,373,560	4,387,761	6,885,142	5,410,993	1,321,531	0	0	0	19,378,988					
	64.89	Acres	51.91			Gallons Per Day:					0	0	0	0	44,308	146,259	222,101	174,548	44,051	0	0	0	53,093
Greens	102,366	1.0000	102,366	1.00	0.80	0	0	0	0	62,180	198,629	311,683	244,950	59,824	0	0	0	877,266					
	2.35	Acres	2.35			Gallons Per Day:					0	0	0	0	2,006	6,621	10,054	7,902	1,994	0	0	0	2,403
Tees	47,480	1.0000	47,480	1.00	0.80	0	0	0	0	28,840	92,129	144,567	113,614	27,748	0	0	0	406,899					
	1.09	Acres	1.09			Gallons Per Day:					0	0	0	0	930	3,071	4,663	3,665	925	0	0	0	1,115
Total The Preserve at Indian Hills	3,874,661	N/A	3,309,339	N/A	N/A	0	0	0	0	2,010,173	6,421,385	10,076,244	7,918,862	1,934,030	0	0	0	28,360,692					
	88.95	Acres	75.97			Gallons Per Day:					0	0	0	0	64,844	214,046	325,040	255,447	64,468	0	0	0	77,701