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THE LAKES COMMUNITY ASSOCIATION
5501 South Lakeshore Drive
Tempe, Arizona 85283

Re: **THE LAKES--TEMPE**
Irrigation System Evaluation and Master Plan Report

Thank you for the opportunity to provide the Irrigation System Evaluation and Master Plan for **The Lakes Community Association** located in Tempe, Arizona.

Coates Irrigation Consultants Inc. (CICI) began the field evaluation procedure on February 23, 2015. We traveled the H.O.A. areas to observe the condition of the existing irrigation system. We collected data from the irrigation system, observed the existing equipment and conditions, and took photo images of specific examples as part of the evaluation.

In addition to field evaluation, CICI obtained plans of the various parcels from your office and as provided by the landscape maintenance personnel. It appears that most of the parcels are represented in these plans.

The purpose of this Evaluation is a General Overall Review, and to identify priorities which will improve the condition and efficiency of the irrigation system to result in water savings. A Master Irrigation Plan is included in the scope, along with recommendations for improvement. We have divided the Report into segments according to certain categories.

Recommendations and Priorities for Action, as well as cost estimates, are listed near the end of the Report.

Several crucial categories were part of the process:

- Design plan study
- Field evaluation discovery
- Irrigation Control system overview
- Recommendations / priorities for action
- Master Irrigation Plan
- Potential water savings comparison
- Standards for repair / replacement
- Cost estimates

Each of the above categories is explored more specifically in this report.

I. DESIGN PLAN STUDY:

CICI compared design plans for landscape tracts with areas visited in the field. The "Common Area Turf & Utilities Map" plan identifies irrigation areas within the property boundaries. The following separations are understood:

A. Irrigation zones along Rural Road, Baseline Road, McClintock Drive, and the medians and some frontages along Lakeshore Drive are served from City of Tempe water meters but are maintained by the LCA. These will remain as they currently exist.

B. Irrigation zones at all other internal parcels are served by LCA water meters, and are to be considered as potential lake water irrigation areas.

C. Existing irrigation components such as water meters, backflow preventers, and controllers are shown on the maps. These items have been evaluated and the results are discussed below.

II. FIELD EVALUATION DISCOVERY:

CICI traveled to the various parcels to evaluate the irrigation system. Descriptions of these evaluations are listed in this section.

In general, irrigation water sources were found to be potable water meters, with backflow preventers installed on the downstream side of each meter. Controllers which schedule operation of valves and sprinklers are located throughout the parcels. One focus of the evaluation was to

determine whether lake water may be used for irrigation to decrease cost, along with how to connect the various systems together to minimize pumping locations.

A. Park at Compass and East Driftwood

A 2" backflow preventer was discovered. Valve boxes were found to contain Richdel electric valves, with wire nuts which are not proper waterproof connectors. Hunter I-20 rotary sprinklers were located, and many are too high out of the ground and are susceptible to mower damage. This is a typical condition in this park area.

Another valve box was found with four (4) different valves inside, along with a battery-operated timer. These valves, all ¾" to 1" size, have been jammed into the box. It is impossible to obtain access to maintain the valves properly in this condition.

We turned on sprinkler heads in the park area. We observed uneven coverage. Many of the Hunter I-25's and other sprinklers are too high and are susceptible to damage. Coverage is poor; much of this has to do with nozzle selection and / or adjustment. Water pressure is too high for some of these sprinklers to operate at their optimum condition. There are no pressure regulators on the electric valves, but this should be considered as a recommendation for improvement to save water.

We checked the domestic water pressure in the area, and it was measured as 80 psi.

We observed a pump house which contains an aeration pump. We were not able to get inside, but it appears that the pump includes a wetwell below it to draw water from the lake.

It is possible to place a new irrigation pump at this location, since electric power is existing at the site. However, how to connect the mainline pipes together to extend from the proposed lake-based pump to the various landscape tracts must be considered carefully. Boring under roadways will likely be required with new mainline piping.

We visited a lake area at the extreme southwest corner of the project. A manual flood gate apparatus with grate was found. The lake at this location contains a great deal of debris, which is a potential issue regarding using this water for irrigation.

B. Boat Ramp Area

A Richdel controller was located, and it is falling off of the wall. A valve was found with two valves jammed inside it, and others included more than two valves. Wire nuts were installed as connectors, which are not adequate for protecting the system from electrical faults in the long-term.

C. Sandpiper and South Lighthouse

Near the corner, we observed the conditions at the park area. The overseeded turf seemed to be satisfactory. The area appeared quite wet due to irrigation. We found a 2" water meter and 2" backflow preventer which appear to be the water source for this park area.

On the other side of the park we located a smaller 1" water meter and backflow preventer. Static water pressure was measured at 79 psi.

On the edge of the lake, we found an aeration pump house at the boat ramp. The pump includes a vertical turbine motor in a metal case which appears to extract water from the lake via an underground wetwell below it. The discharge pipe appears to be 10" or 12" in size. This may be a potential new irrigation pump location, since electrical service is already in place.

D. The Lakes Club (Club House)

We observed Hunter I-25 sprinklers operating down into the sloped area. The heads appear to cover the turf adequately, but are out of adjustment and include incorrect nozzles preventing matched precipitation over the lawn. Also, we found full-circle and part-circle sprinklers operating on the same valve or zone, which creates a scheduling nightmare since the full-circles cover half the area of part-circles in the same elapsed time so precipitation is not equal and efficient.

A Rain Dial controller was found, which is typical of what was found on the property. These are middle of the road in terms of quality, but are not "smart" and able to operate according to weather and other on-site conditions.

The drip irrigation system was evaluated. We found a large amount of ¼" vinyl tubing (known as "spaghetti" tubing) above ground. This situation is extremely susceptible to damage during maintenance (raking, digging) and also by ground squirrels and rabbits. This condition will result in plants not receiving the correct amount of water. Irrigation schedules tend to over-water these areas.

An electronic Moisture Meter was utilized to record readings of moisture in the soil. Overall throughout the project the readings ranged from 83.4% to well over 90% range in the Club area (70-80% is normal). This indicated that over-watering has been prevalent.

E. Whalers East Way and Steamboat Bend

From the Club, we traveled east to the park near the corner of Whalers East Way and Steamboat Bend. We found a 1" water meter and 1" backflow preventer which appear to be the irrigation water source for this area. Static water pressure was measured as 71 psi.

We observed sprinkler heads operating which were not matched in terms of nozzles, and two different types of heads were installed on the same valve. Sprinkler spacing was inconsistent between the types of heads. Two heads operated up by the road on one valve, along with several others down by the boat dock. By the time the water travels from the source to the valve, and through the down-sized piping, sprinklers were barely operating. Shady and sunny areas were also on the same valve. The pipe and control situation needs to be re-done. The moisture meter recorded 118%, which is a sure sign that over-watering had occurred.

Valve boxes were found with multiple valves inside, with wire nuts rather than waterproof connectors. The irrigation system needs to be replaced, since there are so many issues that repair would be cost prohibitive.

We located another pump house, and found a vertical turbine pump and motor. The electrical situation must be considered carefully if we are going to consider adding an irrigation pump at this area.

F. South Rocky Point and South Outrigger

We went to a small park at this location, and were not able to find a backflow preventer. It is remote from other tracts, so likely has its own water source and controller. This area was extremely wet; the moisture meter recorded 154%.

We traveled to another park which included another main pump for lake aeration. We found a 2" water meter and 2" backflow preventer which supplies the irrigation system in this area. This is one location where a potential irrigation pump may be sited, to link several landscape tracts together to utilize lake water for irrigation.

G. East Driftwood and South Marine

We found a vertical turbine pump (which appears to be 5-HP) just off the lake, possibly for lake aeration. This is a possible irrigation pump location.

The park area includes Hunter I-25 sprinklers, with mismatched nozzles and part-circle and full-circle heads on the same valves. Static water pressure was measured as 75 psi. The water pressure is insufficient for the sprinklers to operate effectively. The moisture meter read 133%.

Electric valves were found to be Richdel, with wire nuts as connectors. Some are "grease packs," but they are still not per industry standards. We will be recommending replacing the entire irrigation system, not just the wire connectors at the valves.

III. IRRIGATION CONTROL SYSTEM OVERVIEW:

Irrigation control is currently accomplished by a series of individual time clocks located throughout the property. Approximately thirty-eight (38) separate controllers are mounted on walls or other structures, and are provided electrical power from the LCA system. According to our field evaluation, many of these controllers are falling off the wall, and their condition is questionable at best in terms of longevity. The brand and model of controller was not intended for long-term use in a setting such as an HOA. All controllers should be replaced in our opinion with "Smart" devices capable of automatic operation adjustments based upon weather conditions.

As mentioned above, wire connections at the electric valves are not per industry standards. It is recommended that the irrigation control system, as well as the sprinklers and piping, be replaced with new equipment.

IV. RECOMMENDATIONS / PRIORITIES FOR ACTION:

Following is a list of key items that need attention:

- Overwatering has occurred as measured by the moisture meter (86-154% as compared with 70-80% normally). Replacement of controllers is recommended to adjust to weather conditions.
- Rotary sprinklers were observed with all the same nozzles, whether part-circle or full-circle, and many operate on the same zone. Matching of precipitation is not possible this way, and water is

wasted due to poor distribution. Replacement of sprinklers is recommended.

- We observed several bad wire connections in valve boxes, many of which were simply wire nuts. These connections must be replaced with waterproof connectors along with new electric valves.
- Elimination of as much potable water from meters as possible is recommended. This will require new lake-based irrigation pump stations. Higher pressures created by the pumps will require replacement of mainline pipes.
- A new state-of-the-art irrigation system is recommended. This will allow improved distribution uniformity of sprinklers, and automatic adjustments of operating schedules based upon weather. These improvements will save water and cost.
- Lake water is far less expensive than metered potable water. Conversion of the Pirates Cove, 975 Driftwood, West and East Lighthouse, Whalers Way, Club House, and Marine areas to lake water for irrigation (and eliminating those meters) will save both water and meter costs. Those seven (7) meters account for 83% of the Association's $65,000 annual municipal water bill.

V. MASTER IRRIGATION PLAN:

Please refer to the accompanying Master Irrigation Plan documents. The map provided by the LCA shows the existing irrigation water sources and controllers. We have added the proposed irrigation pumps and pipeline replacements which are shown in red. Appurtenances such as isolation gate valves, air-relief valves, and manual drain valves are also noted on the plan. A second sheet includes typical irrigation details for the infrastructure elements included in the master plan.

It is understood that the existing irrigation systems along Rural Road, Baseline Road, McClintock Drive, and the northern portion of Lakeshore operate from City of Tempe water meters but are maintained by LCA. These areas will remain as existing, so are not included in the master plan study. New "smart" irrigation control is strongly recommended in these areas.

Prior to drafting the master plan, a study of turf irrigation demand was accomplished. Please refer to the accompanying spreadsheet charts. Irrigation demands were based upon acreages for the individual "Association Turf Area" tracts as listed in the "Table of the Community's Acreage Summary" you provided. These turf acreages are:

Pirates Cove	0.91 ac
Compass Park	0.86 ac
Lighthouse-West	0.71 ac
Lighthouse-East	0.38 ac
Driftwood	0.08 ac
Lakeshore	0.15 ac
Club House	1.13 ac
Jolly Roger	0.54 ac
Whalers Way	0.25 ac
Bayview	0.17 ac
Northshore	0.45 ac
Marine	1.55 ac
Total:	7.19 ac

A study revealed where these areas exist on the map, and which tracts could logistically be combined when considering pumping zones. You stated that an easement exists along the lake edge which has been used for pipe installation in connecting landscape tracts together. This concept has been utilized in the planning of pipe replacement on the master plan. The only two tracts which were not included due to the distance and possible disturbance are Bayview and 1114 Driftwood. All ten (10) other tracts have been included and are recommended to be converted to lake water irrigation.

The landscape tracts were grouped into "pump" areas as follow:

Pump Area	**Landscape Tract**	**Approx demand**
Compass Pump	Pirates Cove Compass Park	35 gpm
Boat Ramp Pump	Lighthouse-West Lighthouse-East	22 gpm
Marine Pump	Lakeshore Club House Jolly Roger Whalers Way North Shore Marine	81 gpm

Please notice that the spreadsheet charts are organized into three "pump" zone groups. Each of these groups includes a page for the individual tracts showing a month-by-month list of irrigation factors based upon the acreage of turf. Drip irrigation has not been considered in this

study. Each pump zone includes a "totals" page which lists the total turf acreage, annual acre-feet of irrigation, momentary demand (gpm), and peak daily demand estimates.

For example, the Compass Pump (including Pirates Cove and Compass Park) contains 1.77 acres of turf; requires 11.74 ac-ft annually to maintain turf; has a peak season flow of 35 gpm over a 9-hour nightly water window schedule; and requires approximately 19,000 gallons per peak day. Keep in mind that new "smart" controllers that automatically adjust to weather conditions can reduce the peak daily demand.

The Master Irrigation Plan itself is a graphic description showing the connection of tracts into the pump zones. In general, the recommendation is to replace mainline pipes in areas where pipes currently exist. New pipe is recommended to minimize leakage from old pipes, and in view of pumps being added pressures will be higher than currently exist. The plan shows potential new connections:

- From 5322 Marine to Northshore
- Southeast of the Club House to Marine
- Northeast of the Club House to Whalers Way

These connections will minimize the proposed new pump locations to three (3). If any or all of the connections are not feasible, more pumps will be required and/or certain tracts will have to remain on potable water.

In addition, existing sleeves under roads will need to be located and utilized at places such as Driftwood, Pirates Cove, and Marine.

The Southshore area which currently is irrigated by SRP flood water is recommended to remain as it exists.

POTENTIAL WATER SAVINGS COMPARISON:

For the purpose of this comparison study, the 7.19 acres of turf currently irrigated by City of Tempe water and LCA meters (Association Turf Area) has been considered. As mentioned earlier, the Tempe Turf Area (along the major roadways) and Southshore are recommended to remain on their current water sources. New state-of-the-art control is recommended.

The Association's documentation shows that the 7.19 acres of Association Turf has used between 58.24 and 71.64 AF/yr between 2010 and 2013. This is an average of 64.04 ac-ft per year. The chart that shows this information

also indicates that the percentage of water use over the ADWR allotment is significant—over by 203% in 2013 in comparison to 35.25 AF / yr.

Please notice on the accompanying spreadsheet charts that combining all three pump zones in terms of annual demand totals:

11.74 + 26.99 + 7.23 = **45.96** ac-ft per year

This is a significant decrease from the 64.04 average (29%), and especially from the 71.64 AF (36%) demand just two years ago. While 45.96 is not as low as the ADWR allotment, the chart is based upon industry standards and does not reflect "smart" control. The irrigation efficiency for turf on the individual tract spreadsheets is 80%, which is conservative. Smart controllers typically save up to 25% on irrigation demand annually. It is entirely possible that with a new irrigation system with properly installed and adjusted sprinklers; pressure-regulated electric valves; and "smart," weather-based control, 10 acre-feet could be saved each year to match the ADWR allotment.

VI.STANDARDS FOR REPAIR AND REPLACEMENT:

A new state-of-the-art irrigation system design for the individual landscape tracts is recommended. When we design the systems, standards of equipment and methods of installation will be established.

- Standard sprinklers, nozzles, valves, controllers, drip pressure regulators, etc. must be established.
- Typical installation details shall be included in the new design to result in consistent installation and maintenance procedures.

VII. COST ESTIMATES:

The overall goal is to improve the efficiency of the irrigation system in order to save water, and therefore annual water cost. Documents show that nearly $65,000 was spent for irrigation water among the 13 Common Area meters (probably in 2013). Adding in the Club House meter, the total is over $70,000. Calculations revealed that in delivering water via potable meters to the 7.19 acres of Association turf, this water cost about **$ 1,015 per acre-foot** ($64,953 / 64.04 avg AF/yr = $ 1,015 / ac-ft).

Projecting ahead to using lake water for irrigation, further study was warranted. The documents show that the total surface of lakes is 48.88 acres, and that $ 8,775.83 was spent on lake water. Since lake water was

not used for irrigation, the only consideration is evaporation (at the rate of 6.2 feet per year). So, 6.2 x 48.8 = 302.56 ac-ft of lake water. At the cost listed, this is about **$29.00 per ac-foot** (48775.83 / 302.56 = $ 29.01 per ac-ft).

Following is a basic cost estimate for infrastructure construction:

		Pump	Main	Wire, Vlvs	Rd Crosg	Total
1.	Compass pump station	45,000	18,700	5,500	12,000	$81,200
2.	Boat Ramp pump sta	45,000	6,000	4,500	6,000	61,500
3.	Marine pump station	60,000	32,300	12,500	18,000	122,800
	Total:					**$ 265,500**

Pump electrical cost: Annual electrical pumping cost is estimated at $2200 for Marine, and $1100 each for Compass and Boat Ramp; or a total of **$ 3,300** per year.

The cost of the infrastructure irrigation system can be **paid for in water savings** in **5 years.** Please recall that the seven zones with water meters account for 83% of the $65,000 annual Association water cost (83% x 65,000 = **$ 54,000 savings in potable water** and meters per year).

The cost of the **lake water** for irrigation is projected to be $29.00 / AF x 45.96 AF = **$ 1,333 / year.** Subtracting this from 54,000 = a net savings of $52,667 / year. So, $265,500 / $52,667 savings = **5 years** to pay for the infrastructure system.

Remember that this does not include the design and installation of the replacement irrigation system (sprinklers, electric valves, lateral piping, and control system). It also does not consider the electrical cost for pumping the irrigation water. Each electrical situation must be evaluated further to determine if it must be upgraded. Even with this situation, the amortization is projected to be less than 5 years and then every year the Association will realize savings.

Thank you for the opportunity to assist with your project. We trust that this report is sufficient at this time. Please review this information and contact our office with any questions.

Prepared and presented by:
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