GOLF COURSE IRRIGATION AUDIT

Submitted by William Baker & Associates, LLC

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GOLF COURSE IRRIGATION AUDIT

A water audit was conducted on an irregularly shaped putting green that has a total area of 4,328 square feet. The plant canopy of the putting surface is composed of Tifdwarf bermudagrass, which is over-seeded in the fall with a combination of perennial ryegrass and Poa trivialis. The warm season ultradwarf bermudagrass is able to withstand summer temperatures exceeding 100 degrees, while the over-seeded cool season grasses provide a green putting surface that rolls true and fast during the winter golfing season.

When the audit was performed in late May, the cool season mixture of grasses were transitioning back to ultradwarf bermudagrass. The estimated plant canopy was 85% ultradwarf bermudagrass, and 15% cool season grasses. The dominance of a warm season grass during the summer is preferred, because this grass species will survive the hot ambient temperatures, and require less water.

WILLIAM BAKER & ASSOCIATES LLC

Golf Course Irrigation Audit

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GOLF COURSE IRRIGATION AUDIT- OVERVIEW

Site Address: Coachella Valley Area Golf Course (Riverside County)

WUCOLS Region # 6 Sunset Zone 13: Average summer time temperatures range from 106 to 108 degrees Fahrenheit. Winters are short and mild, with frosts anticipated from December 1 to February 15.

Closest CIMIS Station: Rancho Mirage M.W.E.L.O. ETo 71.6"

Green #12 Square Footage: 4,328

Name	Office	Cell	Email

GENERAL SITE DESCRIPTION

#12 Green at Golf Course in Coachella Valley, California

Turf Irrigation Audit Description: The 4,328 square foot putting green is irrigated with five gear driven rotary sprinklers. The Rainbird Model 750 contains a #18 yellow nozzle, that is directed to apply water inward towards the green, and rotate 180 degrees or to the outside of the green surface. Backup sprinklers of the same type, irrigate outwards from the green 180 degrees. Each sprinkler is valve-in-head, so each sprinkler has a dedicated station from the irrigation controller. This allows greater flexibility to apply different amounts of water if needed.

A field clock relays programmed information from a central computer to the sprinkler. The computer records daily evapotranspiration rates from an in-house weather station, so water is delivered daily according to weather conditions. Also, flow rates in irrigation mainlines are regulated from the computer to the variable speed pump station, so flow rates never exceed pipe capacities, and the irrigation system operates at peak efficiency, while managing flow in real time.

WATER AUDIT PROCEDURES

An initial visit to the golf course was done on May 17, 2016, meeting with the golf course superintendent and irrigator. We selected the 12th Green to conduct the water audit, and with the assistance of the irrigator the following information was obtained:

1. Irrigation Controller #603: Stations – 1, 2,3,4,5
2. The clock was activated and all five sprinklers were flagged. Each sprinkler was checked for proper operation, and adjustment.
3. A field test area data map was drawn. Sprinkler operating pressure, static pressure, dynamic pressure, and sprinkler head spacing was recorded.
4. A soil probe was inserted into the green to determine root depth, thatch layer buildup, organic matter accumulation, and the soil moisture content.
5. It was determined to use 32 catch devices throughout the green surface when performing the catch can test. Each catch location was recorded on the map.
6. Irrigation Controller and Pump Station information was documented.
7. The current watering schedule for the green was verified.

On May 26, 2016 a catch can test was conducted on #12 Green and the following procedures were performed:

1. All five sprinklers were activated and checked for proper operation, adjustment, and operating pressures.
2. A total of 32 catch devices were placed on the green surface and five separate columns were used to distribute all of the catch devices.
3. A five minute run time was used to collect water in the catch devices.
4. Water volumes were read and logged on the test area map.
5. The distribution uniformity and precipitation rate were calculated.
6. An irrigation schedule was developed utilizing the plant water requirement, sprinkler performance, and soil–water properties.
7. Properly managing an irrigation schedule will incorporate the following scheduling factors:

    - The proper amount of water (considering weather and turf).
    - The proper frequency of irrigation (based on the soil's ability to store water and the intake rate of the soil.
    - The performance characteristics of the irrigation system (how quickly and evenly water is applied to the turfgrass).
    - The features of the irrigation controller and the characteristics of the site that determine appropriate program start times and maximum station run times without runoff.

GREEN WORKSHEET #1 - SITE INSPECTION

Site Name: Coachella Valley Area Golf Course **Audit Date:** 5/26/2016

Candidate ID #: 69674 **Sheet # 1 of 1**

Site inspection is only necessary on the zones being audited. Record the number of defects for each sprinkler problem or check mark for zone problems; leave blank if no problem exists.

Controller Identification WST: Warm Season Turf

Station Number:	**1**	**2**	**3**	**4**	**5**				
Turfgrass Type	WST	WST	WST	WST	WST				
Sprinkler Type Geared Rotary	Rotary	Rotary	Rotary	Rotary	Rotary				
Observed problems:									
Valve Malfunctions									
Low Pressure									
High Pressure									
Tilted Sprinklers									
Spray Deflection									
Sunken Sprinklers									
Plugged Sprinklers									
Arc Misalignment									
Low Sprinkler Drainage									
Leaky Seals or Fittings									
Lateral or Drip Line Leaks									
Missing or Broken Heads									
Slow Drainage or Ponding									
Compaction/Thatch/Runoff									

Notes and Comments: Sprinkler: Rainbird 750 - #18 yellow nozzle. No problems were observed involving sprinkler or piping equipment.

GREEN WORKSHEET #2 – SITE INSPECTION
Controller and Point of Connection (POC Information

Site Name: Coachella Valley Area Golf Course /#12 Green **Audit Date:** 5/26/2016
Candidate ID #: 69674 **Sheet #1 of 1**

Central Control x yes ____ no

Controller Make & Model:
Rainbird Par ES

Features:

Number of Stations	72	**Minimum run time**	1 min.	**Maximum run time**	120 min.
Number of programs	8	**Cycles per program**	12	**Stations per program**	72
Days per week	7	**Max. hours per day**	24	**Calendar Period**	7 days or variable
Slip Day	Yes	**Cycle Soak**	Yes	**Percent adjust**	0-200%

Other controller features
Cycle and soak, pump profiling, Flo Manager, Smart Pump

List sensors installed/capabilities
Weather Station, Rain season

Program	Start Time(s)	Start Days	Cycle/Rest Time	Station	Run Time
A	4:00 AM	MTWTHFSS	2 cycle/15 min	1	5 minutes
A	One Start	MTWTHFSS	2 cycle/15 min	2	5 minutes
A	Time For	MTWTHFSS	2 cycle/15 min	3	5 minutes
A	Greens, Flo	MTWTHFSS	2 cycle/15 min	4	5 minutes
A	Manager	MTWTHFSS	2 cycle/15 min	5	5 minutes
Completes the (2) 5 minute cycles					

POC PRESSURE DATA

Dynamic pressure at source: 110 **psi** **Dynamic pressure at test area:** 110 **psi** **Time of Day:** 7:39 AM
Static Pressure at source: 110 **psi** **Static pressure at test area:** 110 **psi** **Time of Day:** 7:36 AM

Notes: Backflow device, pump station, regulator
Pump station – Flotronex Variable Frequency Drive (4) 75 HP Booster Pumps (1) 25 HP Jockey Pump

POC FLOW DATA (use catalog data if non-metered sources exist)

Meter Number	Station Number	Gallons (cf)	Beginning Readings	Ending Readings	Total	Beginning Time	Ending Time	Elapsed Time
Pump	Station	Gallons	5,375,420	5,375,995	575 gals.	7:35 AM	7:40 AM	5 min.

GREEN WORKSHEET #3 – TEST AEA DATA AND MAP

Site Name: Coachella Valley Area Golf Course **Sub Area:** #12 Green **Audit Date:** 5/26/2016
Candidate ID #: 69674

STATION # 1, 2, 3, 4, 5

CONTROLLER 603

RUN TIME 5 minutes

PRESSURE 110 psi

PLANT MATERIAL

- ☐ Cool season turf
- ☒ Warm season turf
- ☐ Ground Cover
- ☐ Shrubs

DENSITY FACTOR (Kd)

- ☐ High
- ☒ Average
- ☐ Low

MICROCLIMATE FACTOR (Kmc)

- ☐ High
- ☒ Average
- ☐ Low

ROOTZONE DEPTH

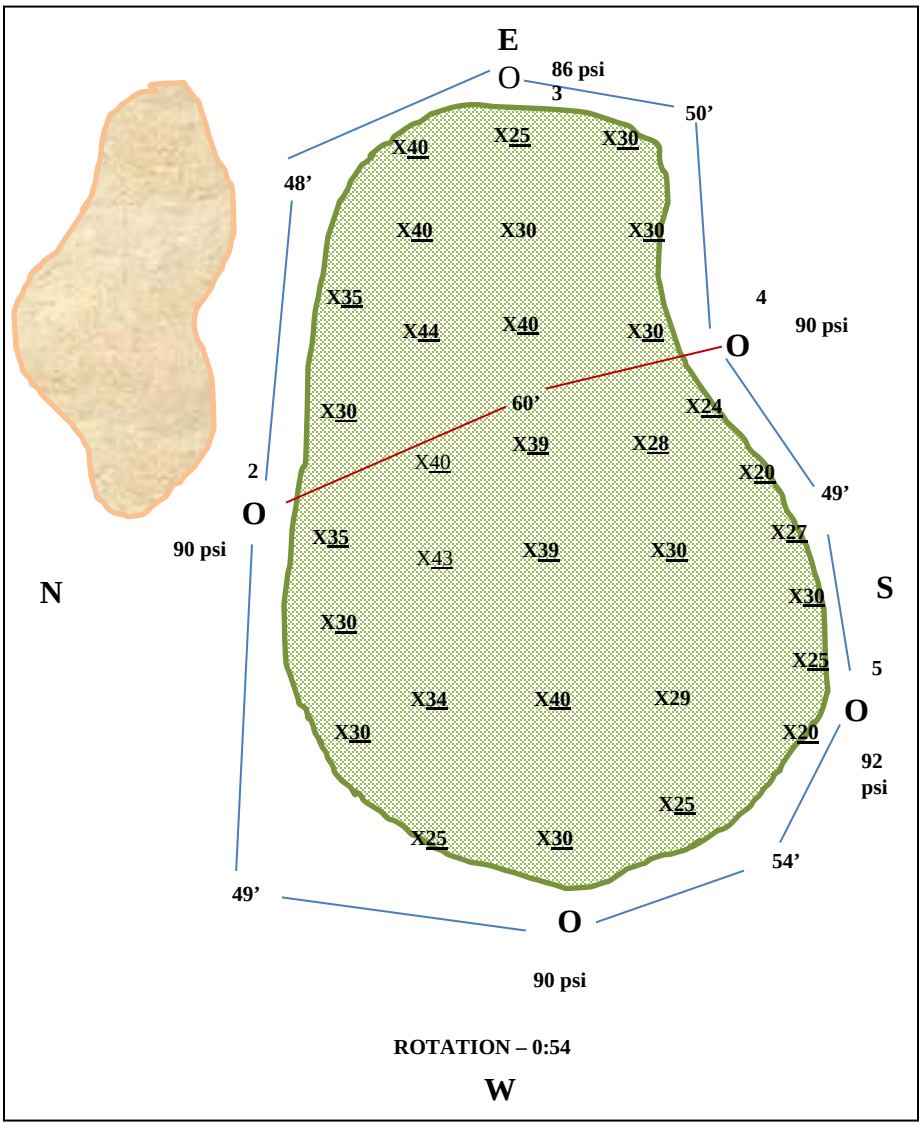
3 inches

SOIL TYPE

- ☐ Clay
- ☐ Loam
- ☒ Sand
- ☐ Other____

ZONE

- ☐ Overlap
- ☐ Stand-alone
- ☒ Valve-in-head
- ☐ Block



32 Catchments ⬅ **Indicate north and ALL audit area dimensions** ➡ **4,328 sq. ft.**

O = SPRINKLER Record the location of each sprinkler and sprinkler spacing.

X = CATCH DEVICE Record the location of each catch device and catch amount.

GREEN WORKSHEET #4 – DU AND PR CALCULATIONS

Site Name/Location: Coachella Valley Area Golf Course/#12 Green

Audit Date: 5/26/2016 **Candidate ID #:** 69674

All Values and calculations must be completed on this page; auditing software is not acceptable for use in determining these values.

Run time (t_R): 5 minutes **Catchment type:** Texas A & M **Catchment Device Area (A_{CD}):** **16.5 sq. in.**

1) Record ALL catch device values 2) ***bold*** *ALL values to calculate lower quarter*

Can #1	30	#11	40	#21	29	#31	**20**	#41	#51	#61
Can #2	30	#12	40	#22	30	#32	**24**	#42	#52	#62
Can #3	35	#13	30	#23	28	#33		#43	#53	#63
Can #4	30	#14	40	#24	30	#34		#44	#54	#64
Can #5	35	#15	39	#25	30	#35		#45	#55	#65
Can #6	**25**	#16	39	#26	30	#36		#46	#56	#66
Can #7	34	#17	40	#27	**20**	#37		#47	#57	#67
Can #8	43	#18	30	#28	**25**	#38		#48	#58	#68
Can #9	40	#19	**25**	#29	30	#39		#49	#59	#69
Can #10	44	#20	**25**	#30	**27**	#40		#50	#60	#70
Column Subtotals	**346**		**348**		**279**		**44**			

TOTAL CATCH: **1,017 mL** **AVERAGE CATCH:** **31.78 mL**

TOTAL CATCH IN LOWER QUARTER: **191 mL** **AVERAGE CATCH IN LOWER QUARTER:** **23.88 mL**

Calculate Distribution Uniformity (DU)

DU_{LQ} (Average Catch in Lower Quarter)
(Average Catch Overall)
= (23.88 mL)
= (31.78 mL)
= 0.75

Calculate Precipitation Rate (PR)

$PR_{net} = \frac{3.66 \times V_{avg}}{t_R \times A_{CD}}$
= 3.66 x (31.78 mL)
(5 min) x (16.5 $in.^2$)

= 1.41 in./h

DISTRIBUTION UNIFORMITY (DU) = 0.75 **PRECIPITATION RATE (PR_{net}) =** 1.41 **in./h**

GREEN WORKSHEET #5 – SCHEDULE

Site Name/Location: Coachella Valley Area Golf Course/#12 Green

Audit Date: 5/26/2016 **Candidate ID #:** 69674

Controller No: 603 **Station No:** 1, 2, 3, 4, 5 **Reference Period:** 1 day

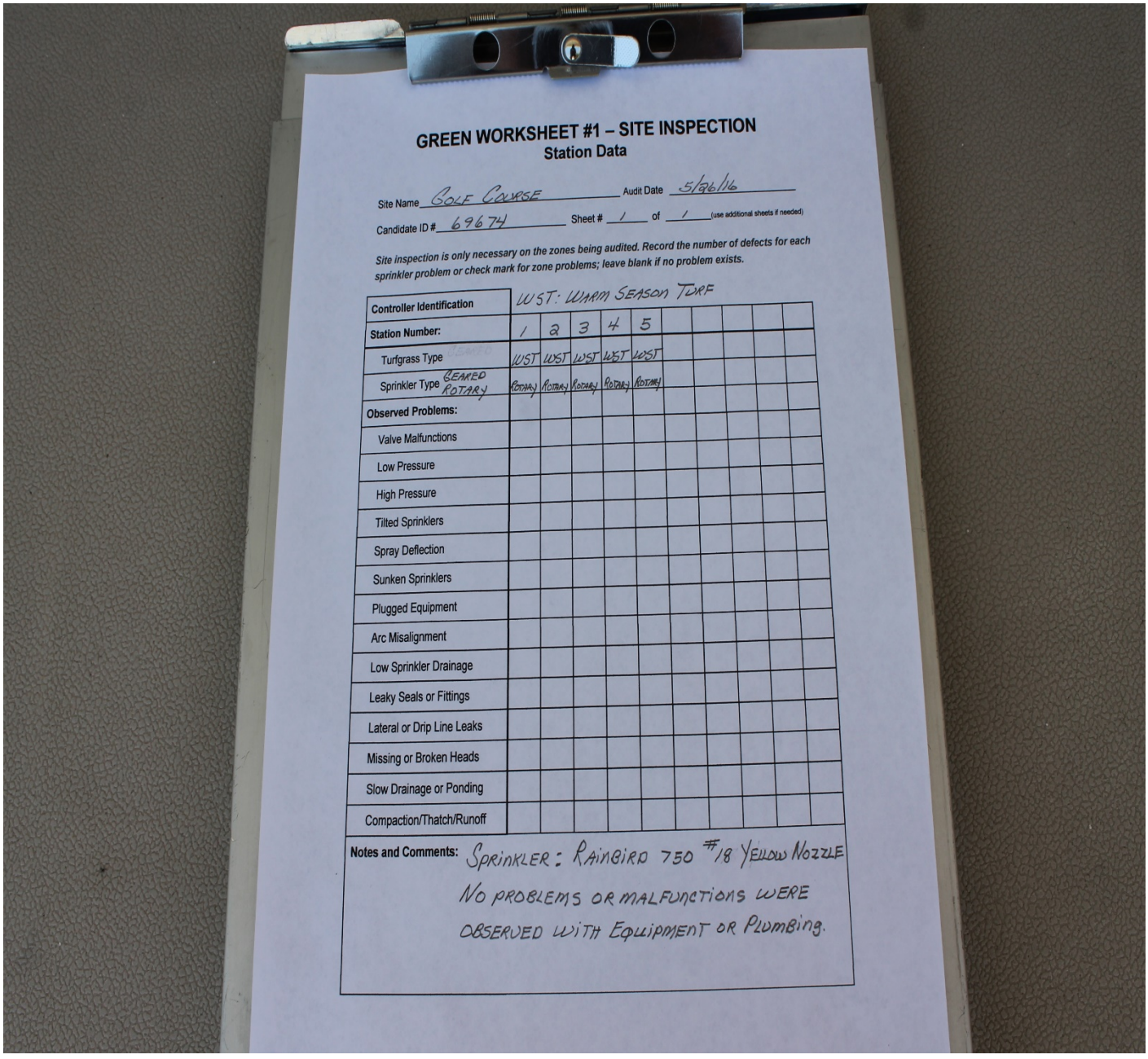
CIMIS Station 25 Rancho Mirage Year ETo 71.6" May ETo 8.7"

ITEM	SOURCE		VALUE	UNIT OF FUNCTION
I. Plant Water Requirement				
A. Plant Material	Audit		WST	Grass species
B. Reference Period	Judgment		1	days
C. Reference ETo	Various sources		0.28	inches of water
D. Crop Coefficient (Kc)	Various sources		0.60	species factor
E. Microclimate Facto (Kmc)	Judgment		1.0	factor
F. Plant Water Requirement (PWR)	Kc x Kmc x ETo	CxDxE	0.17	inches of water
II. Sprinkler Performance				
G. Precipitation Rate (PR)	Audit		1.41	inches per hour
H. Distribution Uniformity (DUlq)	Audit		0.75	percent
III. Soil Reservoir				
I. Soil Type	Audit		Fine Sand	classification
J. Infiltration Rate	Table		1.25	inches per hour
K. Available Water (AW)	Table		0.06	inches per inch
L. Root Zone (RZ)	Audit		3	inches
M. Plant Available Water (PAW)	AW x RZ		0.18	inches
N. Managed Allowable Depletion (MAD	Judgment		0.60	percent in decimal
O. Allowable Depletion (AD)	PAW x (MAD/100)		0.11	inches
IV. Scheduling – Run Time				
P. Run Time Multiplier (RTM)	Table		1.18	factor
Q. Base Run Time (RTb)	60 x (PWR/PR)		7	minutes
R. Adjusted Run Time (RT)	RTb x RTM		8	minutes
S. Maximum Run Time per Cycle (CRT)	(I/PR) x 60		53	minutes
V. Scheduling - Programming				
T. Irrigation Days per Period*	PWR/AD		1	days (round up)
U. Minutes per Irrigation Day*	RT/Irr. Days		8	minutes (round off)
V. Days Between Irrigation Events*	Ref Period/Irr. Days		1	days (round down)
W. Number of Cycle Starts*	Min per Day/Cycle RT		1	cycles (round up)
X. Minutes per Cycle*	Min per Day/Cycle Starts		8	minutes (round down)

*Must be expressed as an integer.

PROCEDURAL STEPS FOR A WATER AUDIT CONDUCTED BY WBA STAFF

Station data



GREEN WORKSHEET #1 – SITE INSPECTION
Station Data

Site Name GOLF COURSE Audit Date 5/26/16

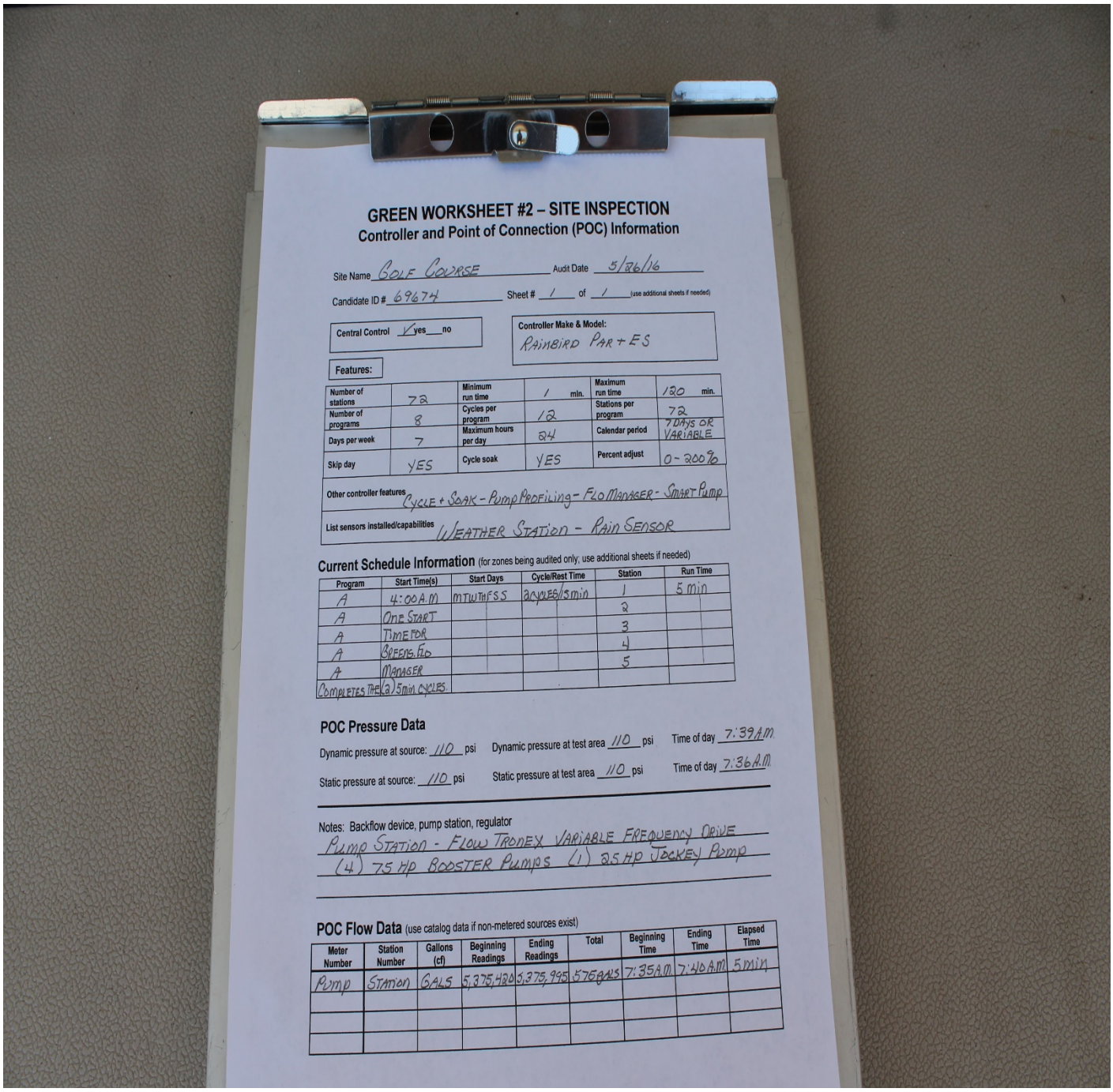
Candidate ID # 69674 Sheet # 1 of 1 (use additional sheets if needed)

Site inspection is only necessary on the zones being audited. Record the number of defects for each sprinkler problem or check mark for zone problems; leave blank if no problem exists.

Controller Identification	WST: WARM SEASON TURF									
Station Number:	1	2	3	4	5					
Turfgrass Type	WST	WST	WST	WST	WST					
Sprinkler Type BEAKED ROTARY	ROTARY	ROTARY	ROTARY	ROTARY	ROTARY					
Observed Problems:										
Valve Malfunctions										
Low Pressure										
High Pressure										
Tilted Sprinklers										
Spray Deflection										
Sunken Sprinklers										
Plugged Equipment										
Arc Misalignment										
Low Sprinkler Drainage										
Leaky Seals or Fittings										
Lateral or Drip Line Leaks										
Missing or Broken Heads										
Slow Drainage or Ponding										
Compaction/Thatch/Runoff										

Notes and Comments: SPRINKLER: RAINBIRD 750 #18 YELLOW NOZZLE
NO PROBLEMS OR MALFUNCTIONS WERE OBSERVED WITH EQUIPMENT OR PLUMBING.

Test Area Data and Map – Controller and Point of Connection Information



GREEN WORKSHEET #2 – SITE INSPECTION
Controller and Point of Connection (POC) Information

Site Name GOLF COURSE Audit Date 5/26/16

Candidate ID # 69674 Sheet # 1 of 1 (use additional sheets if needed)

Central Control ✓ yes ___ no

Controller Make & Model: RAINBIRD PAR+ES

Features:

Number of stations	72	Minimum run time	1 min.	Maximum run time	120 min.
Number of programs	8	Cycles per program	12	Stations per program	72
Days per week	7	Maximum hours per day	24	Calendar period	7 DAYS OR VARIABLE
Skip day	YES	Cycle soak	YES	Percent adjust	0-200%
Other controller features	CYCLE + SOAK - PUMP PROFILING - FLO MANAGER - SMART PUMP				
List sensors installed/capabilities	WEATHER STATION - RAIN SENSOR				

Current Schedule Information (for zones being audited only; use additional sheets if needed)

Program	Start Time(s)	Start Days	Cycle/Rest Time	Station	Run Time
A	4:00 A.M	MTWTHFSS	2CYCLES/5min	1	5 min
A	ONE START			2	
A	TIME FOR			3	
A	GREENS FLO			4	
A	MANAGER			5	
COMPLETES THE (2) 5min CYCLES					

POC Pressure Data

Dynamic pressure at source: 110 psi Dynamic pressure at test area 110 psi Time of day 7:39 A.M.

Static pressure at source: 110 psi Static pressure at test area 110 psi Time of day 7:36 A.M.

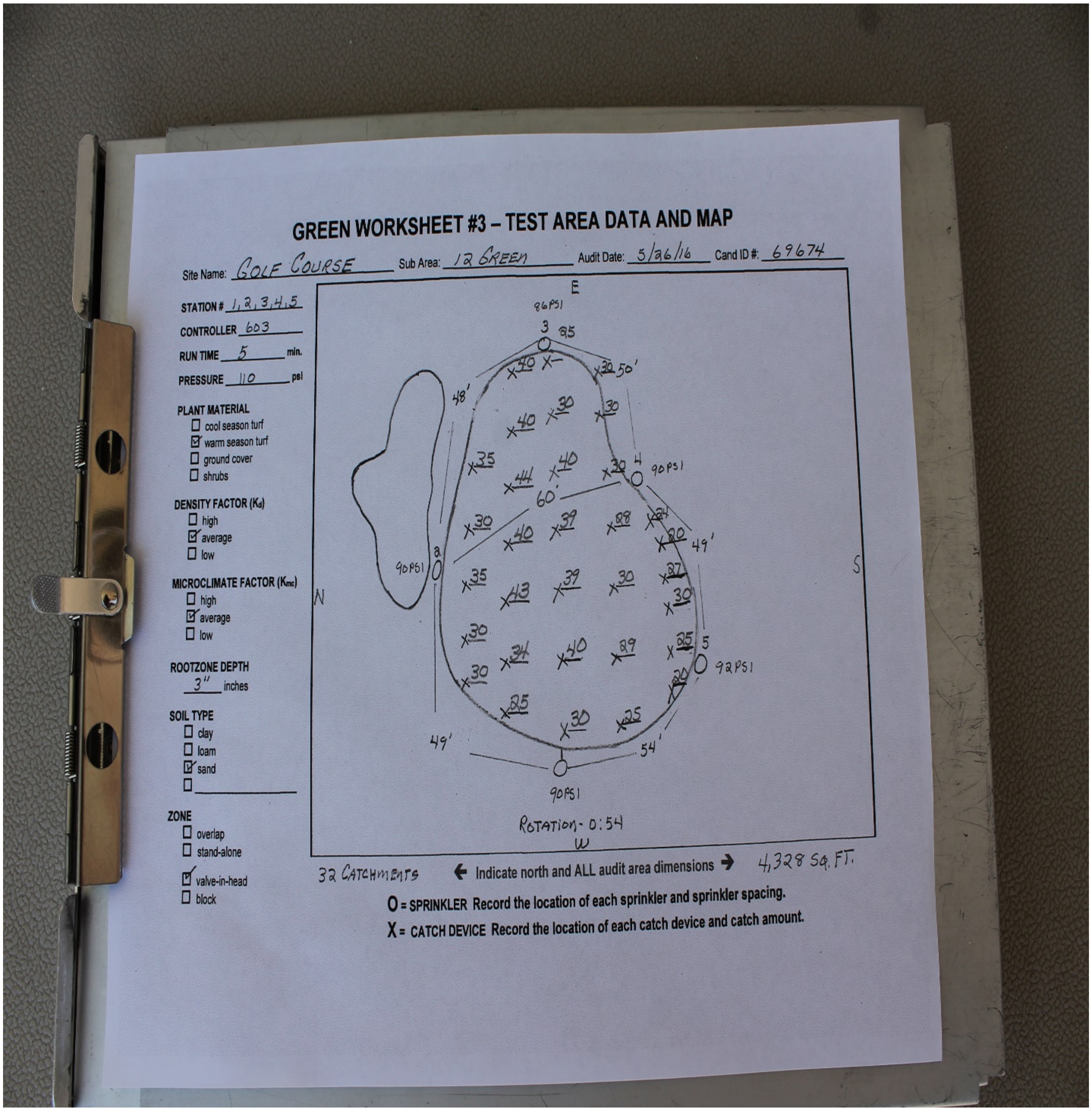
Notes: Backflow device, pump station, regulator

PUMP STATION - FLOW TRONEX VARIABLE FREQUENCY DRIVE
(4) 75 Hp BOOSTER PUMPS (1) 25 Hp JOCKEY PUMP

POC Flow Data (use catalog data if non-metered sources exist)

Meter Number	Station Number	Gallons (cf)	Beginning Readings	Ending Readings	Total	Beginning Time	Ending Time	Elapsed Time
PUMP	STATION	GALS	5,375,420	5,375,995	575 GALS	7:35 A.M.	7:40 A.M.	5 MIN

Test Area Data and Map



GREEN WORKSHEET #3 – TEST AREA DATA AND MAP

Site Name: GOLF COURSE Sub Area: 12 GREEN Audit Date: 5/26/16 Cand ID #: 69674

STATION # 1, 2, 3, 4, 5

CONTROLLER 603

RUN TIME 5 min.

PRESSURE 110 psi

PLANT MATERIAL
- ☐ cool season turf
- ☑ warm season turf
- ☐ ground cover
- ☐ shrubs

DENSITY FACTOR (K_d)
- ☐ high
- ☑ average
- ☐ low

MICROCLIMATE FACTOR (K_{mc})
- ☐ high
- ☑ average
- ☐ low

ROOTZONE DEPTH
3" inches

SOIL TYPE
- ☐ clay
- ☐ loam
- ☑ sand
- ☐ ____

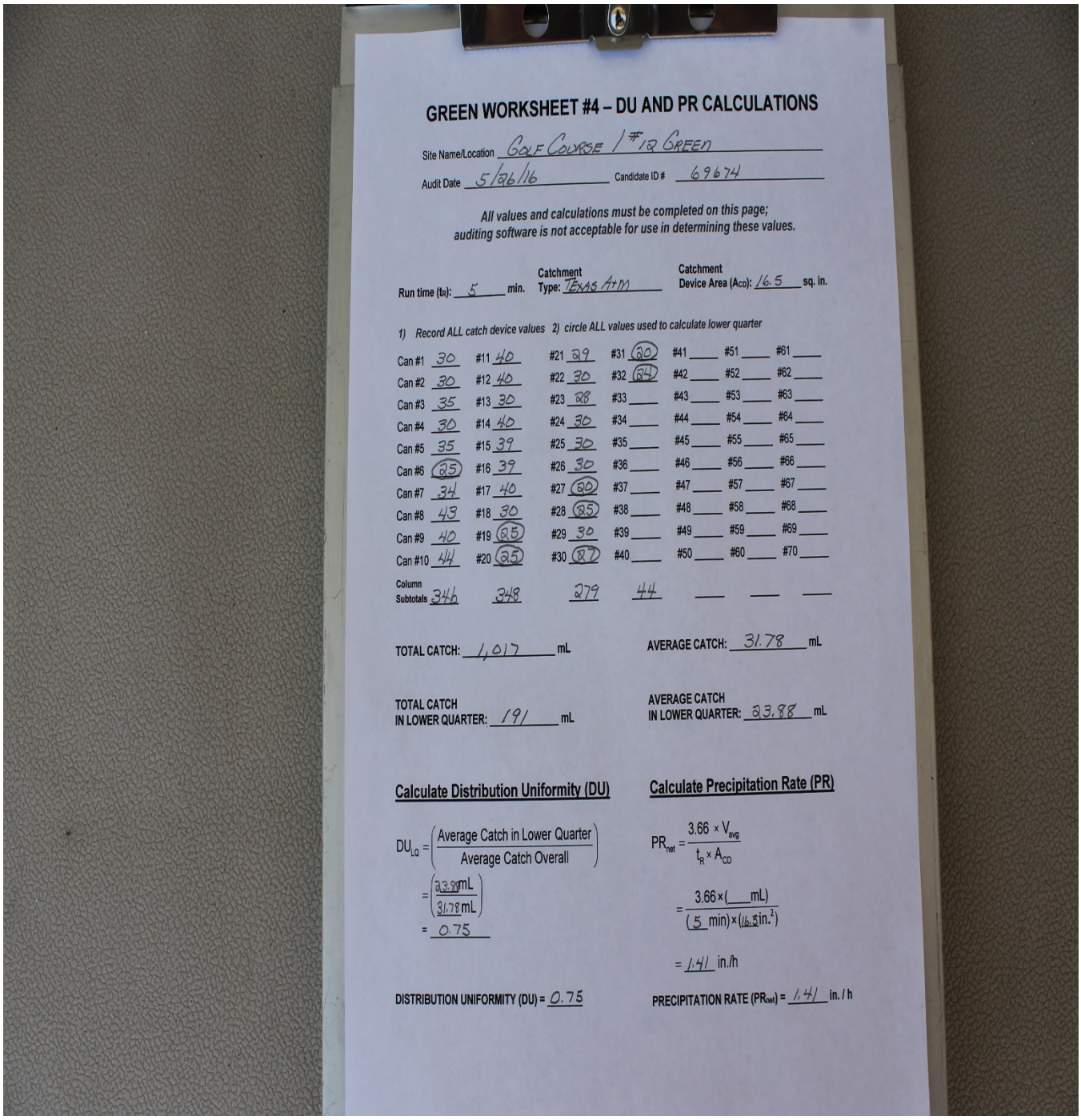
ZONE
- ☐ overlap
- ☐ stand-alone
- ☑ valve-in-head
- ☐ block

32 CATCHMENTS ← Indicate north and ALL audit area dimensions → 4,328 SQ. FT.

O = SPRINKLER Record the location of each sprinkler and sprinkler spacing.

X = CATCH DEVICE Record the location of each catch device and catch amount.

DU and PR Calculations



GREEN WORKSHEET #4 – DU AND PR CALCULATIONS

Site Name/Location: GOLF COURSE / #12 GREEN

Audit Date: 5/26/16 Candidate ID #: 69674

All values and calculations must be completed on this page; auditing software is not acceptable for use in determining these values.

Run time (t_R): 5 min. Catchment Type: TEXAS A+M Catchment Device Area (A_{CD}): 16.5 sq. in.

1) Record ALL catch device values 2) circle ALL values used to calculate lower quarter

Can #1	30	#11	40	#21	29	#31	(20)	#41	#51	#61
Can #2	30	#12	40	#22	30	#32	(24)	#42	#52	#62
Can #3	35	#13	30	#23	28	#33		#43	#53	#63
Can #4	30	#14	40	#24	30	#34		#44	#54	#64
Can #5	35	#15	39	#25	30	#35		#45	#55	#65
Can #6	(25)	#16	39	#26	30	#36		#46	#56	#66
Can #7	34	#17	40	#27	(20)	#37		#47	#57	#67
Can #8	43	#18	30	#28	(25)	#38		#48	#58	#68
Can #9	40	#19	(25)	#29	30	#39		#49	#59	#69
Can #10	44	#20	(25)	#30	(27)	#40		#50	#60	#70
Column Subtotals	346		348		279		44			

TOTAL CATCH: 1,017 mL AVERAGE CATCH: 31.78 mL

TOTAL CATCH IN LOWER QUARTER: 191 mL AVERAGE CATCH IN LOWER QUARTER: 23.88 mL

Calculate Distribution Uniformity (DU)

$$DU_{LQ} = \left(\frac{\text{Average Catch in Lower Quarter}}{\text{Average Catch Overall}}\right)$$

$$= \left(\frac{23.88\,\text{mL}}{31.78\,\text{mL}}\right)$$

$$= 0.75$$

DISTRIBUTION UNIFORMITY (DU) = 0.75

Calculate Precipitation Rate (PR)

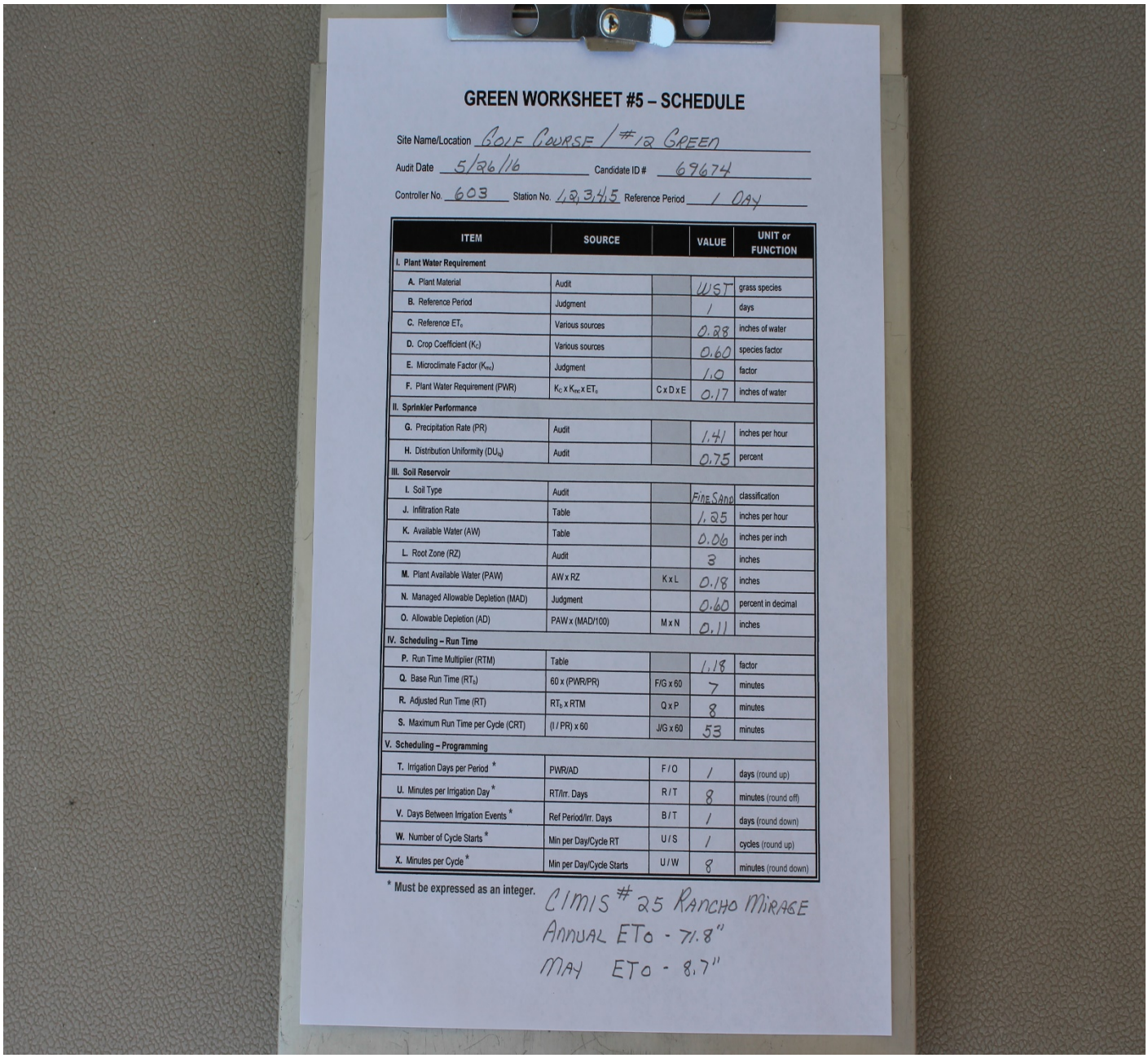
$$PR_{net} = \frac{3.66 \times V_{avg}}{t_R \times A_{CD}}$$

$$= \frac{3.66 \times (\_\_\_\,\text{mL})}{(5\,\text{min}) \times (16.5\,\text{in.}^2)}$$

$$= 1.41\ \text{in./h}$$

PRECIPITATION RATE (PR_{net}) = 1.41 in./h

Schedule



GREEN WORKSHEET #5 – SCHEDULE

Site Name/Location GOLF COURSE / #12 GREEN

Audit Date 5/26/16 Candidate ID # 69674

Controller No. 603 Station No. 1,2,3,4,5 Reference Period 1 DAY

ITEM	SOURCE		VALUE	UNIT or FUNCTION
I. Plant Water Requirement				
A. Plant Material	Audit		WST	grass species
B. Reference Period	Judgment		1	days
C. Reference ET_o	Various sources		0.88	inches of water
D. Crop Coefficient (K_c)	Various sources		0.60	species factor
E. Microclimate Factor (K_{mc})	Judgment		1.0	factor
F. Plant Water Requirement (PWR)	$K_c \times K_{mc} \times ET_o$	C x D x E	0.17	inches of water
II. Sprinkler Performance				
G. Precipitation Rate (PR)	Audit		1.41	inches per hour
H. Distribution Uniformity (DU_lq)	Audit		0.75	percent
III. Soil Reservoir				
I. Soil Type	Audit		FINE SAND	classification
J. Infiltration Rate	Table		1.25	inches per hour
K. Available Water (AW)	Table		0.06	inches per inch
L. Root Zone (RZ)	Audit		3	inches
M. Plant Available Water (PAW)	AW x RZ	K x L	0.18	inches
N. Managed Allowable Depletion (MAD)	Judgment		0.60	percent in decimal
O. Allowable Depletion (AD)	PAW x (MAD/100)	M x N	0.11	inches
IV. Scheduling – Run Time				
P. Run Time Multiplier (RTM)	Table		1.18	factor
Q. Base Run Time (RT_b)	60 x (PWR/PR)	F/G x 60	7	minutes
R. Adjusted Run Time (RT)	RT_b x RTM	Q x P	8	minutes
S. Maximum Run Time per Cycle (CRT)	(I / PR) x 60	J/G x 60	53	minutes
V. Scheduling – Programming				
T. Irrigation Days per Period *	PWR/AD	F / O	1	days (round up)
U. Minutes per Irrigation Day *	RT/Irr. Days	R / T	8	minutes (round off)
V. Days Between Irrigation Events *	Ref Period/Irr. Days	B / T	1	days (round down)
W. Number of Cycle Starts *	Min per Day/Cycle RT	U / S	1	cycles (round up)
X. Minutes per Cycle *	Min per Day/Cycle Starts	U / W	8	minutes (round down)

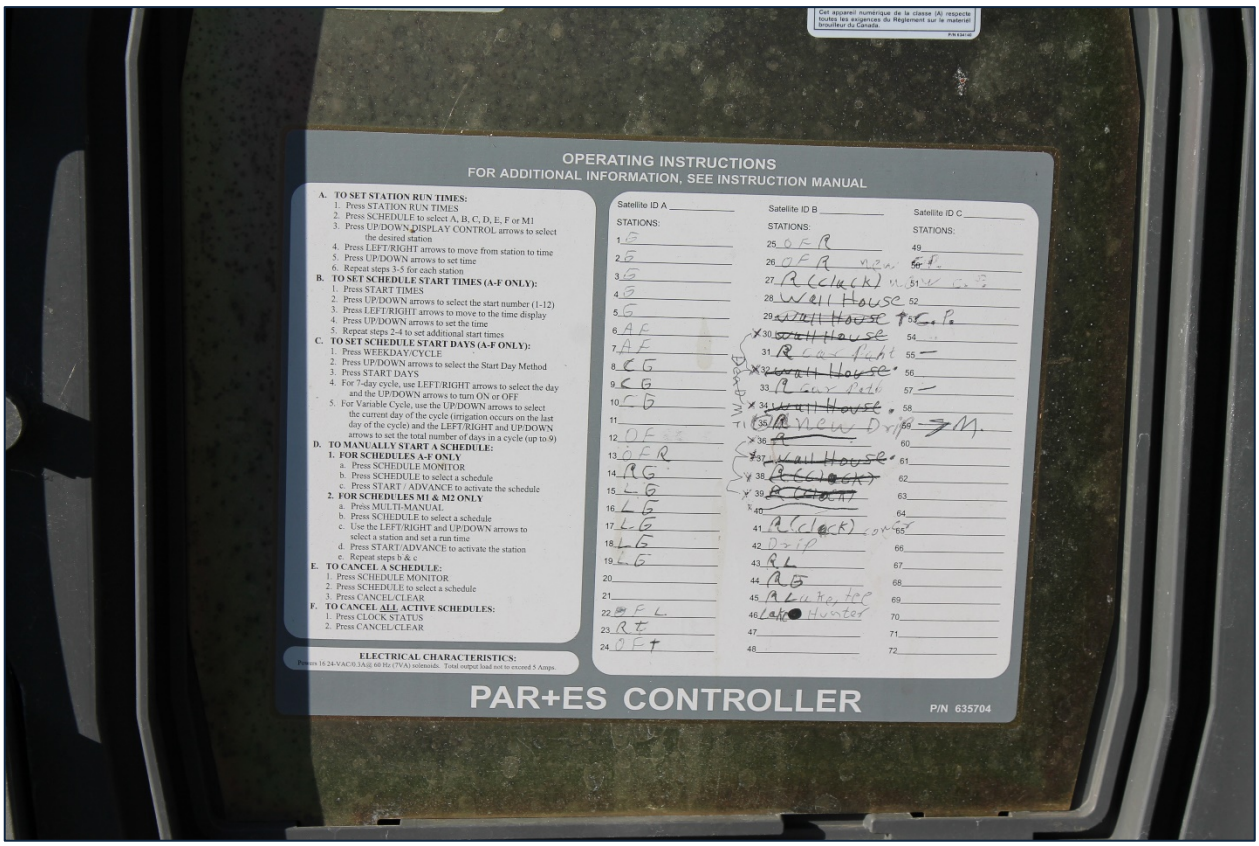
* Must be expressed as an integer.

CIMIS #25 RANCHO MIRAGE
ANNUAL ETo - 71.8"
MAY ETo - 8.7"

Measuring Area for Placement of Catch Cans

Placement of catch cans

Controllers



Irrigation

Measuring catch can water

Soil & Plant Laboratory, Inc.
Leaders in Soil & Plant Testing Since 1946
4741 E. Hunter Ave, Suite A Anaheim, CA 92807 714-282-8777 (phone) 714-282-8575 (fax)
www.soilandplantlaboratory.com

COMPREHENSIVE SOIL ANALYSIS

Sample Description - Sample ID	Half Sat % / TEC	pH / Qual Lime	ECe dS/m	NO_3-N ppm	NH_4-N ppm	PO_4-P ppm	K ppm	Ca ppm	Mg ppm	Cu ppm	Zn ppm	Mn ppm	Fe ppm	Organic % dry wt.	Lab No.
	Sufficiency Factors														
Site Soil	28	6.9	1.7	116	6	25	199	1820	145	2.0	6.2	3	112		11449
	102	None		2.2		0.8	1.1	1.1	0.6	1.5	1.2	0.3	2.2		

Saturation Extract Values						SAR	Gravel %		Percent of Sample Passing 2 mm Screen					USDA Soil Classification	Lab No.
Ca meq/L	Mg meq/L	Na meq/L	K meq/L	B ppm	SO_4 meq/L		Coarse 5 - 12	Fine 2 - 5	Sand: Very Coarse 1 - 2	Sand: Coarse 0.5 - 1	Sand: Med. to Very Fine 0.05 - 0.5	Silt .002-.05	Clay 0-.002		
11.1	2.6	4.0	0.8	0.08	4.3	1.5	0	0.4	1.6	9.3	66	16.9	6.1	Sandy Loam	11449

Infiltration Rate = .37 inches/hour

Very Slow	<0.06
Slow	0.06 – 0.20
Moderately Slow	0.20 – 0.60
Moderate	0.60 – 2.00
Moderately Rapid	2.00 – 6.00
Rapid	6.00 – 20.00
Very Rapid	>20.00

Sufficiency factor (1.0=sufficient for average crop) below each nutrient value. N factor based on 200 ppm constant feed. SAR = Sodium adsorption ratio. Half Saturation %=approx field moisture capacity. Nitrogen(N), Potassium(K), Calcium(Ca) and Magnesium(Mg) by sodium chloride extraction. Phosphorus(P) by sodium bicarbonate extraction. Copper(Cu), Zinc(Zn), Manganese(Mn) & Iron(Fe) by DTPA extraction. Sat. ext. method for salinity (ECe as dS/m),Boron (B), Sulfate(SO_4), Sodium(Na). Gravel fraction expressed as percent by weight of oven-dried sample passing a 12mm(1/2 inch) sieve. Particle sizes in millimeters. Organic percentage determined by Walkley-Black or Loss on Ignition.

* LOW , SUFFICIENT , HIGH

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IRRIGATION WATER

Sample Id : **Water**

CATIONS		mg/L	meq/L
Sodium	Na	41	1.78
Calcium	Ca	97	4.84
Magnesium	Mg	11	0.91
Potassium	K	8	0.20
Ammonium	NH_4	0	0.00
	NH_4 - N	0	
SUM OF CATIONS			**7.73**

ANIONS		mg/L	meq/L
Chloride	Cl	45	1.27
Sulfate	SO_4	88	1.83
	S	29	
Bicarbonate	HCO_3	158	2.59
Carbonate	CO_3	17	0.28
Nitrate	NO_3	111	1.79
	NO_3 - N	25	
Phosphate	PO_4	2	0.06
	P	1	
SUM OF ANIONS			**7.82**

Hydrogen Ion Activity	pH	7.7	
Equilibrium Reaction	pHc	6.18	
Electrical Conductivity	ECw	0.74	dS/m
Total Dissolved Solids	TDS	474	mg/L
Adj Na Adsorption Ratio	SARadj	1.25	
Sodium Adsorption Ratio	SAR	1.05	

Copper	Cu	0.05	mg/L
Zinc	Zn	0.05	mg/L
Manganese	Mn	0.01	mg/L
Iron	Fe	0.31	mg/L
Boron	B	0.10	mg/L
Fluoride	F	0.18	mg/L
Aluminum	Al	0.44	mg/L
Molybdenum	Mo	0.05	mg/L

mg/L = parts per million parts water meq/L - milliequivalents per liter
TDS calculated by ECw * 640

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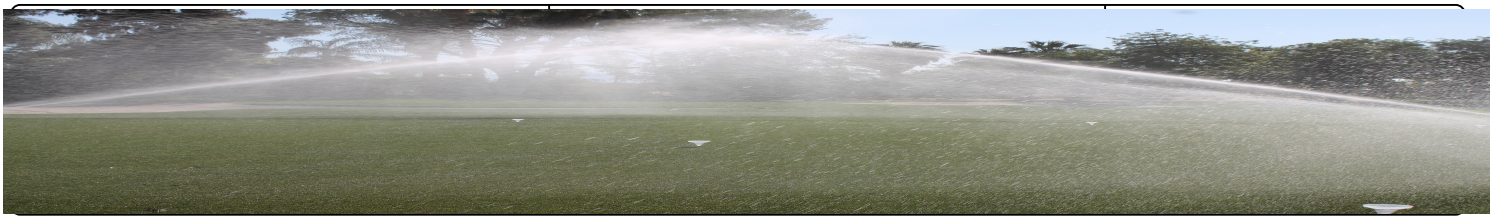
IRRIGATION WATER



Sample Id : **Water**

WATER ANALYSIS INTERPRETATION, AGRICULTURAL

Potential Problem	Units	Test Result	Degree of Restriction on Use					
			Criteria			Graphical Results		
			None	Slight to Moderate	Severe	None	Slight to Moderate	Severe
Salinity								
ECw[1]	dS/m	0.74	< 0.7	0.7 - 3	> 3			
Specific Ion Toxicity								
Sodium (Na)[1]								
Surface irrigation	SARadj	1.25	< 3	3 - 9	> 9			
Sprinkler irrigation[2]	meq/L	1.78	< 3	3 - 6	> 6			
Chloride (Cl)[1]								
Surface irrigation	meq/L	1.27	< 4	4 - 10	> 10			
Sprinkler irrigation[2]	meq/L	1.27	< 3	3 - 5	> 5			
Boron (B)[1]	mg/L	0.10	< 0.7	0.7 - 3	> 3			
Fluoride (F)[1]	mg/L	0.18	< 1	1 - 5	> 5			
Clogging of Drip Systems or Unsightly Residues								
Iron (Fe)[3]	mg/L	0.31	< 0.3	0.3 - 1.5	> 1.5			
Manganese (Mn)[3]	mg/L	0.01	< 0.2	0.2 - 1.5	> 1.5			
pH - pHc[4]		1.52	<= 0	> 0				
Reduced Water Infiltration[5] **(Based on ECw and SAR values)**		1.69	< 4	4 - 10	> 10			
Alkalinity								
Bicarbonate (HCO3)[6]	meq/L	2.59	< 2	2 - 8.5	> 8.5			
Potential Low Nutrient Issues (Soilless media)[7]								
Sulfur	mg/L	29	> 48	48 - 20	< 20			
Magnesium	mg/L	11	> 10	10 - 4	< 4			
Boron	mg/L	0.10	> 0.3	0.3 - 0.05	< 0.05			

1. Crop tolerance to salinity, sodium, chloride, boron and fluoride varies widely. Most tree crops are sensitive to sodium and chloride while many annual crops are not. Soil conditions, irrigation method and climate must be considered.
2. Leaf burn from foliar and root absorption will be enhanced under conditions of : low humidity, high temperature and high air movement .
3. Elevated iron in combination with sulfides or tannins can result in bacterial slimes that can clog drip systems. Removal of iron and manganese often involves oxidation (aeration or chlorination) followed by filtering.
4. Positive pH - pHc (saturation index) values indicate the potential for calcium and magnesium carbonate precipitates that might impair efficiency of irrigation systems with small orificed parts and/or may leave unsightly lime deposits on leaves. Problems can be reduced by mineral acid addition.
5. Infiltration problems are most likely when water with low ECw and/or high SAR adj. is used on mineral soils containing some silt and clay. Evaluation of infiltration problems should include analysis of both irrigation water and soil-water extracts. Treatment may involve injecting gypsum into the water or applying gypsum to the soil surface.
6. Bicarbonate when excessive may result in difficulty in controlling soil pH and may impair root assimilation of minor elements.
7. Sulfur, magnesium and /or boron may become limiting if not supplied by soil or fertilizer. Use soil and leaf analysis to confirm need.

Comments :