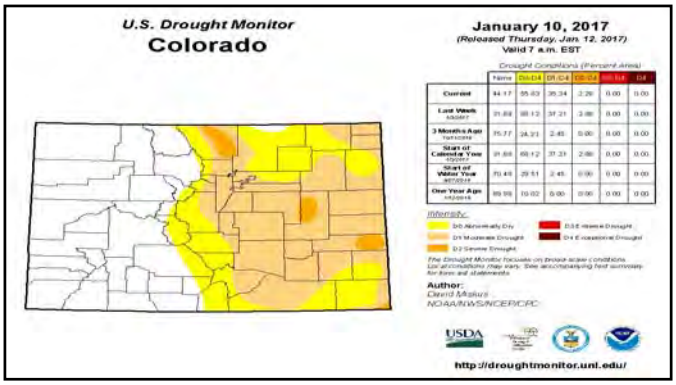
Understanding the Advantages of Central Irrigation

Benefits of Central Control with flow monitoring

- Ability to suspend irrigation system wide anywhere at anytime
- Ability to modify irrigation programs remotely (seasonal adjustments)
- Ability to run irrigation zones/programs from mobile phone
- Flow monitoring and reporting
- High and low flow shutdown
- Generate alarms and reports via email
- Records flow data and water use data for analysis

Objective

Understanding the use and advantages of Central Irrigation and soil moisture sensors as it relates to differing soil types and athletic fields. From sand based models and fields to natural fields in Boulder. This presentation will relate to Water Conservation, scheduling, and the difference between soil moisture based and ET based programs and platforms for Irrigation control and Management



Advantages of Central Irrigation

SAVE TIME: Your system will do all the watering for you

SAVE WATER: An automatic system uses less water than watering by hand

SAVE MONEY: Your water bills will be lower and your plants will live longer

IMPROVE GROWTH: when watered with the appropriate amounts of water plant life will grow healthier and faster

ANALOGY BETWEEN A HOME A/C SYSTEM AND SOIL MOISTURE SENSORS

In cooler weather the A/C system stays off and much like the A/C system the water stays off with employing soil moisture sensors. The same can be said in hotter weather. The A/C system comes on more frequently and in dryer/hotter weather the irrigation system comes on more frequently until the soil moisture again reaches the desired threshold set on the sensor.

Soil Moisture Sensors Vs. Rain Sensors

Vs

Both rain sensor (RS) and soil moisture sensor (SMS) technologies offer water conservation potential in automated irrigation systems. Although RS devices can be effective, thay are much less so then the SMS devices that have tested with SMS controllers typically reducing irrigation two to three times more than RS devices.

Michael Dukes, Ph.D., P.E., , is professor, University of Florida Agriculture and biological engineering department and interim director for the Center for Landscape Conservation and Ecology.

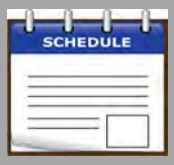
TARGET MAXIMUM WATER USE

Determine target maximum water use per week based on local weather data. Best to utilize information with some history involved

Northern Water

Station Name	Code	Date/Time	ETos Grass Tot (in)
Boulder South West	230	7/1/2016	0.11
Boulder South West	230	7/2/2016	0.14
Boulder South West	230	7/3/2016	0.22
Boulder South West	230	7/4/2016	0.25
Boulder South West	230	7/5/2016	0.23
Boulder South West	230	7/6/2016	0.24
Boulder South West	230	7/7/2016	0.25
Boulder South West	230	7/8/2016	0.22
Boulder South West	230	7/9/2016	0.25
Boulder South West	230	7/10/2016	0.28

Setting up Irrigation Schedules for use with Soil Moisture Sensors

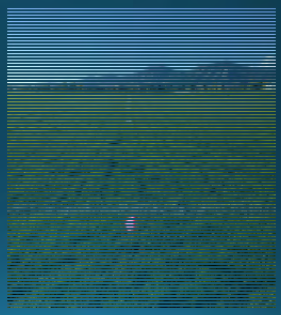


What is Best?

Will the site actually allow 2 to 3 days between irrigations or will the water window and system capacity require the need to water 5 to 7 days per week

Irrigation audit

Conduct an irrigation audit at the site to determine PR (precipitation rate) and DU (distribution uniformity) of some representative zones. Link information for similar zones wherever appropriate

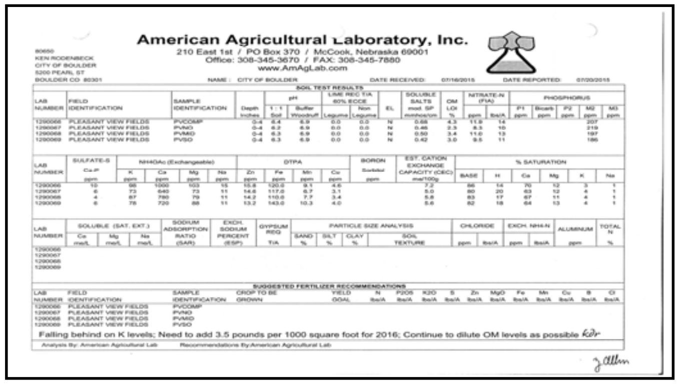


Calculations and Conversion

Determine the amount of water to be applied per irrigation run day and convert to run time in minutes for each zone site.

Cycle and Soak

Utilize cycle and soak when possible and/or necessary due to heavier soil textures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5200 PEARL ST
BOULDER CO 80301

NAME: CITY OF BOULDER — DATE RECEIVED: 07/16/2015 — DATE REPORTED: 07/20/2015

SOIL TEST RESULTS

LAB NUMBER	FIELD IDENTIFICATION	SAMPLE IDENTIFICATION	Depth Inches	pH 1:1 Soil	Buffer Woodruff	Lime Rec T/A Legume	Lime Rec T/A Non Legume	EL	Soluble Salts mmhos/cm	OM LOI %	Nitrate-N ppm	Nitrate-N lbs/A	Phosphorus M2 ppm
1290066	PLEASANT VIEW FIELDS	PVCOMP	0-4	6.4	6.9	0.0	0.0	N	0.68	4.3	11.9	14	207
1290067	PLEASANT VIEW FIELDS	PVNO	0-4	6.2	6.9	0.0	0.0	N	0.46	2.3	8.3	10	219
1290068	PLEASANT VIEW FIELDS	PVMID	0-4	6.3	6.9	0.0	0.0	N	0.50	3.4	11.0	13	197
1290069	PLEASANT VIEW FIELDS	PVSO	0-4	6.3	6.9	0.0	0.0	N	0.42	3.0	9.5	11	186

LAB NUMBER	Sulfate-S Ca-P ppm	K ppm	Ca ppm	Mg ppm	Na ppm	Zn ppm	Fe ppm	Mn ppm	Cu ppm	CEC meq/100g	% Sat. Base	H	Ca	Mg	K	Na
1290066	10	98	1000	103	15	15.8	120.0	9.1	4.6	7.2	86	14	70	12	3	1
1290067	6	73	640	73	11	14.6	117.0	6.7	3.1	5.0	80	20	63	12	4	1
1290068	4	87	780	79	11	14.2	110.0	7.7	3.4	5.8	83	17	67	11	4	1
1290069	6	78	720	88	11	13.2	143.0	10.3	4.0	5.6	82	18	64	13	4	1

SUGGESTED FERTILIZER RECOMMENDATIONS

Falling behind on K levels; Need to add 3.5 pounds per 1000 square foot for 2016; Continue to dilute OM levels as possible

Analysis By: American Agricultural Lab — Recommendations By: American Agricultural Lab

Seasonal Adjust

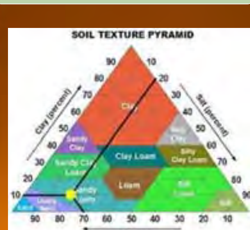
Leave seasonal adjust at 100% and let the soil moisture sensor control the days that the system will actually water

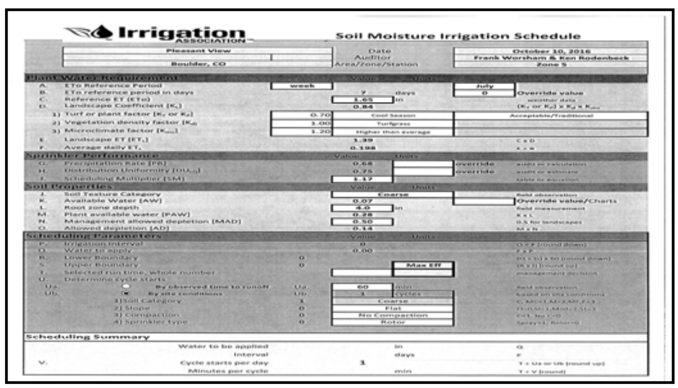
Soil Moisture Irrigation Schedule Pleasant View

At the period of peak water use, the daily water requirement actually exceeds what the soil can store for water in the effective root zone depth. 10 to 20 percent of this site actually required daily supplemental watering just to help the turf recover from wear abuse and to maintain good appearance during windy and hotter days

Pleasant View Soil Test

At the Pleasant View site we deal with a very sandy soil that can lose both N & K soil nutrients due to leaching




Irrigation Association — Soil Moisture Irrigation Schedule

Pleasant View, Boulder, CO — Date: October 10, 2016 — Auditor: Frank Worsham & Ken Rodenbeck — Area/Zone/Station: Zone 5

Plant Water Requirement
A. ETo Reference Period: week — July
B. ETo reference period in days: 7 days
C. Reference ET (ETo): 1.65 in
D. Landscape Coefficient: 0.84
1) Turf or plant factor: 0.70 — Cool Season — Acceptable/Traditional
2) Vegetation density factor: 1.00 — Turfgrass
3) Microclimate factor: 1.20 — Higher than average
E. Landscape ET: 1.39
F. Average daily ET: 0.198

Sprinkler Performance
G. Precipitation Rate (PR): 0.68
H. Distribution Uniformity: 0.75
I. Scheduling Multiplier (SM): 1.17

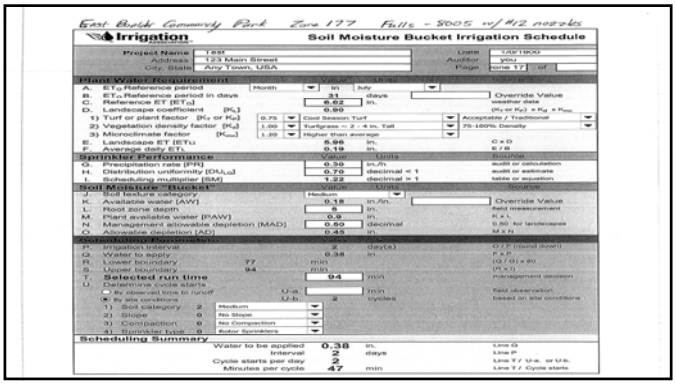
Soil Properties
J. Soil Texture Category: Coarse
K. Available Water (AW): 0.07
L. Root zone depth: 4.0 in
M. Plant available water (PAW): 0.28
N. Management allowed depletion (MAD): 0.50
O. Allowed depletion (AD): 0.14

Scheduling Parameters
Max Eff
Ua. By observed time to runoff: 60 min
Ub. By site conditions: 1 cycles
1) Soil Category: 1 — Coarse
2) Slope: 0 — Flat
3) Compaction: 0 — No Compaction
4) Sprinkler type: 0 — Rotor

Scheduling Summary
Water to be applied — in
Interval — days
V. Cycle starts per day: 1
Minutes per cycle — min

East Boulder soil test

East Boulder community Park practice fields both face nutrient availability challenges due to higher soil pH and lower soil organic matter levels



East Boulder Community Park Zone 177 Falls - 3005 w/ #12 nozzles

Irrigation — Soil Moisture Bucket Irrigation Schedule

Project Name	Test	Date	1/6/1900
Address	123 Main Street	Auditor	you
City, State	Any Town, USA	Page	Zone 17 of

Plant Water Requirement		Value	Units	Source
A. ET_o Reference period	Month	in	July	
B. ET_o Reference period in days		31	days	Override Value
C. Reference ET (ET_o)		6.62	in.	weather data
D. Landscape coefficient	(K_L)	0.90		(K_s or K_d) x K_d x K_{mc}
1) Turf or plant factor	(K_s or K_d)	0.75 Cool Season Turf		Acceptable / Traditional
2) Vegetation density factor	(K_d)	1.00 Turfgrass +/- 2 - 4 in. Tall		75-100% Density
3) Microclimate factor	(K_{mc})	1.20 Higher than average		
E. Landscape ET (ET_L)		5.96	in.	C x D
F. Average daily ET_L		0.19	in.	E / 31
Sprinkler Performance		Value	Units	Source
G. Precipitation rate (PR)		0.30	in./h	audit or calculation
H. Distribution uniformity (DU_{LQ})		0.70	decimal < 1	audit or estimate
I. Scheduling multiplier (SM)		1.22	decimal > 1	table or equation
Soil Moisture "Bucket"		Value	Units	Source
J. Soil texture category		Medium		
K. Available water (AW)		0.18	in./in.	Override Value
L. Root zone depth		5	in.	field measurement
M. Plant available water (PAW)		0.9	in.	K x L
N. Management allowable depletion (MAD)		0.50	decimal	0.50 for landscapes
O. Allowable depletion (AD)		0.45	in.	M x N
Controlling Parameters				
P. Irrigation interval		2	day(s)	O / F (round down)
Q. Water to apply		0.38	in.	F x P
R. Lower boundary	77	min		(Q / G) x 60
S. Upper boundary	94	min		(R x I)
T. **Selected run time**		94	min	management decision
U. Determine cycle starts				field observation
By observed time to runoff		U-a.	min	based on site conditions
By site conditions		U-b.	cycles	
1) Soil category	2 Medium			
2) Slope	0 No Slope			
3) Compaction	0 No Compaction			
4) Sprinkler type	0 Rotor Sprinklers			
Scheduling Summary				
Water to be applied		0.38	in.	Line G
Interval		2	days	Line P
Cycle starts per day		2		Line Y / U-a. or U-b.
Minutes per cycle		47	min	Line Y / Cycle starts

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BOULDER CO 80301

NAME : CITY OF BOULDER — DATE RECEIVED: 03/24/2015 — DATE REPORTED: 03/26/2015

SOIL TEST RESULTS

LAB NUMBER	FIELD IDENTIFICATION	SAMPLE IDENTIFICATION	Depth Inches	pH 1:1 Soil	pH Buffer Woodruff	LIME REC T/A 60% ECCE Legume	LIME REC T/A 60% ECCE Non Legume	EL	SOLUBLE SALTS mod. SP mmhos/cm	OM LOI %	NITRATE-N (PAN) ppm	NITRATE-N (PAN) lbs/A	PHOSPHORUS P1 ppm	PHOSPHORUS Bicarb ppm	PHOSPHORUS P2 ppm	PHOSPHORUS M2 ppm	PHOSPHORUS M3 ppm
1282306	EAST BOULDER	EBW	0-4	7.5				H	1.40	2.9	4.8	6					
1282307	EAST BOULDER	EBE	0-4	7.7				M	1.66	3.3	4.1	5				111	
																97	

LAB NUMBER	SULFATE-S Ca-P ppm	NH4OAc (Exchangeable) K ppm	Ca ppm	Mg ppm	Na ppm	DTPA Zn ppm	Fe ppm	Mn ppm	Cu ppm	BORON Sorbitol ppm	EST. CATION EXCHANGE CAPACITY (CEC) me/100g	% SATURATION BASE	H	Ca	Mg	K	Na
1282306	40	377	2370	307	91	7.6	77.6	6.1	0.0		15.8	100	0	75	18	6	3
1282307	61	325	1940	275	92	6.4	116.0	12.9	5.1		13.2	100	0	74	17	6	3

LAB NUMBER	SOLUBLE (SAT. EXT.) Ca me/L	Mg me/L	Na me/L	SODIUM ADSORPTION RATIO (SAR)	EXCH. SODIUM PERCENT (ESP)	GYPSUM REQ T/A	PARTICLE SIZE ANALYSIS SAND %	SILT %	CLAY %	SOIL TEXTURE	CHLORIDE ppm	CHLORIDE lbs/A	EXCH. NH4-N ppm	EXCH. NH4-N lbs/A	ALUMINUM ppm	TOTAL N %
1282306																
1282307																

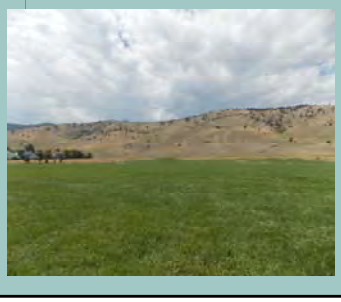
SUGGESTED FERTILIZER RECOMMENDATIONS

LAB NUMBER	FIELD IDENTIFICATION	SAMPLE IDENTIFICATION	CROP TO BE GROWN	YIELD GOAL	N lbs/A	P2O5 lbs/A	K2O lbs/A	S lbs/A	Zn lbs/A	MgO lbs/A	Fe lbs/A	Mn lbs/A	Cu lbs/A	B lbs/A	Cl lbs/A
1282306	EAST BOULDER	EBW													
1282307	EAST BOULDER	EBE													

Organic matter levels OK, but could still use some help from additional compost and sand topdressing

Analysis By: American Agricultural Lab — Recommendations By:American Agricultural Lab

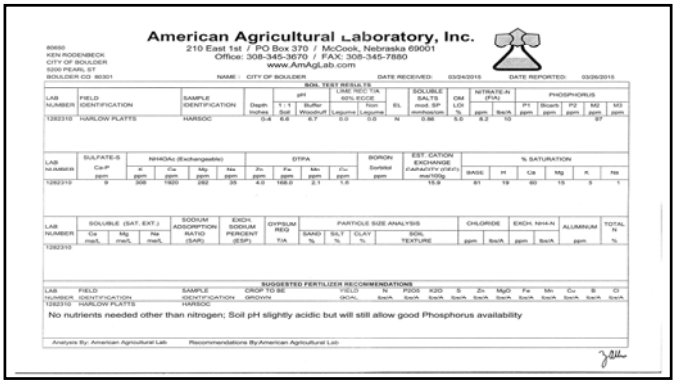
HARLOW PLATTS SOIL TEST



While this site has relatively good soil properties, the infiltration rate is poorer due to the heavier soil texture.

East Boulder soil moisture bucket irrigation schedule

Even though the soil can store enough water to be irrigated every 2 days, the watering window and system capacity require the need to water 5 to 6 days per week during peak water use period.



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NAME : CITY OF BOULDER — DATE RECEIVED: 03/24/2015 — DATE REPORTED: 03/26/2015

SOIL TEST RESULTS

LAB NUMBER	FIELD IDENTIFICATION	SAMPLE IDENTIFICATION	Depth Inches	pH 1:1 Soil	pH Buffer Woodruff	LIME REC T/A 60% ECCE Legume	LIME REC T/A 60% ECCE Non Legume	EL	SOLUBLE SALTS mod. SP mmhos/cm	OM LOI %	NITRATE-N (PAN) ppm	NITRATE-N (PAN) lbs/A	PHOSPHORUS P1 ppm	PHOSPHORUS Bicarb ppm	PHOSPHORUS P2 ppm	PHOSPHORUS M2 ppm	PHOSPHORUS M3 ppm
1282310	HARLOW PLATTS	HARSOC	0-4	6.8	6.7	0.0	0.0	N	0.68	5.0	8.2	10				97	

LAB NUMBER	SULFATE-S Ca-P ppm	NH4OAc (Exchangeable) K ppm	Ca ppm	Mg ppm	Na ppm	DTPA Zn ppm	Fe ppm	Mn ppm	Cu ppm	BORON Sorbitol ppm	EST. CATION EXCHANGE CAPACITY (CEC) me/100g	% SATURATION BASE	H	Ca	Mg	K	Na
1282310	9	300	1920	282	39	4.0	166.0	2.1	1.6		15.9	81	19	60	15	5	1

LAB NUMBER	SOLUBLE (SAT. EXT.) Ca me/L	Mg me/L	Na me/L	SODIUM ADSORPTION RATIO (SAR)	EXCH. SODIUM PERCENT (ESP)	GYPSUM REQ T/A	PARTICLE SIZE ANALYSIS SAND %	SILT %	CLAY %	SOIL TEXTURE	CHLORIDE ppm	CHLORIDE lbs/A	EXCH. NH4-N ppm	EXCH. NH4-N lbs/A	ALUMINUM ppm	TOTAL N %
1282310																

SUGGESTED FERTILIZER RECOMMENDATIONS

LAB NUMBER	FIELD IDENTIFICATION	SAMPLE IDENTIFICATION	CROP TO BE GROWN	YIELD GOAL	N lbs/A	P2O5 lbs/A	K2O lbs/A	S lbs/A	Zn lbs/A	MgO lbs/A	Fe lbs/A	Mn lbs/A	Cu lbs/A	B lbs/A	Cl lbs/A
1282310	HARLOW PLATTS	HARSOC													

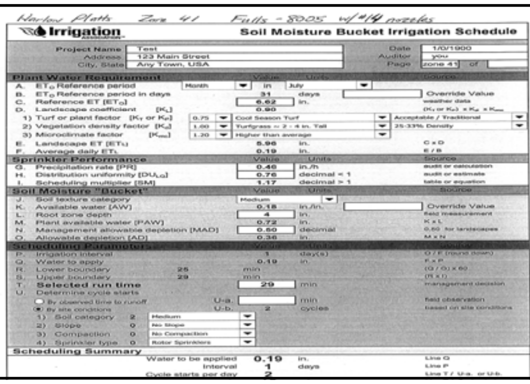
No nutrients needed other than nitrogen; Soil pH slighty acidic but will still allow good Phosphorus availability

Analysis By: American Agricultural Lab — Recommendations By:American Agricultural Lab

HARLOW PLATTS SOIL MOISTURE BUCKET IRRIGATION SCHEDULE

Multiple irrigation cycles especially help at this site to increase infiltration and ultimately water storage

WATER USE VS. ET….. AS IT RELATES TO THE COB



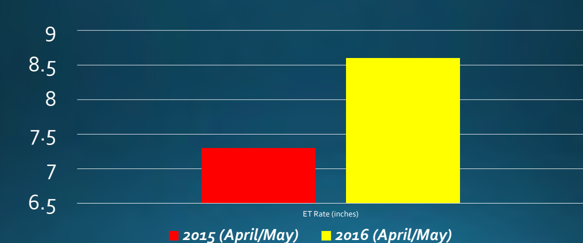
Harlow Platts Zone 41 Fulls - 8005 w/ #14 nozzles

Irrigation Association — Soil Moisture Bucket Irrigation Schedule

Project Name: Test
Address: 123 Main Street
City, State: Any Town, USA
Date: 1/0/1900
Auditor: you
Page: zone 41 of

	Plant Water Requirement	Value	Units	Source
A.	ET_O Reference period	Month	in July	
B.	ET_O Reference period in days	31	days	Override Value
C.	Reference ET [ET_O]	6.62	in.	weather data
D.	Landscape coefficient [K_L]	0.90		(K_T or K_P) x K_d x K_{mc}
	1) Turf or plant factor [K_T or K_P]	0.75	Cool Season Turf	Acceptable / Traditional
	2) Vegetation density factor [K_d]	1.00	Turfgrass ≈ 2 - 4 in. Tall	25-33% Density
	3) Microclimate factor [K_{mc}]	1.20	Higher than average	
E.	Landscape ET [ET_L]	5.96	in.	C x D
F.	Average daily ET_L	0.19	in.	E / B
	Sprinkler Performance	**Value**	**Units**	**Source**
G.	Precipitation rate [PR]	0.46	in./h	audit or calculation
H.	Distribution uniformity [DU_{LQ}]	0.76	decimal < 1	audit or estimate
I.	Scheduling multiplier [SM]	1.17	decimal > 1	table or equation
	Soil Moisture "Bucket"	**Value**	**Units**	**Source**
J.	Soil texture category	Medium		
K.	Available water [AW]	0.18	in./in.	Override Value
L.	Root zone depth	4	in.	field measurement
M.	Plant available water [PAW]	0.72	in.	K x L
N.	Management allowable depletion [MAD]	0.50	decimal	0.50 for landscapes
O.	Allowable depletion [AD]	0.36	in.	M x N
	Scheduling Parameters	**Value**	**Units**	**Source**
P.	Irrigation interval	1	day(s)	O / F (round down)
Q.	Water to apply	0.19	in.	F x P
R.	Lower boundary 25 min			(Q / G) x 60
S.	Upper boundary 29 min			(R x I)
T.	Selected run time	29	min	management decision
U.	Determine cycle starts			
	By observed time to runoff (U-a.)		min	field observation
	By site conditions (U-b.)	2	cycles	based on site conditions
	1) Soil category 2	Medium		
	2) Slope 0	No Slope		
	3) Compaction 0	No Compaction		
	4) Sprinkler type 0	Rotor Sprinklers		
	Scheduling Summary			
	Water to be applied	0.19	in.	Line Q
	Interval	1	days	Line P
	Cycle starts per day	2		Line T / U-a. or U-b.

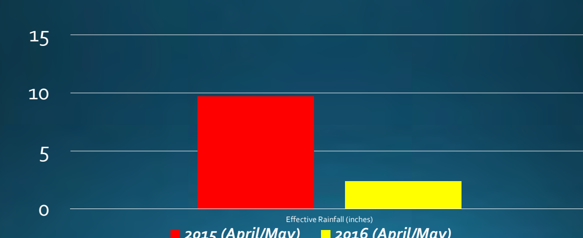
Pleasant View *ET Rate*



.....To Sum it Up

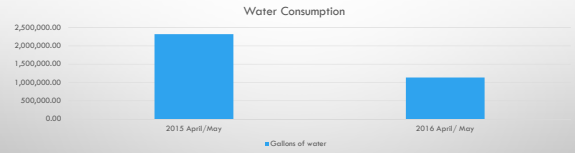
- At Pleasant View (very sandy coarse soil), the moisture sensors were very effective at saving water during the cooler, wet spring weather and also during the fall as days became shorter and cooler at night. During mid to late summer, sensors did not provide as much savings just primarily due to the lack of rainfall and heavy wear on some isolated portions of the fields
- On sites with medium to heavy textured soils (native sites, not sand based), such as East Boulder and Harlow Platts soil moisture sensors can become a much more relied upon technology throughout the season.
- Most soil moisture sensors on the market today will generally require some monitoring and calibration in order to be effective tools and are not automatically perfect.

Pleasant View *Effective Rainfall*



CITY OF BOULDER WATER CHALLENGE'S

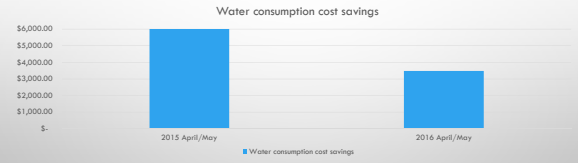
2015 VS 2016 WATER CONSUMPTION AT PLEASANT VIEW



* between 2015 and 2016 for the combined months of April and May 1,184,000 gallons of water were saved.

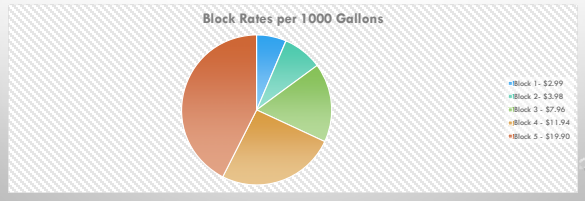
2016 UTILITY/COST RATE CHANGE

2015 VS 2016 COST SAVINGS AT PLEASANT VIEW



* Cost savings of $5098 between 2015 and 2016 for the combined months of April and May

CITY OF BOULDER MONTHLY WATER USER CHARGES



Specification

look for WaterSense Meets EPA Criteria

Replacing a standard irrigation controller with a WaterSense labeled irrigation controller can save an average home nearly 8,800 gallons of water annually. If every home in the United States with an automatic sprinkler system installed and properly operated a WaterSense labeled controller, we could save $435 million in water costs and 120 billion gallons of water across the country annually from not overwatering lawns and landscapes. That's equal to the annual household water needs of nearly 1.3 million average American homes

Credits

- John Cogdill – Parks Sports Turf/ Irrigation Manager
- Ken Rodenbeck – Parks Landscaper
- Matt Soderberg – Parks Irrigation Lead
- Frank Worsham – Parks Irrigation Technician
- Aaren LeMieux – Parks Carpenter