Assessing the Water Savings Impact of Irrigation and Landscape Management Strategies

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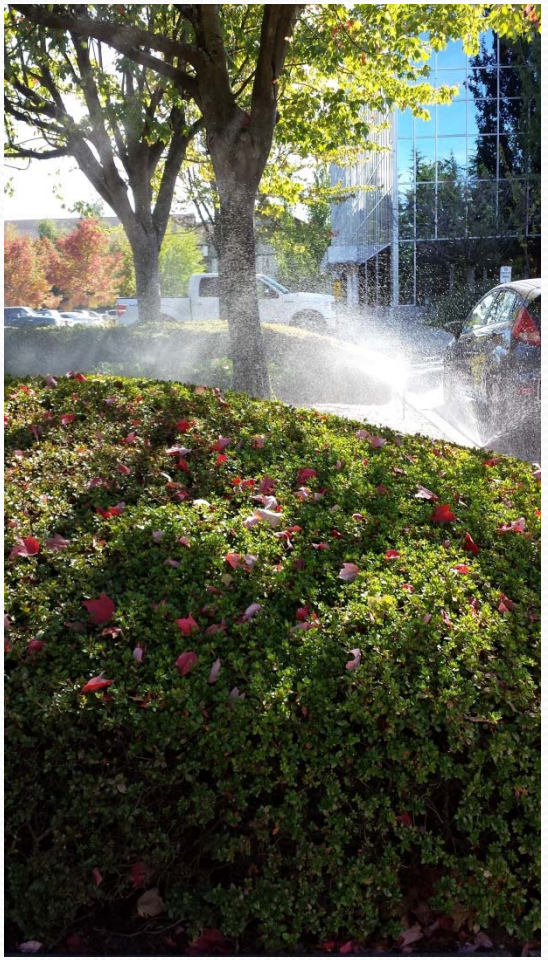
Representing Seattle Public Utilities & the Saving Water Partnership

www.savingwater.org

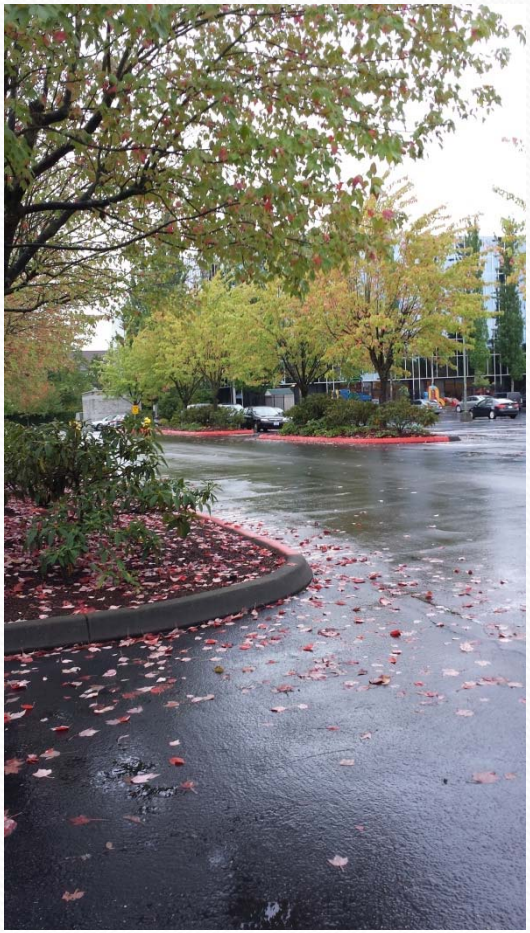
Special thank you…

- JSH Properties
- Signature LLC
- City of Renton
- Hunter Irrigation



Presentation

- Background
- Objectives
- Study Process
  - AMR
  - Field Observation
- Findings and Results



Discovery Tools

- Automatic Meter Reading
- Field Observation

Background

- 13 Years with SPU on Irrigation Efficiency Program
- Managed the Water Efficient Irrigation Program
  - Rebates
  - Technical Information
    - On-line irrigation run-time calculator
  - Market Transformation
- Worked directly
  - Landscape and Irrigation Professionals
  - Property Managers and Owners
  - Residential, Commercial, Multifamily
  - Industry groups
- Landscape Team – Utility Related Resource Conservation
  - Water
  - Solid Waste
  - Drainage
  - Water Quality

Background

- Industry change
- More customer interest in sustainability
- Identified site
- Developed approach
- Implemented and documented
- Publish findings

Objectives

- Save Water - Efficiency
- Analyze the impact of water saving strategies:
  - Technology
  - Management
- Understand how to manage efficiently while maintaining high quality landscape:
  - Fine-tuning the scheduling
  - Checking for problems

Questions:

- Unknown
- Requirements
- Time
- Cost
- Issues
- Who
- Skills
- Opportunity

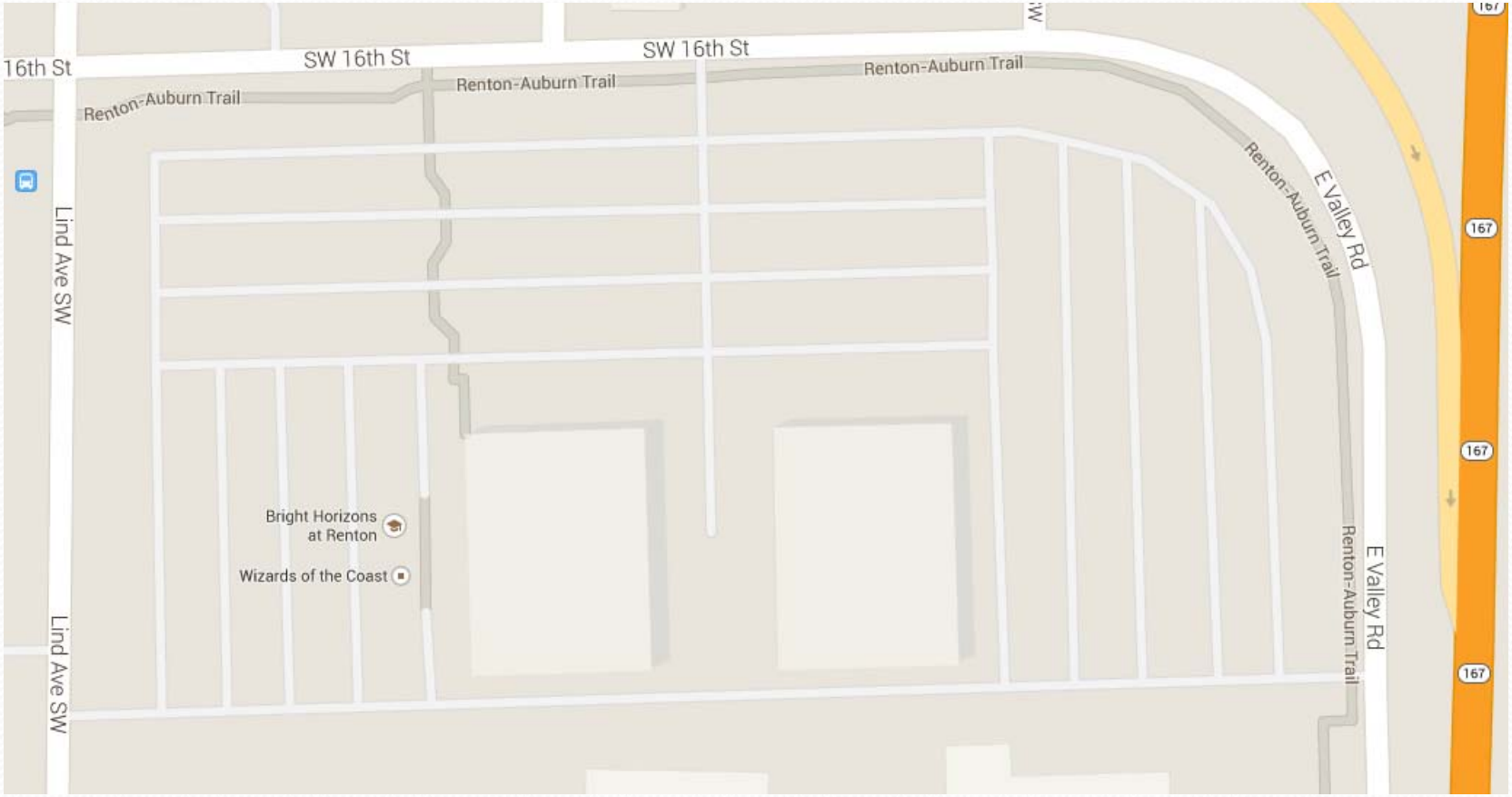
Study Process

- Assessment
  - Utility bills
  - Walk-about
  - Record irrigation runtimes and frequency
  - Audit irrigation zones
- Implement
  - Change irrigation schedules
- Assess/Analyze
  - Watch and record
- Adjustments
  - Change irrigation schedules
- Analyze/Results

Test Site Selection

- Landmark East & West in Renton, WA
  - Good case study candidate
    - Two similar landscapes
    - Separately metered
    - Sustainability specialist
    - Real-time meter data
    - Landscape contractor

Landmark East & Landmark West



Landmark East & Landmark West

Assessment

- Historical water consumption
- Irrigation runtimes
- Management
- Observe
- Identify issues
- Review consumption

Historical Water Consumption

- 1 CCF or 748 gallons
- City of Renton Irrigation Water - $3.92 per CCF
- Generally around $8,000 per year
- Consumption patterns

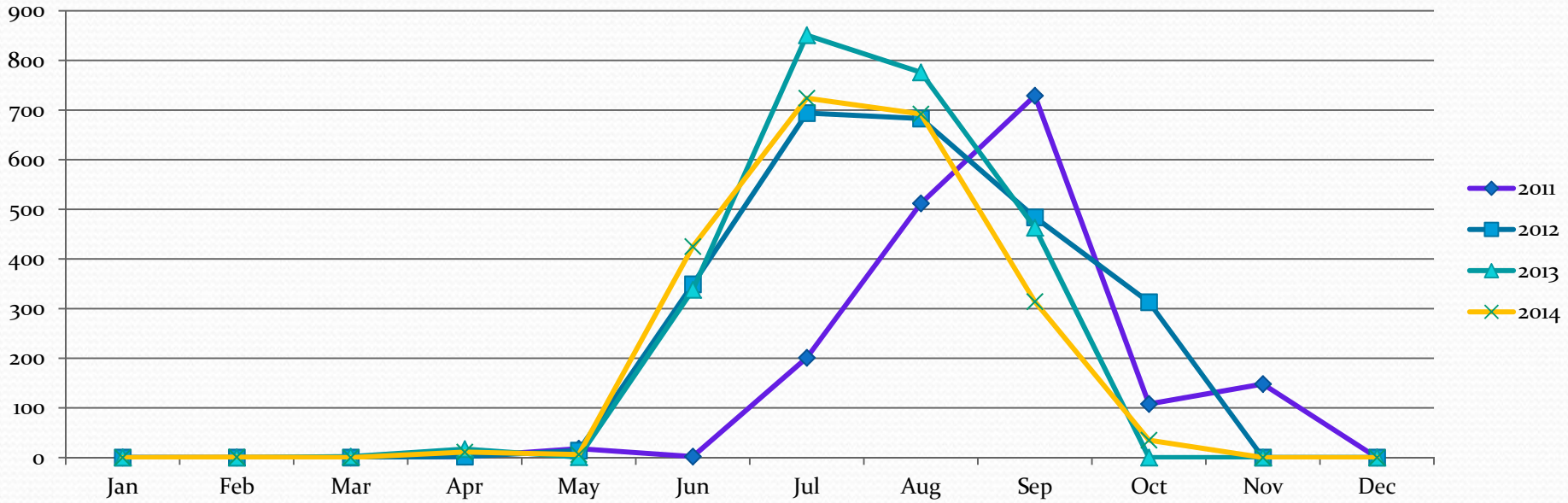
1 Unit = 1CCF or 748 gallons

West	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2005	2	0	0	0	127	182	246	482	463	620	10	0	2,132
2006	0	0	4	28	23	331	500	447	569	100	247	0	2,249
2007	0	0	0	0	0	0	816	377	493	250	0	2	1,938
2008	64	1	0	12	4	153	175	613	345	186	6	0	1,559
2009	0	0	0	8	8	87	200	424	338	214	141		1,420
2010	11	10	8	11		547	213	538		115	1	0	1,454
2011	0	0	0	0	9	2	119	284	296	108	0	0	818
2012	0	0	0	2	9	133	323	314	236	149	0	0	1,166
2013	0	0	2	10	0	156	369	355	199	0	0	0	1,091

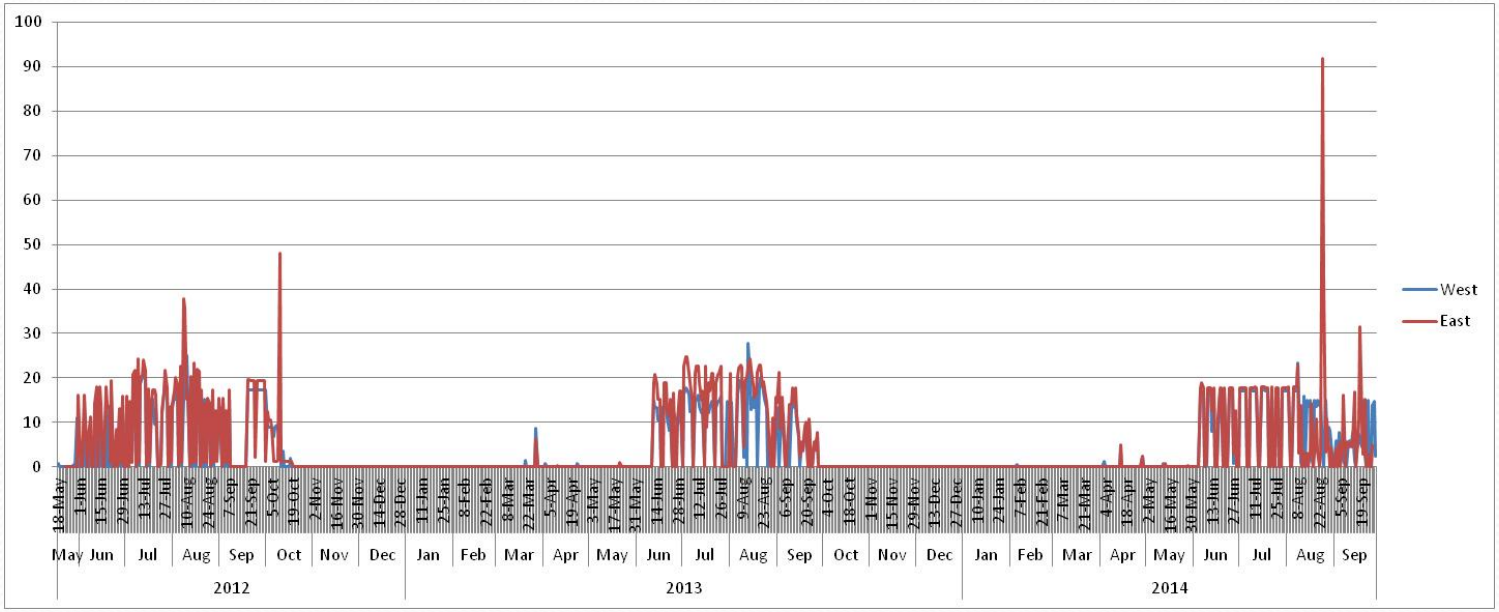
East	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2005			0		20	300	369	680	713	1062	0	0	3,144
2006	0	0	0	12	1	419	464	397	576	471	79	0	2,419
2007	0	0	0	0	47	433	492	418	635	306	0	0	2,331
2008	0	0	0	11	7	234	274	651	472	233	3	0	1,885
2009	0	0	0	12	43	208	381	778	654	285	2		2,363
2010	6	0	13	0		424	373	520		94	0	0	1,430
2011	0	0	0	2	9	0	82	228	433	0	148	0	902
2012	0	0	0	0	5	216	371	369	248	164	0	0	1,373
2013	0	0	0	7	1	182	482	421	264	0	0	0	1,357

Utility Billing Information

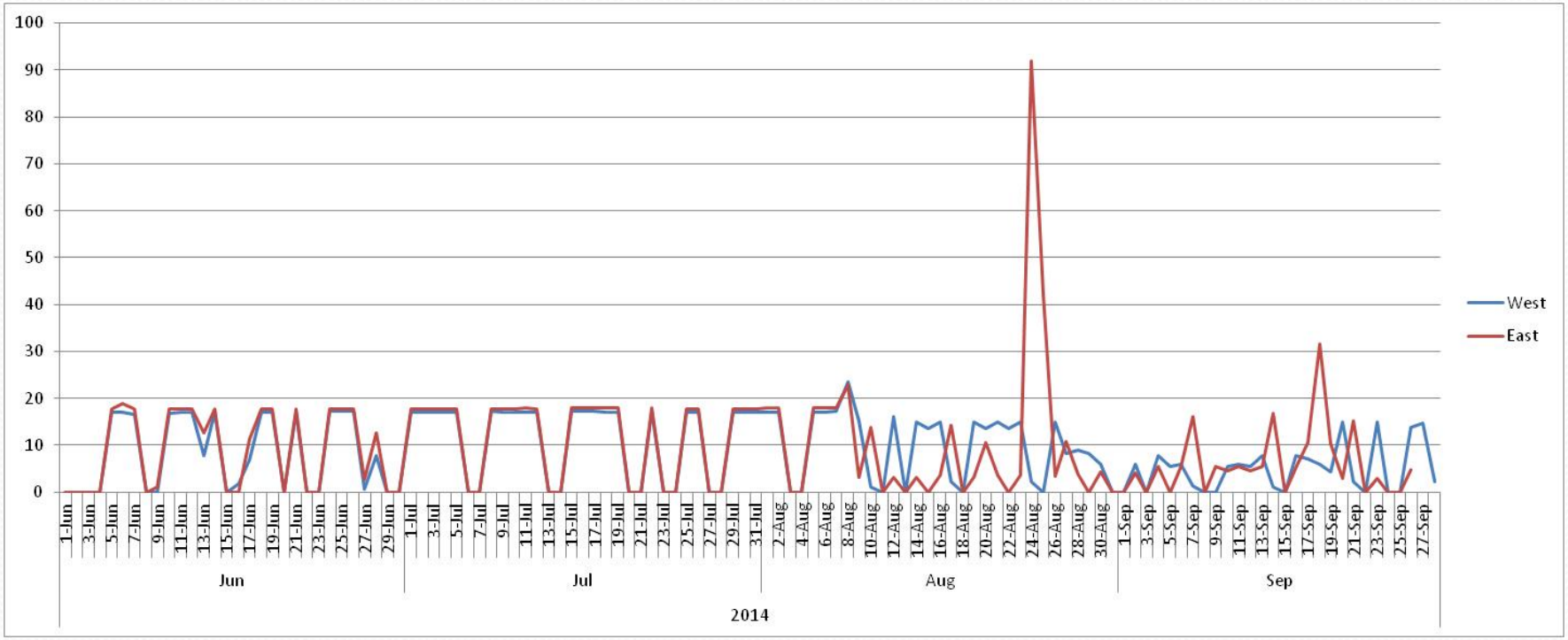
- Multiple Years by Month



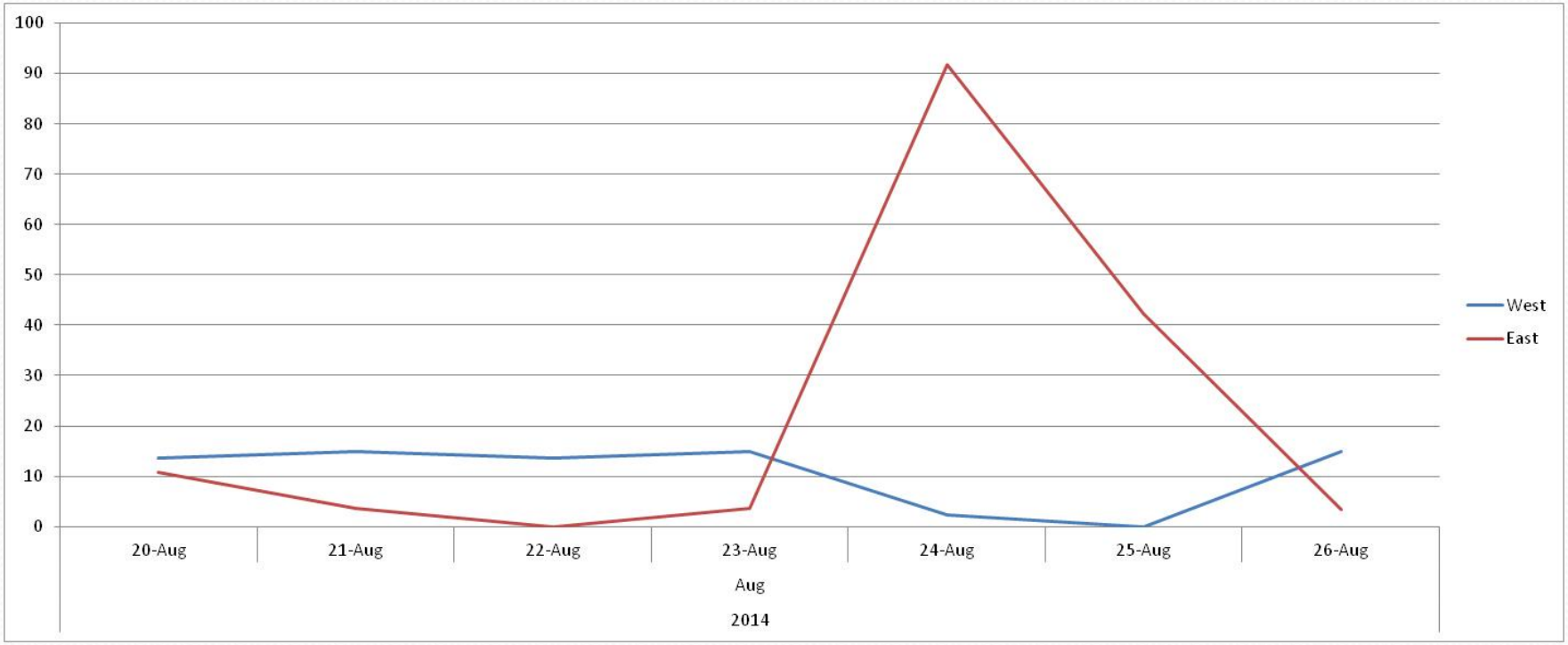
AMR – Years, Months, Days & Hours



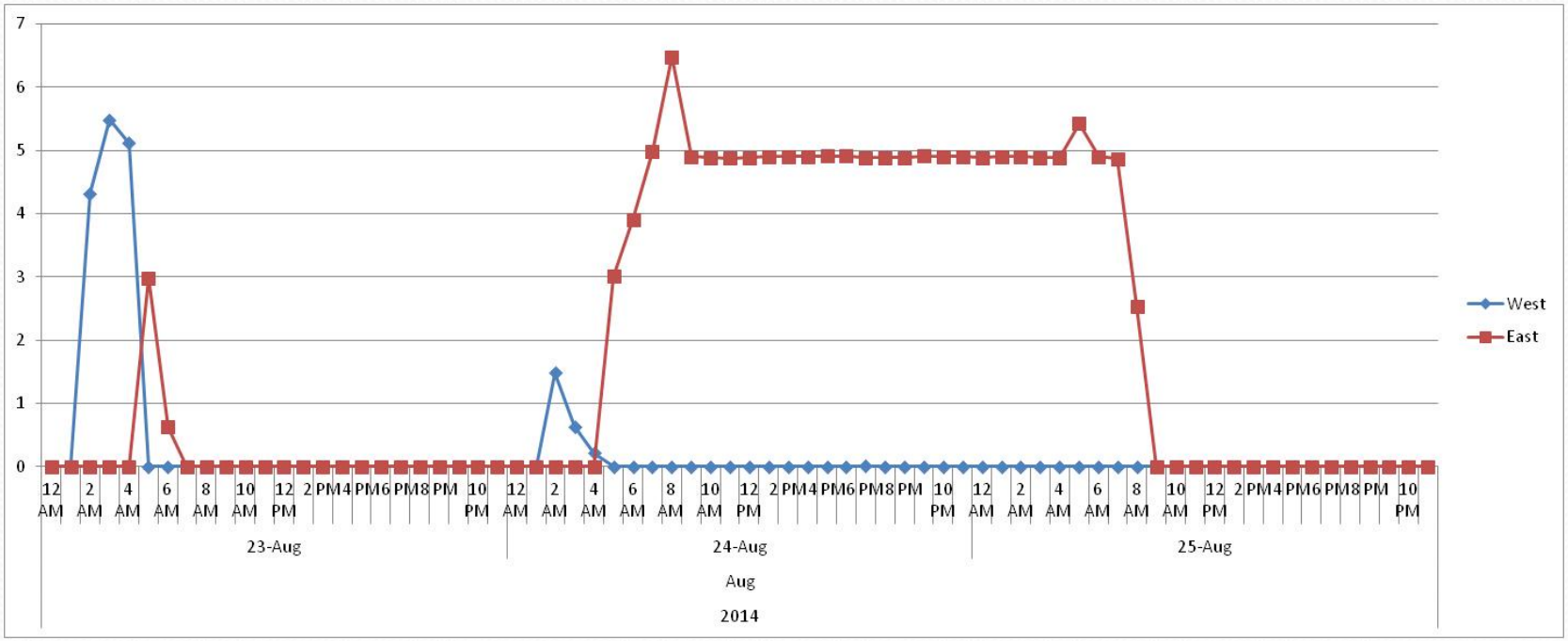
AMR – Months & Days



AMR – Week & Days



AMR - Hourly


7
6
5
4
3
2
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12 AM
2 AM
4 AM
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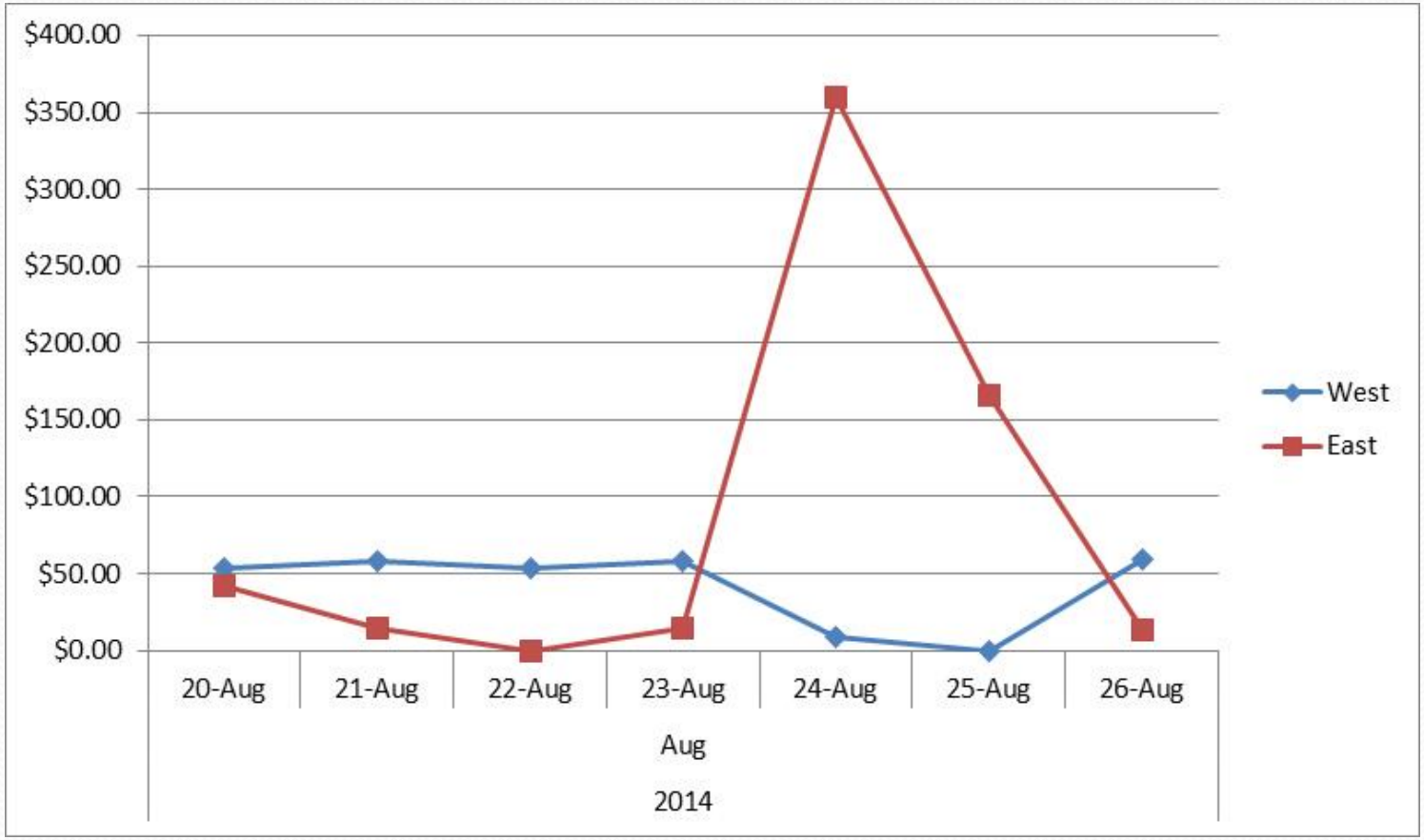
8 AM
10 AM
12 PM
2 PM
4 PM
6 PM
8 PM
10 PM
23-Aug
24-Aug
25-Aug
Aug
2014
West
East

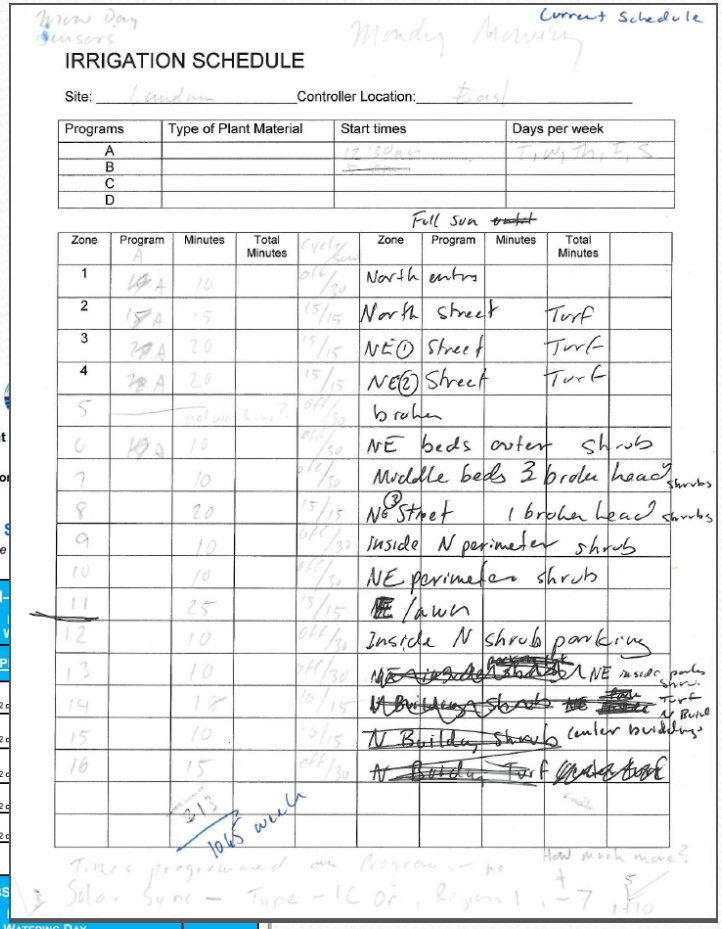
AMR – Cost of the Stuck Valve



Irrigation Runtimes

- Document existing schedules
- Assess use of conservation features
- Compare to standard

Hunter controller with Solar Sync (rain and weather sensor)



IRRIGATION SCHEDULE

Site: _____ Controller Location: _____

Programs	Type of Plant Material	Start times	Days per week
A			
B			
C			
D			

Zone	Program	Minutes	Total Minutes	Zone	Program	Minutes	Total Minutes
1							
2							
3							
4							
5							
6							
7							
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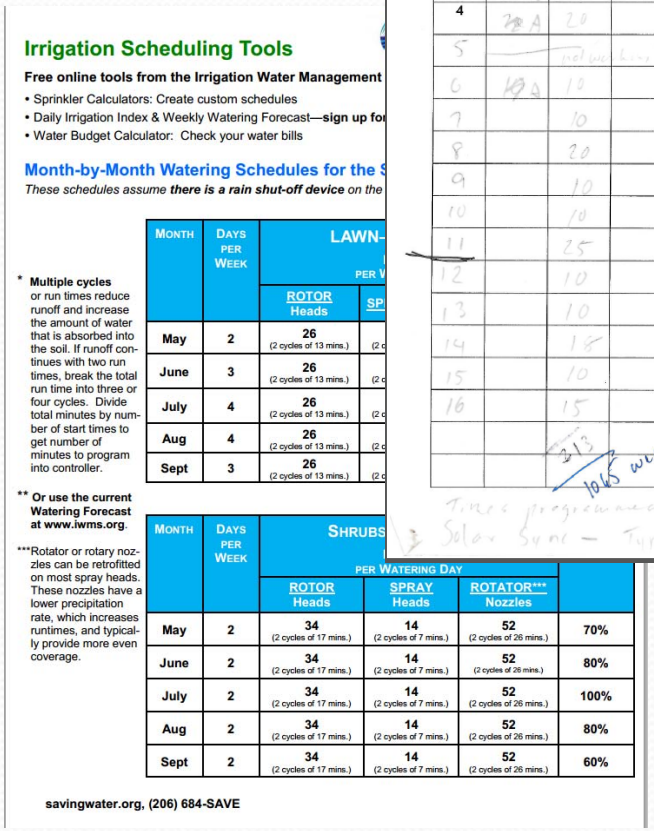


Irrigation Scheduling Tools

Free online tools from the Irrigation Water Management

- Sprinkler Calculators: Create custom schedules
- Daily Irrigation Index & Weekly Watering Forecast—**sign up fo**
- Water Budget Calculator: Check your water bills

Month-by-Month Watering Schedules for the S

*These schedules assume **there is a rain shut-off device** on the*

Month	Days per Week	LAWN- per V ROTOR Heads	SP
May	2	26 (2 cycles of 13 mins.)	(2 c
June	3	26 (2 cycles of 13 mins.)	(2 c
July	4	26 (2 cycles of 13 mins.)	(2 c
Aug	4	26 (2 cycles of 13 mins.)	(2 c
Sept	3	26 (2 cycles of 13 mins.)	(2 c

* **Multiple cycles** or run times reduce runoff and increase the amount of water that is absorbed into the soil. If runoff continues with two run times, break the total run time into three or four cycles. Divide total minutes by number of start times to get number of minutes to program into controller.

** **Or use the current Watering Forecast at www.iwms.org.**

***Rotator or rotary nozzles can be retrofitted on most spray heads. These nozzles have a lower precipitation rate, which increases runtimes, and typically provide more even coverage.

Month	Days per Week	Shrubs per Watering Day ROTOR Heads	SPRAY Heads	ROTATOR*** Nozzles	
May	2	34 (2 cycles of 17 mins.)	14 (2 cycles of 7 mins.)	52 (2 cycles of 26 mins.)	70%
June	2	34 (2 cycles of 17 mins.)	14 (2 cycles of 7 mins.)	52 (2 cycles of 26 mins.)	80%
July	2	34 (2 cycles of 17 mins.)	14 (2 cycles of 7 mins.)	52 (2 cycles of 26 mins.)	100%
Aug	2	34 (2 cycles of 17 mins.)	14 (2 cycles of 7 mins.)	52 (2 cycles of 26 mins.)	80%
Sept	2	34 (2 cycles of 17 mins.)	14 (2 cycles of 7 mins.)	52 (2 cycles of 26 mins.)	60%

savingwater.org, (206) 684-SAVE

Management

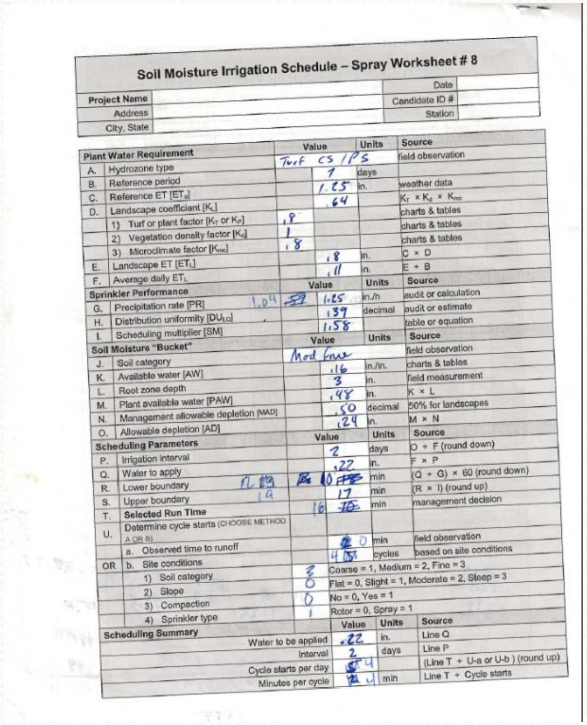
- Determine who is in charge of landscape and irrigation system
- Walk the site with irrigation manager
  - Wet areas
  - Broken heads

Observe

- Operate each zone for 5 minutes
  - Leaks and breaks
  - Other hardware issues
  - Document:
    - Plant material
    - Microclimate
    - Head type
    - Mulch

Identify Problem Areas

- Audit a few zones
- Compare programmed, and audited to standard schedules
- Estimate savings potential



Soil Moisture Irrigation Schedule – Spray Worksheet # 8

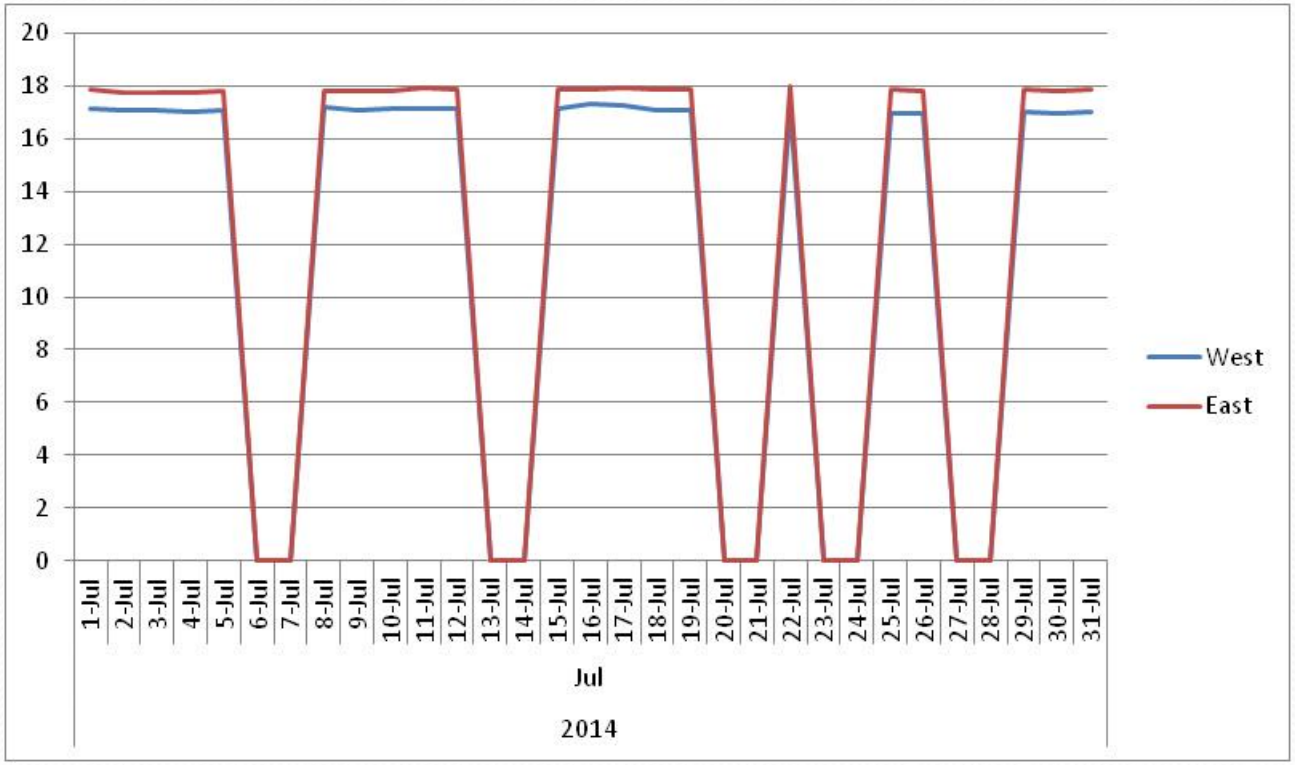
Project Name			Date	
Address			Candidate ID #	
City, State			Station	

	Plant Water Requirement	Value	Units	Source
A.	Hydrozone type	Turf CS IPS		field observation
B.	Reference period	7	days	
C.	Reference ET [ET_o]	1.25	in.	weather data
D.	Landscape coefficient [K_L]	.64		$K_r \times K_d \times K_{mc}$
	1) Turf or plant factor [K_r or K_p]	.9		charts & tables
	2) Vegetation density factor [K_d]	1		charts & tables
	3) Microclimate factor [K_{mc}]	.8		charts & tables
E.	Landscape ET [ET_L]	.8	in.	C × D
F.	Average daily ET_L	.11	in.	E ÷ B
	Sprinkler Performance	**Value**	**Units**	**Source**
G.	Precipitation rate [PR]	1.04 1.25	in./h	audit or calculation
H.	Distribution uniformity [DU_{LQ}]	.39	decimal	audit or estimate
I.	Scheduling multiplier [SM]	1.58		table or equation
	Soil Moisture "Bucket"	**Value**	**Units**	**Source**
J.	Soil category	Med Fine		field observation
K.	Available water [AW]	.16	in./in.	charts & tables
L.	Root zone depth	3	in.	field measurement
M.	Plant available water [PAW]	.48	in.	K × L
N.	Management allowable depletion [MAD]	.50	decimal	50% for landscapes
O.	Allowable depletion [AD]	.24	in.	M × N
	Scheduling Parameters	**Value**	**Units**	**Source**
P.	Irrigation interval	2	days	O ÷ F (round down)
Q.	Water to apply	.22	in.	F × P
R.	Lower boundary	11 .09 10 .08	min	(Q ÷ G) × 60 (round down)
S.	Upper boundary	17 .14	min	(R × I) (round up)
T.	**Selected Run Time**	16 15	min	management decision
U.	Determine cycle starts (CHOOSE METHOD A OR B)			
	a. Observed time to runoff	10	min	field observation
OR	b. Site conditions	4 (5)	cycles	based on site conditions
	1) Soil category	3	Coarse = 1, Medium = 2, Fine = 3	
	2) Slope	0	Flat = 0, Slight = 1, Moderate = 2, Steep = 3	
	3) Compaction	0	No = 0, Yes = 1	
	4) Sprinkler type	1	Rotor = 0, Spray = 1	

Scheduling Summary	Value	Units	Source
Water to be applied	.22	in.	Line Q
Interval	2	days	Line P
Cycle starts per day	5 4		(Line T ÷ U-a or U-b) (round up)
Minutes per cycle	12 4	min	Line T ÷ Cycle starts

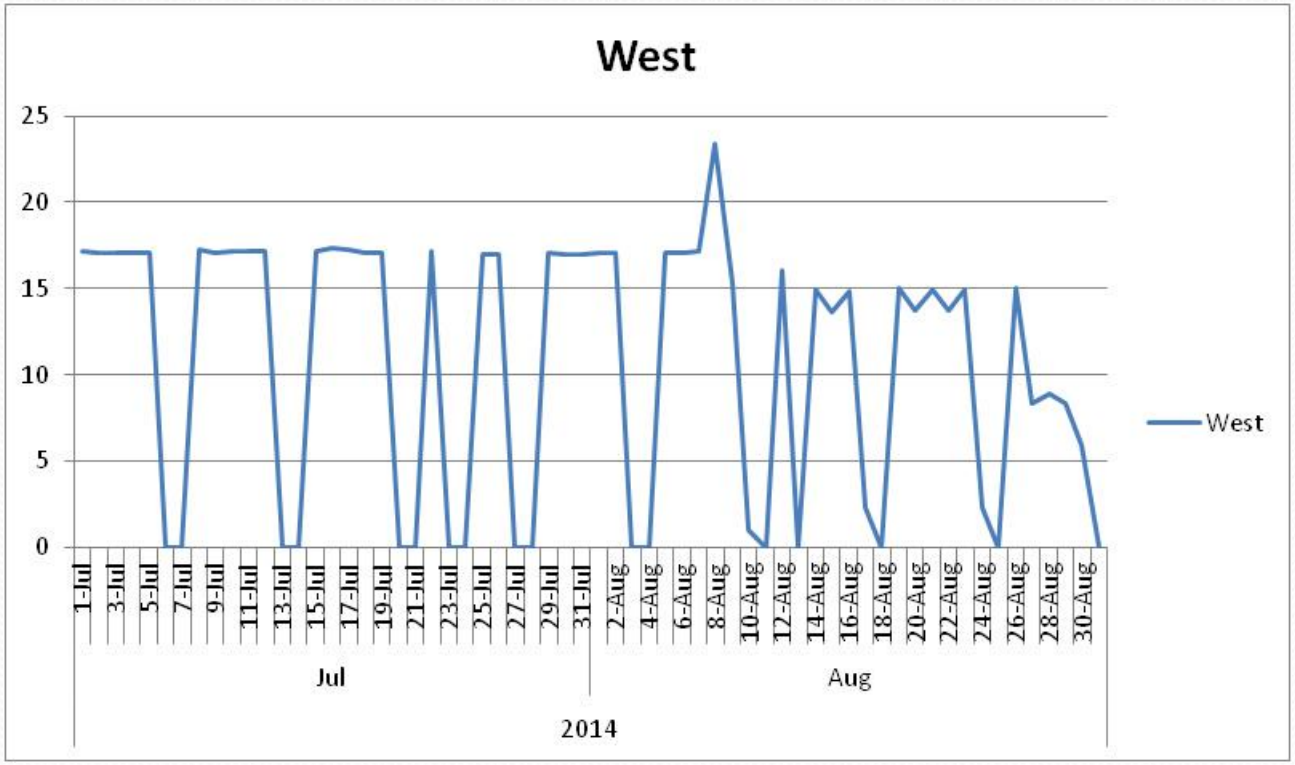
Discovery

- Rain sensors working
- Weather sensors turned on but not adjusting schedules



Discovery

- Solar Sync
  - Controller requires Programs to be set to specific type of sensor - Solar Sync



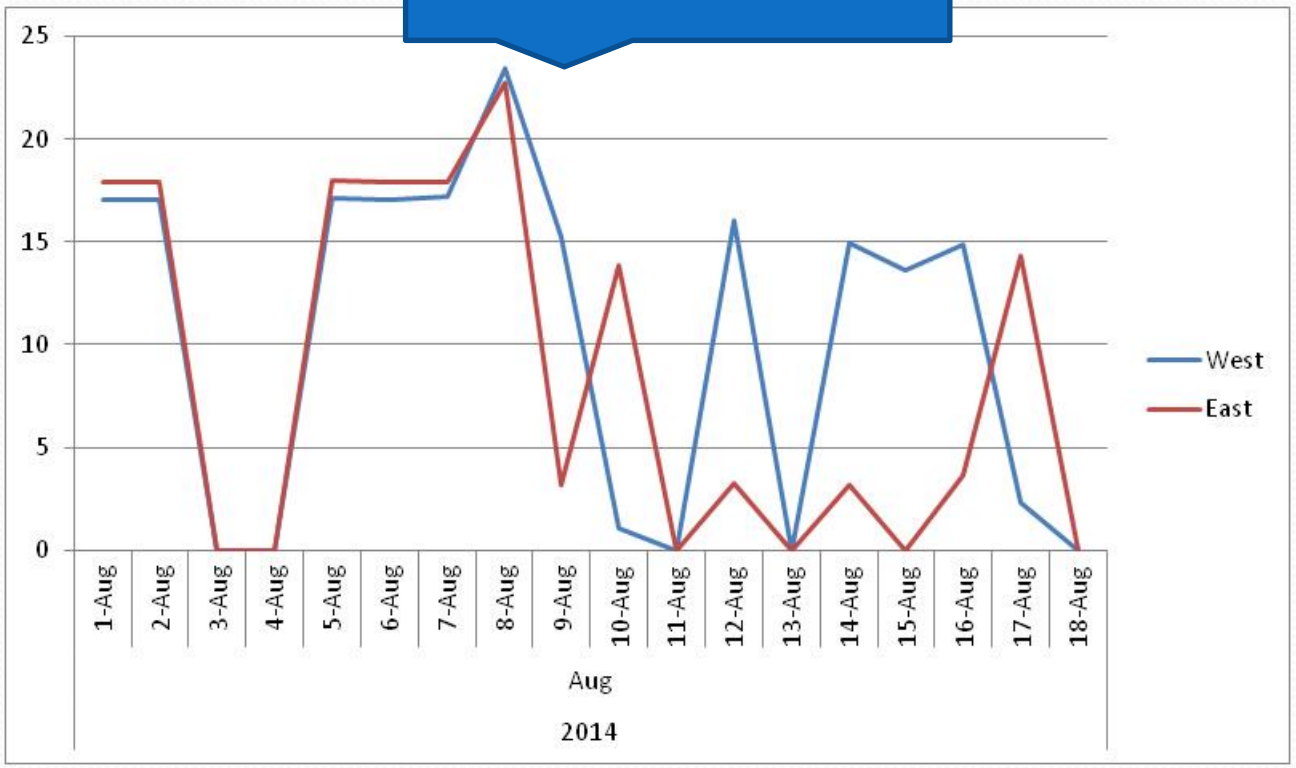
Step 2 – New Irrigation Schedules:

Programmed the Clocks

- Aug 8 – New schedules on East Landmark – Used standard and audited schedules, turned on weather sensors and set for Seattle area climate (Solar Sync)
- West – Changed one zone that was audited and turned on weather sensors
  - Fixed module Aug. 20

Step 2 – New Irrigation Schedules:

- Red – New schedules and Turned on Weather Sensor
- Blue-Turned on Weather Sensor

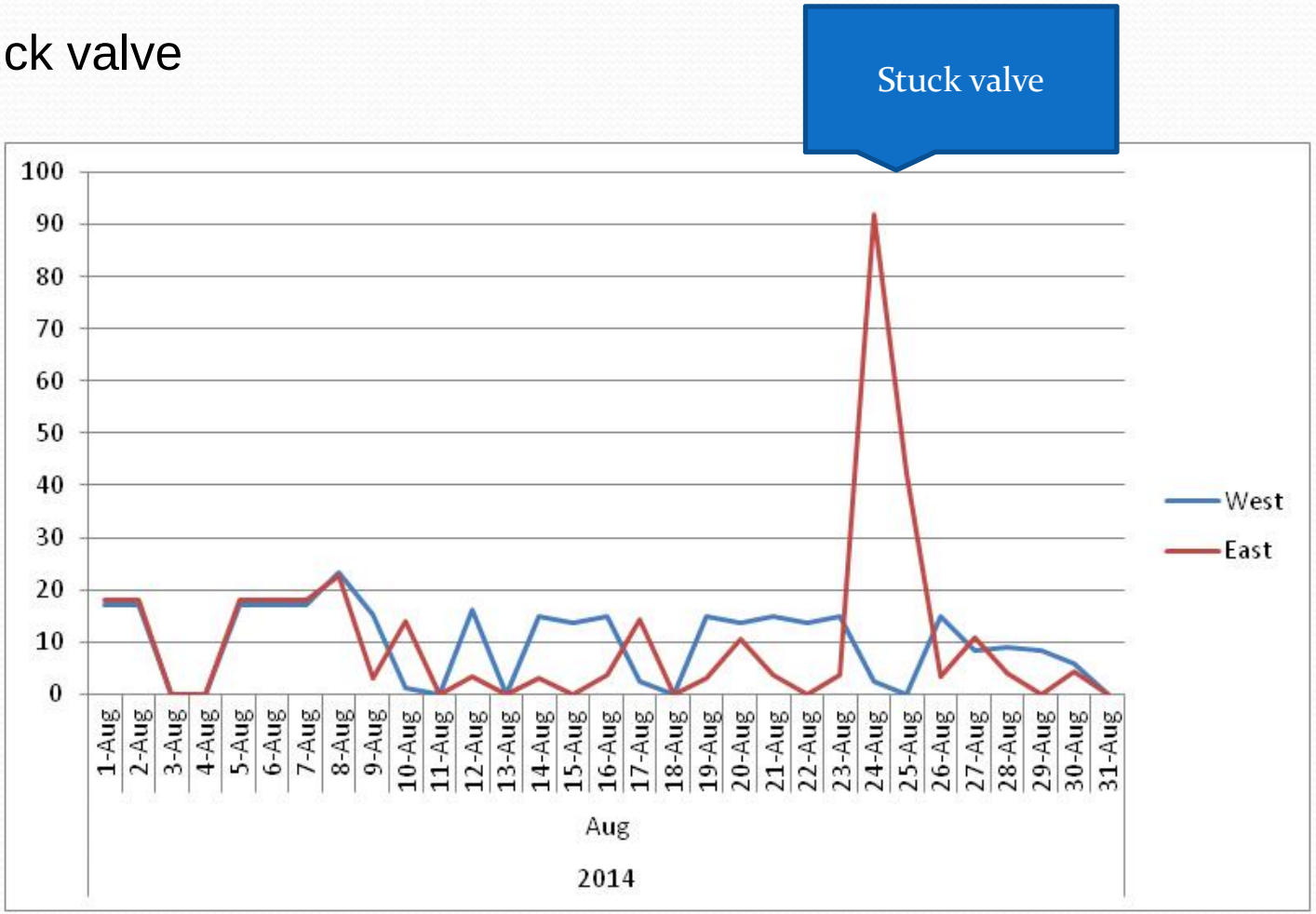


Step 3 – Monitoring:

- Visit the site weekly and review billing data or read the meter to monitor consumption and visual quality of plant material.
- Adjust irrigation schedules.

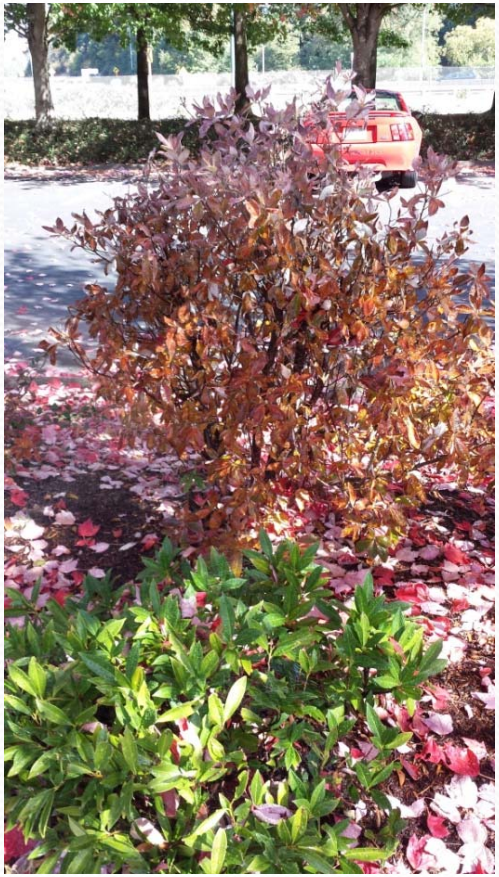
AMR Insights

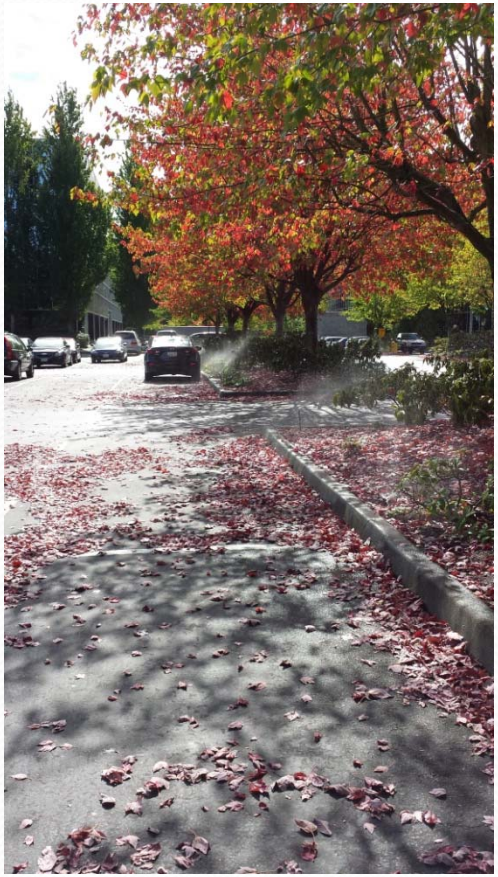
- Stuck valve

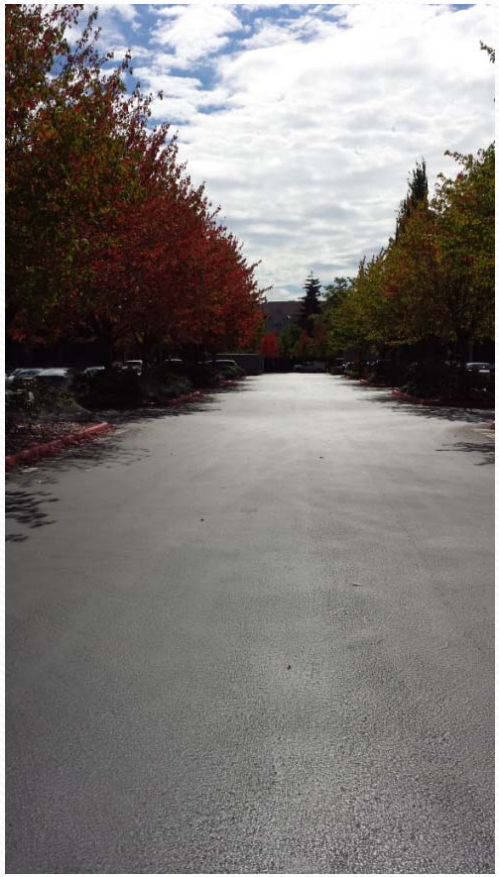


Turf – Looks okay but not perfect

September 19, 2015

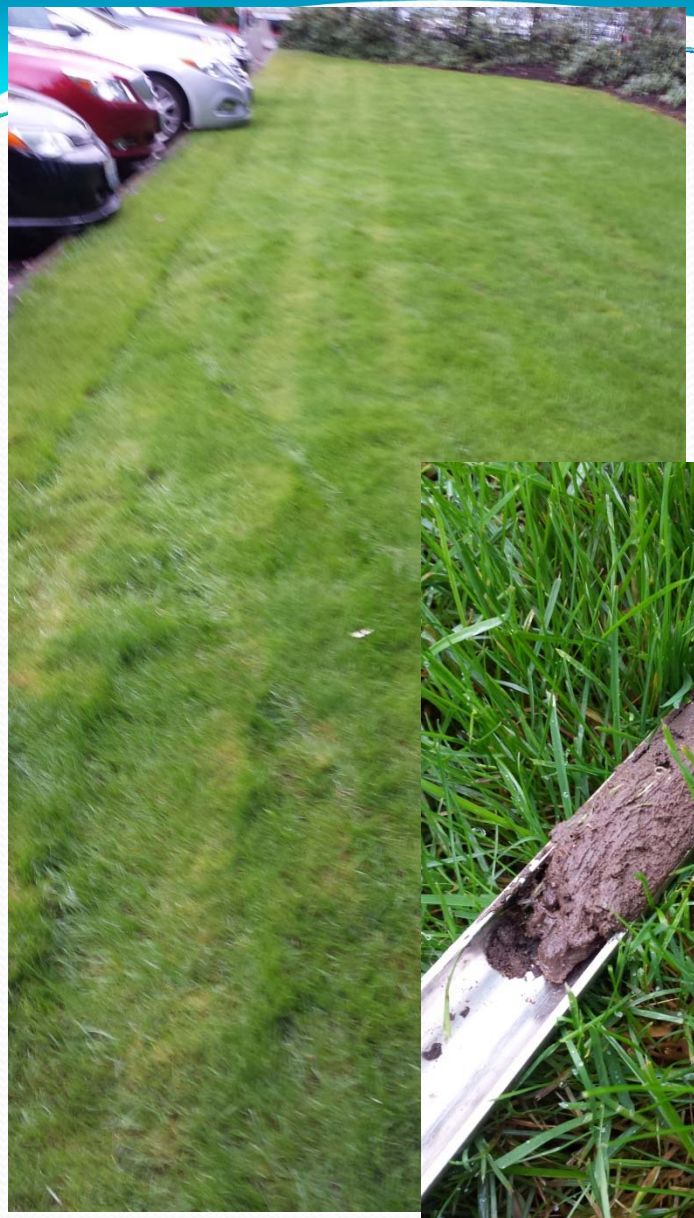






September 25, 2015

1.5 inches of rain

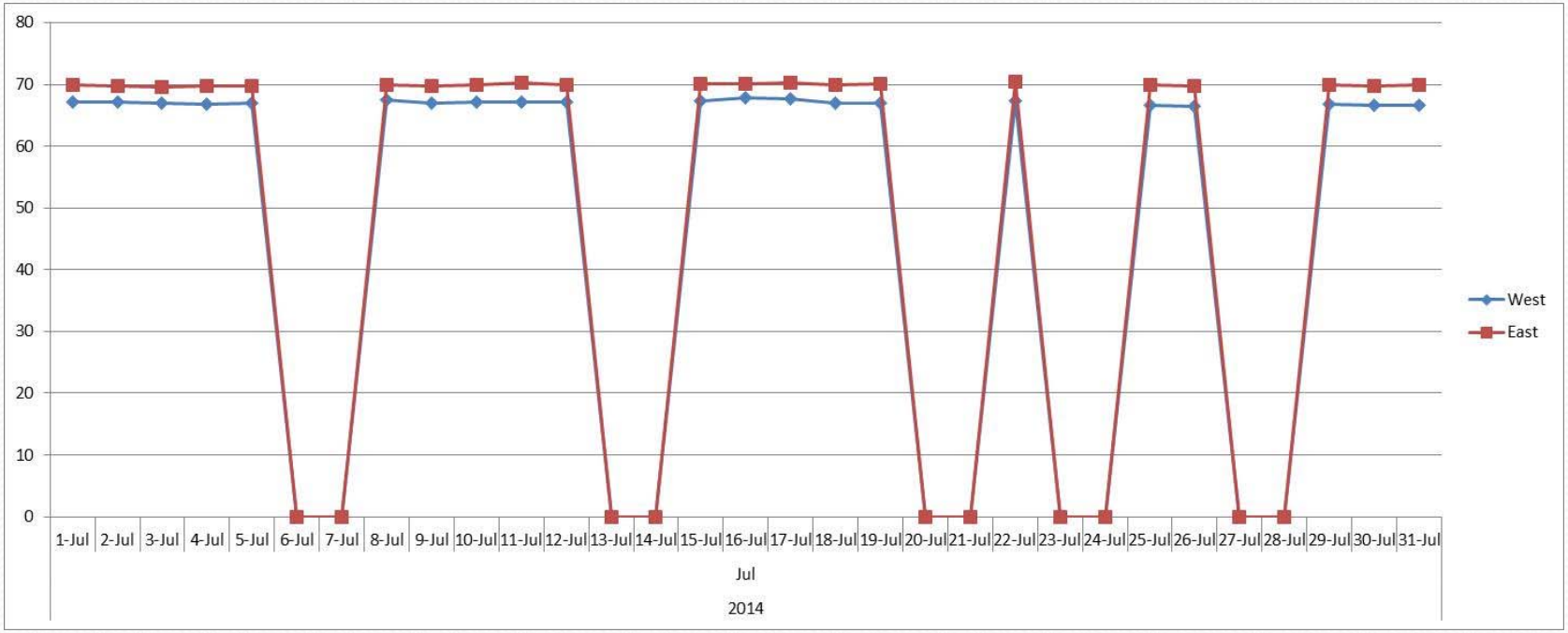


Step 4 – Results:

- Identify major issues affecting irrigation
- Program controllers for 2015
- Estimate savings

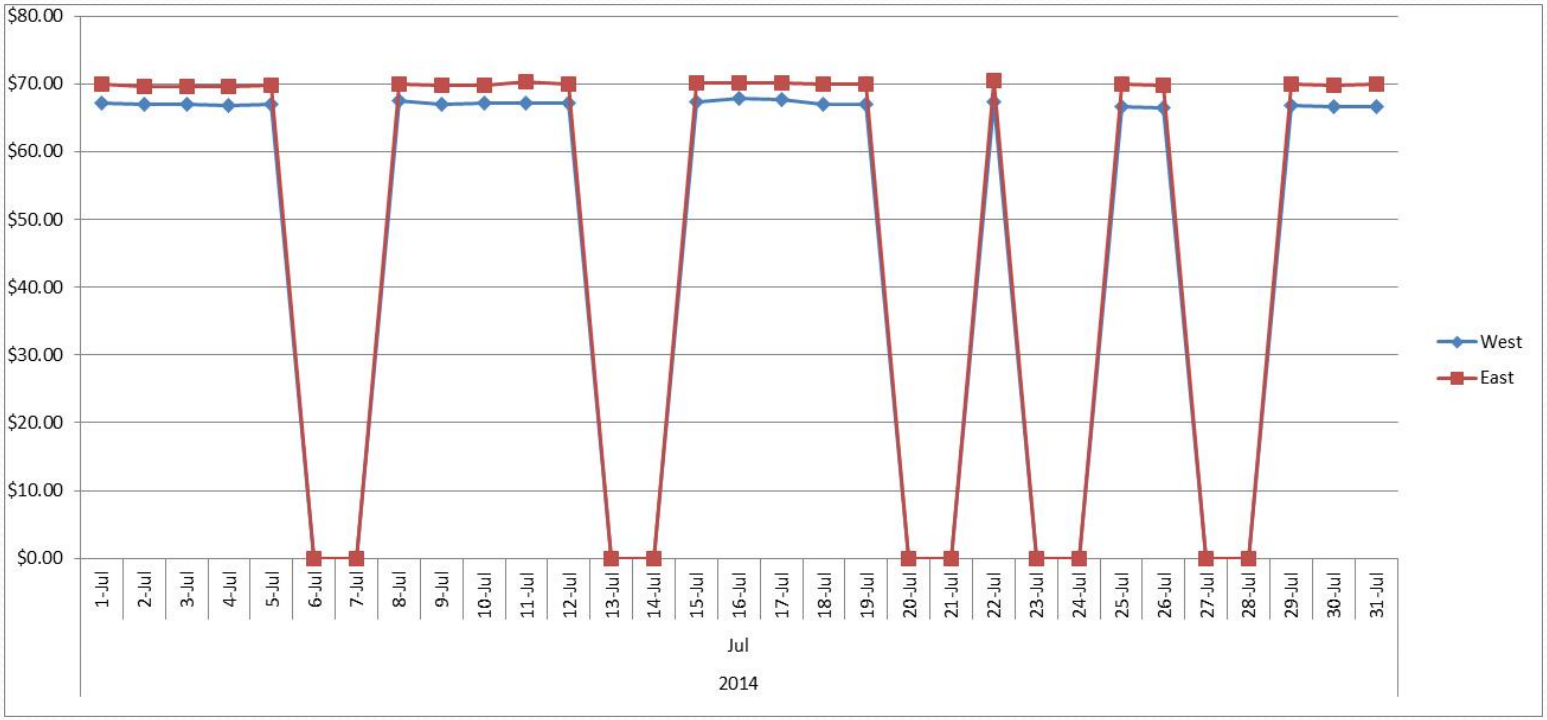
Bottom-line: Rain Sensors

- Rain sensors work



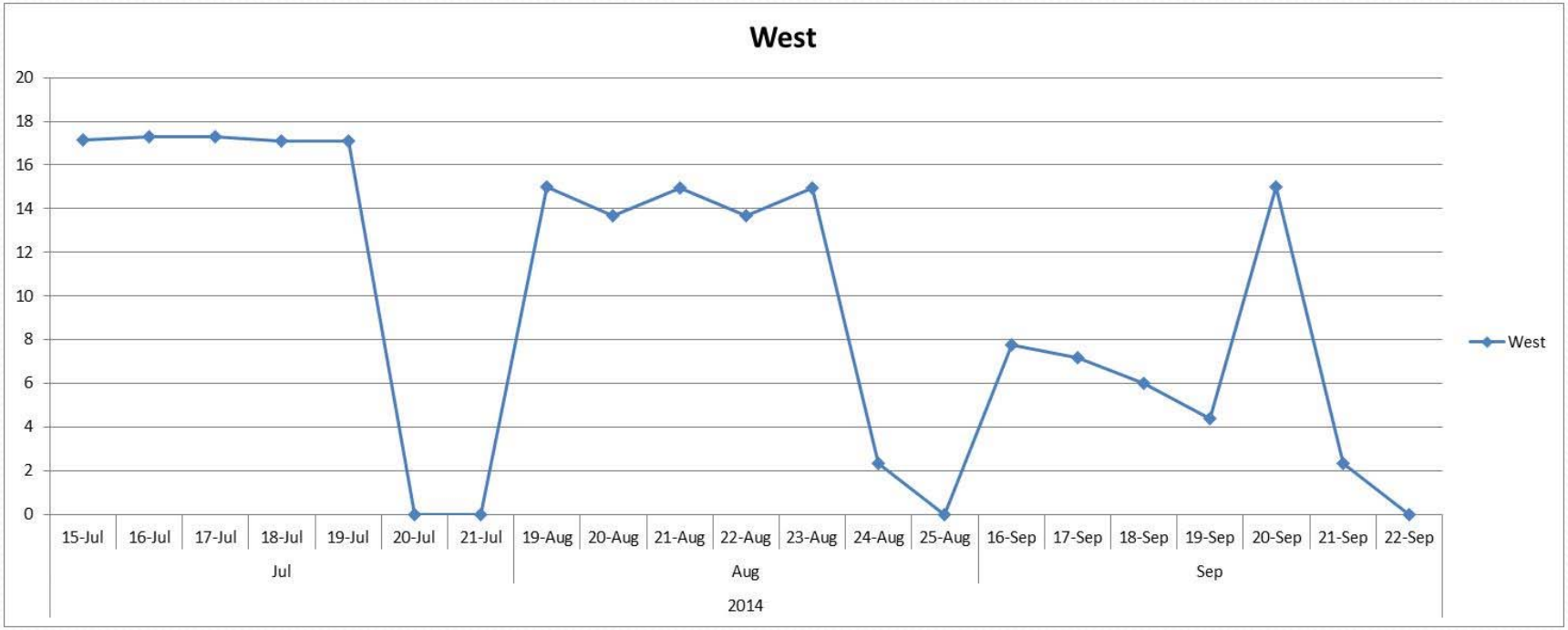
Bottom-line: Rain Sensors

- Rain sensors saving money



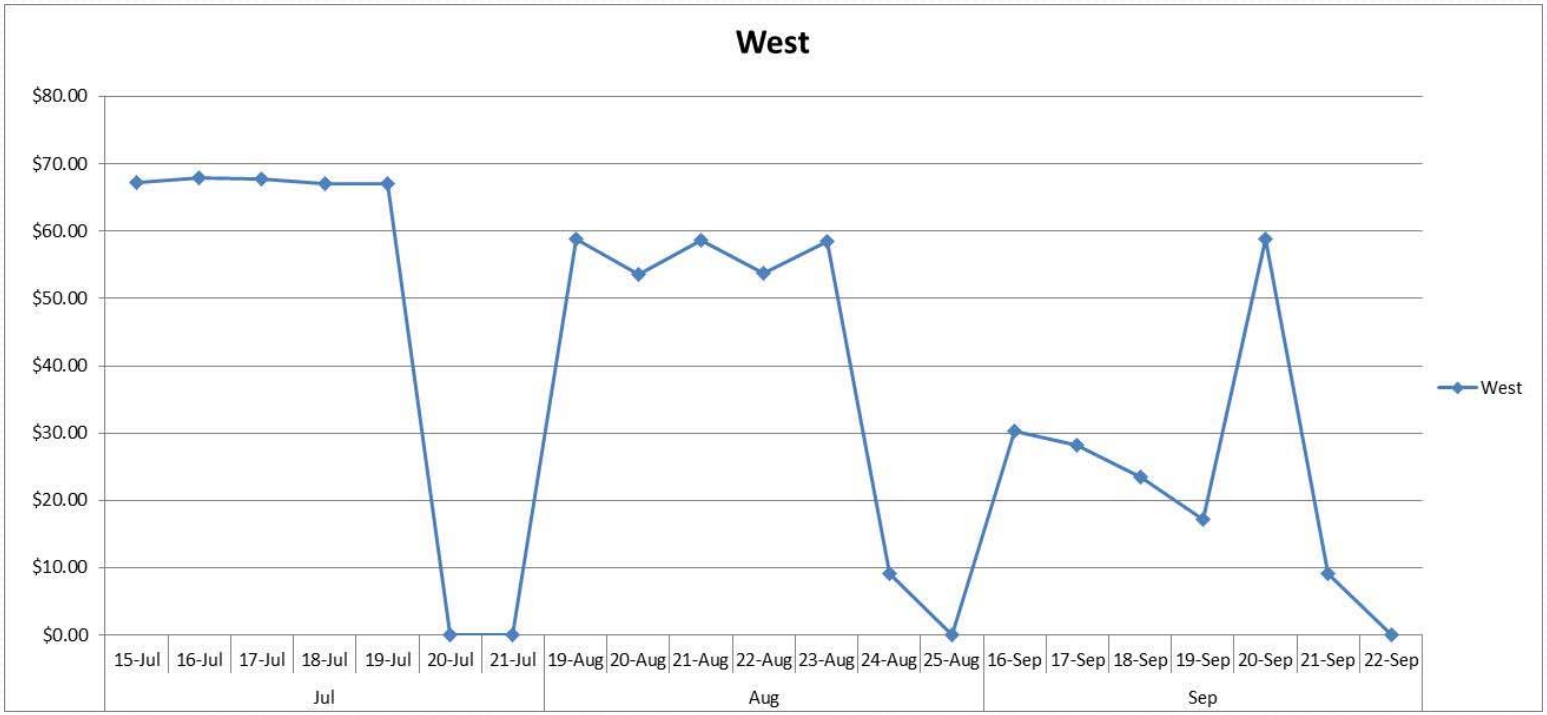
Bottom-line: Weather Sensors

- **Weather sensors work – Weekly comparison**

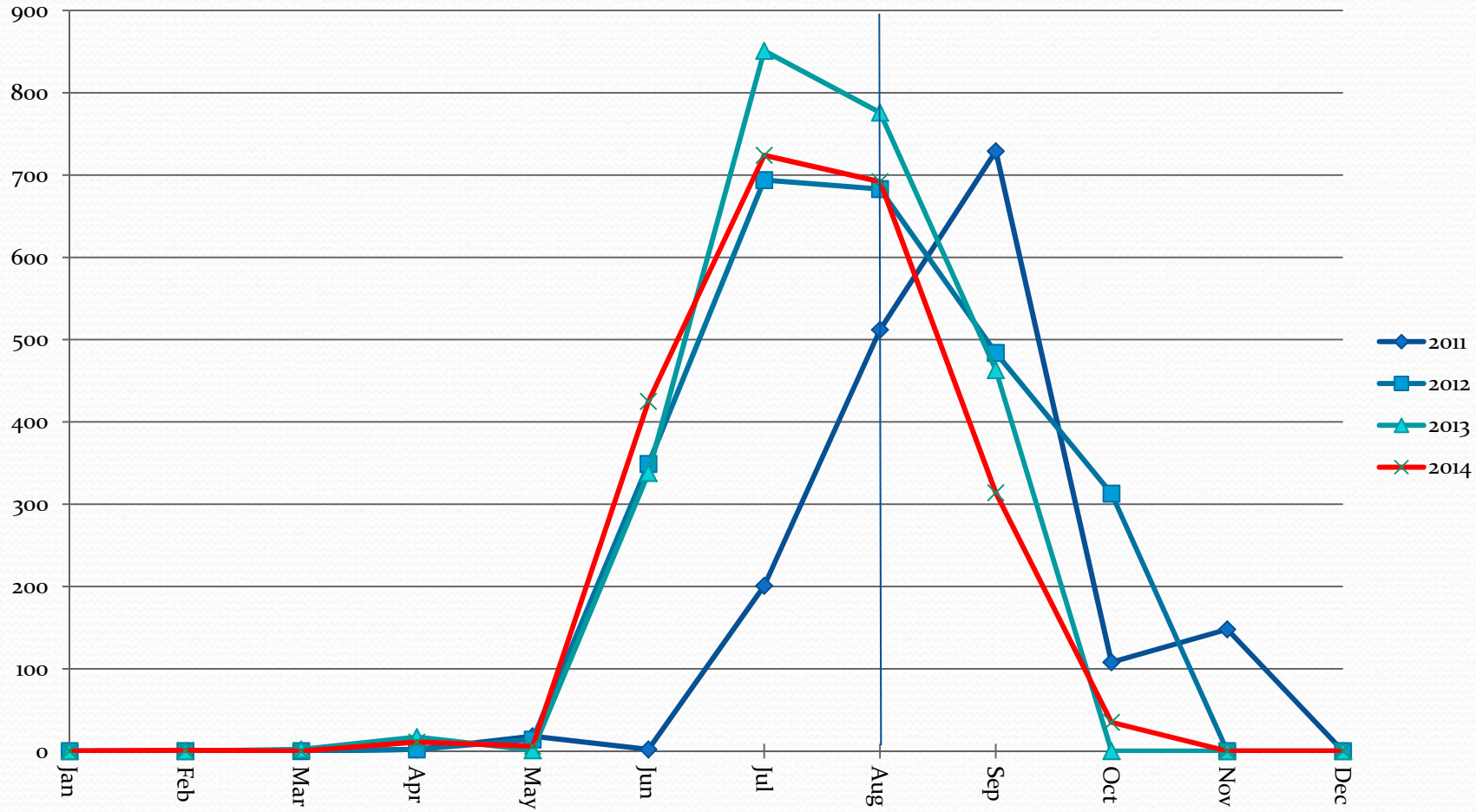


Bottom-line: Weather Sensors

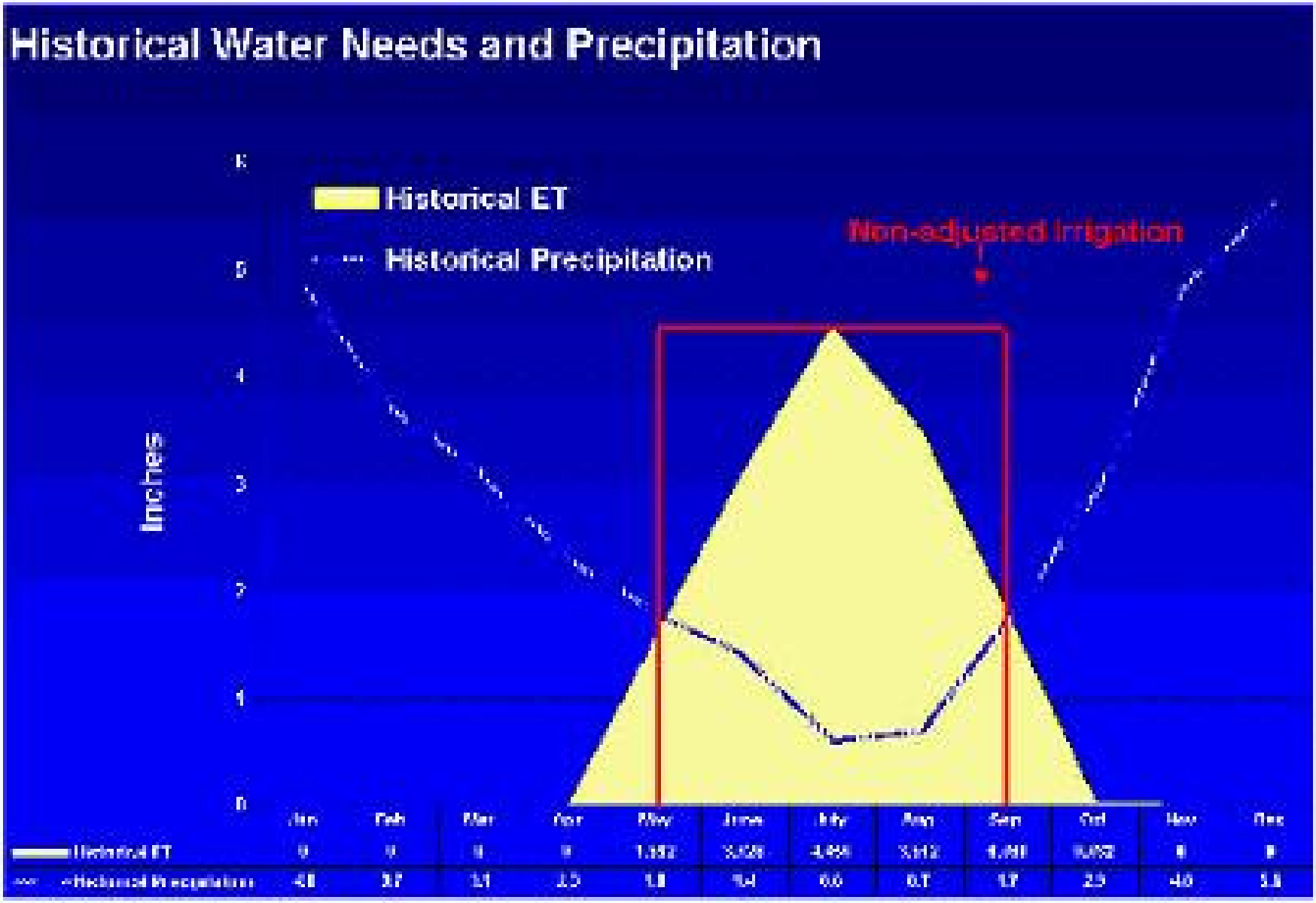
- **Weather sensors save money – Weekly comparison**



Bottom Line: Evapotranspiration



Historical Water Needs and Precipitation



Bottom-line: Irrigation Scheduling

- Guessing
- Standard Schedules
- Audit Schedules
- Fine-tuned

Bottom-line: Irrigation Scheduling

- Guessing – 20 minutes, 5 days per week: 100 minutes
- Standard Schedules – 5 minutes, 2 starts, 4 days: 40 minutes
- Audit Schedules – 4 minutes, 3 starts, 7 days: 84
- Fine-tuned: 3 minutes, 5 starts, 4 days: 60 minutes

Discovery

- There’s an opportunity for a service
  - Estimate costs and benefits
- Verify sensors work
- Standard schedules good place to start
  - May need adjustment.
- Auditing provides much more insight
  - Auditing still requires some guesswork
- The environment makes a big difference
  - Fine mulch may create barrier

Final Bottom Line

Row Labels	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Grand Total
2011	0	0	0	2	18	2	201	512	729	108	148	0	1720
2012	0	0	0	2	14	349	694	683	484	313	0	0	2539
2013	0	0	2	17	1	338	851	776	463	0	0	0	2448
2014	0	1	0	11	6	425	724	692	314	35	0	0	2208

Final Bottom Line

- Good question!
- Depends on weather
- Based on pre and post schedules
  - about 30% reduction in number of minutes

  - Potentially $3,000 per year