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Urbana Irrigation Controls Study

Scott R. Tess
City of Urbana, Illinois

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Abstract

The Urbana Irrigation Controls Study was undertaken to determine if measurable potable water savings and financial savings would result from the installation of irrigation control sensors on automatic landscape irrigation systems. The study utilized three existing irrigation meters at two different locations. One location received a rain sensor control on its meter and this meter's subsequent use was compared to its historic use. Another location had separate meters on both sides of a street. One meter received a combination evapotranspiration control, rain sensor, and freeze sensor (hereafter ET control) while the other side only had the existing timer. Both sides of the street had irrigation lines replaced as pre-existing damage to the existing lines would have caused leaks that would have impacted meter consumption results. The study was inconclusive because high precipitation rates precluded the need to utilize irrigation for most of the study period.

Chapter 1: Introduction

As Illinois is a water-rich state compared to many other states, irrigation control sensors on automatic irrigation systems are not widely utilized. Few municipalities have irrigation control requirements. Furthermore, studies examining the savings from utilizing irrigation controls such as timers, rain sensors, and evapotranspiration (ET) controls are rarely conducted in Illinois, but rather occur in states such as Florida and California. Studies conducted by the University of Florida at various Florida locations found anywhere from 34% to 72% reductions in water use (Dukes, 2008) when irrigation controls were installed. On a national scale, the US EPA WaterSense program estimates that 30% of water used in the US is for landscape irrigation and 50% of that water is wasted (United States Environmental Protection Agency, n.d.).

The City of Urbana evaluated the water and financial savings from utilization of irrigation control sensors on automatic irrigation systems. Project investigators expected that the installation of rain sensors would conserve water compared to existing timers, and that the installation of rain sensors with ET controls would conserve an even greater percentage of water. While irrigation timers and rain sensors are not new technologies, they are not widely used – even in water-limited regions – and are still seen as innovative. Demonstrating irrigation control sensor efficacy in the East-Central Illinois context would be novel.

Chapter 2: Methodology

The study utilized three existing irrigation meters at two different locations, over a period of 12 months. The 211 N. Vine St. irrigation system consisted of one meter with an irrigation timer. As part of the study, the 211 N. Vine St. meter received a rain sensor control. Philo Rd. has one meter at 1710 S. Philo Rd. and another meter at 1717 S. Philo Rd. These two meters are located on opposite sides of the same street, irrigating nearly identical spaces. The 1710 S. Philo Rd. meter received an ET control (ET, rain sensor, freeze sensor; Figure 1), while the 1717 side only had the existing timer. Both 1710 S. Philo Rd. and 1717 S. Philo Rd. needed to have irrigation lines replaced, as damage to the existing lines caused leaks that could have impacted meter results. Irrigation control sensors were installed at 211 N. Vine St. and 1710 S. Philo Rd. in September 2014, making October 2014 the first month of the twelve-month experimental period. Monthly irrigation water consumption data was collected from Illinois-American Water Company bills for months before and after installation of irrigation control sensors (Appendix A).

Figure 1: Hunter Solar Sync ET Sensor.

In addition to irrigation water consumption data from utility bills, project staff also conducted monthly inspections of plant health to determine if the irrigation control sensors were delivering too little water to maintain proper plant health. There was no indication that plants were receiving insufficient water. Photos and a text description were recorded at all three locations and are shown in Appendix B.

The City of Urbana was constrained from conducting similar testing at additional automatic irrigation locations for several reasons. In some locations, irrigation systems did not have meters separate from a building water meter. In other locations, historic data was skewed due to significant leakage from broken equipment or from irrigation systems being completely turned off due to leakage problems. The City of Urbana is interested in the placement of sub-meters on additional existing irrigation systems, allowing for an expansion of this study in future years.

To ensure study results were properly represented, final project reporting includes any damaged or failed equipment or operator errors that may have impacted meter results. Also, any instances where irrigation controls delivered insufficient irrigation to serve desired purpose are reported here.

Chapter 3: Results and Discussion

The irrigation water consumption data certainly showed a decrease in consumption after the installation of irrigation control sensors. However, in this instance, the result does not indicate that decreased consumption is due to the irrigation control sensors. Instead, in 2015, after the irrigation control sensors were installed, Urbana experienced a high level of precipitation during the summer months when irrigation is typically used. In fact, Arbor Division staff simply turned off the irrigation meters for most of the summer as a result the newly installed irrigation control sensors could not be tested for impact.

Figure 2 shows irrigation water consumption by month for three years at 211 N. Vine St. Irrigation control sensors were installed at 211 N. Vine St. in September 2014, making October 2014 the first month of the twelve-month experimental period. However, this meter was never turned on in 2015 due to substantial precipitation. For this reason, the trend line for 2015 in Figure 2 is flat, representing zero consumption.

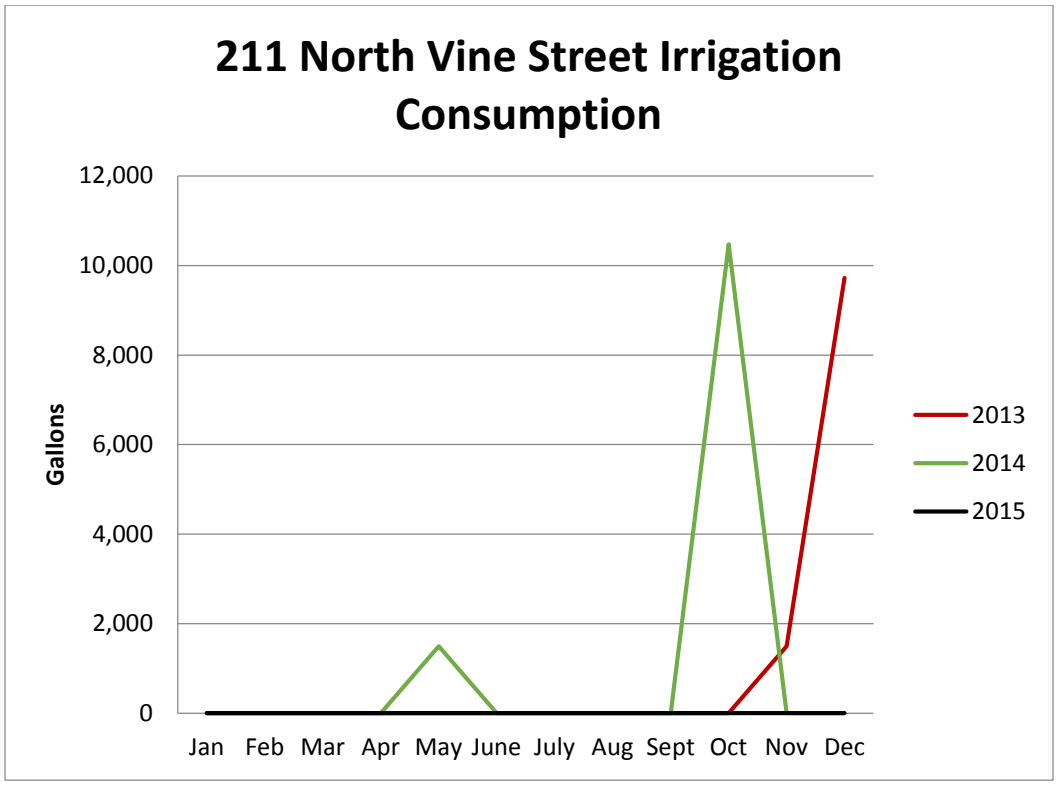

Figure 2: Water consumption at 211 N. Vine St. over three years (sensors installed Oct. 2014).

Figure 3 shows irrigation water consumption by month for the 1717 S. Philo Rd. meter (control) and the experimental meter at 1710 S. Philo Rd. The Baseline Periods indicated by the green shading in Figure 3 represent time periods prior to the installation of irrigation control sensors. The Test Period represented by the red shading in Figure 3 represents the time period where the 1710 S. Philo Rd. meter was under the control of the newly installed irrigation control sensor.

Due to substantial precipitation in 2015, the control meter at 1717 S. Philo Rd. was never turned on, while the experimental group at 1710 S. Philo Rd. had its irrigation meter suppressed by the timer and the ET sensor for most of 2015. For this reason, the trend line for the control group meter at 1717 S. Philo Rd. in 2015 shows zero consumption, while the experimental group meter at 1710 S. Philo Rd. shows only a small amount of irrigation water consumption for one month. This pattern is also depicted in Figure 4.

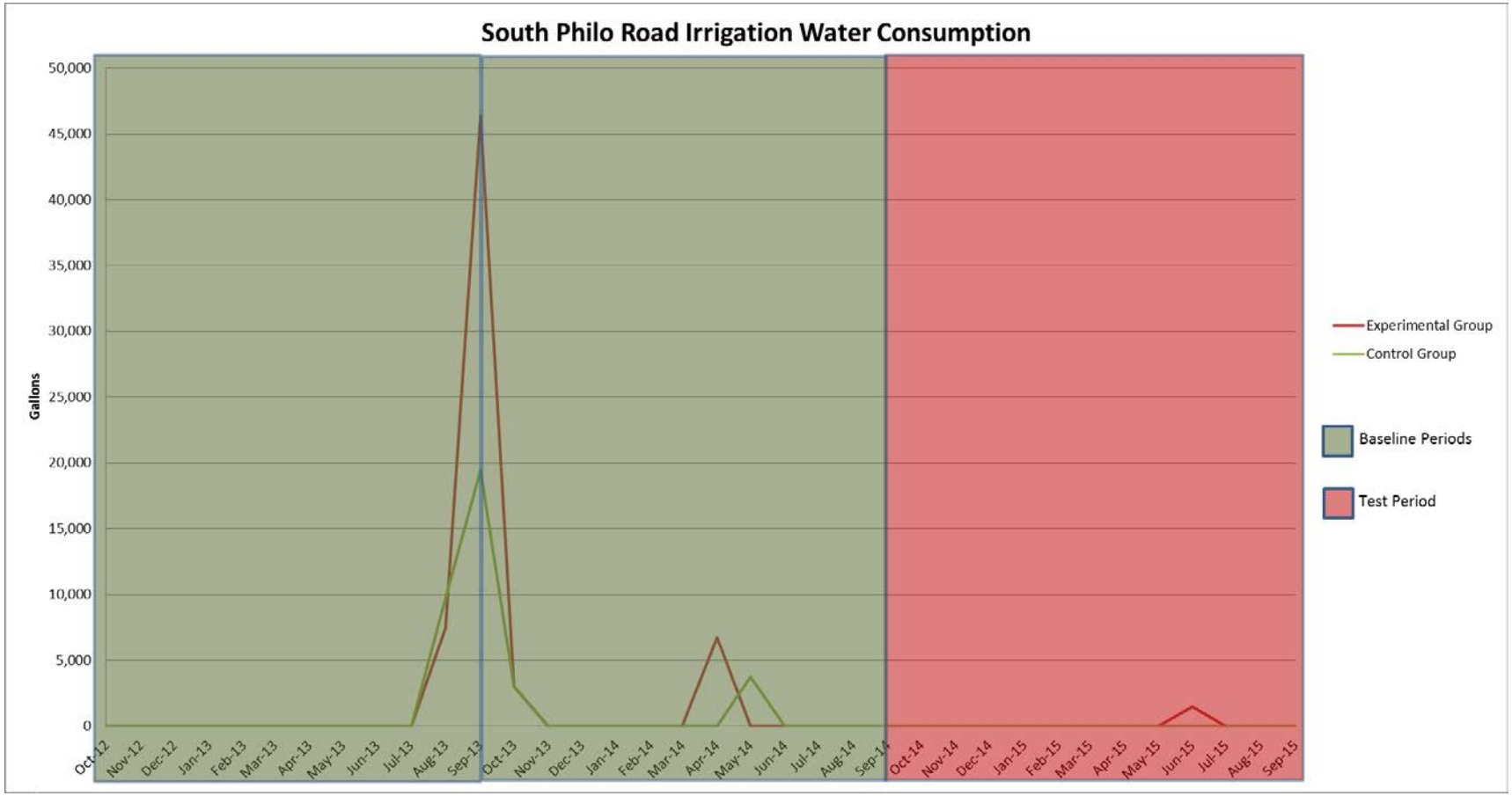

Figure 3: Water consumption at two locations on Philo Rd. Red line shows control location (1717 S. Philo Rd.), and green line shows the experimental location (1710 S. Philo Rd.).

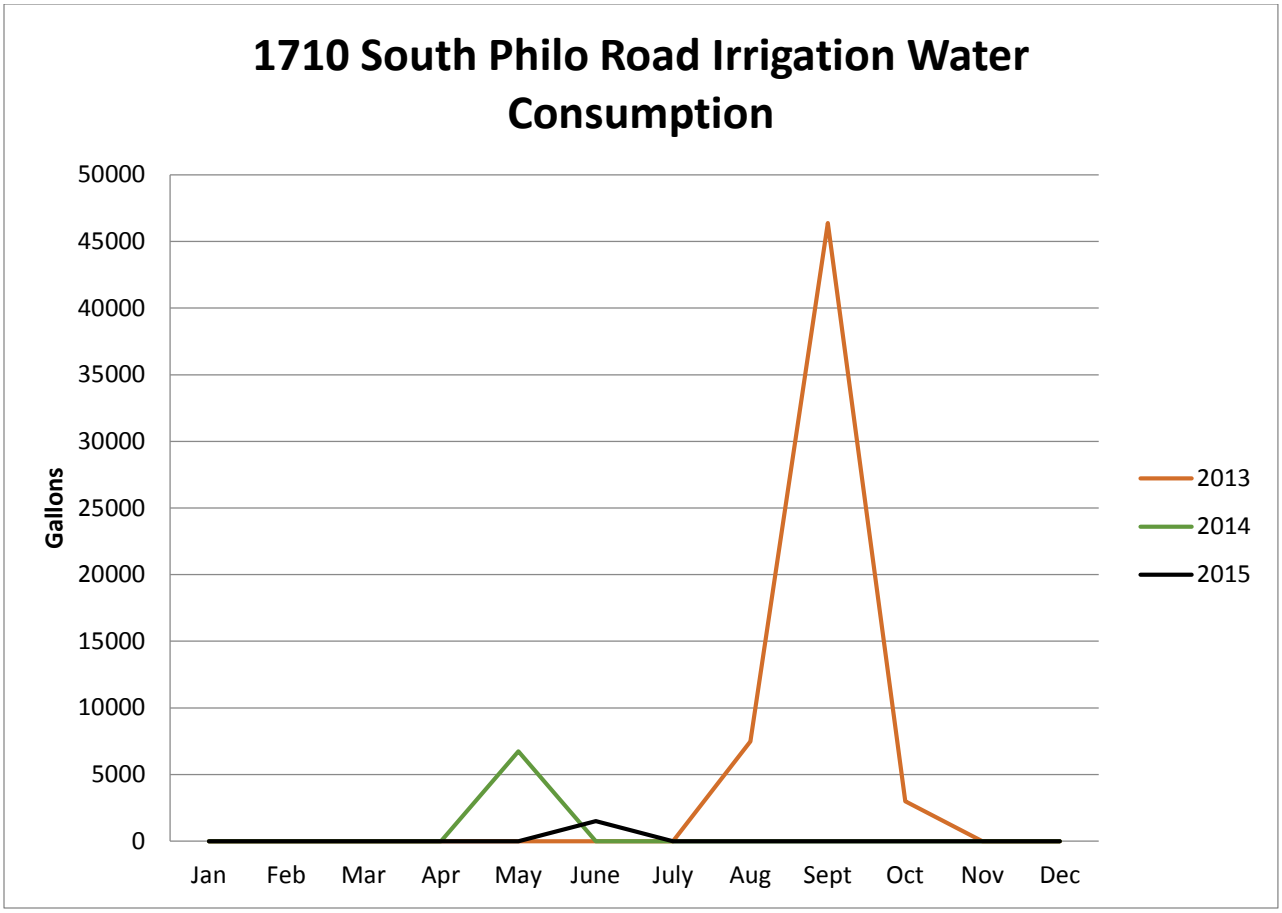

Figure 4: Water consumption at 1710 S. Philo Rd. over three years (sensors installed Oct. 2014).

Chapter 4: Conclusions and Recommendations

This study was inconclusive in determining the impacts of irrigation control sensors.

Project staff recommend and are committed to executing maintenance of irrigation control equipment as well as collection of irrigation water consumption data. Because irrigation use can fluctuate for several different reasons, it will be important to maintain the study conditions for multiple years to determine the conservation efficacy of irrigation control sensors. Project staff will furnish irrigation water consumption data upon request.

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Appendix A: Irrigation Consumption by Month for Three Study Locations

Table A-1 shows irrigation consumption for three locations by month. 211 N. Vine St. received a rain sensor control on its meter and this meter's subsequent use was compared to its historic use. Philo Road has one meter at 1710 South Philo Road and another meter at 1717 South Philo Road. These two meters are located on opposite sides of the same street, irrigating nearly identical spaces. The 1710 South Philo Road meter received an ET control (ET, rain sensor, freeze sensor). The 1717 South Philo Road retained its existing timer with no new equipment added.

Table A-1: Irrigation Water Consumption by Month

SERVICE	Month/Year	Gallons
1710 Philo - Irrig	Mar-12	0
1710 Philo - Irrig	Apr-12	34,500
1710 Philo - Irrig	May-12	33,750
1710 Philo - Irrig	Jun-12	34,500
1710 Philo - Irrig	Jul-12	36,000
1710 Philo - Irrig	Aug-12	7,500
1710 Philo - Irrig	Sep-12	0
1710 Philo - Irrig	Oct-12	0
1710 Philo - Irrig	Nov-12	0
1710 Philo - Irrig	Dec-12	0
1710 Philo - Irrig	Jan-13	0
1710 Philo - Irrig	Feb-13	0
1710 Philo - Irrig	Mar-13	0
1710 Philo - Irrig	Apr-13	0
1710 Philo - Irrig	May-13	0
1710 Philo - Irrig	Jun-13	0
1710 Philo - Irrig	Jul-13	0
1710 Philo - Irrig	Aug-13	7,480
1710 Philo - Irrig	Sep-13	46,376
1710 Philo - Irrig	Oct-13	2,992
1710 Philo - Irrig	Nov-13	0
1710 Philo - Irrig	Dec-13	0
1710 Philo - Irrig	Jan-13	0
1710 Philo - Irrig	Feb-14	0
1710 Philo - Irrig	Mar-14	0
1710 Philo - Irrig	Apr-14	6,732
1710 Philo - Irrig	May-14	0
1710 Philo - Irrig	Jun-14	0
1710 Philo - Irrig	Jul-14	0
1710 Philo - Irrig	Aug-14	0
1710 Philo - Irrig	Sep-14	0
1710 Philo - Irrig	Oct-14	0
1710 Philo - Irrig	Nov-14	0
1710 Philo - Irrig	Dec-14	0
1710 Philo - Irrig	Jan-15	0
1710 Philo - Irrig	Feb-15	0
1710 Philo - Irrig	Mar-15	0
1710 Philo - Irrig	Apr-15	0
1710 Philo - Irrig	May-15	0
1710 Philo - Irrig	Jun-15	1,496
1710 Philo - Irrig	Jul-15	0
1710 Philo - Irrig	Aug-15	0
1710 Philo - Irrig	Sep-15	0
1717 Philo - Irrig	Apr-12	1,500
1717 Philo - Irrig	May-12	26,250
1717 Philo - Irrig	Jun-12	25,500
1717 Philo - Irrig	Jul-12	24,750
1717 Philo - Irrig	Aug-12	27,750
1717 Philo - Irrig	Sep-12	6,000
1717 Philo - Irrig	Oct-12	0
1717 Philo - Irrig	Nov-12	0
1717 Philo - Irrig	Dec-12	0
1717 Philo - Irrig	Jan-13	0
1717 Philo - Irrig	Feb-13	0
1717 Philo - Irrig	Mar-13	0
1717 Philo - Irrig	Apr-13	0
1717 Philo - Irrig	May-13	0
1717 Philo - Irrig	Jun-13	0
1717 Philo - Irrig	Jul-13	0
1717 Philo - Irrig	Aug-13	9,724
1717 Philo - Irrig	Sep-13	19,448
1717 Philo - Irrig	Oct-13	2,992
1717 Philo - Irrig	Nov-13	0
1717 Philo - Irrig	Dec-13	0
1717 Philo - Irrig	Jan-13	0
1717 Philo - Irrig	Feb-14	0
1717 Philo - Irrig	Mar-14	0
1717 Philo - Irrig	Apr-14	0
1717 Philo - Irrig	May-14	3,740
1717 Philo - Irrig	Jun-14	0
1717 Philo - Irrig	Jul-14	0
1717 Philo - Irrig	Aug-14	0
1717 Philo - Irrig	Sep-14	0
1717 Philo - Irrig	Oct-14	0
1717 Philo - Irrig	Nov-14	0
1717 Philo - Irrig	Dec-14	0
1717 Philo - Irrig	Jan-15	0
1717 Philo - Irrig	Feb-15	0
1717 Philo - Irrig	Mar-15	0
1717 Philo - Irrig	Apr-15	0
1717 Philo - Irrig	May-15	0
1717 Philo - Irrig	Jun-15	0
1717 Philo - Irrig	Jul-15	0

1717 Philo - Irrig	Aug-15	0
1717 Philo - Irrig	Sep-15	0
211 N Vine - Irrig	Apr-12	5,250
211 N Vine - Irrig	May-12	0
211 N Vine - Irrig	Jun-12	1,500
211 N Vine - Irrig	Jul-12	27,750
211 N Vine - Irrig	Aug-12	39,750
211 N Vine - Irrig	Sep-12	13,500
211 N Vine - Irrig	Oct-12	6,000
211 N Vine - Irrig	Nov-12	0
211 N Vine - Irrig	Dec-12	0
211 N Vine - Irrig	Jan-13	0
211 N Vine - Irrig	Feb-13	0
211 N Vine - Irrig	Mar-13	0
211 N Vine - Irrig	Apr-13	0
211 N Vine - Irrig	May-13	0
211 N Vine - Irrig	Jun-13	0
211 N Vine - Irrig	Jul-13	0
211 N Vine - Irrig	Aug-13	0
211 N Vine - Irrig	Sep-13	0
211 N Vine - Irrig	Oct-13	0
211 N Vine - Irrig	Nov-13	1,496

211 N Vine - Irrig	Dec-13	9,724
211 N Vine - Irrig	Jan-14	0
211 N Vine - Irrig	Feb-14	0
211 N Vine - Irrig	Mar-14	0
211 N Vine - Irrig	Apr-14	0
211 N Vine - Irrig	May-14	1,496
211 N Vine - Irrig	Jun-14	0
211 N Vine - Irrig	Jul-14	0
211 N Vine - Irrig	Aug-14	0
211 N Vine - Irrig	Sep-14	0
211 N Vine - Irrig	Oct-14	10,472
211 N Vine - Irrig	Nov-14	0
211 N Vine - Irrig	Dec-14	0
211 N Vine - Irrig	Jan-15	0
211 N Vine - Irrig	Feb-15	0
211 N Vine - Irrig	Mar-15	0
211 N Vine - Irrig	Apr-15	0
211 N Vine - Irrig	May-15	0
211 N Vine - Irrig	Jun-15	0
211 N Vine - Irrig	Jul-15	0
211 N Vine - Irrig	Aug-15	0
211 N Vine - Irrig	Sep-15	0

Appendix B: Plant Health Inspection Forms and Photos

Project staff conducted monthly inspections of plant health to determine if the irrigation control sensors were delivering too little water to maintain proper plant health. There was no indication that plants were receiving insufficient water. Inspections labeled “Philo East” refer to 1710 S. Philo Rd. Inspections labeled “Philo West” refer to 1717 S. Philo Rd. Inspections labeled “Viaduct” refer to 211 N. Vine St.