

Sonoma County Water Agency

Badger Meter, Barnacle Pilot Program

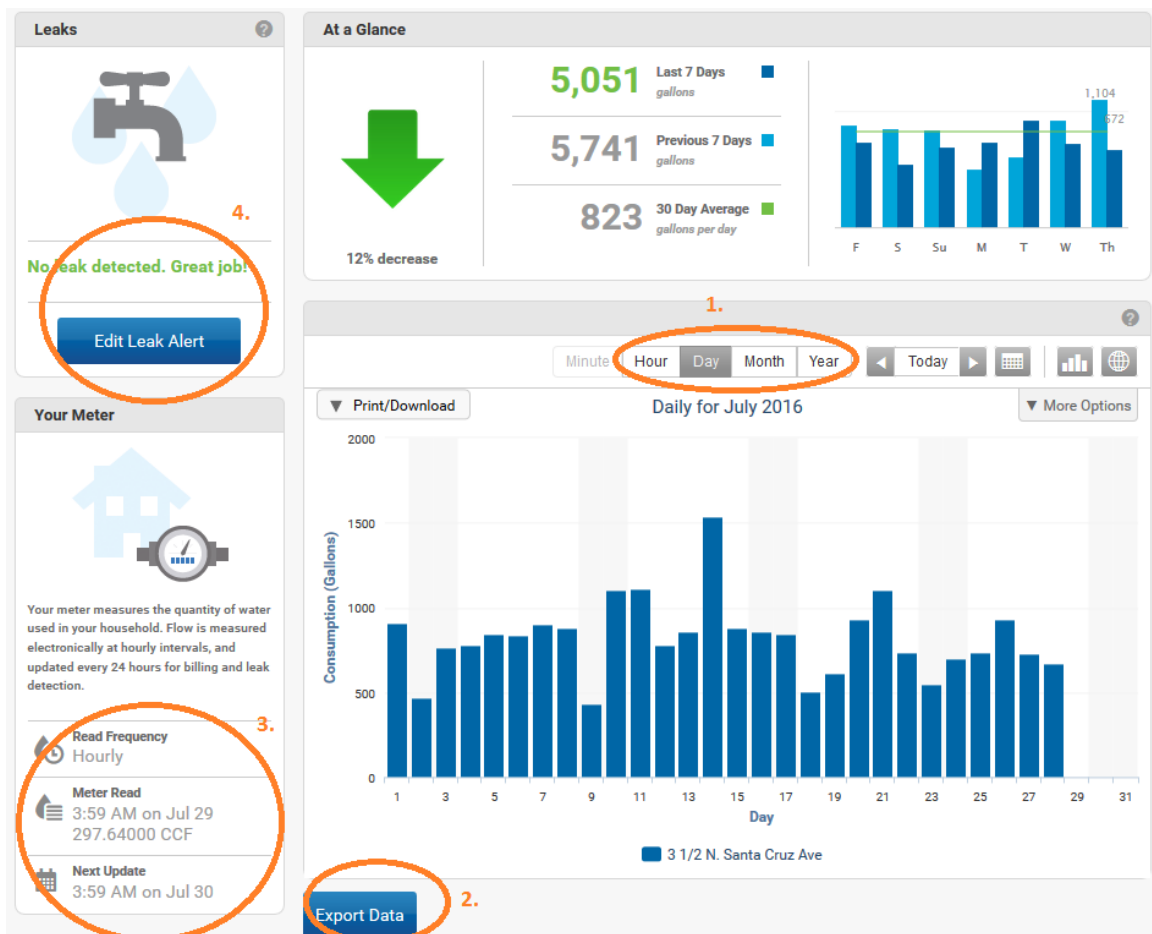
A Review of the Barnacle Pilot Program and Leak Prevalence in Customers with Barnacles

July 26, 2016

The Barnacle is a device manufactured by Badger Meter, which attaches to most water meters and monitors and records the water use. This data is captured in real time and sent once a day through cell phone networks to an online platform. In October 2014, the Sonoma County Water Agency (Agency) launched a year-long pilot program with 59 commercial, industrial, institutional, multi-family and single-family accounts to monitor their water use through the Barnacle.

The purpose of the pilot study was to assist customers in understanding their water use, monitor the number and duration of water leaks, and determine the engagement of the customers with their water use data.

The Barnacle online platform provided information on yearly, monthly, daily and hourly use from a water meter (1). All data is able to be exported into a Microsoft Excel sheet for sorting and filtering (2). Information is also provided about the read frequency, when the meter was last read and the next planned transmission of data (3). Finally, there is the capability to set leak alerts which will send out an email or text warning of constant use at a site (4). Unfortunately this feature was not used frequently by the participants.



In 2012 the Agency first purchased Barnacles from Aquacue, a start-up from Silicon Valley for a onetime fee of \$350 per unit and \$180 yearly per unit for the online platform. When Aquacue was purchased by Badger Meter in 2013, the unit cost became a onetime fee of \$390 per unit and a yearly ongoing cost of \$60 for the online platform. Later that same year the cost for the unit was a onetime fee of \$135 per unit and a yearly fee of \$120. In 2014, because the units were no longer being produced by Badger meter and the technology is now obsolete, Badger meter offered the Agency the units for free with an ongoing fee of \$10 per month per unit for the online platform.

Participants

The Water Agency worked with its water retailers to recruit customers that the retailers thought would benefit from the program because of past high water use, unexplained water use increases or an expressed interest in water use efficiency. 59 different accounts were chosen with 69 Barnacles distributed due to compound meters. Below is a table that describes the distribution of Barnacles across type of customers and meter type.

Type of Customer	Irrigation Meters	Domestic Meters	Mixed Use Meters
Group Living (Retirement Home, Group Home, Apartment Building)		1	1
Hospitals		3	
Libraries		1	
Office Buildings	17	5	6
Parks and HOA Irrigation	3		
Retail Outlets			
Schools	9	7	2
Single Family Homes			4
Total	29	17	13

Although 59 different locations participated in the pilot program, these locations were controlled by only 16 entities, either property managers, facilities staff or single family homeowners.

The City of Sonoma and The Town of Windsor requested that their customers or the City itself install the Barnacles. The Cities of Santa Rosa and Petaluma and North Marin Water District requested that the Agency install the Barnacles for their customers. Installation includes strapping the Barnacle to the face of the meter and then placing a magnet on the side of the unit until it emits one beep. Additionally, the unit then needs to be activated through the online platform.

Training

On November 12, 2014, a training was hosted at the Water Agency for the participating customers to learn about the Barnacle, the installation process, the online platform and answer any questions they might have had about the program. Several staff from Badger Meter also attended the meeting to discuss the technology of the Barnacle and answer questions about the program.

During this meeting the Barnacles were distributed to the customers and the Participation (Appendix A) and Water History Release Forms (Appendix B) were collected.

A few customers were not able to attend the meeting. Follow up calls and emails occurred individually to train them on the Barnacle.

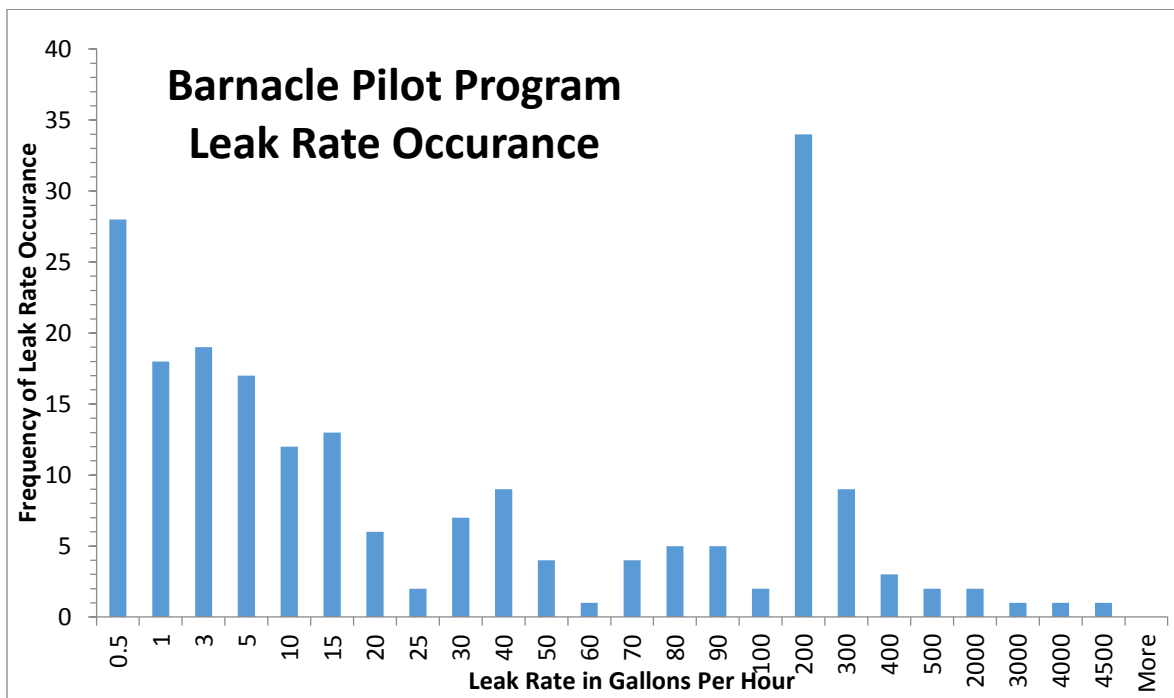
Water Leaks

One of the most interesting aspects of the Barnacle is its leak detection ability. A leak in the Barnacle system is defined as constant use of water over a 24 hour or more period. This definition therefore captures locations that are expected to have continuous use, such as some commercial and institutional entities.

Through this pilot program, many leaks were discovered. 36% of the meters had no leak at any time during the approximately one year pilot program. However, 64% of meters experienced a leak at least once during the pilot program. One meter had 14 separate leaks during the year long program.

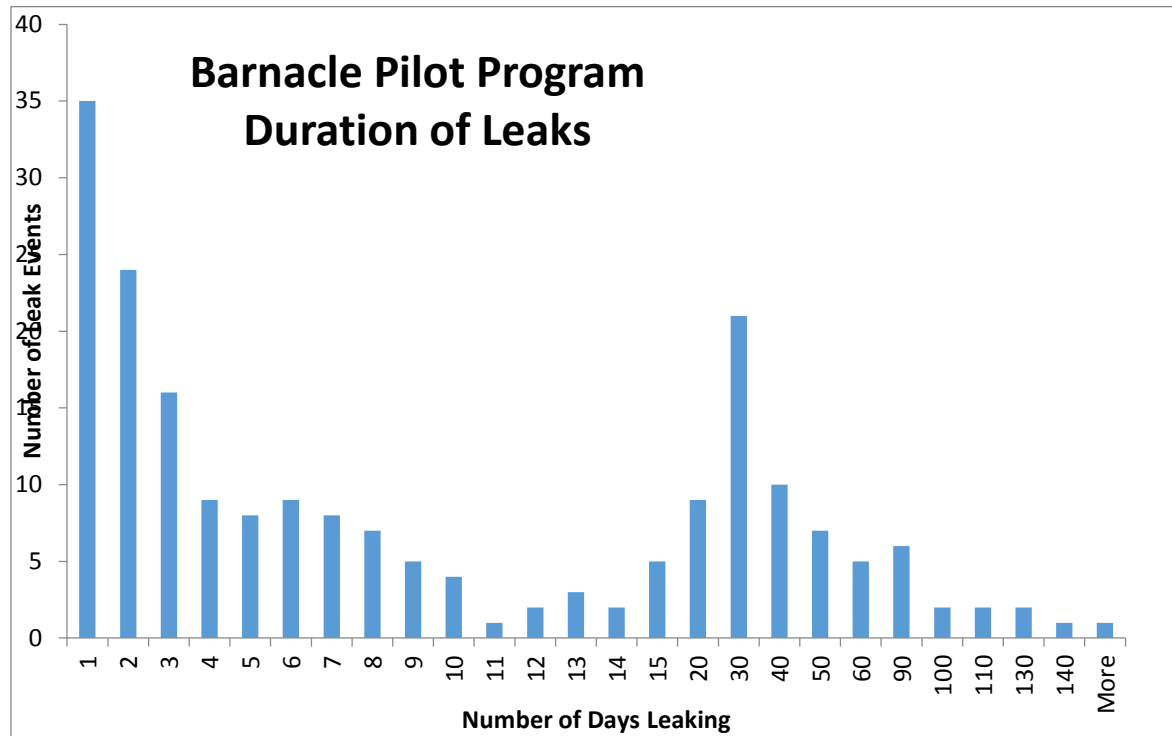
Of the locations that had a leak, the leaks ranged from 0.08 gallons per hour to 4,300 gallons per hour with the average being 117 gallons per hour. When removing this peak leak, the average gallons per hour leaked dropped to 100.

Below is a chart of the distribution of water leaks by gallons per hour. As shown, many leaks that occurred were in the less than 1 gallons per hour range, although there were also many leaks in the 200 gallons per hour range.



The duration of the leaks ranged from 1 day to 245 days with an average duration of leaking lasting 15 days. Since all the locations with the Barnacles have either a monthly or bimonthly billing cycle this 15 day repair time points to customers using the Barnacle or other means to find and fix their leaks prior to receiving their water bill.

Below is a chart that shows the average duration of water leaks during the pilot program. Most leaks were in the one to ten day range, with a few leaks lasting up to 140 days or more.



Below is a table by water retailers of water and money lost from leaks.

Water Retailer	Number of pilot program participants	Number of locations that experienced a leak	Total Gallons Leaked	Acre Feet Leaked	Total Money Lost Due to Leak
Petaluma	24	13	10,035,588	30.80	\$ 105,475
Santa Rosa	11	8	72,992	0.22	\$ 1,228
North Marin Water District	9	7	1,268,733	3.89	\$ 9,768
Windsor	7	7	620,852	1.91	\$ 9,040
Sonoma	8	3	249,384	0.77	\$ 48,966
Total	59	38	12,247,549	37.59	\$174,476

The participants in this pilot program were selected by the water retailers specifically because of unusual past usage, high water use that was possibly caused by a leak or because of the participant’s dedication to water use efficiency and interest in learning more. In other words, this sample was not random and should not be used to characterize the service area’s average leak rate.

Customer Survey

In August 2015, a survey was sent out to all participating customers to receive feedback about the program. 13 customers responded to the survey which is an 81% response rate. The full responses to the survey are in Appendix D.

The first question asked how often customers checked the online platform to see their water use. The majority stated that they checked the platform monthly. The next highest category was weekly and one person each answered “quarterly”, “a few times this last year” and “when I thought I might have had a leak”.

Another question asked whether or not they implemented any water saving changes because of the Barnacle. The results were mixed with about 53% of participants answering yes and the remaining customers answering no. Interestingly, one customer who retrofitted about 80 toilets with high efficiency toilets to save water during the time they had the Barnacle on their meter, stated that they did not implement any water saving measures due to the Barnacle.

One aspect of the online platform – signing up for a leak alert was under-utilized and could have been better emphasized at the training. The majority of participants (69%) did not sign up for this function with one customer commenting that he did not know this function existed. Another thought that the Water Agency was going to set the leak alert up for them. This function, although easy to set up, does require frequent fine tuning after the installation of the Barnacle to ensure that false leaks are not reported, or that small leaks are not passed over.

When asked what customers liked the most about the Barnacle, the two answers with the most responses were “Easy to use online platform” and “Helpful in understanding water use patterns”. About 53% of people also responded that “Leak detection earlier than through the monthly bill” was important. 23% said that the data was, “Helpful in providing information to a Board or supervisor about the company’s water use”.

Conversely, when asked what customers disliked the most about the Barnacle, 62% of people said “Malfunctioning Barnacle”. This could include a dead battery on the Barnacle, which happened multiple times for most customers, or data not displaying properly. One customer commented, “Seems like the days of the week are offset. For instance water use was down in the recent hot spell, when I know I applied more water by hand outside. Conversely, water use was up when the temperature is lower and I didn’t apply additional water”. 50% of customers also stated that they did not have enough time during their day to review the water use.

The last question on the survey asked customers if they thought that the Barnacle helped them save water. The majority (61%) answered in the affirmative and added these comments, “We have definitely saved water. I love this program.” and “We could see what the water usage was week to week and where we could cut back.” 38% of customers did not think the Barnacle saved them water and left the following comments, “But I think it could if we analyzed water usage on a weekly basis.” and “it’s hard to save water when the Governor mandates water use restrictions and you let your turf die.”

The start of the pilot program coincided with the start of the fourth year of drought and followed the driest year on record in Sonoma County. It also overlapped with the Governor of California’s drought declaration and mandatory water use reductions throughout the State. These factors influenced any

potential savings from the pilot program due to the Barnacle and make parsing out the savings specifically due to the Barnacle virtually impossible.

Conclusion

The Barnacle pilot program provided useful information to customers, the water retailers and the Agency that helped save water, and inform the conversation about water leaks in our service area. This technology is inexpensive to deploy, non-invasive, and easy to install in that it does not require cutting of any pipe. The downsides of the Barnacle however are also numerous. The Barnacle is now obsolete technology that is no longer supported by Badger meter, decreasing available technical support. The battery life of the unit is unpredictable and can range from a few days to four months. Additionally there is no warning of a decreasing battery, the unit will simply stop capturing reads but does not provide an alert that it is no longer working. The online platform on the back end of the technology is cumbersome and difficult to use. The export data function only captures current leaks, it does not retain past leak rate or duration meaning that this data must be captured manually. Finally, the Barnacle uses cell phone technology to transmit the water use data so if cell reception is spotty at a location the unit is not able to transmit the data at all or will transmit only a small portion of the available reads it captures during that period.

An ideal tool for leak detection and real time water use information would include/be:

- non-invasive, straps onto the water meter
- inexpensive
- easy to navigate online customer-facing platform
- minimum battery life of one year ideally with a way to replace or charge the battery at that time
- a low battery alert system via automatic email or phone call
- step-by-step instructions on how to install, monitor and swap Barnacles
- ability to export water use data including past leak rate and duration
- ability to enhance cell signal through use of an antenna on the unit
- customer service for trouble shooting

This type of technology is a valuable tool to save water and should be implemented on a wide scale. However, the Barnacle is not the tool for this job due to the reasons discussed above. A similar technology that combines the useful features of the Barnacle as well as fixes the problems of the current Barnacles, should be sought out and implemented.

Badger Meter Barnacle Pilot Program Agreement

The Barnacle is a device that fits to any water meter and reads the water passing through the meter. This data is read in real time and sent once a day through the cell phone network to a website that can be accessed from anywhere in the world. This technology has been in place for several years, and has been used by property managers, water utilities, school campuses and parks to save water. With this pilot study, the Sonoma County Water Agency (the Agency) will evaluate the extent to which the Barnacle helps users save water by allowing users to monitor their use before their next bill and detecting leaks as soon as they start.

To participate in this study you must meet the following terms and conditions:

- Agree to install the Barnacle on at least one meter on your property;
- Obtain consent to install the Barnacle on your meter from any applicable owners, property managers, utility company, or other partners;
- Keep the Barnacle on your selected meter for 12 months without removing it or moving it to a different meter during that time;
- Be a water customer of one of the Sonoma-Marín Saving Water Partnership member agencies (<http://www.savingwaterpartnership.org/>);
- Agree to release historical and future water use data to the Agency for statistical purposes;
- Agree to an onsite inspection and verification pre- and post-installation; and
- Be able to attend one training on how to install and use the Barnacle.

The Sonoma County Water Agency commits to:

- Provide Barnacle(s) and the Wave platform at no charge to eligible customers for 12 months;
- Offer training on the installation and use of the Barnacle;
- Facilitate the installation and initial monitoring of the Barnacle;
- Respond to phone, email and in person questions from participating customers; and
- Prepare a final report about water savings achieved, for the public with personalized information removed.

The steps to participate include:

1. Contact your water provider to verify your eligibility to participate.
2. Sign this agreement, certifying that you have read and understand the above terms and conditions.
3. Submit this form to both your water provider and Claire Nordlie at the Sonoma County Water Agency (Claire.Nordlie@scwa.ca.gov).
4. Sign up for one training by contacting Claire Nordlie at the email above or at 707-524-1165.
5. Attend the training and receive your Barnacle(s).
6. Install the Barnacle(s) and sign up for the Wave platform.

7. If at the end of 12 months you decide to continue to use the Barnacle hardware and the Wave platform **you will be solely responsible for the cost** (approximately \$10.00 / month for the Wave platform.)

By signing below, you agree to the above terms and the following:

I am the owner, lessee or property manager of the property, and I am signing below on behalf of myself and, if applicable, the Company named below ("Participant"). Participant agrees to install, maintain, and manage the use of the Barnacle for a minimum of one (1) year. During this period, Participant agrees to give Sonoma County Water Agency ("Water Agency") and Participant's water provider permission to enter Participant's property for the purpose of conducting installation verification of the Barnacle. Participant agrees that participation in this program does not exempt Participant from any water use ordinances that may become or are already in effect, including imposed landscape watering restrictions during periods of drought. Participant remains responsible for complying with all applicable laws, ordinances, and restrictions.

Participant agrees to release, defend, indemnify, protect, and hold harmless the Water Agency, their agents, officers, and employees, and Participant's water provider, their agents, officers, and employees, from and against any and all costs or expenses, including attorneys' fees, and all claims asserted or liability established for costs or expenses including attorneys' fees, and/or damages or injuries to any persons or property, or from conditions on my property arising out of or in connection with the Badger Meter Barnacle Pilot Program; provided, however, that Participant's duty to indemnify and hold harmless shall not include any liability arising from the established sole negligence or willful misconduct of Water Agency, their agents, officers or employees, in performing the above described work or services.

_____ Company	_____ Print Name
_____ Signature	_____ Date

Appendix B: Water History Release Form

Water History Release Form

I, _____, authorize the Sonoma County Water Agency to be given access to all current and historical water use data information for:

Account Number	Service Address

This release form is valid from the date executed below until _____.

I declare under penalty of perjury under laws of the State of California that I am authorized to execute this release form, and hereby release the Sonoma County Water Agency from any liability, claims, demands, causes of action, damages, or expenses arising out of this release of information. I understand that I may revoke this authorization by submitting a written request to: Sonoma County Water Agency, Attn: Water Use Efficiency, Claire Nordlie, 404 Aviation Blvd., Santa Rosa, CA 95403.

(Water Service Customer Signature)

(Date)

Barnacle Installation Sheet

Company Name			
Location Address and Zip Code			
Location Name (school name)			
Meter Type	(Domestic)	(Irrigation)	(Mixed)
Customer Type	(Single Family)	(Multi-Family)	(Commercial)
Meter Units (Circle One)	(Cu Ft)	(Gallons)	
Meter Manufacturer and Model			
Meter Size			
Compound Meter	(Yes)	(No)	
Meter Number			
Barnacle Serial Number			
Cover Type for Pit/Vault (Circle One)	(Metal Cover)	(Concrete Cover)	(Plastic Cover)
	(Concrete Cover w/Metal Door)	(Above Ground)	

Please send to Claire Nordlie:

Claire.Nordlie@scwa.ca.gov

or

Sonoma County Water Agency

Attention: Claire Nordlie

404 Aviation Blvd

Santa Rosa, CA 95403

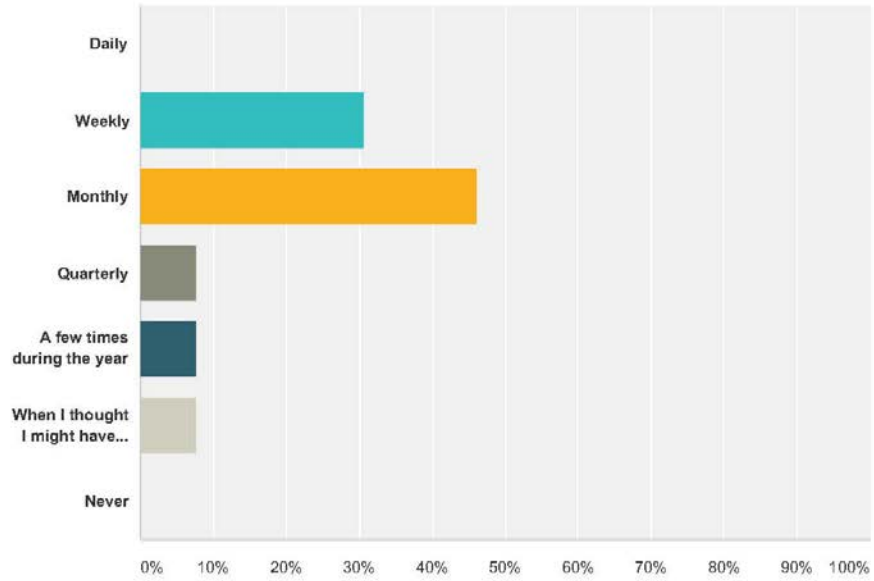
Appendix D: Customer Survey results

Barnacle Pilot Program Feedback

SurveyMonkey

Q2 On average, approximately how often did you check your water use through the Barnacle online platform?

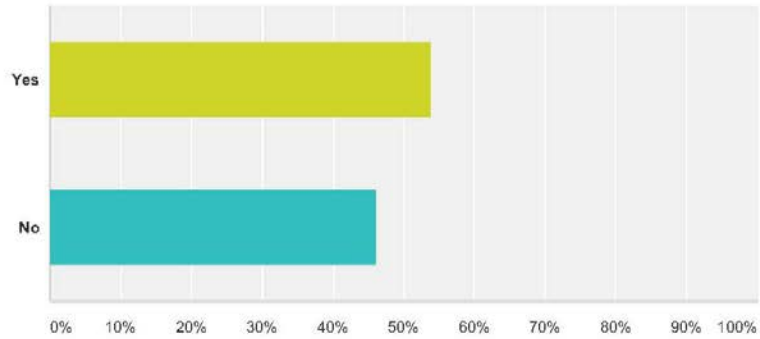
Answered: 13 Skipped: 0



Answer Choices	Responses
Daily	0.00% 0
Weekly	30.77% 4
Monthly	46.15% 6
Quarterly	7.69% 1
A few times during the year	7.69% 1
When I thought I might have had a leak	7.69% 1
Never	0.00% 0
Total Respondents: 13	

Q3 Did your company implement any water saving measures or behaviors because of the Barnacle?

Answered: 13 Skipped: 0

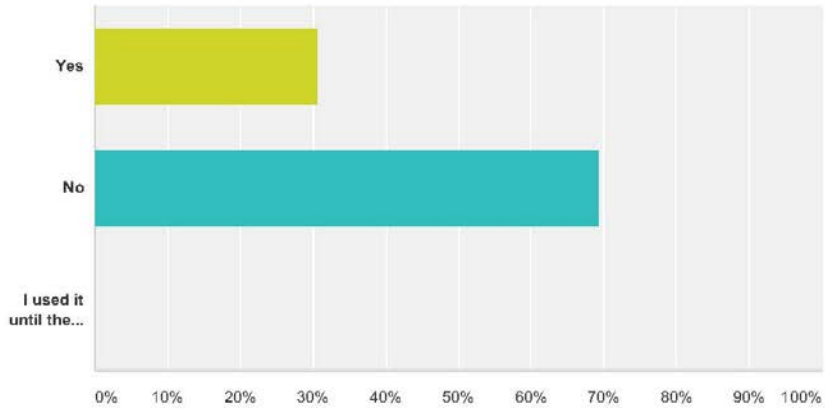


Answer Choices	Responses	
Yes	53.85%	7
No	46.15%	6
Total		13

#	Please explain what measures you implemented, if any.	Date
1	But the information from the Barnacles helped us to see the effect of our measures	9/23/2015 2:39 PM
2	All staff and residents are aware of our barnacle which has tied in perfectly with the drought. We have all discussed from turning water off while shaving to using less water when washing dishes and pots and pans, cut back and repairs with irrigation and everything in-between	9/22/2015 12:55 PM
3	I was able to track how much water my drip system used and realized that the timer was set incorrectly after a power failure resulting in daily watering not every 3 days. By using the Barnacle system I was able to find and correct this problem sooner.	9/22/2015 9:36 AM
4	Irrigation was cut back.	9/16/2015 10:10 AM
5	help us with programming and meeting water budgets	9/16/2015 8:19 AM
6	Follow up with water customers in response to SCWA alert.	9/15/2015 4:16 PM
7	The MMWD notified us on a few occasions to let us know of leaks. We were able to view when they started and if we thought we fixed the issue. It is great to be able to view the activity without having to visit the site. Sometimes, it simply requires the Landscaper to respond, make an adjustment, and then we can confirm from our office that it had been fixed.	9/15/2015 2:01 PM
8	This Barnacle was installed at a single family residence.	9/15/2015 1:58 PM

Q4 Did you use the leak alert email notice service through the Barnacle online platform?

Answered: 13 Skipped: 0

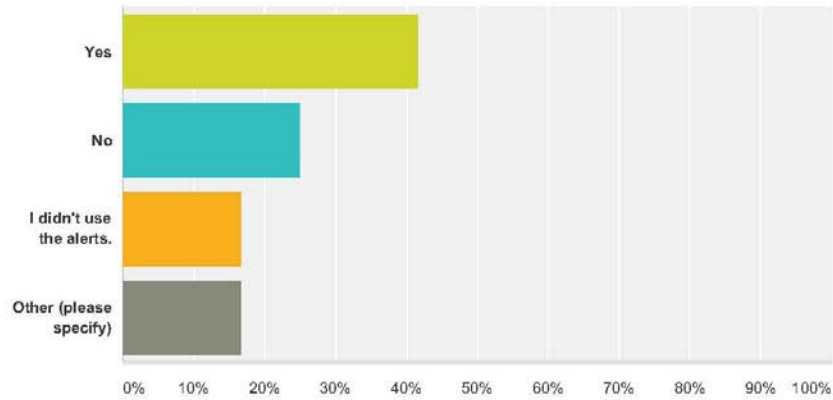


Answer Choices	Responses
Yes	30.77% 4
No	69.23% 9
I used it until the emails seemed to come too often.	0.00% 0
Total	13

#	If not, why?	Date
1	We are 24 hour operation. There is always water usage.	9/23/2015 2:39 PM
2	Was not aware	9/22/2015 12:55 PM
3	These were for our own water meters I alerted our crew when a leak alert was noted.	9/16/2015 10:10 AM
4	I'm not sure if it had been set up properly. We would receive notifications from Clair at MMWD rather than the notifications from the barnacle website.	9/15/2015 2:01 PM

Q5 Did the leak alerts cause you to take action to fix / investigate the leak?

Answered: 12 Skipped: 1

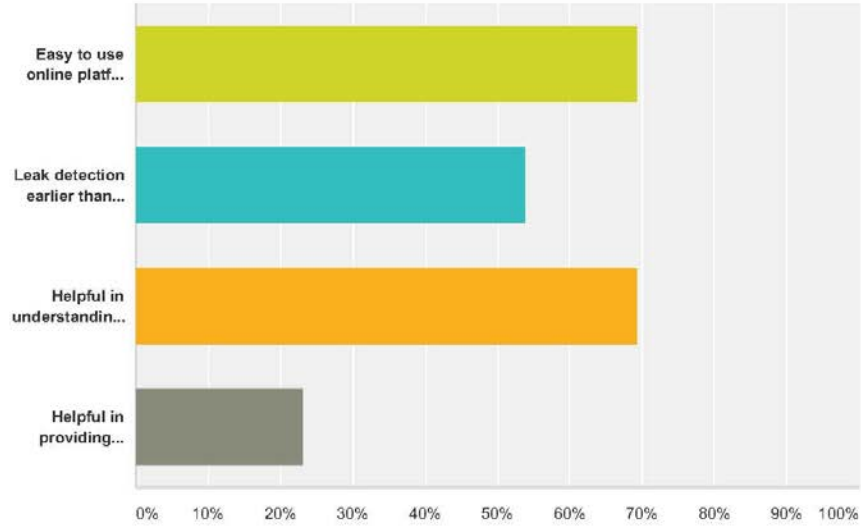


Answer Choices	Responses
Yes	41.67% 5
No	25.00% 3
I didn't use the alerts.	16.67% 2
Other (please specify)	16.67% 2
Total	12

#	Other (please specify)	Date
1	We ignored leak alert because we operate 24/7	9/23/2015 2:39 PM
2	I didn't have any leaks identified by the Barnacle.	9/15/2015 1:58 PM

Q6 What did you like most about the Barnacle? Please check all that apply.

Answered: 13 Skipped: 0

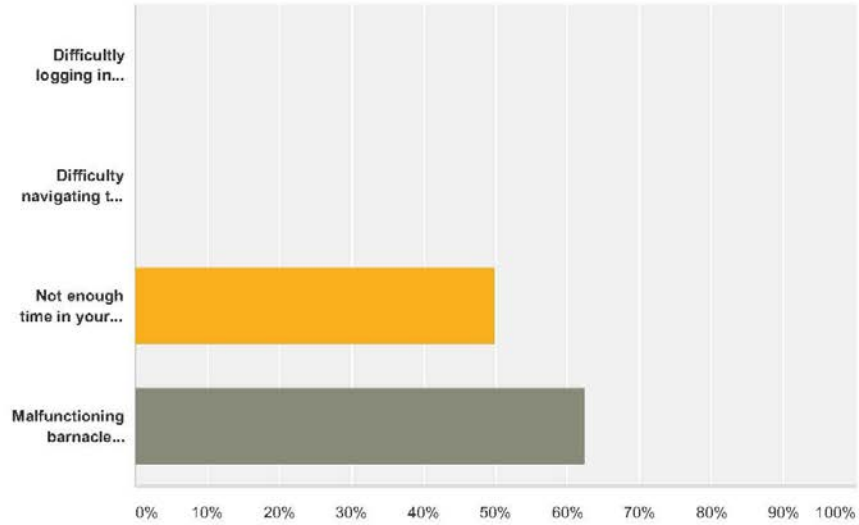


Answer Choices	Responses
Easy to use online platform (navigation, found the information you wanted)	69.23% 9
Leak detection earlier than through your monthly / bi-monthly water bill	53.85% 7
Helpful in understanding your water use patterns	69.23% 9
Helpful in providing information to your Board or supervisor about the company's water use	23.08% 3
Total Respondents: 13	

#	Other (please specify)	Date
1	Being more aware	9/22/2015 12:55 PM

Q7 What was your biggest hurdle in using the Barnacle? Please check all that apply.

Answered: 8 Skipped: 5

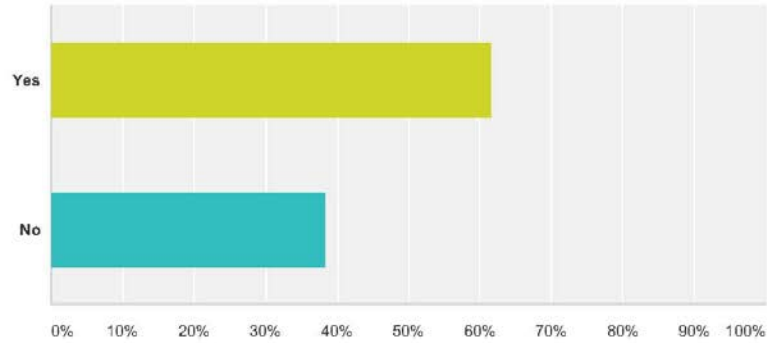


Answer Choices	Responses
Difficulty logging in (lost password or username etc)	0.00% 0
Difficulty navigating the online platform (hard to understand, couldn't find information)	0.00% 0
Not enough time in your work day to look at your water use	50.00% 4
Malfunctioning barnacle (includes dead battery etc)	62.50% 5
Total Respondents: 8	

#	Other (please specify)	Date
1	Not a big deal, had 2 dead batteries but had them replaced in a short amount of time.	9/22/2015 12:55 PM
2	Towards the beginning this was an issue but thanks to Claire's diligence this hurdle was overcome.	9/18/2015 3:29 PM
3	After viewing the daily consistency of water use, there was little point in logging in review it again.	9/17/2015 8:48 AM
4	Seems like the days of the week are offset. For instance water use was down in the recent hot spell, when I know I applied more water by hand outside. Conversely, water use was up when the temperature is lower and I didn't apply additional water.	9/15/2015 1:58 PM

Q8 Do you think the Barnacle helped you save water at your company?

Answered: 13 Skipped: 0



Answer Choices	Responses	
Yes	61.54%	8
No	38.46%	5
Total		13

#	Elaborate as desired.	Date
1	But I think it could if we analyzed water usage on a weekly basis.	9/23/2015 2:39 PM
2	We have most definitely saved water. I love this program	9/22/2015 12:55 PM
3	Yes for my personal residence. See comment above about timer malfunction.	9/22/2015 9:36 AM
4	We could see what the water usage was week to week and where we could cut back.	9/16/2015 10:10 AM
5	Helped us find leaks immediately, rather than waiting for large increases on the bills.	9/15/2015 2:01 PM
6	It's hard to save more water when the Governor mandates water use restrictions and you let your turf die.	9/15/2015 1:58 PM
7	potentially if used regularly	9/15/2015 1:52 PM