



# ADVANCED METERING INFRASTRUCTURE (AMI) 101



Crescenta Valley Water District  
October 7, 2020



## AMI – Definition

### Advanced Metering Infrastructure (AMI)

is an integrated **system** of:

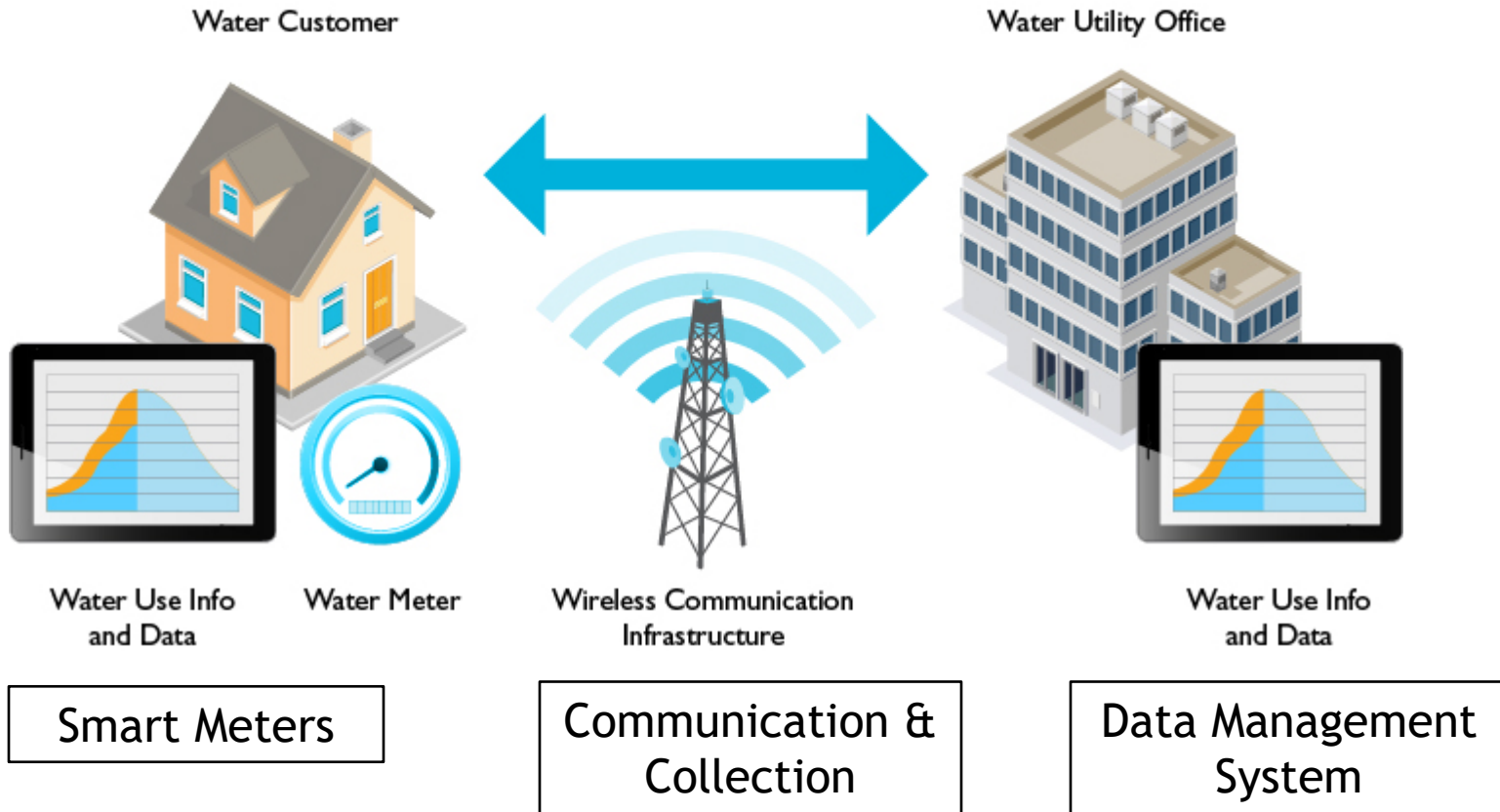
A. Smart meters

B. Communications network

C. Data management system

that enables two-way communication between CVWD and the water meter.

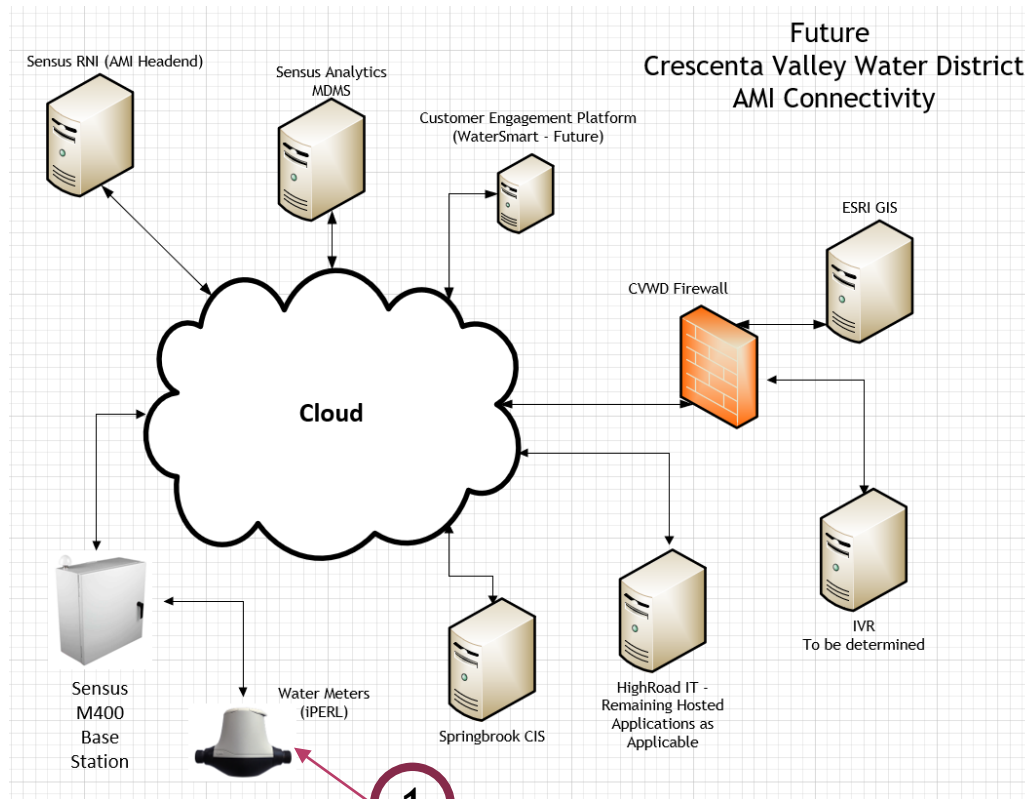
# AMI – Components



# AMI – Terms & Definition

<u>Acronym/Term</u>	<u>Definition</u>	<u>Common Terms</u>
AMI	Advanced Metering Infrastructure	Smart Meter, End Points, Collectors, etc..
Smart Meter	Meter that reads, transmits and stores data	iPERL meters
AMI Endpoint	Device that sends data from the meter to a collection point	SmartPoint, “Mushroom”, the radio
AMI Collector	Receives data via RF from AMI Endpoint – called M400B Base Station	Base Station
Command Link	Bluetooth device to connect to meter during installation/configuration	Handheld programming device
AMI Repeater	Relays RF from the AMI Endpoint to the AMI Collector	Middleman between Smart Point and Base Station (if required)
Backhaul Communications	Facilitates transfer of data from AMI Collector to AMI Head-end	Method to transfer or send data to the internet cloud and Sensus RNI such as Cellular Modem
AMI Head-end	Accepts data from AMI Collector via Cellular Backhaul Communications	The RNI. A hosted, Cloud (web) based environment
Proof of Concept	A controlled deployment methodology focusing on system integration and data verification	Install SmartPoints & lids at 100 meters in different locations throughout the District to verify getting information
MDMS	Meter Data Management System	Software that takes the data from the AMI Head-end (RNI) and evaluates it for completeness, Enables CSRs to better understand customer water usage
Sensus Analytics Software	Sensus software tool to display the meter interval read data.	An MDMS. Loads meter interval read data received from the RNI. Sends data to the CEP and CIS
CIS	Customer Information System	For CVWD – Springbrook billing software
CEP	Customer Engagement Portal	Software that engages with CVWD customers through a customer portal. Allows for customer Information & payments
RNI	Regional Network Interface – the Xylem Headend	Software located within the AMI Collector that collects and transmits data to AMI Head-end
NaaS	“Network as a service” is infrastructure owned and serviced by others, not CVWD	Not being used at CVWD. Its hardware is owned by Utility but supported by Aqua-Metric with a Service Agreement
SaaS	Software as a service (or SaaS) is a way of delivering applications over the Internet as a service.	A software application hosted in the Cloud managed by Aqua-Metric. Establishes Service Level Agreements (SLAs) for performance metrics and service guarantees.
Xylem and Sensus	Sensus is the brand, Xylem owns Sensus	This will be Sensus technology for your AMI deployment
Aqua-Metric	The Sensus local distributor	Aqua-Metric will be managing and servicing the AMI network

# Smart Meters – The Starting Point



## Water Meters:

- ¾" & 1" meter – IPEARL – Sensus and Aqua-Metric
- 1-½" meter – OMNI - Sensus
- 2", 3" & 4" meters – Octave Ultrasonic Meter – Master Meter

# The iPERL Smart Meter

## Water Meter:

- ¾" & 1" meter – Sensus iPERL
- All-electronic, programmable, 9-digit register, hermetically sealed (IP68 rated) with a tempered glass cover
- **20-year** battery life design
  - 15/5 prorated guarantee
  - Meters installed in 2012 should last until 2032
- Interval data with ability to capture about 1,100 data points (Up to 45 days of hourly reads – 24 per day)
- Monitoring alarms:
  - leak detection, reverse flow, empty pipe, magnetic tampering and battery life
- Connects from Smart Meter to Smart Point by a 2-wire connector. Also called TouchCoupler. (if spliced, and these will not be, the term 'pig-tail' has been used)



# SmartPoint M520

## SmartPoint M520:

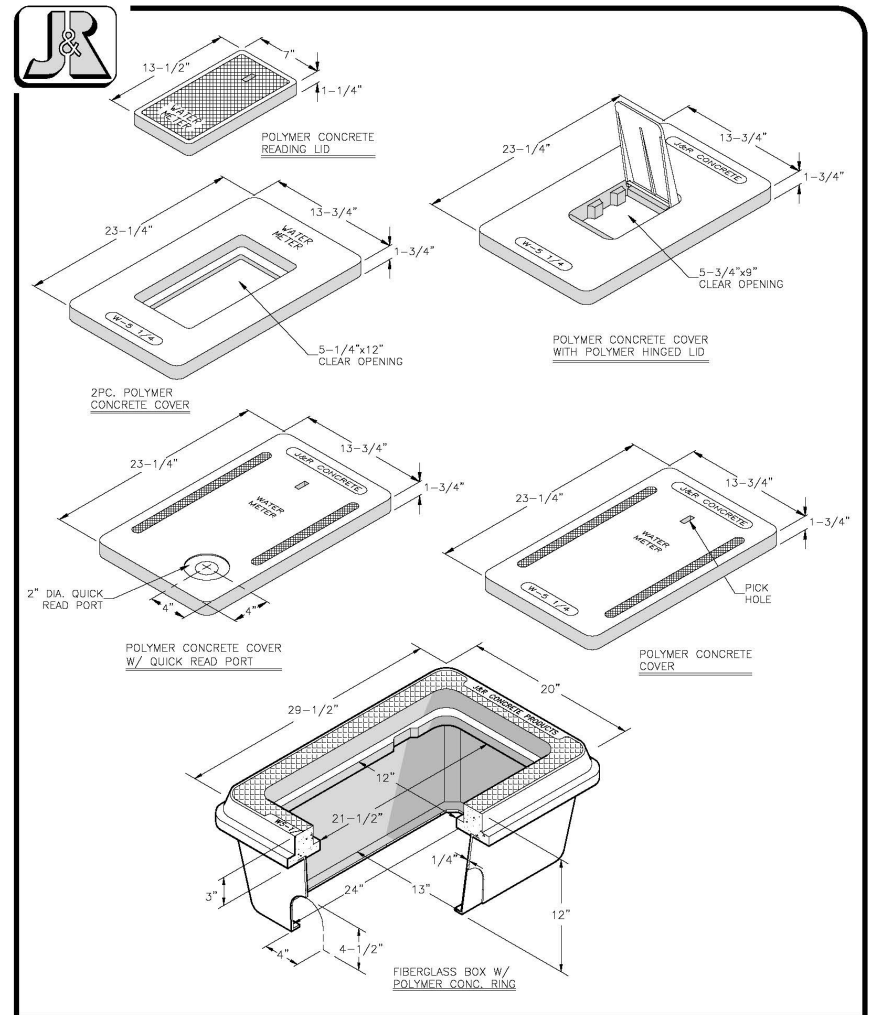
- Radio Transceiver which collects & sends data. Also called “Mushroom”. Recessed in lid to prevent tripping.
- Collects (or holds) data from the meter register
- Transmits data to the AMI Network base by radio frequency between 900-950 MHz
- Future – two-way communications (i.e. turn-off meter)
- Installed through the Water Meter Box Lid
  - Top – Exposed Mushroom with an antenna that transmits data
  - Bottom – Small computer that holds data and alerts
  - **20-year** battery life design (15/5 prorated guarantee)
- Readings and other messages/alerts are transmitted to the Base Station or Collector and then to the Regional Network Interface (RNI)<sup>™</sup>.
- After SmartPoint is installed, meter Communications is established between the RNI and the meter by using the Meter Serial No. and M520 (MXU) ID as the meter’s “unique” number.



# Water Meter Boxes & Lids

## Standard Meter Box:

- J&R Concrete Products
- P-W5-1/4 Series – Polymer Concrete Meter Box
- Lid – Polymer or Metal
- **Action Item:** Are Polymer Meter Box and Lid rated for H-20 loading?
- **Action Item:** Can we replace Metal lids with Polymer Lids?
- **Action Item:** Does J & R have a lid with AMI Port and reading lid?



P-W5 1/4 SERIES POLYMER  
CONCRETE METER BOX

**J&R CONCRETE PRODUCTS**

440 W. MARKHAM ST.  
PERRIS, CA. 92571  
PHONE:(951) 943-5855 FAX:(951) 940-9207

# Water Meter Boxes & Lids

- CVWD has at least 30 different type of meter boxes and lids.

## Survey of Existing Meter Box Lid Sizes and Manufacturers - Zones 6 - 11

ID No.	No. of Lids	Meter Box # or Model	Catalog Size	Manuf.	Concrete Lid	Curve-shape Lid	Square-shape Lid	Lid covers all of Box	Lid fits inside Box	Metal Lid	Curve-shape Lid	Square-shape Lid	Lid covers all of Box	Lid fits inside Box
1	5	W3	14.50 x 8.75	J & R	1	0	1	0	1	4	0	4	0	4
2	6	W3-1/2	15.38 x 10.00	J & R	5	0	5	0	5	1	0	1	0	1
3	262	W-4.0	19.00 x 10.75	J & R	234	230	4	0	234	28	28	0	0	28
4	239	W-4-1/2	18.13 x 11.25	J & R	200	4	196	1	199	39	2	38	2	38
5	436	W5-1/4	23.25 x 13.75	J & R	412	4	408	2	410	24	0	24	9	15
6	110	W5-1/2	27.00 x 15.50	J & R	3	0	3	3	0	107	4	104	100	8
7	3	W6B	30.62 x 17.62	J & R	3	0	3	0	3	0	0	0	0	0
8	1	3	9.00 x 14.50	H & C	1	0	1	0	1	0	0	0	0	0
9	59	433	18.88 x 10.63	H & C	59	57	2	0	59	0	0	0	0	0
10	150	437	18.25 x 11.25	H & C	141	3	138	0	141	9	0	9	0	9
11	9	438	23.25 x 13.75	H & C	8	0	8	0	8	1	0	1	0	1
12	4	No. 3	14.50 x 8.75	Brooks	2	2	0	0	2	2	0	2	0	2
13	16	No. 36	15.25 x 10.00	Brooks	13	4	9	0	13	3	0	3	0	3
14	268	No. 37	18.00 x 11.25	Brooks	221	5	216	0	221	47	1	46	1	46
15	3	No. 38	23.25 x 13.75	Brooks	1	0	1	0	1	2	0	2	1	1
16	542	No. 33	20.75 x 12.69	Brooks	505	475	30	0	505	37	36	1	1	36
Total	2113				1809	784	1025	6	1803	304	71	235	114	192
					86%	37%	49%	0%	85%	14%	3%	11%	5%	9%

# Water Meter Boxes & Lids

## ○ Meter Box Lid Replacement

- ¾" & 1" meters – 7,900 Lids
- 1-½" & 2" Meters – 215 Lids
- 3" & 4" Meters – 35 Lids
- Total = 8,150 Lids

## ○ SmartPoint M520 Cut Out:

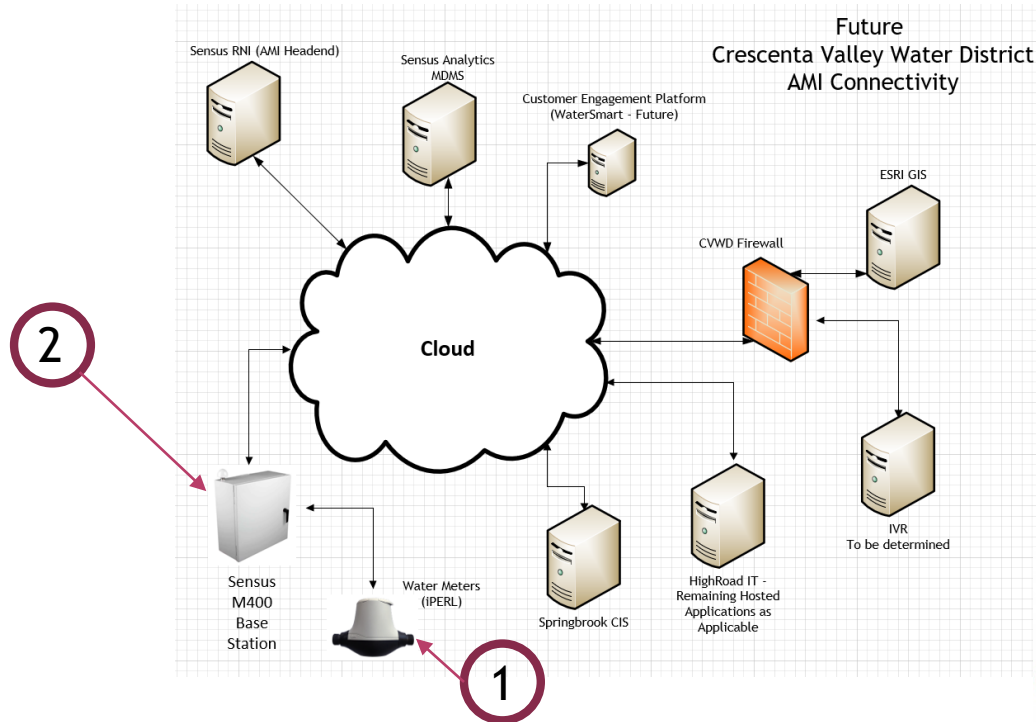
- 1.75" diameter hole in pit lid
- Height of Smart Point above or below the top of lid

## ○ Option 1 – Replace with new lid with Smart Point Cut Out

## ○ Option 2 – Drill Smart Point Cut Out



# AMI – M400 Base Station



- **Base Stations** by Aqua-Metric (Sensus Distributor)
- The SmartPoint interacts or communicates with the AMI Collector or Base Station (M400B), then the data is passed to the RNI
- On-Demand Reads from CSR processed thru M400

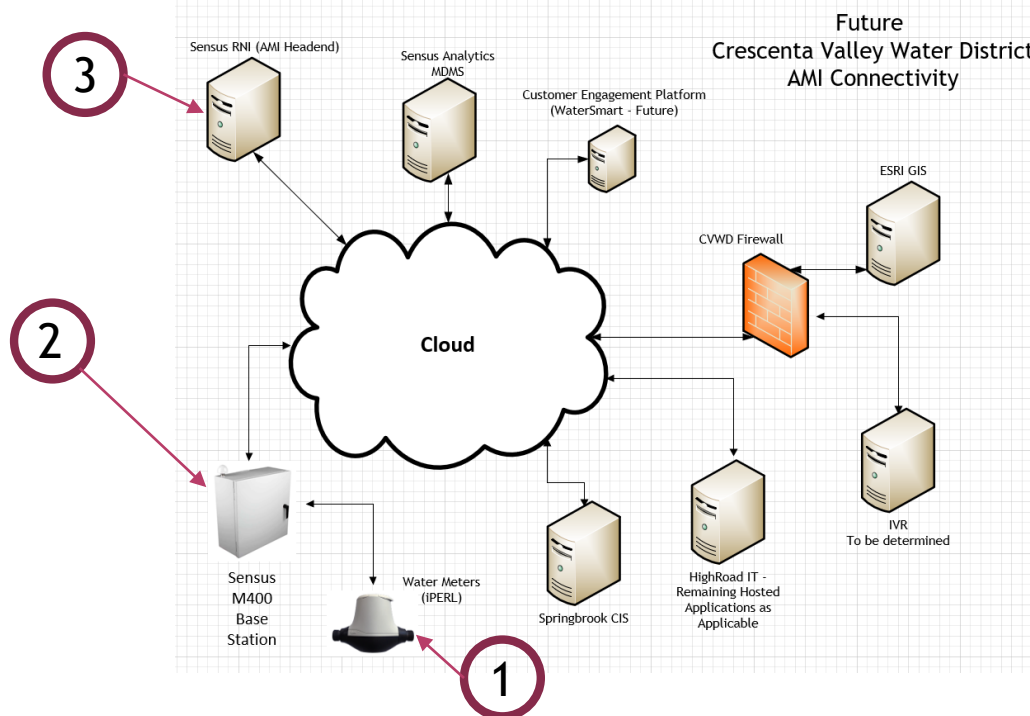
# AMI Collector or Base Station

## Base Station

- M400B FlexNet® base stations:
  - Efficient transceivers of meter data
  - Transmitted four (4) times daily.
- Top of the hour readings and other diagnostics are transmitted from meter to the Regional Network Interface (RNI)<sup>™</sup>
- Preliminary Locations – Rosemont & Edmund #1 Reservoirs.
- Installation – Aqua-Metric
  - Power & Conduits - CVWD



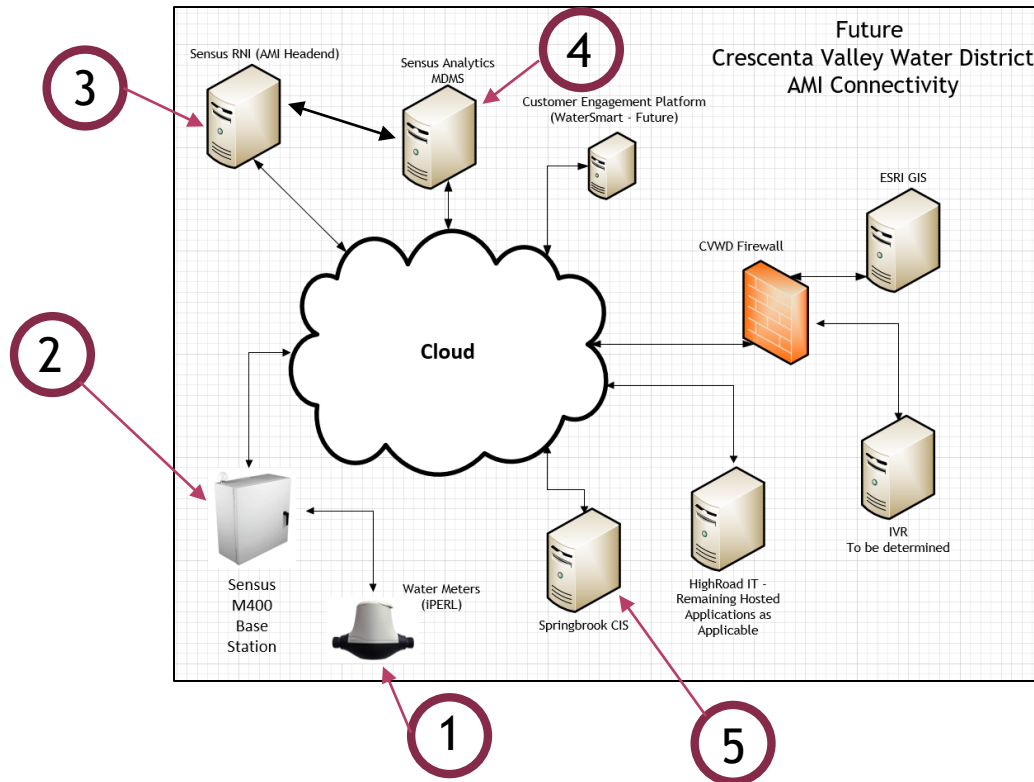
# AMI – Head End System



## AMI – Head-End System – The RNI

- Data from AMI Collector or Base Station is sent via cellular modem to the Internet Cloud.
- Data captured from the Internet Cloud by the Sensus website or server, also called the AMI Head-End (The RNI).
- Data is then consumed by the Sensus Analytics software (MDMS).

# Meter Data Management System



- **Meter Data Management System (MDMS)** - collects and stores meter data from a head-end system (RNI) and processes that meter data into information that can be used by other utility applications including billing (CIS), customer information (CEP) and outage management systems.

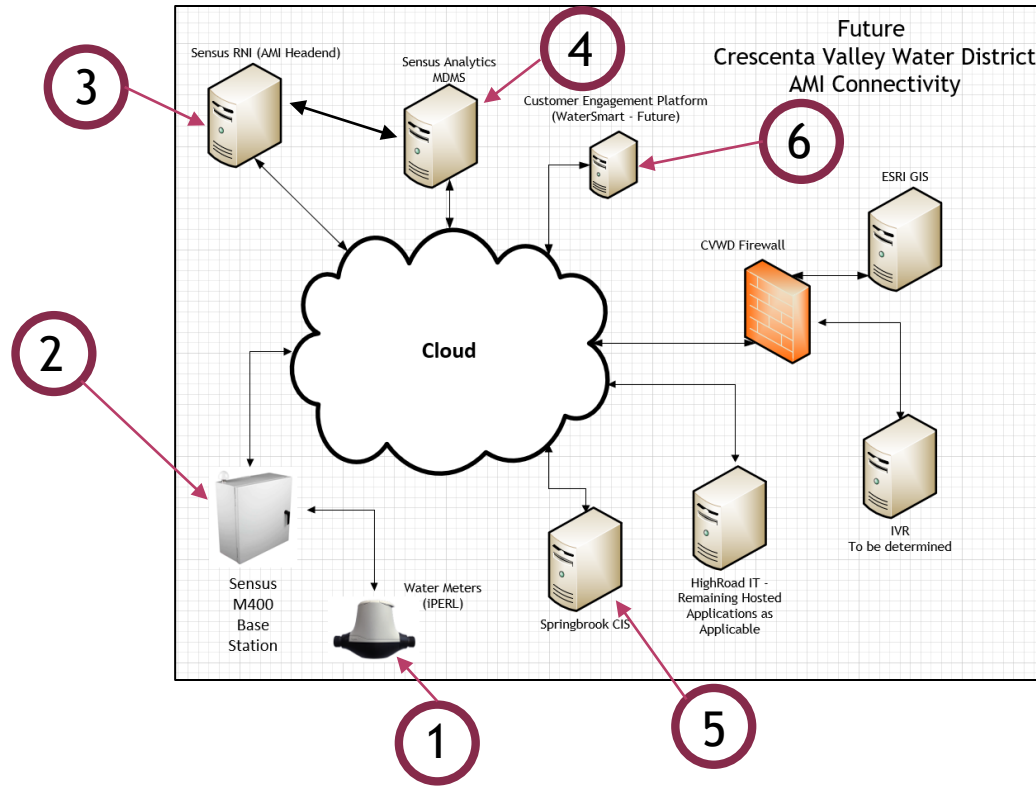
# Meter Data Management System

- **Sensus** has three (3) levels of Analytic Software (MDMS)
  - Essential Analytics – include with AMI Communication Network
  - Enhanced Analytics – Future
  - Advanced Analytics – Future
- **Proof of Concept** – Validating the AMI Communications Network by installing about 100 meters and verifying that data is being properly transferred
  1. From the Smart Meter to the SmartPoint
  2. From the SmartPoint to the AMI Collector (M520 Base Station)
  3. From the AMI Collector to the AMI – Head End (RNI)
  4. From the AMI Head End (RNI) to the Sensus Analytic Software (MDMS)
  5. From the Sensus Analytic Software (MDMS) to CVWD's Springbrook billing software enabling accurate water bills to be generated and future CEP (WaterSmart?) customer consumption data presentation and bill payment options

# Meter Data Management System (MDMS)

- **Sensus Essential Analytics (MDMS)** - Core meter data management performance including:
  - Admin - Manage system level settings (access and privileges, device groups, billing calendars, etc.)
  - Billing Access - View, audit and generate monthly billing files in one simple step
  - Device Access - Detailed device information to spot trends, identify usage anomalies such as leaks or track specific issues with custom alerts
  - Meter Insight - Validate incoming meter data from your network and proactively address communication issues
  - Report Access – Provides a menu of reports or configure custom reports that instantly summarize the information you need.
- CVWD will have access to the Essential Analytics by logging into the Sensus website and downloading data.
- Meter consumption data for end of month can be integrated into Springbrook for billing by Highroad IT.

# Customer Engagement Platform



- **Customer Engagement Portal (CEP)** is software that helps you engage with your customers through a **customer portal**.
- The CEP enables customers to monitor their water use, learn of conservation programs being offered and gain access to bill payment portals (if desired).

# Customer Engagement Platform

- CEP included in FY 21/22 CIP Budget
  
- **CEP's available to CVWD:**
  - WaterSmart (<https://www.watersmart.com>)
  - Dropcountr (<https://www.dropcountr.com>)
  - AquaHawk (<https://www.utilityhawk.com>)
  - Aclara (ACE®) (<https://www.aclara.com>)
  - Olea Edge Analytics (<https://www.oleanetworks.com>)
  - Sensus (<https://sensus.com>)

# Customer Engagement Platform

## ○ Example of CEP – GWP & WaterSmart

The screenshot displays the WaterInsight Program interface. At the top left is the logo for "Orange WaterSmart" with the tagline "Be Smart. Be Green. Be WaterSmart." To the right of the logo, it says "WaterInsight Program", "English", and "Logout". Below the logo is a navigation bar with icons for "Home", "Billing", "Track", "Take Action", and "Settings".

Below the navigation bar, there are two columns of information: "SERVICE ADDRESS" (4646 Moore St, La Crescenta CA 91214) and "ACCOUNT NUMBER" (21263880-03).

The main content area is divided into sections:

- Notifications:** Contains an "Announcement" with the text: "Get help understanding if your bill is higher than normal. Evaluate your bill, online, any time, from anywhere. See if your bill is higher than normal. Ge... read more".
- My WaterScore:** A section for water usage tracking.
- Way To Go!:** A celebratory message for the period "May 27 - Jul 25". It states: "Way to go, WaterSaver! You ranked in the top 20%. Who am I compared to?".

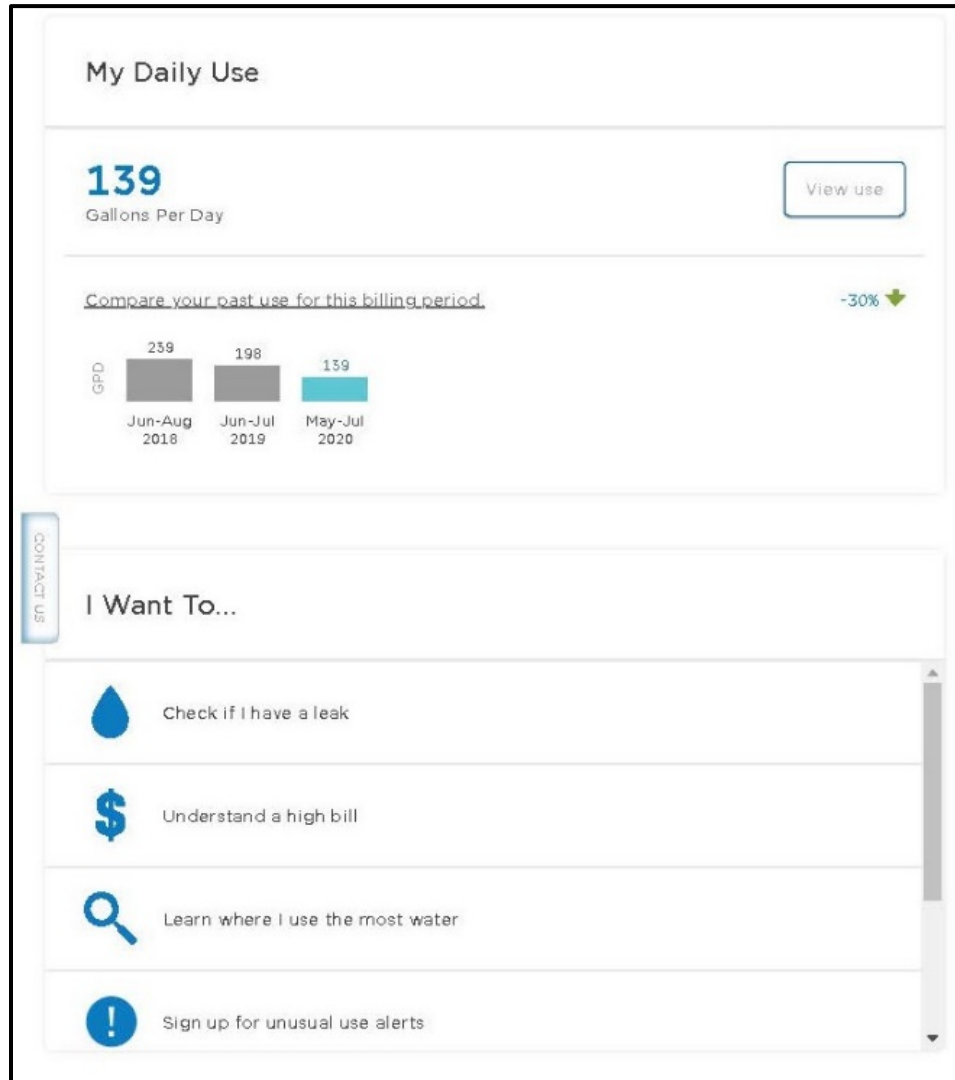
Below the "Way To Go!" section is a table comparing water usage:

You	139 GPD
Efficient	146 GPD
Average	255 GPD

A vertical "CONTACT US" button is visible on the left side of the interface.

# Customer Engagement Platform

## ◉ Example of CEP – GWP & WaterSmart



# Customer Engagement Platform

## ○ Example of CEP – GWP & WaterSmart

Fill Your Bathtub 1/3 Full

Savings up to  
3 GPD \$8/year

See more

Help and FAQs Account Settings  
Contact Us Household Profile  
Logout

CONTACT US  
Privacy Policy  
Terms of Use  
Personal Information Request

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Contact us

[Privacy Policy](#) | [Terms of Use](#)

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# Customer Engagement Platform



WaterInsight Program

English Logout

Home **Billing** Track Take Action Settings

SERVICE ADDRESS: 4646 Moore St, La Crescenta CA 91214  
ACCOUNT NUMBER: 21263880-03


- Payment
  - Pay Bill
- Evaluate Bill**
  - Compare Bill
  - Forecast Bill

CONTRACT ID

### Evaluate Bill

Compare Billed Water Use

PREVIOUS YEARS PREVIOUS PERIODS

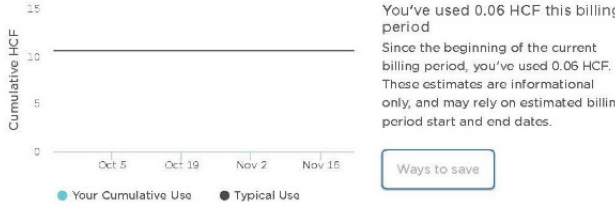


Next Steps

Avoid Bill Surprises  
Get notified when you're on track for an unusually high bill, before it arrives. [Set Alerts](#)

Ways To Save  
View your personalized list of recommended actions. [Take Action](#)

Your Use This Billing Period



# Customer Engagement Platform



# Customer Engagement Platform

## Seasonal use and irrigation

You use more water in the summer than in the winter; most likely due to irrigation.

Ways to save

Comparing Your Use: Last 24 Months

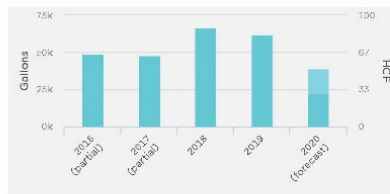


### Decreasing use

You used about 48% less water during the most recent twelve-month period compared to the prior twelve-month period.

Set use notifications

## Tracking Your Long-Term Use

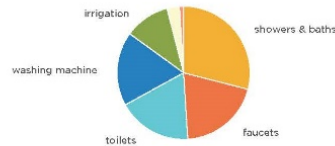


### Better than last year

You're tracking to use about 37% less than last year.

Download your data

## Estimating Your End Uses: 2019 - 2020



### Biggest estimated use is showers & baths

Based on your water use history, your household profile, and national averages, your biggest estimated end use is modeled to be showers & baths. This model may not reflect your actual water use patterns.

Update profile to improve estimates

# Customer Engagement Platform

The screenshot displays the Waterinsight Program interface. At the top left is the logo for the City of La Brea Water Department. The header includes the text "Waterinsight Program" and navigation links for "English" and "Logout". A secondary navigation bar contains "Home", "Billing", "Track", "Take Action" (highlighted), and "Settings".

Below the navigation, the user's account information is shown: "SERVICE ADDRESS: 4646 Moore St, La Crescenta CA 91214" and "ACCOUNT NUMBER: 21263880-03".

The main content area is titled "Recommended Actions" and includes a filter bar with categories: "Recommended (8)", "Cash Back (2)", "Outdoor (36)", "Indoor (32)", "Resources (5)", and "All (73)". Below this, it states "Selected based on your Household Profile" and "Gallons Per Day (GPD) 9".

The actions are presented in a grid of six cards, each with a "Read more" button and a "Savings up to..." summary:

- Install a rainwater catchment system:** Expert Advice, Savings up to... 8 GPD \$18/yr
- Take a 5-Minute Shower:** Savings up to... 8 GPD \$18/yr
- Choose low water-use plants:** Savings up to... 6 GPD \$8/yr
- Wash Dishes Efficiently:** Savings up to... 5 GPD \$7/yr
- Don't Waste Cold Water:** Savings up to... 5 GPD \$6/yr
- Fill Your Bathtub 1/3 Full:** Savings up to... 3 GPD \$8/yr

A vertical sidebar on the left is labeled "WATER INSIGHTS". The footer contains links for "Help and FAQs", "Contact Us", "Account Settings", "Household Profile", "Logout", "Privacy Policy", "Terms of Use", and "Personal Information Request". It also includes the copyright notice "© 2020 WaterSmart Software" and social media icons for Facebook and Twitter.

# Customer Engagement Platform

Account Settings

- My Account
- Additional Accounts
- Additional Users

Communication Preferences

- Leak Alerts
- High Use Notifications
- Bill Forecast Notifications
- Unplanned Use Notifications
- Water Reports
- Utility Connect

Communication Preferences

Leak Alerts

You will be notified if we think you have a leak. If your property uses water continuously, tell us [how much](#).

Email  
 Text Message  
 Voice Message

High Use Notifications

You will be notified when your daily use is over 2X times your normal seasonal use.

1X 3X 5X  
\*Typical Seasonal Use: 155 GPD

Email  
 Text Message  
 Voice Message

Bill Forecast Notifications

You will be notified if your use in the current period is on track to exceed 2X times your normal seasonal use. We will only contact you a maximum of once per billing period.

1X 3X 5X  
\*Typical Seasonal Use: 10.9 HCF

Email  
 Text Message  
 Voice Message

Unplanned Use Notifications

You will be notified when use from your property exceeds your Daily Threshold setting.

Daily Threshold (Gallons)

Starts on  Ends on   
 Never

Email  
 Text Message  
 Voice Message

Water Reports

A periodic report including your current water use.

Email  
 Paper

Utility Connect

Glendale Water & Power WaterInsight communications regarding your water utility account, water use, and important related announcements.

Email  
 Text Message  
 Voice Message

Unsubscribe from All Communications

# Customer Engagement Platform

WaterSmart | Profile Deborah

WaterSmart Program Welcome, Brayden  
Profile 4% complete.

## Customer Survey

Survey UTILITY HOUSEHOLD OUTDOOR INDOOR SPECIAL

☆☆☆

Please let us know how we are doing.

How satisfied are you with:	Very satisfied	Somewhat satisfied	Neutral	Somewhat dissatisfied	Very dissatisfied
The value of the services provided by your water utility?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

City of WaterSmart makes it easy for you to:	Strongly agree	Somewhat agree	Neutral	Somewhat disagree	Strongly disagree
Understand your water use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Save money on your water bill	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Take steps to use water efficiently	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Communicate with us	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

[Continue](#)

# Customer Engagement Platform

WaterSmart | Profile x Deborah

https://demo.watersmart.com/index.php/profile/household1

**Customer Information** Welcome, Brayden  
Profile 0% complete.

Survey UTILITY HOUSEHOLD OUTDOOR INDOOR SPECIAL

We want to know you better so we can provide accurate comparisons to similar households.

**How many people typically live in your home?**  
If this changes regularly, choose the number of occupants that are in the home most of the time.

01  02  03  04  05  06  07  08  09+

# Customer Engagement Platform

WaterSmart | Profile x

Deborah

https://demo.watersmart.com/index.php/profile/household3

City Water


## Customer Information

Welcome, Brayden

Profile 4% complete.

Survey

UTILITY HOUSEHOLD OUTDOOR INDOOR SPECIAL



We want to know you better so we can provide accurate comparisons to similar households.

**Do you have a yard?**  
If you live in an apartment or a condo, you might not have a yard.

Yes  No

**How much of your front and back yard is hardscape?**  
For example, your driveway, patio, or any paved or gravel-covered area.

1-25%  76-100%  
 26-50%  Don't know  
 51-75%

**How much of your planted area is grass?**

0%  51-75%  
 1-25%  76-100%  
 26-50%  Don't know

# Project Schedule & Costs

Summary FY 20/21 - Year 1				
Task	Quality	Unit Cost	Cost	Comments
AMI Network Communication System	1	\$140,700	\$140,700	Estimate - RFQ, award, integration, installation, testing including Project Management from Vendor
Project Management - UtiliWorks	1	\$104,600	\$104,600	Project Management for AMI Communication Network & Proof of Concept
Proof of Concept - 100 meters	100	\$175	\$17,500	Alpha & Beta Testing - 100 meters for testing - Lids & connectors, equipment only
Meters - 3/4"	400	\$160	\$64,000	Meter Replacement - Zones 1, 2 & 3; Ordered 300 meters; add 100 more meters, end Jan 16, 2021
Meters - 1"	100	\$225	\$22,500	Meter Replacement - Zones 1, 2 & 3; Ordered 50 meters; add 50 more meters, end Jan 16, 2021
Project Management - Highroad IT	240	\$85	\$20,400	Assistance with AMI Network
<b>Total</b>			<b>\$369,700</b>	
		<b>Budget</b>	<b>\$200,000</b>	
Summary FY 21/22 - Year 2				
Task	Quality	Unit Cost	Cost	Comments
MDMS + Customer Engagement Platform	1	\$115,000	\$115,000	Estimate - Purchase of Software, programing, integration & testing
Project Management - UtiliWorks	1	\$65,000	\$65,000	Project Management for MDMS + Customer Engagement Platform
Meters - 3/4"	670	\$160	\$107,200	Meter Replacement - Zone 1 & 2
Meters - 1"	175	\$225	\$39,375	Meter Replacement - Zone 1 & 2
3/4" & 1" lids & connectors	845	\$175	\$147,875	Replace lid, add connector and connect to AMI network
Project Management - Highroad IT	160	\$100	\$16,000	
Misc.			\$550	
<b>Total</b>			<b>\$491,000</b>	

# Project Schedule & Costs

Summary FY 22/23 - Year 3				
Task	Quality	Unit Cost	Cost	Comments
Pressure Zone 9, 10 & 11 - lids & connectors	694	\$175	\$121,450	Replace lid, add connector and connect to AMI network
Project Management - UtiliWorks	1	\$20,000	\$20,000	Project Management
1.5" & 2" Meter, replace	179	\$2,500	\$447,500	Replace with Smart Meter
1.5" & 2" lids & connectors	212	\$750	\$159,000	Replace meter lid, add connector and programing into AMI Network
Project Management - Highroad IT	120	\$105	\$12,600	
Misc.			\$450	
<b>Total</b>			<b>\$761,000</b>	
Summary FY 23/24 - Year 4				
Task	Quality	Unit Cost	Cost	Comments
Pressure Zone 6, 7 & 8 - lids & connectors	1,395	\$175	\$244,125	Replace lid, add connector and connect to AMI network
3" & 4 " Meter, replace	15	\$3,500	\$52,500	Replace with Smart Meter
3" & 4" - lids & connectors	31	\$750	\$23,250	Replace meter lid, add connector and programing into AMI Network
Project Management - Highroad IT	120	\$110	\$13,200	
Misc.			\$925	
<b>Total</b>			<b>\$334,000</b>	

# Project Schedule & Costs

Summary FY 24/25 - Year 5				
Task	Quality	Unit Cost	Cost	Comments
Pressure Zone 1, 2, 3, 4 & 5 - lids & connectors	3,000	\$175	\$525,000	Replace lid, add connector and connect to AMI network
Project Management - CVWD	1	\$25,000	\$25,000	
Project Management - Highroad IT	120	\$95	\$11,400	
Misc.			\$600	
<b>Total</b>			<b>\$562,000</b>	

# Project Schedule & Costs

<b>Project Summary Costs</b>	
Summary FY 20/21 - Year 1	\$369,700
Summary FY 21/22 - Year 2	\$491,000
Summary FY 22/23 - Year 3	\$761,000
Summary FY 23/24 - Year 4	\$334,000
Summary FY 24/25 - Year 5	\$562,000
<b>Total Project Costs</b>	<b>\$2,517,700</b>

# AMI System

## Questions & Answers

