Advanced Metering Infrastructure Project Assessment Final Report for Marin Municipal Water District

June 2022

E Source || esource@esource.com || 1-800-ESOURCE

Contents

Table 1 – Document History and Distribution

Recipient Name	Date	Recipient Organization	Distribution Method
Project Core Team	06/17/22	Marin Municipal Water District	Email / SharePoint

Table 2 – Acronyms & Definitions

Acronym/Term	Definition
AMI	Advanced Metering Infrastructure
CapEx	Capital Expenses
CEP	Customer Engagement Portal
CIS, or CMS	Customer Information System, or Customer Management System. Marin Water uses SAP
DWR	Department of Water Resources
EMF	Electromagnetic Field
GIS	Geographical Information Systems
HES	Headend Software, typically related to AMI
IDA	Initial Deployment Area
IRR	Internal Rate of Return
ISPS	ISPS is Information System in Project Systems in SAP
ISU	SAP's Industry Specific Solution for the Utilities Industry
MDMS	Meter Data Management System
MIV	Meter Installation Vendor
MMWD, Marin Water	Marin Municipal Water District
MTC	Meter-to-Cash
NPV	Net Present Value
OGS	Marin Water's customer billing portal
OpEx	Operational Expenses
Project Systems	A software module in SAP for project management
RDM	Remote Disconnect Meter
RF	Radiofrequency
ROI	Return on Investment
SAP	Systems Applications Products
SME	Subject Matter Expert
UDL	Unified Data Library

1. Executive Summary

This assessment presents the estimated costs, benefits, and risks to deploying an Advanced Metering Infrastructure (AMI) system and provides recommendations on the AMI roadmap moving forward for Marin Municipal Water District (Marin Water). A key focus of the effort includes Marin Water's current state discovery, business process impact assessment, development of goals and priorities, business case financial impacts, a technology roadmap, and implementation planning. If Marin Water proceeds to move forward with the AMI project, this assessment report will prepare Marin Water for the subsequent phases – starting with RFP development, plans and specifications, and AMI procurement to move to bid and award. Final phase is construction and integration.

1.1. AMI Project Goals

Each organization is unique in its strengths, weaknesses, and business needs. Understanding the business needs facilitates alignment of the purchased AMI system to meet those needs. The Marin Water team determined a list of AMI project goals that represents the business needs along with the priority of each goal. The top three goals Marin Water wanted to achieve with the AMI implementation are: 1) enhancement of Marin Water's customer engagement, 2) timely water leak notifications, and 3) utilization of AMI data to support effective conservation programs.

Of particular note is the advantage customers will see related to timely leak notifications. Because Marin Water bills residential customers every other month, a leak can result in large unintended bills for its customers. An AMI system can facilitate early notification to customers of leaks or other high usage. This allows customers to take action and resolve plumbing issues before they become a large bill.

1.2. AMI Assessment Results

The assessment began with discovery and understanding of Marin Water's current state environment and business processes, which serves as the foundation for the development of the business case, roadmap and implementation planning for a successful AMI deployment.

From an operations perspective, the teams within Marin Water are well-informed and well-positioned for an AMI program implementation. Key findings of the current state assessment include:

- Marin Water team is already familiar with AMI technology, particularly with the implementation of an AMI pilot and the fact that their surrounding utilities have been implementing AMI.
- The AMI pilot and the recent historic drought demonstrated the importance of AMI for Marin Water, to assist customers issues, monitor leaks, monitor trends/overall usage and support conservation programs.
- Having confidence in the AMI data accuracy would reduce Marin Water team's efforts related to re-works/implausibles, field visits, customer inquiries.

- There is a desire to have an AMI system that is "future-proof", with the potential addition of other capabilities down the road (such as cost-effective pressure monitoring sensors, water quality sensors, etc.).

1.3. Financial Model

The Marin Water business case assumes the deployment of AMI, a Meter Data Management System (MDMS), a Customer Engagement Portal (CEP), and water meters (mix of replacements and retrofits, performed by third-party meter installation vendor). All model assumptions were reviewed with Marin Water staff. The business case considered upfront capital expenses, annual operational expenses and annual benefits for a 20 year life cycle.

Business Case Results

Table 3 – Marin Water AMI Business Case Financial Metrics

Financial Metric	Base Case
Est. Capital Expense (CapEx)	$ 25.64 M
CapEx per Meter	$ 409.77/meter
Net Present Value (NPV)	$ 3.32 M
Internal Rate of Return (IRR)	4.7%
Return on Investment (ROI)	38.9%
Payback Period (Years)	15

Further discussion regarding the business case is presented in this assessment in the Financial Analysis section, with a summarized financial model (Microsoft Excel workbook) attached as Appendix 3.

Considering that Marin Water were very careful to not underestimate costs and overestimate benefits, a positive business case result is favorable for Marin Water.

1.4. Next Steps and Roadmap

Next Steps

1. Confirm the prefered scenario for meter replacement schedule to implement full system-wide AMI based on a long-term vision, and not a short-term capital expenditure.
2. Assess funding options – short-term and long-term to support AMI implementation.
3. Obtain necessary approvals from Marin Water Board, regulatory authorities, local jurisdictions as needed.
4. Confirm Project Sponsor, Project Manager(s), and AMI Project Team Members

Roadmap

Based on the preferred implementation scenario, Marin Water will proceed with an AMI project, the AMI Roadmap and Project Implementation Planning section of this assessment identifies major phases and tasks for a strategic deployment of an AMI

system and its supporting components. This roadmap identifies the steps required and the relative timeframe it will take to accomplish Marin Water goals, while the AMI implementation planning (Appendix 5) file details typical tasks and its subtasks for a successful AMI project deployment.

2. Introduction

2.1. Document Purpose

The purpose of this assessment report is to provide Marin Water with a technology and operational assessment and to assist in determining the best options for pursuing an advanced metering infrastructure solution. This document also serves as a foundation to document program goals and strategic direction, and ultimately prepare Marin Water for AMI deployment.

Marin Water's current business functions, meter hardware and equipment, systems and software, and staffing were examined. Information was acquired via data requests and through a series of stakeholder meetings. This information was used to develop a business case, outlining the quantitative and qualitative benefits that can be realized with an AMI program, given the options available.

2.2. Utility Overview

Marin Water was the first municipal water district created in the State of California and provides water services to customers in southern and central Marin County. Marin Water's mission is to manage their natural resources in a sustainable manner and provide its customers with high-quality water at a reasonable price.

Currently, Marin Water serves more than 191,000 people in a 147 square miles service area. One hundred percent of Marin Water's water are locally sourced, with about 75% of the water supply coming from a network of seven local rain-fed reservoirs and the remaining water supply is supplemented by the neighboring Sonoma County's Russian River water system.

Marin Water is governed by a five-member board of directors who establish policies on the district's mission, goals and operations and represent the general public in deciding issues related to the water supply.

2.3. Scope of Work

Scope of work was to perform an assessment study to baseline Marin Water's operations and potential for an AMI implementation. This Assessment Report and associated business case effectively provides Marin Water with a roadmap on how to proceed with the AMI Project.

The assessment tasks performed per are as follows:

Project Kick-off Meeting
Data Requests and Discovery
Technology and State of the Industry Presentation
IT Systems and Network Documentation
Financial Metrics, Direct and Indirect Benefits Model
Business Process Impact Assessment
Technology Roadmap

Draft AMI Implementation Plan
Final Assessment Report and Workshop
Project Management and Services

3. Discovery and Operational Impact Assessment

3.1. Operations

To inform the roadmap and financial analysis outlined in this report, Marin Water's current utility business processes, meter hardware and equipment, systems and software, reporting capabilities, and resources were examined. Information on current state operations was acquired via data requests and remote meetings.

Meter Reading

Marin Water's meter population is organized into 15 meter reading areas that are broken down into 35 portions and further broken down into 366 routes. Most all small water meters (5/8"x3/4", 3/4" and 1" size) are read every other month, approximately 27,000 read in even months and approximately 35,500 read in odd months. There are 120 large meters (1 1/2" size and larger) associated with high volume commercial customers that are read every month.

The meters are read according to a dynamic reading schedule created by SAP (Marin Water's Customer Information System (CIS)), which can be adjusted every two months. The meter operations staff (meter reader and repair workers) perform the meter reads and handle approximately 1,740 reads/day.

Currently, meter readings are mostly performed manually using Itron handhelds (which will be replaced with Honeywell Dolphin CN-80 handhelds in 2022). There is an exception for approximately 5,000 meters that have Badger Orion cellular endpoints and are connected and read via Badger's Beacon AMI system. The Badger cellular AMI network was funded by multiple California Department of Water Resources (DWR) grants in 2014, 2015, and 2018. The pilot program focused on irrigation meters, high water users and hard to access meter reading routes.

Meter operations staff also perform re-reads and double skips (can only skip or estimate a read for once cycle) assigned by the meter operations supervisor (via print out, not via service order). They also record issues such as leaks, lid or box work, pruning, fogged or scratched glass and stuck meter replacements in their handhelds. The meter operations supervisor then enters the information into SAP.

Table 4 – Current Marin Water Meter Reading Department Roster

Position	Count
Supervisor	1
Large Meter Techs	2
Permanent Full Time Meter Readers	8
Temporary Full Time Meter Readers	2

Meter Data System of Record and Inventory

Marin Water has a high level of confidence in their meter data information which is being stored in SAP with approximately 99% confidence in the size information and 95% confidence in the meter manufacturer and model. The meter data information stored in SAP includes meter serial numbers that are found in both the meter body and register, install date, manufacturer, model, size, and latitude/longitude coordinates (within 10 feet accuracy).

Water Operations

Marin Water operates three water treatment plants: Bon Tempe Treatment Plant (20 MGD capacity), San Geronimo Treatment Plant (35 MGD) and Ignacio Treatment Facility (16 MGD). These treatment plants treat water supply that comes from Marin Water's seven local rain-fed reservoirs that totals to 79,566 acre-feet of storage. In addition, the Ignacio Treatment Facility receives treated water purchased from Sonoma County Water Agency (SCWA).

Treated water is stored in 130 above-ground tanks and one underground tank, Marin Water's total storage capacity is 81.9 million gallons. Water is distributed via 886 miles of water main through 89 pump stations, spread across 144 pressure zones. The water main is comprised of mainly welded steel, high-density polyethylene (HDPE) and cast iron. Marin Water has a SCADA system to monitor and control treatment plants, tank levels, pump pressure and pressure relief valves (PRVs).

Marin Water has a formal leak detection survey program. Two fulltime utility system technicians use sonic leak detection equipment to find hidden leaks. The survey is accomplished by using handheld listeners, amplifiers, correlators, and automated loggers. The team surveys 20% of the system per year and generates a report on their findings annually. From 2015 through 2020, Marin Water surveyed 503 miles of pipeline and detected 791 customer leaks and 214 Marin Water services leaks.

Marin Water has a meter testing program run by the meter operations shop. Most of the meters of high consumption users are tested annually, while smaller size meters are tested based on age and consumption data. Small meters (5/8", 3/4", 1") are tested both in-house, using the meter shops bench tester, and by a third party vendor; a majority of the testing is done on meters that are over 10 years old. In addition, Marin Water has two mobile test benches that can test 5/8", 3/4", and up to 8" size meters. Two hundred and sixty of the highest use meters are part of an annual testing program that either calibrates the meter back to the AWWA range, or, if it cannot be calibrated, is replaced if it fails testing. These high use meters are all 1.5" or larger.

In 2020 and 2021, 104 and 73 small meters were tested. In 2020, the results from the 5/8" meter test showed an average performance at low flow (0.25 gallons per minute (gpm)) of 92.25%, average performance at mid flow (2 gpm) of 99.15%, and average

performance at high flow (15 gpm) of 98.33%. The blended average is 96.58%, which results in a drop of accuracy of 3.4%.

Customer Service

Table 5 – Current Marin Water Customer Service Department Roster

Position	Count
Customer Service Manager	1
Business Analyst	1
Customer Service Supervisor	1
Customer Service Representatives	6
Office Assistant	1
Field Inspectors	2

The customer service representatives (CSRs) are responsible for servicing walk-ins to the main office, incoming phone calls and emails regarding customer's moving in and out of the service area, discount programs, leak adjustments, water consumption, billing, rates, payment plans and past due accounts. CSRs also process accounts receivable/payments, customer move-ins and move-outs, facilitate non-pay disconnects/reconnects, and generate service orders and investigations. On average, calls last 5 minutes.

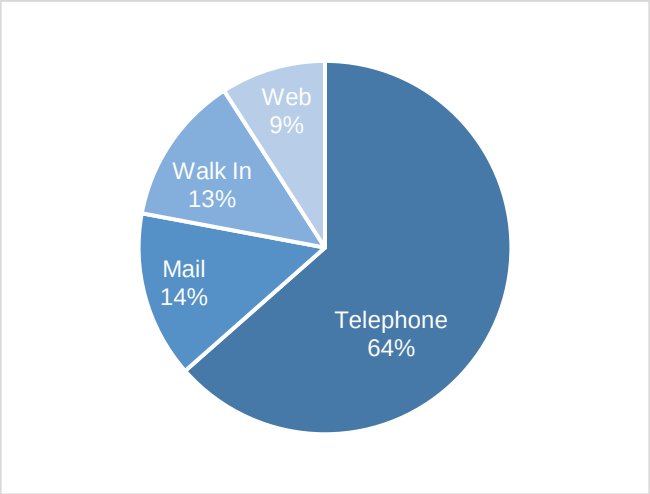


Figure 1 – Marin Water Customer Inquiries Method, 2019

The Customer Service Field Inspectors perform move in/move out reads, service disconnects/turn-ons and deliver notices regarding termination of water service for non-payment. The Customer Service Field Inspectors also, complete billing related investigations such as failure to sign up for service, high consumption, off using water and verify which parcel the meter serves. Based on investigation type, multiple trips to the same service address, over the course of several days/weeks, may be necessary to facilitate a resolution.

Billing

Billing reads are performed by the meter readers and are currently entered into Itron handhelds. These reads are then uploaded into SAP for billing purposes. The majority of customers are billed bi-monthly, with the exception of approximately 120 high volume commercial customers that are billed monthly. The unit of billing is one hundred cubic feet

(ccf, which is equivalent to 748 gallons. In total, there are approximately 32,000 bills which include 58-62 days of usage generated and delivered to customers every month.

Approximately 83 bills are estimated every month, due to skip reads. Marin Water also offers payment arrangements with approximately 70 arrangements per month. In addition, bills may be adjusted due to water loss beyond Marin Water or customer's control such as blind leak, water theft, and mechanical malfunctions. The bill adjustment request must be submitted in writing and limited to two billing periods and one adjustment every 36 months. On average Marin Water receives 10 billing adjustment requests every day.

Customers have several options to pay their Marin Water bill. The majority of bill payments are received through Marin Water's online payment system portal. This portal

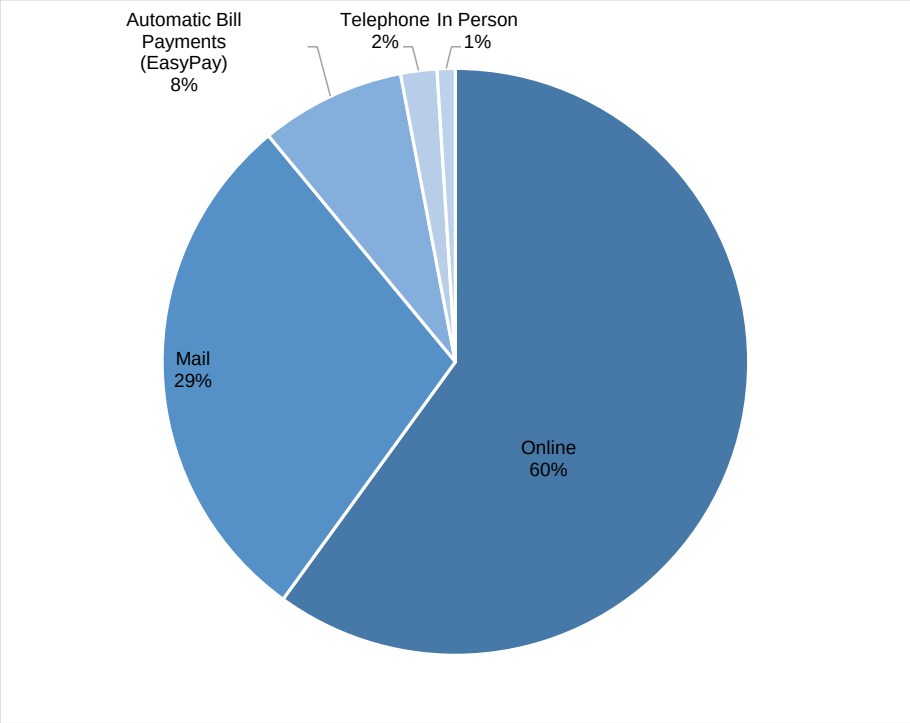


Figure 2 – Marin Water Customer Bill Payment Methods

provides access for customers to view, print and pay their bill online. In addition, customers can submit questions regarding their online bill pay access to customer service. The portal displays the customer's bill, which is updated bi-monthly with interval consumption data. Aside from the portal, customers can pay their bills via phone, mail, direct ACH debit, through their financial institutions bill pay service, walk-in or drop box.

There are three days between when the meter is read and a bill is sent to customer, which is a fairly quick turnaround time. The customer has 30 days to pay their bill after the bill date and the bill is considered delinquent after that with late charges being applied. Bills that are more than 60 days delinquent are grounds for customer water service

termination. Due to the Covid-19 pandemic and consistent with state law, Marin Water temporarily suspended all water shut-offs related to nonpayment.

Water Efficiency

Marin Water has a number of rebate programs to offer which can be viewed at Rebates and Programs | Marin Water to encourage conservation for customers. The rebates are being tracked in an Access database and exported into SAP, however level of detail in SAP is fairly limited and difficult to access.

The Water Efficiency (WE) team develops and implements programs that reduce potable water demand. WE develops and implements education, technology and incentive programs to help customers use water wisely, respond effectively to drought and water shortage conditions, maintain District Code compliance and enforcement to avoid wasting water, and take advantage of emerging technology. WE representatives interact with customers via phone, email, and at in person site visits. All WE program activity is tracked in Microsoft Access databases. A limited amount of the available data is exported and uploaded into SAP. Through the Conservation Assistance (CAP) program, WE representatives use historical customer water use data as a tool for making recommendations and investigating high water use and leaks. The AMI pilot has proven to be an effective tool to aid in this work due to increased customer engagement and more granular water use data. Customers frequently contact the WE department after receiving leak or high water use notification. WE representatives use AMI data to assist customers through analysis of water use patterns and flow rates. As well as saving water, the availability of AMI data and a customer portal improves customer satisfaction as it often results in a more complete explanation of events compared to bi-monthly billing data.

Table 6 – Current Marin Water Water Efficiency Department Roster

Position	Count
Water Efficiency Manager	1
Water Conservation Supervisor	1
Water Conservation Representatives	4
Office Assistant	1

3.2. Marin Water AMI Pilot

AMI Pilot Overview

In 2014, the District was awarded $975,000 from the Department of Water Resources (DWR), through the Integrated Regional Water Management (IRWM) process, to implement an AMI test pilot project for 800 irrigation meters. Utilizing that funding plus subsequent awards of $1.2M (2015) and $350,000 (2018) from DWR, the District expanded the footprint of AMI meters installed with grant funding from the initial pilot of 800 meters to approximately 5,000 meters. The selected AMI vendor for the pilot was

Badger, utilizing their Beacon cellular AMI network. The AMI meters installed, focused on the irrigation meters, high water users and hard to access meter reading routes.

AMI Pilot Results

The AMI pilot demonstrated the importance of AMI technology for Marin Water and its customers, especially with the recent historic drought they've experienced. The AMI pilot data was used extensively to monitor consumption trends, detect leaks, assist customers, and identify issues.

The Water Efficiency team actively sent out leak notifications to customers, with 3,200 leak letters sent which accounted for average leaks of >200 gallons per day. There were 62 participants in the AMI leak notifications program analysis, which resulted in 29,023 gals/account/year savings which is the highest among the conservation programs at Marin Water.

Approximately 40% of customers involved in the pilot signed up on Badger's customer engagement portal, EyeOnWater. Customers found the AMI data extremely useful and frequently provided positive feedback.

AMI Pilot Integrations

To keep customer information current, Marin Water regularly exports a file from SAP and uploads it into Beacon. The Meter Operations team currently prints the reads from Beacon by AMI routes for readers to enter directly into the handhelds which is then uploaded into SAP for billing purposes. Although the entry process is relatively quick (20 times faster than reading the route manually in the field), an AMI headend software (HES) and Customer Information System (CIS) integration (with an MDMS in between, if applicable) is essential for a full scale AMI implementation.

4. Current Technology and Systems Assessment

This section provides a review of the Information Technology components that are typical of an AMI implementation. Also included are Marin Water specific considerations that were discussed during workshops with key AMI Project stakeholders as part of this study.

While there are several MDMS vendors capable of meeting the Marin Water's functional needs, it will be important to evaluate and select an appropriate technology since there are certain platforms that can be overly complex. This complexity would require higher levels of maintenance and support, and likely higher implementation and licensing costs that would provide Marin Water with only limited additional benefit.

E Source held two workshops with Marin Water. The first was a review of the Current Technology and Systems Assessment. The second was a review of a potential implementation of AMI, MDMS, and Customer Portal, based on current market offerings and the direction of other water utilities and districts. E Source reviewed Marin Water's existing information systems and integrations to establish an Existing state to allow identification of areas that must be modified for effective integration to achieve the benefits of AMI. E Source presented the potential Future state implementation were presented to Marin Water for review and consideration.

4.1. Existing or As-Is Systems

The diagram below shows the contextual view of the current Marin Water systems as understood through the first IT workshop.

The details of current state integrations are as follows:

- Batch file integration between SAP and Tokay (Backflow Prevention software) run nightly.
- SAP internal integration between these two modules, ISU and ISPS. ISU is SAP's industry specific solution for the utility industry and includes solutions to help manage items such distribution, metering, and customer care. ISPS is the Public Sector Module for SAP which helps manage day to day operations in the form of work orders and related information in SAP.
- A 2-way integration between the ISU module of SAP and OSG Portal that requires manual intervention in both directions
- A 2-way integration between the ISU module of SAP and ITRON that requires manual intervention in both directions
- One way integration from ESRI (GIS) to Document Management (Content Server) for image retention

Solution Architecture Diagram – Existing

v1.0 March 2022

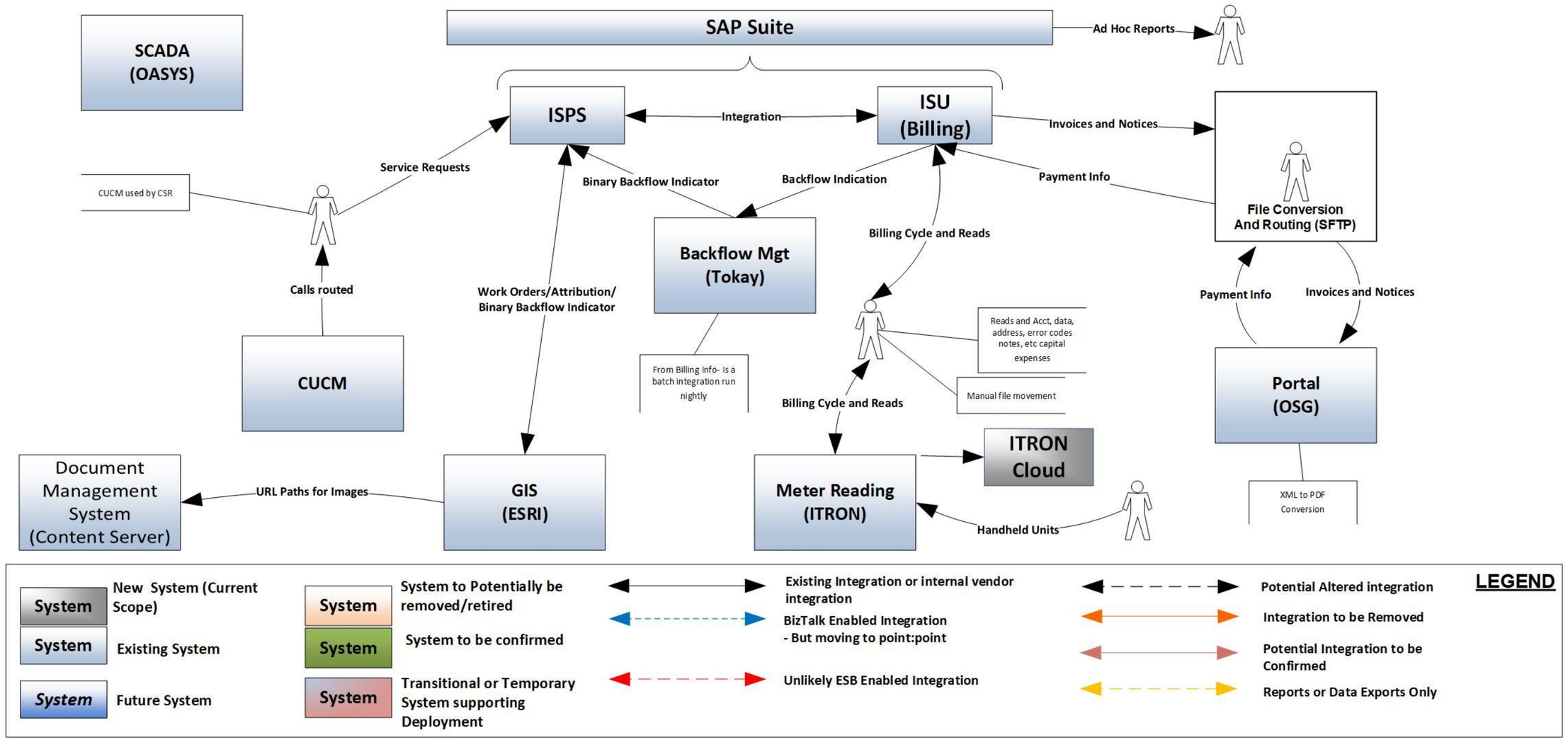


Figure 3 – Marin Water "Existing" Solution Architecture Diagram

4.2. Potential Future System Context – AMI with MDMS

The section below describes the potential future state of the systems at Marin Water with the introduction of AMI (and associated systems) that were gathered/established during the workshops with Marin. An approach to implementation of an AMI system with an integrated MDMS platform is recommended. MDMS provides integrations and analytics supporting Marin Water's future needs for billing, customer portal, reporting, and analytics.

The integration between these systems will include additional integration points along with current integrations. A list of the future integration items is as follows:

- Integration between AMI and MDMS: 2-way communication.
    - Meter Data: Meter Reads (Interval and Register reads) and Meter Events (File based and Instantaneous events such as leaks)
    - 2-way integrations: For Remote Actions such as Connects, Disconnects, On Demand Reads

Integration between ISU Module of SAP and MDMS: 2-way integration

- Data Sync: From ISU to MDMS
- Billing Request: From ISU to MDMS
- Billing Response: From MDMS to ISU

Remote Action Requests: Connects/Disconnects/On Demand Reads

- Integration between MDMS and Tokay: 1-way integration to provide reads
- Integrations between MDMS and a potential UDL: Provide AMI data needed for reporting and monitoring
- Integration between MDMS and OSG Portal: 1-way integration from MDMS to OSG portal; interval data will be sent to OSG portal for web presentment.

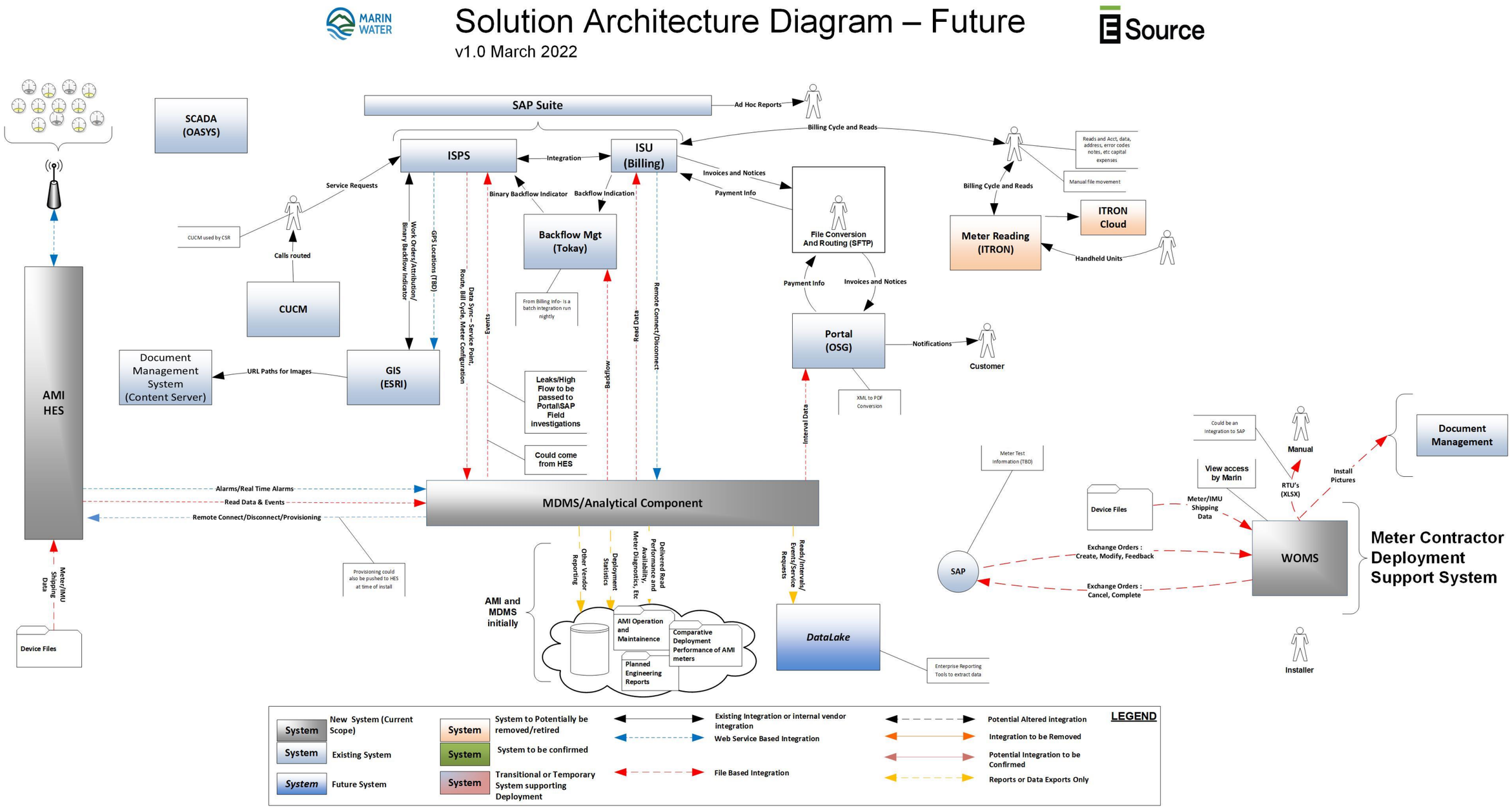


Figure 4 – Marin Water "Future" Solution Architecture Diagram

4.3. Key Impacts to Existing Systems

The implementation of an AMI system will require some retrofitting to a number of existing back-office systems. With most existing systems the required changes are usually functional, or code related and therefore unnoticeable to users. That makes the AMI implementation impact on those systems low. Some systems may benefit from alternate sources of data or require reconfiguration of core functions. That impact would be classified as medium. In other cases, the changes will be very apparent to users or the software will be eliminated. Where noticeable user-facing changes are made and/or where significant effort is required to retrofit the system, the AMI project impact to those systems is considered high. The table below is intended to help illustrate which existing systems are impacted and whether that impact is high, medium, or low.

Table 7 – Key Impacts of AMI to Existing Marin Water Systems

System	Description	Post-AMI Disposition	AMI Impact
ITRON	Manual meter reading	Replaced by AMI	High
SAP	Customer Information and Billing System	Direct automated integration between AMI assets and CIS billing with AMI data. Will require changes to support AMI meters/modules and cycle changes to support monthly billing.	High
Customer Portal (OSG)	Web portal for customers	Recommended to enhance or replace to support additional functionality such as real time billing information, updated payment methods and alerts	High
Backflow Management (Tokay)	Backflow System	Recommended integration added to accept MDMS reads	Medium
Document Management (Content Server)	Document Repository	May house installation pictures and other asset related pictures	Low
GIS (ESRI)	GIS and Asset Management System	Potential for additional field and information collected during and after AMI Implementation such as GPS Coordinates	Low

Bill Print	Internal bill print processes	No change	N/A

5. Financial Analysis

The foundation of this assessment is the rigorous analysis of the business case toward the implementation of a comprehensive AMI solution. Though AMI is a mature technology, it is recommended that a utility justify the implementation of any technology system or infrastructure project based on the cost-benefit, readiness, and goals of the utility. The alignment of these elements is key to a successful implementation. The objective of this business case is to arrive at a realistic and conservative financial result—not to underestimate project costs and not to overstate potential benefits.

Several iterations of the financial model were presented to the Marin Water team, each time updated with the team's feedback. An agreed upon final results of the business case is presented in this section.

5.1. Final Results Overview

An overview of the financial metrics associated with a 20-year program lifespan is shown in Table 8.

Table 8 – Marin Water AMI Business Case Financial Metrics

Financial Metric	Base Case	Optimistic Scenario	Pessimistic Scenario
Est. Capital Expense (CapEx)	$ 25.64 M	$ 24.36 M	$26.92 M
CapEx per Meter	$ 409.77/meter	$ 389.28/meter	$ 430.26/meter
Net Present Value (NPV)	$ 3.32 M	$ 6.29 M	$ 0.35 M
Internal Rate of Return (IRR)	4.7%	6.2%	3.2%
Return on Investment (ROI)	38.9%	53.5%	25.7%
Payback Period (Years)	15	13	16

**Optimistic & Pessimistic Scenarios represents a +/-5% variation of the Capital Expenses, Annual Operational Expenses and Benefits.*

The financial model presents a payback period under the typical 20-year life of an AMI endpoint, which is a favorable result. The ability to realize savings within the life of project means that, should another technology supplant AMI in the intermediate future, Marin Water will be able to pivot before the useful life of an endpoint has been reached, precluding the need to absorb additional sunk costs or invest additional capital in the AMI system prior to achieving breakeven investment.

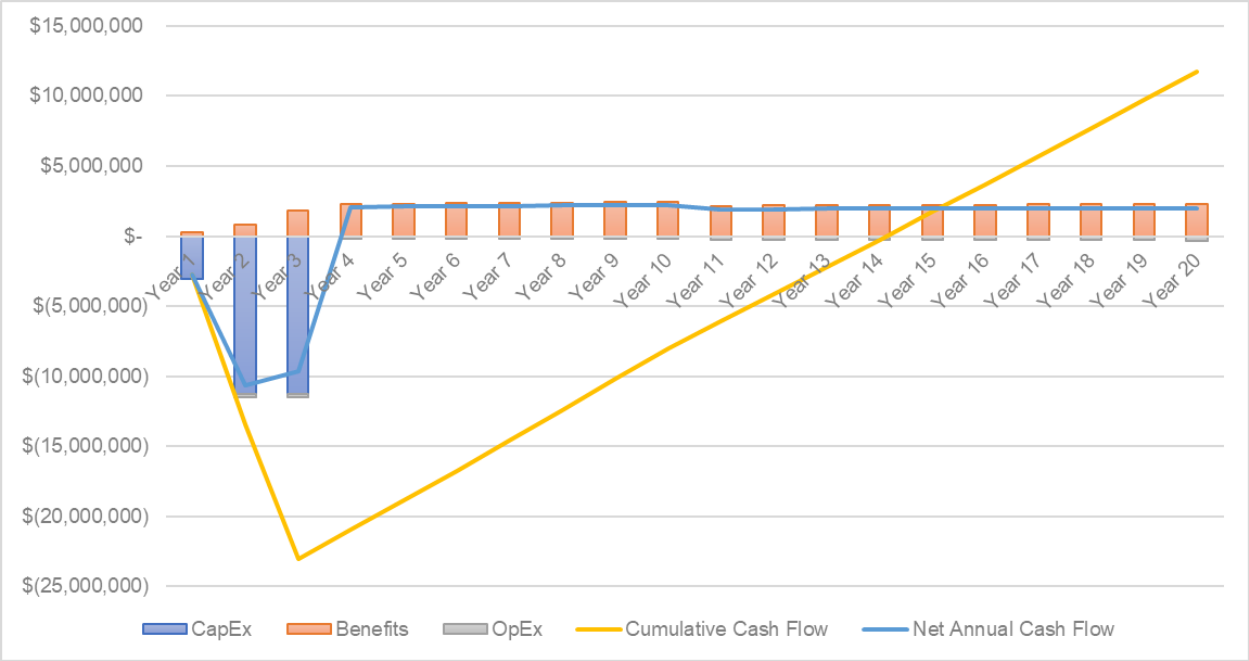


Figure 5 – Marin Water AMI Project Cost-Benefit Analysis Over 20 Years

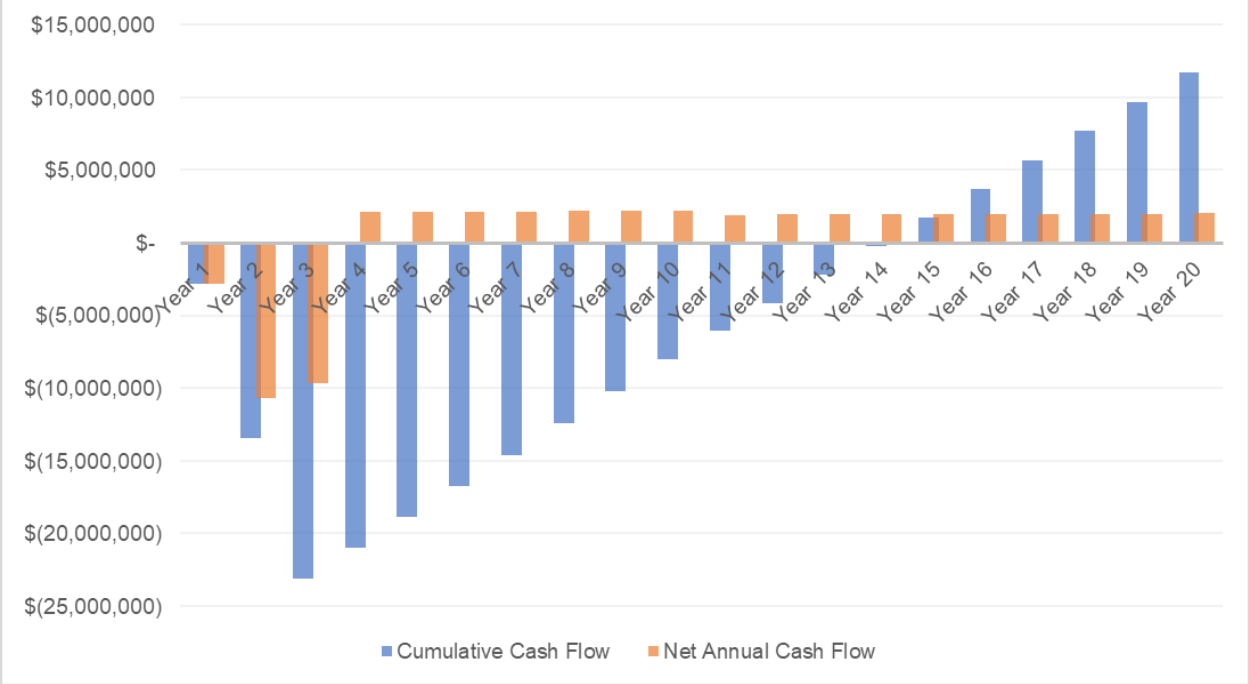


Figure 6 – Marin Water AMI Project Cash Flow Illustration Over 20 Years

As illustrated in the table and the graphs above, the estimated benefits (even at a conservative estimate, as described in the upcoming section) outpace the total cost of ownership of an AMI system in the final scenario, not only recouping capital and ongoing operational costs, but also providing for a significant return on investment (ROI) for the

implementation. Implementing an AMI system provides a significantly greater value proposition, as compared with continuing to invest monies in Marin Water's current metering system without realizing much relative gain on said investment.

With respect to the benefits identified in this report, we recognize the strong service commitment Marin Water has to its customers. In addition to those benefits that can be readily quantified as operational savings to the utility, a number of "soft" customer service-oriented benefits can be realized that improve both customer satisfaction and the relationship Marin Water has with its customers.

AMI provides both Marin Water and its customers near-real-time information about individual water usage. With this information, customers will be empowered to more effectively manage water usage to suit their wants and needs, allowing choices that sustain and improve quality of life. Because of the amount of usage data Marin Water will have access to, customer service representatives will also be able to more readily and expediently address customer concerns and inquiries.

Additionally, customer service will be improved with tools to transform from reactive to proactive—alerting customers of potential leaks, planned service outages, or other events before they become problematic. With the deployment of this technology, customers can receive immediate alerts and set up their own notifications.

Based on the results of the business case, along with the many "soft" benefits to be realized, the deployment of an AMI solution is a favorable project for Marin Water to undertake. When implemented and utilized strategically, this technology allows the utility to realize improved operations and planning, as well as greater service to its customers. The combination of projected hard benefits and soft benefits appears to provide superior levels of value to Marin Water and its customers, as compared to the current operations and services that are offered today.

5.2. Methodology

Scenario

The project scope considerations underlying this financial analysis included:

- An AMI system with infrastructure and equipment to transmit data at prefered intake intervals and billing meter reads and to provide a network and meter configuration management toolkit;
- An MDMS for validation of large volumes of meter register and interval data, basic data analysis, and data retention;
- A CEP for presentment of data and to improve customer communications;
- Metering equipment and miscellanous equipment (water meters, registers, water meter box lids etc.);
- Third-party meter installation vendor to perform meter replacement and retrofits;
- The necessary professional services and integration of systems to AMI and other business-critical systems;
- Sales tax, contingency and inflationary consideration

The estimated infrastructure and equipment costs are based on various AMI technology solutions, including cellular networks and radio frequency networks. Please refer to section 5.5. for a comparison of the typical cost model between cellular and radio AMI implementations.

Upon project completion, meter reading in Marin Water's service area will migrate to an automated, two-way method of communication. Marin Water plans to replace some meters entirely, while retrofitting other meters, and equipping all meters with AMI endpoints. As part of this effort, three (3) meter replacement scenarios were presented to Marin Water team. These scenarios are described below:

- Replacement of meters 10 years and older, retrofit (replace register and add endpoint) the rest
- Replacement of meters 15 years and older, retrofit the rest
- Replacement of all meters 20 years and older, retrofit the rest

Based on the results of the different scenarios, Marin Water selected the first scenario (replacement of meters 10 years and older) as it produces the most beneficial business case.

Table 9 – Estimated Meters to be Replaced (10 years and older cutoff) vs Retrofit

Water Meter Size	Replace	Retrofit	Total
5/8"	34,453	8,075	**42,528**
3/4"	2,316	1,570	**3,886**
1"	9,385	3,550	**12,935**
1 1/2"	1,308	1,015	**2,323**
2"	270	384	**654**
3"	117	69	**186**
4"	13	26	**39**
6"	7	10	**17**
8"	4	1	**5**
Total	**47,873 (77%)**	**14,700 (23%)**	**62,573**

As part of the cost-benefit analysis a comprehensive financial model was developed, which represents the deployment of AMI and related technologies and services. The primary components of this financial model include:

Capital Expense (CapEx) e.g., AMI infrastructure, equipment, installation, professional services, etc. costs incurred during deployment

Operational Expense (OpEx) e.g., annual fees related to software hosting and licensing incurred post-deployment; and maintenance of meters, transceivers, and data collectors

Anticipated Benefits – mitigated future cost or recovered revenue; e.g., operational savings, revenue enhancement, reduction of water leaks, improved

service for customers, improved asset utilization, etc. realized over the program lifespan

The combination of these three areas is used to project net annual cash flow.

We utilize the most recent vendor pricing when modeling the components of the estimated project capital and operational expenses. Pricing from proposals, bids, and contracts that were received on behalf of clients is aggregated into a comprehensive database, inclusive of hardware, software, installation, professional services, and other ancillary costs. Each of these categories is itemized so as to provide a high degree of accuracy. Whenever conflicting pricing is noted an upper estimate is used. This methodology ensures that Marin Water is provided with a conservative estimate for planning and budgeting.

Our approach when developing the cost-benefit analysis underpinning this business case is to review assumptions with respective utility staff experts to ensure that each one is adequately and accurately reflected in the financial model. The underlying philosophy is not to *underestimate* the cost and not to *overstate* the potential benefits so as to ultimately arrive at a conservative result.

Global Model Assumptions

A series of data requests were submitted to Marin Water related to the utility's operational costs and current business functions. A data collection workbook was developed, and, through a series of iterative requests and discussions, the workbook was populated to inform the assumptions used in the financial model. The workbook is comprised of the following areas of inquiry:

- **Base Assumptions** — general Marin Water demographics and financial assumptions used to inform the project meter replacement rate and growth projections.
- **Benefits Assumptions** — all internal expense and revenue categories related to water, and other ancillary operations at Marin Water used to inform the service-related benefits of the project.

The following base assumptions are reflected in the business case herein:

The components and implementation options to this approach include: utility-owned and utility-managed AMI network; hosted/SaaS AMI HES; hosted/SaaS MDMS; hosted/SaaS CEP and accompanying integrations.

The lifespan of the project is aligned to the industry-standard lifespan of an endpoint, at 20 years (10 year full warranty; remaining lifespan prorated).

A 12-month Initial Deployment Area (IDA) will be initiated (inclusive of planning and selection of a small area of the service territory to conduct meter upgrades) before full deployment of an AMI system across the service territory.

The CapEx estimate includes a 10% contingency on top of capital expenses.

The CapEx estimate includes a 5% inflationary consideration on top of capital expenses.

A discount rate of 3.0% is assessed to calculate NPV.

The following systems will need to be integrated: AMI, MDMS, CEP and CIS. Implementation of the AMI network, meters, and endpoints, from IDA to total system functionality, is estimated to span approximately 36 months (3 years).

5.3. High-Level Capital and Operational Expenses Estimate

A summary of the estimated capital and operational expenses is presented below. The detailed line-by-line estimate can be found in Appendix 3.

Table 10 – Summary of Estimated Capital Expenses

Capital Expense Category	Estimate
Upfront AMI HES, AMI Network Infrastructure, MDMS, CEP	$ 0.67 M
AMI Endpoints	$ 5.32 M
Water Meters, Registers, Lids	$ 8.93 M
Third-party Meter Installation Vendor Services	$ 3.71 M
Professional Services	$ 2.69 M
Other Cost (Contingency, Sales Tax, etc.)	$ 4.32 M
Total Estimated Capital Expenses	**$ 25.64 M**

Table 11 – Summary of Estimated Annual Operational Expenses

Operational Expense Category	Estimate*
AMI Network and HES	$ 106.37 K
MDMS	$ 37.54 K
CEP	$ 31.29 K
Total Estimated Operational Expenses/Year	**$ 175.20 K**

**In the financial model, it is assumed that the annual operating expenses increase by 3% every year, starting year 5 of the project.*

5.4. Benefits Assumptions and Estimates

Quantifiable Benefits – Immediate

Table 12 summarizes quantifiable benefits, explanation of the benefits and the estimated value used in the financial analysis. These benefits are benefits are assumed to be achievable once the AMI system and network are operational at Marin Water.

Table 12 – List of Quantifiable Benefits - Immediate

Quantifiable Benefit	Description	Estimated Annual Savings/ Benefits Percentage
Meter Reading Phased Reduction	Meter reading expenses will not initially be reduced as staff is still required to perform other meter maintenance activities, troubleshooting meter issues and read meters not covered by AMI network.	Estimated starting year 5, an annual reduction of staff due to attrition by 0.25 FTE/year.

Quantifiable Benefit	Description	Estimated Annual Savings/ Benefits Percentage
Customer Call Reduction	Reduction of customer calls expenses due to the expedited resolution time and reduction of customer call volume.	Estimated annual reduction of 15%.
Meter Re-Reading Reduction	Reduction of the majority of physical re-reads due to the availability of meter reads in the AMI/MDMS.	Estimated annual reduction of 98.5%.
Customer-Generated Service Order Reduction	Reduction of effort (field activities, customer service investigations) required to fulfill customer-generated service orders (e.g. move in/move outs, high consumption investigation, no meter movement, etc.).	Estimated annual reduction of 70%.
Billing Exception Handling Expense Reduction	Reduction in time to perform follow-up and investigations in billing exceptions due to validation, estimation, and editing routines available in the MDMS.	Estimated annual reduction of 90%.
Revenue from Theft Identification	Recouperation of revenue via theft detection routines supported by the AMI system tamper alerts	Estimated annual recovery of 0.10%.
Revenue from Recycled Meter Scraps	One-time revenue from old meters that were pulled out.	
Customer Leak Detection Savings	Benefit for the customer as AMI will be able to detect leaks in a timely manner and be notified by Marin Water. Note that this benefit resulted in a negative impact to the business case, as the loss of revenue was also considered.	Estimated 2% leak detection, with 40% customer participation (customer acting on the leak).
Leak Adjustments Reduction	Reduction of leak adjustments as Marin Water will have more pro-active measures in alerting customers about a leak.	Estimated reduction of 80%.
Customer Engagement Savings	Savings accounted for not purchasing or producing product, due to empowered customers using interval data to monitor and manage usage via CEP. Note that this benefit resulted in a negative impact to the business case, as the loss of revenue was also considered.	Estimated 3% conservation with 1% customer participation.
Annual Meter Replacement Budget Offset	Reduction of annual meter replacement budget due to the mass meter replacement during AMI deployment. The duration of years when this offset occurs	Estimated annual offset of 93%, up to year 10 of the project.

Quantifiable Benefit	Description	Estimated Annual Savings/ Benefits Percentage
	depends on the meter replacement year cutoff.	
Revenue Capture from Improved Meter Accuracy	Increased revenue due to the increase of meter accuracy with the installation of new meters. The average meter inaccuracy is assumed at 4%.	Estimated accuracy improvement of 60%. Starting year 11 up to year 20, an annual 1% decline is applied.

Additional Quantifiable Benefits

There are additional quantifiable benefits that were not included in the financial analysis model. Quantifying these additional benefits would require additional analysis, planning and potentially additional software (e.g analytics software) to fully gain an understanding of the benefits. These future quantifiable benefits could increase the value proposition of the AMI technology. Table 13 provides the list of additional quantifiable benefits.

Table 13 – List of AdditionalAdditioanlAdditional Quantifiable Benefits

Quantifiable Benefit	Note
System Loss Reduction	AMI can time stamp usage for the meters across the system and provide a tighter window of usage, resulting in a more accurate accounting of water into and out of the system. Time-synchronized data from the AMI can be used to support system modeling. This data can be correlated to production meters, pressure monitors, backflow devices, etc. to gain a clearer picture of water flow and system performance to a level of confidence heretofore unattainable for most utilities. With a data analytics routine, Marin Water can better identify and reduce system loss.
Pump Schedule Optimization	The frequency of AMI read data will allow Marin Water to optimize its pumping schedule and reduce electricity costs. Data analytics may be required to compare the AMI data demand pattern with the SCADA data supply pattern.
Further Improvement in Water Conservation Savings	Although water conservation savings will be immediately realized, further analysis by Marin Water coupled with further insight of AMI data by the customers may lead to additional strategies and programs to improve water conservation.

Intangible (Soft) Benefits

In addition to those benefits that can be quantified and are included in the cost-benefit analysis, numerous intangible/soft benefits will be realized. While many of these benefits are not easily measurable and have not been included in the financial analysis, they are certainly real and achievable with the successful deployment of an AMI system. Successful deployments of AMI/MDMS/CEP systems frequently act as enablers to creative solutions for operational or analytical problems. By leveraging the AMI system and interval read data for other value-added activities beyond typical meter reading, many of these intangible benefits have a large, direct, and positive impact on the customer experience and operational efficiencies. A summary of intangible benefits is provided in Table 14.

Table 14 – List of Intangible Benefits

Intangible Benefit	Note
Improved Customer Experience and Customer Call Quality	Using interval consumption data and on-demand readings, customers can more effectively manage their usage, and customer service representatives can more readily troubleshoot problems for customers.
Improved Emergency Protocol	The frequency and volume of AMI data will allow Marin Water to respond more swiftly and efficiently to emergencies than it can do currently, especially when paired with the analytic capabilities of an MDMS. Additionally, expedited customer messaging will allow for improved notification of customers during emergencies.
Targeted Messaging	Ability to conduct customer outreach using a portal or other messaging protocol. Targeting individual customer groups by geography, class, or usage, public outreach can be used to augment several different programs within the utility. Examples of types of customer messaging include: • News alerts, such as when new capital improvement projects are underway, billing changes, or new programs • Conservation messaging • General utility activities
Improved Reliability & Conservation	The AMI system will enable Marin Water to model the overall system to facilitate proactive management and improve reliability and conservation.
Improved System Planning Capabilities	Information that can be produced and analyzed from an AMI system can facilitate the improved management and monitoring of system performance, leading to better informed capital investment decisions. System engineering and maintenance programs can be supported with better, more frequent access to the more granular data that will be provided by the AMI system.
Meter Diagnostics to Monitor Device Aging	Using routines for identifying slowing meters or failing batteries, Marin Water can improve the accuracy and precision of its meter replacement program, thereby reducing

Intangible Benefit	Note
	unnecessary meter replacements and service interruptions to customers.
Risk Mitigation and Reliability Assurance	Mitigates risk of revenue loss as a result of a catastrophic failure of meters through identification of systemic failures for any meter batches installed by improving response time. Better preparedness for handling these failures, should they occur, will also prevent unscheduled, emergency labor costs. In addition to protecting revenue, risk mitigation directly improves perception of system reliability to customers.
Improved Budgeting	Use of granular interval data from meters can allow for improved analysis of demand and pricing sensitivity, such as for budget-based rates.
Timely and Accurate Meter Reading	Coordination across a variety of staff within Marin Water. AMI reads will alleviate the strain on staff to deliver timely and accurate meter reads and bills.
Meter Rightsizing	Data and alarms produced by an AMI system will provide Marin Water with the ability to detect if a meter is oversized or undersized.
Improved Safety	With the introduction of AMI, Marin Water will have the ability to remotely read meters and initiate on-demand meter readspotentially . These actions will dramatically reduce exposure to risky conditions on the road and at customer premises, due to weather conditions, unfriendly pets, physically hard to access meters, and theft.
Use of Network	A utility-owned network will provide new communications infrastructure to Marin Water that may be leveraged for other devices, such as any existing flow sensors or pressure sensors, or new Internet of Things (IoT) devices.
Environmental Sustainability	Greater operational efficiencies and fewer field visits will allow for better utilization of natural resources and a reduction in environmental impacts as a result of less wasted water and fuel.
Compliance with Future Legislative Requirements	With the introduction of AMI, Marin Water will better prepare itself to address all legislative and/or California state requirements regarding conservation or other resource-related issues.
Brand Perception	Customer perception improvement as a result of: Faster customer inquiry response times More informed customer service Averted high bills Averted leaks/breaks Expedited outage response Improved public messaging Higher perception of billing accuracy

Intangible Benefit	Note
	Higher perception of staying current with technological improvements
Carbon Footprint Reduction	Reduction of vehicle contributions to carbon footprint and greenhouse emissions.

5.5. Additional Consideration: Radio vs Cellular AMI Lifecycle Cost Comparison

A total lifecycle cost comparison between radio AMI technology and cellular AMI technology was also provided for Marin Water. The assumptions made for the comparison are the following:

- Radio AMI technology will require upfront AMI network and installation cost, while cellular AMI technology does not require any upfront AMI network cost
- Radio AMI technology will utilize the SaaS model (software managed by vendor, hardware managed by utility) while cellular AMI technology will utilize the NaaS model (both software and hardware managed by the vendor)
- The lifecycle cost include the upfront AMI capital expenses and the annual AMI operational expenses for 20 years

Table 15 – Radio vs Cellular AMI Lifecycle Cost Comparison

Category	Radio AMI		Cellular AMI	
Upfront CapEx Estimate				
	Unit Cost	Total Cost	Unit Cost	Total Cost
Cost Differentiator: Upfront Network Equipment & Installation		$ 0.53 M		N/A
Cost Differentiator: Endpoint	$ 90 /endpoint	$ 5.63 M	$ 83 /endpoint	$ 5.19 M
Main CapEx Costs (Metering Equipment, Professional Services, Meter Installation Services, etc.). Same estimate for Radio & Cellular.		$ 15.47 M		$ 15.47 M
Other CapEx Costs based on % (Inflationary Consideration, Performance Bond, Sales Tax, Contingency)		$ 4.43 M		$ 4.22 M
Estimated Total CapEx		**$ 26.05 M**		**$ 24.09 M**
Annual OpEx Estimate				
AMI SaaS for Radio, AMI NaaS for Cellular	$ 0.18 /endpoint /month	$ 2.20 /endpoint /year	$ 0.55 /endpoint /month	$ 6.60 /endpoint /year

Category		Radio AMI		Cellular AMI
AMI Network Backhaul		$ 21,600 /year		N/A
Estimated Total AMI OpEx (20 Years) SaaS only for Radio AMI NaaS (includes SaaS) for Cellular AMI		**$ 3.57 M**		**$ 9.49 M**
Estimated Total MDMS OpEx (20 Years)		$ 0.97 M		$ 0.97 M
Estimated Total CEP OpEx (20 Years)		$ 0.81 M		$ 0.81 M
Estimated Total 20 Year Lifecycle Cost	**Radio:**	**$ 31.41 M**	**Cellular:**	**$ 36.15 M**

For radio AMI, the OpEx includes the annual software-as-a-service costs only. For cellular AMI, the OpEx includes the annual software-as-a-service costs and the network as-a-service cost.

Notes pertaining to the radio versus cellular AMI comparison:

For the radio AMI SaaS solution, Marin Water will incur additional internal cost as the utility will be responsible for the

AMI network equipment, installation and maintenance
AMI network backhaul connectivitiy
Maintenance and management of AMI network
Necessary lease, permits to secure AMI network site.

Several radio AMI vendors will also offer NaaS solution, where they would own and maintain the AMI network equipment.

The endpoint pricings (and annual SaaS, NaaS costs) are based on the most recent quotes we observed in the first half of 2022. In the past, radio AMI endpoints are typically lower in cost compared to cellular AMI endpoints. However, cellular AMI endpoints have become more competitive recently while supply chain issues have caused pricing of other endpoints to increase. As equipment pricing continue to be volatile, actual costs can only be determined once Marin Water conducts a formal solicitation and receives bids from the vendors.

5.6. Financial Analysis Conclusions

With the combination of AMI benefits identified, Marin Water will be positioned to greatly enhance levels of service both to internal stakeholders and external customers relative to the current operations and services that are offered today. In particular, the intangible benefits identified will allow Marin Water to provide significantly greater customer service, and address the goals and objectives set forth herein.

Though no major project should be undertaken solely on the basis of financial gain, the benefits from adopting AMI are significant. It is our conclusion that Marin Water is well-positioned to implement AMI with minimal financial risk to the organization overall.

6. Business Process Impact Assessment

As part of this AMI assessment, we met with members of Marin Water's staff who are responsible for various elements of the utility's day-to-day meter-to-cash processes to identify business processes, organizations, and systems that will be impacted by the implementation of AMI. The discussion was divided roughly into three sections: business processes, staffing impacts, and technological impacts.

6.1. Business Processes

The five areas of business process impact due to AMI that were discussed are: Billing, Customer Inquiry, Field Activities, Move-In/Move-Out, and Non-Pay Disconnect/ Reconnect. These are five of the primary meter-to-cash processes that may experience dramatic impacts due to AMI. We used this opportunity to present the most major impacts to these core processes. The goal of this discussion was for Marin to learn about the possibilities of AMI, what the utility may do in the future using the systems, and how these new abilities may impact the utility.

Billing

The most dramatic impact of implementing AMI is that the meters will be transmitting both register and interval reads to the utility on a consistent basis. Since the meters actively transmit the read data, meter repair workers will not be manually collecting the reads once per billing cycle. Without the need to manually collect the read in the field, there will be fewer skips and fewer estimates. Additionally, Marin Water will receive at least 25 reads per day per customer (including the one register read and the 24 hourly interval reads); rather than collecting one read per billing period, Marin Water will receive approximately 1,500 data points per customer per billing period.

Once those reads are received, it is likely that Marin Water will be able to perform VEE (or Validation, Estimation, end Editing); VEE is a tool in most Meter Data Management Systems (MDMSs), though the exact details of how VEE will function is dependent upon the specific MDMS implemented. VEE can be described as advanced exception handling; it is like the exception handling that Marin Water performs in the CIS prior to billing, but the differences are that VEE is performed daily and it searches for a far larger number of exceptions. By performing VEE daily, the billing staff will discover any anomalies regarding consumption or meter communication on the date of the anomaly. Since the utility will discover these anomalies early, rather than on the day a meter read is collected by a meter repair worker, the utility will have time to proactively respond and correct the issue before bills are generated. Utilities typically perform VEE every business morning, and many set aside .5 full-time equivalent (FTE) and schedule VEE for 8AM-12PM; however, VEE rarely actually takes that long to process each day, and the employee generally spends the remaining time on other tasks.

Finally, in the rare occurrence where rereads will be needed, Marin Water will not need to roll a truck. Since each meter will communicate 25 reads each day, all the relevant data for every day will already be in the system for the date in question.

Customer Inquiry

Since Marin Water will have automated customer consumption data transmitted directly into the billing system, the occurrence of inaccurate bills will be substantially reduced; this should lead to fewer customer complaints about meter mis-reads.

When a customer does call about a bill, the CSR will have a wealth of data at his or her fingertips to assist the customer. By pulling up the customer's account in the MDMS, the CSR will have visibility into detailed, hourly consumption for the period in question, as well as the ability to see trends, spikes, and other pieces of information. There will be much more data to allow a CSR to investigate a customer's account remotely, and this will remove the need to roll a truck in most circumstances.

The implementation of a customer engagement portal (CEP or "portal") as part of the AMI project will empower customers to answer their own questions. Customers will be able to log in and see their own detailed consumption data, and this should result in fewer calls to customer service. It is not possible to predict what the uptake of the portal will be or how many customers will create log-ins; this is heavily dependent upon the utility's existing customer base among other factors. However, there are numerous ways that Marin Water can help to increase portal uptake, such as: promoting the benefits of the portal in bill inserts, the utility website, etc.; assisting customers to download and/or create a sign-in when they call in; and explaining the benefits of the CEP to customers when employees interact with them in the field.

As Marin is performing VEE, the utility will have visibility to suspected water leaks, suspiciously high consumption, and other unique consumption trends. These are examples of exceptions that Marin will experience in the daily VEE process; by checking exceptions daily throughout the service area, Marin will understand if any customers are experiencing unusual consumption trends. Marin then can proactively reach out to customers in advance. Additionally, customers may set up alerts directly through the CEP to self-monitor and advise them of these scenarios. By being proactive throughout the billing cycle, Marin Water and customers would eliminate the shock of receiving a high bill; this may further reduce the number of customer calls generated and received.

Field Activities

Because Marin Water will be receiving reads systematically in the future, meter repair workers will not spend their time manually collecting meter reads. This will free them up for performing more high-value work for the utility, such as data validation and performing proactive meter repairs.

VEE will provide Marin Water insight into many elements of meter operations, but meter reads are not the only types of information that's communicated from the meter to the utility. There will likely be specific meter communications that are high priority, such as alarms for tamper and backflow for example (depending on the MDMS implemented); these high-priority meter communications are received by the utility in real-time, rather

than only being received on the same schedule as meter reads. Marin Water will consistently have a full view of meter operations throughout the whole service area. This is unlike pre-AMI operations, where many meter issues are detected when meter repair workers are manually collecting reads and an issue requires a fast reaction to ensure the bills can be generated and distributed. However, when Marin has daily visibility into the whole service area, the utility will proactively correct issues as soon as possible to ensure billing flows smoothly. Marin Water will be able to prioritize field work and will have smoother operations with better planning for the work that needs to be performed each day.

Under AMI operations, when meter issues are detected, they will be investigated remotely. Depending on the type of issue, this remote investigation may lead to a remote solution without rolling a truck. For example, there may be an issue of a spike of usage one day in the spring; this could possibly be an issue where water is flowing freely through the meter, however if a remote investigation reveals a similar spike in the previous spring it could be assumed to be a pool fill. However, if a meter issue is detected that does require a truck roll, the meter repair worker will travel to the scene with a complete understanding of the problem. The on-site investigation will be minimized as the meter repair worker will get straight to work on the issue, increasing staff efficiency.

It is not possible to predict in advance what percentage of meters will fail to communicate a read due to battery loss, cellular service loss, water in the box, or other problems. However, Marin Water will perform extensive testing before implementing meters in the field, meaning that the utility will be as prepared as possible for meters to be functional once implementation occurs.

One negative element of AMI is that there is no one regularly visiting meters to collect meter reads and place door hangers for high-use notification. This lack of regular mini investigations may lead to problems for the utility over time, such as broken pit lids going unreported or customers landscaping over the meter to where it is not visible. To help resolve this potential issue, it is recommended for meter repair workers to visit each meter in the service area once per year for maintenance. It is typical for utilities to visit each AMI meter every one-to-three years.

Move-In/Move-Out

Marin Water's AMI systems will be collecting reads every day from every customer, which means that in the scenario of a move-in or a move-out the start and final reads will already be collected. There will not need to be truck rolls to collect reads.

When a customer moves out and a premises is vacant, Marin Water will have the opportunity to leave the water on and remotely monitor for unexpected consumption. This is a common utility choice to reduce the number of truck-rolls for move-outs. It is common for a utility to choose to wait for a set number of days (i.e., three or five) to see if a new tenant moves in, and only roll a truck to turn off the meter if the premises is still vacant.

There are some water meters on the market that would allow Marin Water to perform a remote disconnect, which is turning off the meter without rolling a truck. If Marin Water didn't want to leave the water on at a vacant premises but also didn't want to roll a truck, a remote disconnect meter would be a viable solution.

However, if the move-out occurs without a truck roll for either a meter read or a meter turn-off, there will be no way to leave a door hanger for the next customer. Marin Water must decide whether the benefits of the door hangers are more significant than the costs of the truck rolls.

Non-Pay Disconnect/Reconnect

Before a customer reaches the need for a non-pay disconnect, the customer may be able to monitor their own consumption using a portal and be notified proactively about high consumption; This will reduce the number of customers being surprised by a high bill which they may not be able to pay.

Once a customer has been disconnected, Marin Water may monitor VEE daily for any unexpected consumption or tamper alarms; these alarms are common, however the specific alarms and their capabilities will be dependent upon the meters and MDMS installed.

6.2. Staffing

Potential staffing implications of AMI with the Marin Water team were also discussed. This was a high-level discussion which didn't involve any discussion of the number of FTEs, but rather just touched on potential shifts that may occur. In anticipation of the AMI project, Marin Water's management has made it clear that there will be no expected reduction in staff numbers. These conversations covered meter repair workers, customer service representatives, and an AMI administrator.

Meter Repair Workers

Meter repair workers will no longer need to collect reads, which will free up time for them to participate in other activities for the utility. There may be additional tasks to perform in the office by analyzing AMI data and performing remote investigations. As the software systems and the meter hardware evolve and get more complex, there may need to be additional training for meter repair workers. The job description for meter repair workers may evolve to encompass the need for additional skill sets including, software application knowledge and data analysis.

Customer Service Representatives

When a utility introduces a customer portal, it is typical for calls volumes to drop; approximately a 30% drop with the portal. However, all utilities have unique situations and local customer demographics to consider, so the utility may not see a 30% drop in call volumes. However, a customer portal will empower customers to resolve their own questions, and to do so without calling in. When Marin Water does deploy a portal, it will

most likely occur at least one year after the AMI implementation is complete, meaning there will be multiple years to plan for this impact.

On the other hand, during AMI deployment and during portal deployment Marin Water may see an increase in the number of calls as customers question what is occurring. It is recommended that Marin Water performs an awareness and education campaign to proactively resolve customer questions about AMI and the new meters, which should help reduce the number of calls.

AMI Administrator

Some utilities choose to create a position to oversee the AMI on a daily basis. This could be one designated person to perform the daily VEE and to monitor the communications system. For example, there is various information in the daily VEE report which will be important to different people within the utility, and this person could serve as a "digital traffic cop" to ensure that the correct information reaches the appropriate people.

We recommend that, if Marin Water is interested in introducing this role, the role is filled early in the project. Utilities typically see great levels of success with this role when an AMI Administrator's training has been tied into system testing and deployment. It can be tempting to wait to fill the role once the system is functional, however in that case the new staff member won't have been an active participant in the development of the system and will likely be in a position of trying to learn the system while using it live. This can create a situation of trying to "drink from a fire hose" of data and can result in the person (and the utility) needing to try to catch up.

6.3. Technologies

There are other areas of this report that provide a much deeper discussion of the technological impacts of the AMI systems, however we would like to reiterate the two specific technologies spoken about the most during the business process impact assessment: the Meter Data Management System (MDMS) and the Customer Engagement Portal (CEP).

Meter Data Management System (MDMS)

Like the name implies, the MDMS contains all the information that is communicated from the meter, including all interval reads, register reads, VEE, and meter alarms. This system is often a primary system for performing remote investigations and for learning about customer consumption.

However, an MDMS will not replace Marin Water's CIS. The MDMS doesn't contain customer account information or billing information. There will be an automated data sync of one register read per billing period from the MDMS to the CIS, and Marin will generate bills in the CIS in the same manner as occurs today.

Customer Engagement Portal (CEP)

A CEP is a web-based platform and/or a smartphone application that allows customers to see their hourly consumption data and consumption history. Many CEPs are also integrated into existing payment collection systems which allow customers to pay their bills from within the portal.

Many CEPs contain additional functionality, which may include customer push notifications from the utility, educational videos, leak notifications, threshold notifications for consumption/spend, and even gamification of conservation.

6.4. Business Process Impact Assessment Conclusion

Marin Water will see many impacts to the utility's core Meter-to-Cash processes caused by the implementation of AMI, and almost all those impacts will be positive. However, these impacts will require preparation and planning by the utility; if Marin Water is not able to smoothly resolve these impacts or to fully take advantage of the new technology, the utility may miss out on some of the return on this significant investment.

It is recommended that business process design work take place throughout the AMI project. As opposed to technical design work, business process design places an emphasis on the people using the technology. For example, how will a CSR's tasks change using the new systems, or how will a meter repair worker take advantage of the new systems to perform work in the field. This type of planning and work is generally found to be an instrumental element of change management and assists employees with gaining familiarity with the systems and their new tasks. There is often a current state business process assessment to understand how the utility currently performs the core business processes, followed by multiple iterations of future state business process design to ensure that the processes are developed as are best suited for Marin's unique needs, and finalized by a business process audit once the system is functional to determine if the processes were optimized specifically for Marin Water. These different business process workshops are scheduled to provide the greatest value for Marin Water employees at strategic times during the implementation.

These discussions that took place during this assessment illustrated that Marin Water is already thinking of these impacts, which is encouraging to see that there is awareness of the need to change. As could be expected so early in the project, we also discovered areas where the utility could receive further education. Overall, these were positive, fruitful discussions, and we believe that if Marin Water moves forward with an AMI deployment the utility will be prepared to fully take advantage of the tools it acquires.

7. AMI Strategy/Roadmap

7.1. AMI Project Goals

In February 2022, a workshop was held with a wide range of utility stakeholders across the Marin Water organization to solicit AMI project goals, relative to pain points in the utility operation. Key concepts and marketplace trends were presented of AMI, how the functionality and the data might assist with their respective jobs, example goals from other AMI projects, and asked that stakeholders provide their ideas of what defines project success.

Based on the discussion and subsequent review of the goals, Marin Water determined the following goals for the AMI project.

Table 16 – Marin Water AMI Project Goals

No.	AMI Project Goal	Priority
1	Enhance customer engagement through an intuitive customer portal which offers another means of increased customer notifications	High
2	Provide timely leak notifications for customers through direct notification (text, email, call)	High
3	Utilize AMI data to support effective planning and evaluate conservation programs	High
4	Timely and accurate meter reading with improved efficiency and workplace safety	High
5	Availability of AMI data through full integration into Customer Management System (CMS) (Currently SAP)	High
6	Personalize customer engagement and outreach based on individual needs	Medium
7	Establish an AMI system with capabilities to expand based on future needs (e.g. pressure sensors, water quality monitoring)	Medium
8	Improve operational efficiencies (cost mitigation, risk mitigation, demand management, etc.)	Medium
9	Examine the potential to increase billing cycles (from bi-monthly to monthly)	Medium
10	Reduce carbon footprint in support of regional climate actions initiatives	Low

It is recommended that Marin Water work to quantify and measure these goals wherever possible, as the AMI project progresses toward deployment. In the next section, an AMI

Project Roadmap is presented that will guide Marin Water in achieving the established AMI Project Goals.

7.2. AMI Roadmap

The following AMI implementation Plan provides the strategic direction of the implementation,, including milestones and timelines. Marin Water is aware that implementing AMI is far more than merely a meter upgrade, and as such is planning for the long-reaching impacts and new abilities that the related hardware and software will provide. This section provides an understanding of how those plans are constructed.

The AMI Roadmap provides an overview of steps the project will take over multiple years. This allows Marin Water to plan for specific details and to be ready at the correct time as actions occur. The AMI Roadmap covers multiple milestones through the length of the implementation project and on into the future for long-term planning and use cases implementation. By preparing to make relevant changes at the relevant time, Marin Water will consistently ensure that the utility is best prepared for what comes next.

The program roadmap depicted in Figure 7 serves as a high-level illustration of the relative timeframes and scope of each phase.

The ultimate goals of an AMI program at Marin Water are to:

- Timely and accurately bill customers based on AMI meter readings, with improved efficiency and workplace safety
- Turn meter data into actionable information that enhances customer engagement (via an intuitive customer portal) and planning conservation programs

Overall, the near-term and long-term goals of the AMI program are to:

- Near-term (next 1 to 3 years)
  - Design, prepare bid packages and procure an AMI solution that will carry Marin Water well into the future
  - Develop initial customer awarness plan
  - Review and update District code as appropriate to leverage new AMI technology
  - Establish staffing plan and staffing to support the AMI system
  - Plan, test, install and integrate the selected AMI solution
  - Ensure availability of AMI data through full integration into Marin Water's Customer Management System (meter-to-cash)
  - Develop process to provide timely leak notifications for customers through direct notification
  - Establish base AMI use cases
  - Develop initial customer awarness
- Long-term (4 years and beyond)
  - Maintain the integrity of the AMI system (data quality)

Refine successful, value add use cases

Identify and implement new use case opportunites that bring additional value to Marin Water and their customers (e.g. pressure, water quality monitoring)

Improve operational efficiencies (e.g. demand management, cost mitigation, risk mitigation)

Reduce carbon footprint in support of regional climate action initiatives

The roadmap in figure 7 identifies in detail a clear path and timeline for attainment of goals identified by Marin Water.

There were discussions on why a 3 year AMI implementation period was recommended compared to phasing in AMI over 10 years. Although the capital expenses can be spread over multiple years, there are several factors to consider by Marin Water should an AMI implementation is being prolonged:

Extension of staff/vendor time and cost to manage the AMI deployment project.

Increase in overall cost as there maystill be the need for installation project management/quality assurance/quality control and warehousing (particularly if third party meter installation vendor is utilized).

Extension of time where Marin Water will have to collect readings by two different ways (i.e. remote reads via AMI and physcial driveby/manual read collection).

Customer disparity – some customers may be on AMI and have CEP access sooner than the others.

The longer the project deployment is being extended, higher total costs can be expected and some AMI benefits may not be realized until the majority of the population are on AMI meters.

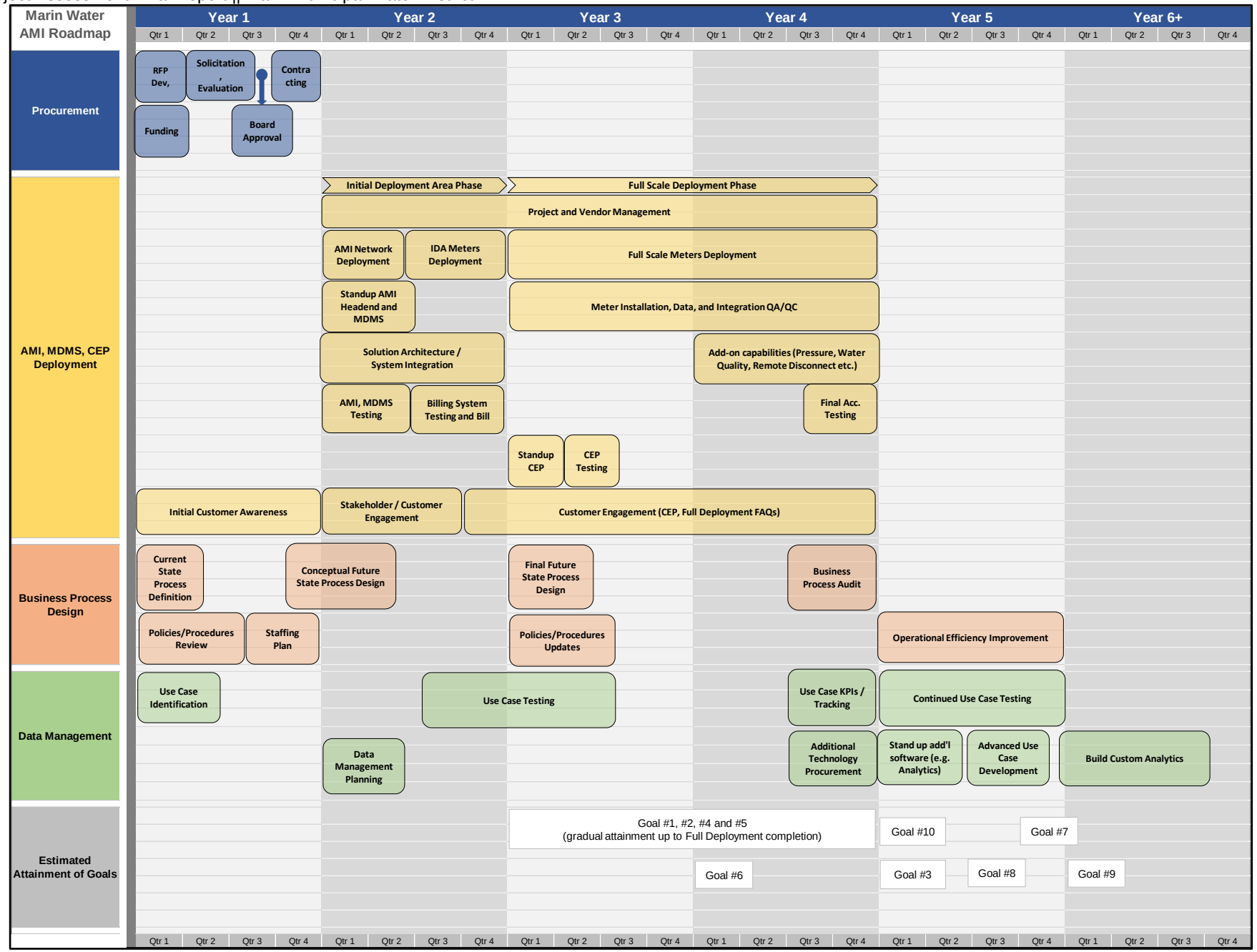


Figure 7 – Marin Water AMI Roadmap

8. Project Implementation Planning

A draft implementation plan in Microsoft Project has been provided in Appendix 4. The draft implementation plan illustrates the various tasks and dependencies that Marin Water can anticipate will need to occur during an AMI project deployment.

The recommended phases and tasks in the implementation plan are built upon the roadmap as presented in the previous section. Based on the discovery efforts and findings in this study, Marin Water appears to be well-equipped to proceed with an AMI program. It is recommended that Marin Water move forward with the implementation of an AMI program, starting with an AMI procurement, initial customer awareness plan, policy review, and staffing plan. This technology will have merits across the organization by driving efficiencies at Marin Water, streamlining work processes, and supporting environmentally friendly initiatives (such as water loss and greenhouse gas reductions).

8.1. Procurement

When Marin Water movesmoves forward with an AMI project, the selection of, and contracting with, the vendor/contractor(s) is a critical step in acquiring a system that meets the business and long-term needs of the utility. It is recommended that Marin Water solicit proposals for AMI, MDMS, CEP and meter installation services. It is important to secure vendors that are the right fit for the utility. Below are some details on the steps to be taken to ensure the right vendor/contractor selection.

Requirements Development and Procurement Strategy

A recommended approach for the procurement is to identify tight, detailed requirements (business and technical) and tailor them specifically to Marin Water's needs. In addition, a procurement strategy review will be needed to document strategy for the release and solicitation of proposals that may consider several factors:

IT practices, physical infrastructure, staffing, software development, software support, software integration, data management, security, and project management

RFP policies, administration, cost considerations, terms & conditions, vendor communications, and timeline

Appendices, attachments, vendor response format, and evaluation methodology / criteria

Funding

Parallel with the start of procurement efforts, Marin Water intends to seek and secure funding for the overall AMI project. Water utilities employ two primary approaches when financing system improvements – cash funding or debt financing. Cash funding is limited to revenues on hand or set aside as reserve funds, generally earmarked for capital improvements. Most utilities must rely on debt financing for major capital projects. We

understand that Marin Water is considering multiple options to fund their AMI project, from revenue bonds funding, grants, to public private financing.

RFP Development

Based on the requirements and functional specifications, an RFP is developed. This comprehensive document provides the vendor community with the essential information to prepare a robust response specific to Marin Water. The scope of work is incorporated into your standard RFP contract template and reviewed by all team members (including purchasing and legal) to ensure that the requirements are accurately reflected. If warranted, vendors should be pre-qualified prior to publication in order to narrow the number of responses to those that can truly offer a preferred solution.

Policy Review

Marin Water will need to review policies that may be impacted by the introduction of AMI technology and per discussion, this review needs to occur early on in the project. It is recommended to start looking into policies in parallel with the AMI procurement efforts.

Example policies that need to be discussed: leak adjustments and potential AMI opt out policy. Best practices in the utility industry need to be reviewed in order to come to a recommendation on fees, policies (AMI and non-AMI related) and procedures. This is anticipated to be an iterative process from the Marin Water AMI project team, legal team and project sponsors, and a policy impact assessment will be the result of this review.

RFP Management

On average it is recommended that the RFP response period for an AMI procurement last approximately six to eight weeks so that the vendor community has ample time to prepare thorough and thoughtful responses. Among the many tasks that must be managed once the RFP is released are:

- advertising the RFP
- setting the agenda and leading a pre-proposal meeting
- receiving and responding to vendor questions; and
- publishing any necessary addenda.

This is also the time to prepare for the work required in upcoming phases including, but not limited to, the evaluation process and criteria; reference checks; and vendor contracting approval tasks.

Response Evaluation & Selection

As the responses are received, the evaluation process starts. Evaluating multiple RFP responses can be complex and time-consuming, especially when it comes to analyzing cost. When lining up the cost proposals side-by-side, it is common to discover that each vendor quote differs in some fashion, making it difficult to perform a direct comparison. This can be minimized by structuring the RFP properly to allow for cost-normalization.

The result of the analysis is a ranking of the proposals based on the utility's evaluation criteria and ultimately concluding on a shortlist of recommended candidates. Preparation

is necessary to customize the shortlist meeting agenda and outline any remaining questions for each shortlisted vendor. Following the shortlist interviews and prior to selection is the time to contact references, document the references' experiences with the vendor(s), and arrange site visits, so that Marin Water may obtain useful feedback on the shortlisted candidates from other utilities.

As the evaluation process concludes, Marin Water will weigh the pros and cons of each shortlist candidate to arrive at a final selection of the optimal solution for the utility.

Board Approval

A critical milestone before the AMI project can continue is gaining Marin Water Board approval for vendor selection. The Marin Water AMI team will present the best vendor(s) for the AMI project to the Board for approval. This will also be an opportunity for the public to learn more about the preferred AMI solution. The initial customer awareness campaign is essential to gain trust and the true understanding of AMI from Marin Water's customers.

Vendor Contracting

Once Marin Water has selected the vendor(s) and gained board approval, contract negotiations can begin. This endeavor is typically lengthy, given the cost of the project, the details that need to be captured, and the approval process.

We recommend a thorough review of the proposed scope of work by the respective project Subject Matter Experts (SMEs) to determine whether the scope of work is in compliance with Marin Water's technical requirements. It is also critical to engage and contract with other third-party vendors (e.g. CIS vendor) with intended integrations at this junction to ensure a proper understanding of requirements and to prevent potential development delays. Finally, the proposed contract(s) must also have a thorough review by legal and purchasing to negotiate terms that are as favorable as possible to Marin Water. It is important to memorialize very specific systems-acceptance criteria, along with detailing the rights and responsibilities of all parties within the contract. The specific acceptance criteria will be developed during vendor contracting with input from Marin Water AMI Team.

8.2. AMI, MDMS, CEP Deployment

Overall Project Management

A project of this scale oftentimes involves a lot of moving parts, vendors, departments, and dependencies which will have to be managed closely. We have found that most vendors and utilities do not have sufficient PM availability and/or capabilities to manage a project of this scale successfully to the project baseline. Thus, it is critical to have a dedicated project management team to maintain and monitor the "iron triangle" dimensions of cost, quality and schedule throughout all project phases.

The project management activities during the deployment will include:

Scope management

Change management
Integration management
Cost management
Equipment procurement support
Quality management
Reporting management
Time management
Vendor management
Resource management
Risk management

Initial Deployment Area (IDA) Phase

The underlying philosophy of the IDA phase is to minimize risk to Marin Water and commit as little project funding as possible while reaching basic system functionality as early as possible in the project. This approach allows Marin Water to work with the vendor(s) to identify and address issues; to test the necessary interfaces with other systems; and to design, develop, and test the future state business processes prior to full deployment. Our recommendation is to split IDA into two phases: Bench Test Phase and Field Test Phase.

Bench Test Phase

The intent of the Bench Phase is to establish and test basic connectivity in a controlled environment. The goal, at a minimum, is to ensure connectivity between the meter, the collectors if applicable, the AMI HES, MDMS, and CEP.

Typically, this is accomplished through a dedicated meter test bench; however, a limited amount of metering hardware can be field-deployed if the hardware is easily accessible for troubleshooting purposes. In addition to software installation, network connectivity will be established including the appropriate data backhaul from collectors if required. This is an opportune time to have Marin Water's field staff train with the AMI vendor to learn about the new meters and system diagnostics and other AMI network equipment that is deployed.

Subsequently, vendors will install and configure the software, most typically the AMI HES, CEP, and MDMS. The timing of standing up each software is to be determined. Systems integration requirements will also be captured as part of this step. Interfaces that need to be in place for Bench testing will proceed through design, development, and testing. A milestone with specific acceptance criteria with each vendor will signal completion.

Field Test Phase

Field testing interface design and development will proceed once the bench phase is complete. The field phase begins with field deployment of approximately 500-1,000 meters, ideally covering at least one billing cycle. Since the field test phase cannot be entered without a successful completion of the bench phase, basic meter reading and billing functionality is available immediately, allowing routes to be moved to automated

billing immediately upon route acceptance (if desired). The balance of systems interfaces, included work order management, are developed and fully tested. There is a comprehensive Quality Assurance (QA) effort that must be planned for during the field phase.

Third-party installation contractor software will be configured and tested in order to have an opportunity to troubleshoot and resolve issues prior to full deployment. For Marin Water performed meter changes, it may be necessary to assess the in-house work order management process and determine if configuration changes are required. This is an opportune time to have Marin Water's field staff train with contract installation crews to learn how to perform change outs and identify communication, or data-related issues in the field.

Business process changes are finalized and tested, so that they can be debugged prior to a production deployment. This provides the users time to adjust to new processes and procedures and builds a familiarity with the new systems, data and methods to be employed. Additional functionality is added and tested in stages, with the goal to complete system integration and documentation activities prior to user training and system acceptance testing.

User training runs in parallel with the end of the field test phase, typically beginning approximately two months before the acceptance testing. The respective users and system administrators are trained on full use of the new software tools.

Field testing in IDA is also the time to plan for parallel testing and the desired timing to "go-live" with AMI meter reads for billing. The existing meter reading process for manual reads will continue during this period, typically with 1-2 months of overlap with existing metering reading techniques. The field test phase system acceptance serves as the milestone to more forward to full deployment.

Software Deployment

The software deployment will be conducted in parallel with the field equipment deployment, with an exact schedule to be determined. Typically, the AMI HES and MDMS will be the focus in the beginning, with CEP deployed after once meter data integrity is verified in the AMI HES and MDMS as it is critical that CEP presents accurate data for the customers from the beginning of utilization.

Typical tasks related to the software deployment are the following:

- Software setup
- Requirements discovery
- Software configuration
- Software integation
- Software testing
- Software training

Stakeholder Engagement

We understand that Marin Water puts a special emphasis in ensuring that its stakeholders (Marin Water internal team and its customers) understand the benefits of AMI and its reasons for undertaking this monumental project. Of the many lessons learned in AMI projects over the past decade, one of the most important is the value of building understanding and aligning stakeholder expectations. Both internal and external stakeholders need to be engaged to address the needs of the community and support successful project implementation. An engagement strategy will need to be developed to inform and gain support from stakeholders.

The goal of external stakeholder engagement is to effectively inform and engage customers, by offering factual responses to concerns and options to meet customers' needs. Three main topics of concern that must be addressed include: (1) price/rates; (2) privacy and data security; (3) health and safety. These topics are discussed in more detail below under the Additional AMI Projects Considerations section.

8.3. Business Process Design

The transformative nature of AMI technology requires that utilities adjust work processes and routines to realize benefits both internal and external to the organization. This task supports the need to design business processes to holistically address people and processes when deploying new technology, an often-overlooked requirement.

Staffing Plan

It is essential for Marin Water to develop an AMI program-specific staffing plan that identifies an overall strategy necessary to facilitate an AMI implementation, as well as ownership, governance, and maintenance of AMI operations on an ongoing basis post deployment. During this task, discussions should be held about maintaining the network, hardware, and software systems, as well as responding to the events, alarms, and meter communications generated by the AMI system and utilizing data transmitted to the AMI HES and/or MDMS – as applicable, enabling Marin Water to gain a deeper understanding of what tasks will be required and will lead to recommendations about who will perform them.

Current State Process Workshops

This step is intended to identify and document the steps of current state processes that occur in Marin Water, at the minimum for the following core processes: Billing & Read Validation; Customer Inquiry; Meter Exchange/Retrofit; Move-In/Move-Out; Non-Pay Disconnect/Reconnect; and System Events and Alerts.

Conceptual Future State Workshops

This step will focus on the development of the future state, building upon what was developed in current state, and utilizing the new business applications (MDMS, AMI HES, and AMI meters, as applicable) and the interfaces that will be deployed (AMI/MDMS, MDMS/CIS, etc.).

Based on the policy impact assessment performed during procurement, the timing is appropriate to assist Marin Water in developing any new policies and procedures that will require review and approval. A sample of new policies and procedures will be needed to leverage AMI policy and procedures best practices.

Final Future State Workshops

This step will focus on addressing open items from earlier workshops; refining Marin Water decisions regarding new policies and procedures; and incorporating any new information following vendor training and configuration of systems. The workshops may include time for demonstration of active systems related to core business processes.

Business Process Audits

After initiation of the final future state business processes, Marin Water should review and audit the core business processes to determine how well the processes are working in the live environment. The audit will identify what, if any, adjustments are needed and provide insight into individual user's performance.

8.4. Data Management

Data Management Plan

The high volume of data produced by an AMI system can greatly enhance overall Marin Water operations, but only if that data is properly monitored, managed, and utilized. The AMI/MDMS/customer engagement portal software will introduce a new variety of data sets, such as consumption data, events, alerts, and various system exceptions. A plan to manage and utilize the data from these new systems must be developed to ensure accuracy and completeness for billing and all other reporting functions.

The data management plan should be developed to guide Marin Water on a path toward full system accountability and to maximize utilization of AMI data. Operational / exception reports ("out of the box" reports) from the AMI, MDMS and CEP vendors that Marin Water staff should use to maintain data and system integrity will be compiled.

Use Case Review and Prioritization

Development of use cases is important to satisfy Marin Water's short-term and long-term AMI program goals. A use case is defined as a narrative-based description of how AMI system functionality and dara can be used to realize additional value for a utility and its customers. The use cases need to be identified to meet Marin Water's unique environment and organization, as well as to identify the system requirements to support each use case.

A review of typical AMI use cases should be done to select and prioritize those use cases that will be the most relevant for Marin Water, to achieve the program goals. With this review Marin Water team will understand the possible applications for AMI data to support operational analysis and beyond. Through this effort, the appropriate technology, add-on applications, and/or additional data integrations related to Marin Water AMI program will be identified.

9. Additional AMI Project Considerations

9.1. Water Meter Remote Disconnect/Reconnect Considerations

As water meter remote disconnect/reconnect (RDM – remote disconnect meter) capability became available in the market in the recent years, Marin Water is interested in investigating further the attractiveness of deploying this technology in its service area. This section attempts to provide items to consider in determining the viability of remote disconnect/reconnect meters deployment.

RDM Cost Considerations

The cost of RDM is currently still significantly higher than a regular positive displacement or electronic water meter (3-4 times higher), due to the additional valve and technology. RDMs are also currently only offered for limited sizes (5/8", 5/8" x 3/4", 3/4", and 1"). Additional cost that may be incurred are additional integrations, additional software/analytics, and installation.

The RDM vendor currently requires the utility to utilize their AMI network in order to utilize the remote disconnect/reconnect functionality.

The current warranty offered by the vendors for RDMs is 5 years, less than the typical warranties offered for other meter components (meter accuracy, registers, endpoints). Warranties can also end after a certain maximum amount of the valve open and close actuation cycles.

RDM Benefits Considerations

The potential quantifiable and soft benefits that RDM can bring for the utility:

- Improvement of the non-pay disconnect and reconnect, move-out/move-in business process
  - Reduction of field visits to turn off/on meter
  - Reduction of customer service representative handling time
- Reduction of bad debt/cost of delinquencies
- Reduction of truck maintenance, carbon emissions
- Aversion of
  - Leaks
  - Flood claims and litigation
  - Delinquent bill printing
- Assistance during fire hazard situation
  - Selective turn-offs to maintain water pressure in the system for fire fighting purposes
  - Selective turn-offs to stop hydrocarbons flowing into water mains
- Opportunity to introduce pre-pay program for water customers

RDM Recommendations

A focused financial analysis for RDM should be developed for Marin Water to justify the RDM deployment. Although a full scale RDM deployment at Marin Water's service area may not be the most feasible approach, strategic limited amount of RDMs may benefit Marin Water. Target locations where to deploy RDM may include:

- Locations with repeated history of being disconnected due to delinquency
- Locations with frequent move-in/move-outs
- Locations with high fire hazard risk

9.2. Addressing AMI Privacy, Security and Health Concerns

Marin Water requested a review of the typical concerns customers may have related to AMI technology, based on past AMI program rollouts launched in other communities. This section provides an overview of these identified concerns, specifically related to privacy, security and health. Although public concern to AMI projects has diminished significantly over the last few years, recent experiences indicate that utilities must remain thoughtful in preparing to address these concerns. Marin Water will need a stakeholder (internal and external) engagement plan to ensure a smooth and comprehensive AMI implementation.

Privacy and Security

The AMI privacy concerns generally fall into two categories: (1) privacy related to personal habits and (2) data privacy/security.

Personal Privacy

In relation to meter data providing insight into personal habits, customers may assume that the data provides much more granularity than it actually does. Careful language along with clear response (e.g., in FAQs, fact sheets) helps defuse such concerns.

Advanced meter data is used primarily for billing and enhancing system operations and performance. Meter data indicates volume of usage only, and no customer-identifying information such as names and addresses are stored in the meters or transmitted across the network. Additionally, the granularity of AMI data, at a collection rate of 15 minutes to one hour, is not granular enough to provide disaggregated consumption data or use patterns.

Data Privacy and Security

In this digital age, consumers have legitimate concerns about data privacy and security. Utilities must comply with data privacy, having handled sensitive customer financial data for many years. Offering understanding, reassurance and compliance references are approaches that have proven effective when addressing customer concerns.

E Source advises that Marin Water consider developing a statement regarding its understanding of importance and attention to this critical issue similar to a website privacy statement. It may also prove helpful to restate the Utility's adherence to existing protection of public privacy rules.

Given the volume of data generated by advanced meters, many utilities take the step of reviewing and updating their privacy policies. Even if the review reveals that no changes are necessary, conducting that due diligence recommended and reassuring.

It's also important to note that the Marin Water only uses data for billing purposes when educating stakeholders on program benefits; other programs (such as customer-side, high-usage detection/notification) are strictly voluntary.

Additionally, incorporating a reference from the selected meter manufacturer regarding encryption in stakeholder communications (e.g., website, FAQs, etc.), would support the AMI system's compliance with industry standard security protocol.

The option to keep their existing meter, if offered, can provide a solution for customers who continue to have concerns about personal privacy and data security. However, Marin Water will have to consider and analyze the additional cost required to perform the alternative reading procedure and maintenance. If an AMI opt-out policy is offered, best practice is that customer fees should reflect the cost of service. Some utilities include a one-time fee (e.g., $50 - $170), followed by a monthly meter reading fee (e.g., $10-$60) E Source is prepared to help the utility explore all viable options and develop an opt-out policy if interested.

Health and Safety

Numerous studies have indicated that the Radio Frequency (RF) emissions from advanced meters are far lower than many other electronic devices in routine use. However, concerns persist within some communities.

It is recommended that Marin Water provide opportunity and information to allow customers with more questions and/or a higher level of concern to get the answer to the questions they are asking.

A recommended best practice is to conduct a detailed analysis of the RF emissions of the specific meter and configuration in use. In addition, citing and linking to non-utility sources (e.g., health agencies, scientific sources, and university studies) brings third-party expertise to bear and builds confidence. The United States Environmental Protection Agency and Federal Communications Commission as well as other U.S. agency data, may be cited.

It is essential context to highlight that the advanced meters that will be placed into use at Marin Water have significantly lower exposure levels than the government-established limits. In addition, the RF exposure is lower than many existing household electronic devices such as cell phones and microwave ovens, according to various studies. Developing simple graphical representation of these comparisons for use in various communications is recommended. In some cases, utilities also used electromagnetic radiation (EMF) meters to complete demonstrations. This engagement allowed customers the opportunity to see the measurable difference between the energy outputs from their advanced meter in comparison to other common devices.

Specific analysis of the meters in use and the associated duty cycle (i.e., how often they transmit) can also be useful. It is recommended that FAQs be posted online on the program web page and used as reference for customers and customer-facing personnel. An even more detailed fact sheet can be developed if needed. Printed versions of these materials should also be made available for those who do not readily access the Internet.

An alternative read technology or opt-out policy, if offered, provides a solution for customers who continue to have health concerns to keep the existing meter. However, Marin Water will have to consider and analyze the additional cost required to perform the alternative reading, opt-out policy needed to be developed, and potential customer opt-out fee.

10. List of Appendices

Appendix 1 - Marin Water Current State Discovery Workbook (.xlsx)

Appendix 2 - Marin Water IT Current State and Systems Workbook (.xlsx)

Appendix 3 - Marin Water Summarized AMI Financial Model (.xlsx)

Appendix 4 - Marin Water AMI Business Process Impact Assessment (.pptx)

Appendix 5 - Marin Water AMI Implementation Plan (.mpp)

Key ID	Operation	Function	Question	Response	Source	Follow Up	Additional Response
1	Meter Reading and Field Services	Regular Reading	How many square miles are in the service area?	147 square miles	DSA Feasibility Study (Oct 2020)		
2	Meter Reading and Field Services	Regular Reading	How many cycles are there?	Probably too much info here but… Over 99% of our meters are read bi-monthly. ~27,000 are read in even months and ~35,500 are read in odd months. 120 are read monthly. We have 15 meter reading areas which are broken down into 35 portions which are broken down into 366 routes	Craig L. (Meter Ops)		
3	Meter Reading and Field Services	Regular Reading	How many routes are there?	366	Craig L. (Meter Ops)		
4	Meter Reading and Field Services	Regular Reading	Is there a formalized meter reading schedule published?	SAP creates a "dynamic read schedule" but adjustments are made to it evey 2 months. The schedule can be exported from SAP as needed.	Craig L. (Meter Ops)		
5	Meter Reading and Field Services	Regular Reading	How often are meters read?	~62,500 are read bi-monthly (8% are AMI). 120 large users are read monthly (91% of the monthly read are AMI).	DSA Feasibility Study (Oct 2020) & Craig L. (Meter Ops)		
6	Meter Reading and Field Services	Regular Reading	How many meters are read/day on average?	1,740 per business day	Craig L. (Meter Ops)		
7	Meter Reading and Field Services	Regular Reading	What meter reading hardware/software is used?	Itron handheld, MV-RS software for manual reads and Badger Orion Cellular for AMI	DSA Feasibility Study (Oct 2020)		
8	Meter Reading and Field Services	Regular Reading	How are reads performed (e.g., Manual read / touch read / drive-by)?	Of the 62,620 meters: 88.8% are manual, 8% are AMI, 1.6% are touch read and 1.6% are walk-by radio.	Craig L. (Meter Ops)		
9	Meter Reading and Field Services	Regular Reading	What is the brand / approx. age of the handhelds?	Itron, ~10yrs old. We're in the final year of a 10yr contract (expires June 30th). We'll be replacing the handhelds with Honeywell CN-80 Dolphins in early 2022 (going through contracting process per Feb 2022). The new read system (Itron/Temetra) will be on an annual renewal cycle and the cost is relative to the number of meters read. So the annual renewal cost will go down as the number of AMI meters increases.	Craig L. (Meter Ops)		Athens incorporated in main response
10	Meter Reading and Field Services	Regular Reading	How are compound water meters read (e.g., high/low or as individual meters)?	They are read seperately (high/low) and SAP combines the consumption for billing. (we have <100 with 2 registers on 1 service)	Craig L. (Meter Ops)		
11	Meter Reading and Field Services	Regular Reading	Do you read vacant accounts as part of normal reading cycle?	Yes. If there is consumption it shows up on a "usage on inactive report" so we can re-visit the site and leave a door hanger if there is consumption	Craig L. (Meter Ops)		
12	Meter Reading and Field Services	Regular Reading	Is meter reading outsourced or performed in-house?	In-house	DSA Feasibility Study (Oct 2020)		
13	Meter Reading and Field Services	Regular Reading	If meter reading is outsourced, who owns the meter reading hardware/software?	N/A	DSA Feasibility Study (Oct 2020)		
14	Meter Reading and Field Services	Regular Reading	Which department performs meter reading?	Meter Operations, by Meter Reader and Repair Workers (MRRW)	DSA Feasibility Study (Oct 2020)		
15	Meter Reading and Field Services	Regular Reading	Are there non-meter readers that support the meter reading process? Describe their responsibilities.	Yes, there is a Meter Operations Supervisor (Craig L.) who assigns work, maintains meter info in SAP, orders meters and other tools/equipment, etc.. There are also 2 Meter Technicians that focus on repair, replacement and testing of 1.5" and larger meters. The Meter Techs have been used as meters readers from time to time if there are staffing shortages.	Craig L. (Meter Ops)		
16	Meter Reading and Field Services	Regular Reading	Are there any other ways that meter reads are sent to Billing (e.g., any customer call-in, mail-in or 3rd party)?	We get ~5,000 reads from our AMI pilot and about 30 reads from customer call in (1 is for a raw water meter for a golf course and the others are for mobile hydrant meters)	Craig L. (Meter Ops)		
17	Meter Reading and Field Services	Regular Reading	Does the utility maintain metrics with regard to time spent on various meter reading related tasks? If so, please provide in a separate tab or document.	Meter Ops maintain stats on # of re-reads (verifies), double skips (we can only skip (estimate) a read for one read cycle) and mis-reads. See attached "Meter Reading & Field Services - row 18 - Meter Reading stats"	Craig L. (Meter Ops)		
18	Meter Reading and Field Services	Regular Reading	What is the billing window from the time the meter is read to when a bill is generated?	3 business days	Craig L. (Meter Ops)		
19	Meter Reading and Field Services	Meter Services	How does the utility currently issue/manage work orders for meter service, re-reads, move in/out reads, and service disconnects?	Most meter leaks, lid/box work, dig outs, prunning, fogged/scratched lens and replacing stuck meters is generated by the meter reader via the handheld while reading the route. Re-reads (verifies) and double skips (we can only skip/estimate a meter once) are generated by the supervisor and handed out to the readers who fill in the date, read, yes/no meter movement and if a door hanger (for high consumption) was left; this form is turned in to the supervisor who enters the reaults in SAP. Move in/out reads and turn on's/off's are handled by 2 Customer Service Field Inspections that do not work in Meter Operations. Service disconnects (pulling the meter on a killed or moved service) is handled by either the "field crews" or Meter Operations.	Craig L. (Meter Ops)		
20	Meter Reading and Field Services	Re-Reads	Who collects re-reads?	Meter Operations staff (meter readers)	DSA Feasibility Study (Oct 2020)		

Key ID	Operation	Function	Question	Response	Source	Follow Up	Additional Response
21	Meter Reading and Field Services	Re-Reads	What flags a meter for a re-read?	The handheld flags the reader if the meter fails a high/low audit compared to the same time last year. The Supervisor also sends staff back out for zero usage (check for stuck), consumption too high compared to historical usage and double skips (we can only skip/estimate a meter once)	DSA Feasibility Study (Oct 2020) & Craig L. (Meter Ops)		
22	Meter Reading and Field Services	Re-Reads	Who flags a meter for a re-read?	1st: Handheld device flags if the read fails the hi/low audit, meter reader double checks read, knocks on door or leaves door hanger if there is high usage 2nd: Meter Shop supervisor will review implausible report and assign re-reads (high use, double skips)	DSA Feasibility Study (Oct 2020) & Craig L. (Meter Ops)		
23	Meter Reading and Field Services	Re-Reads	What are the re-read upper/lower thresholds for hi/low exceptions?	There are a few things that factor into this but if consumption is ~3.8X higher than the same billing period last year or if the consumption is ~6% of the same period last year it will flag the reader and the supervisor.	Craig L. (Meter Ops)		
24	Meter Reading and Field Services	Re-Reads	Who receives the re-read request (e.g., meter readers, non-meter reading field or meter shop staff, etc.)?	Meter readers receive the request before the read goes to billing. If a customer requests a re-read than a Customer Service Field Inspector gets the request.	Craig L. (Meter Ops)		
25	Meter Reading and Field Services	Re-Reads	Who receives the re-read (e.g., meter shop, billing, etc.)?	If a meter reader collects the re-read than the Meter Ops supervisor receives it. If a Customer Service Field Inspector collects it they enter it directly into SAP when they return to the office (customer service)	Craig L. (Meter Ops)		
26	Meter Reading and Field Services	Re-Reads	Are re-reads due same day or next day?	If the handheld flags the reader based on high/low audit than the read is cheked before they move on to the next meter. If the re-read is assigned by the supervisor it is due before the read goes to billing, which is 3 business days.	Craig L. (Meter Ops)		
27	Meter Reading and Field Services	Re-Reads	How many re-reads are performed per day? Per month?	The handhelds flag about 940 reads per month (based on high/low audit) but the reader only needs to confirm the read before moving on to the next meter. Re-reads assigned by the supervisor and require a special trip to the meter total ~45 per month	Craig L. (Meter Ops)		
28	Meter Reading and Field Services	Re-Reads	How are re-reads tracked and accounted for?	Once the results are entered into SAP the forms are saved and tallied monthly.	Craig L. (Meter Ops)		
29	Meter Reading and Field Services	Re-Reads	Is a re-read service order generated? If not, how is it communicated to the staff performing the re-read?	No, a "meter read history" screenshot is printed from SAP which shows all the customer, meter location and read history info. The reader makes their notes on the print out and returns it to the supervisor to enter into SAP. Printing the screenshot is quicker than creating and closing out a service order.	Craig L. (Meter Ops)		
30	Meter Reading and Field Services	Re-Reads	If a re-read service order is generated, what system(s) initiate(s)/generate(s) the service order for a re-read?	No service order is generated. The supervisor investigates reads from the implausible (failed hi/low audit) list and determines which meters need a re-read.	Craig L. (Meter Ops)		
31	Meter Reading and Field Services	Move-In/Move-Out Reads	Who collects move in/out reads?	Customer Service Representatives get the calls and generate the service orders (not Meter Ops)	Craig L. (Meter Ops)		
32	Meter Reading and Field Services	Move-In/Move-Out Reads	Who gets the move in/out request?	2 full time Customer Service Field Inspectors (not Meter Ops)	Craig L. (Meter Ops)		
33	Meter Reading and Field Services	Move-In/Move-Out Reads	Who receives the move in/out read?	The 2 full time Customer Service Field Inspectors enter reads when they get back to the office at the end of the day	Craig L. (Meter Ops)		
34	Meter Reading and Field Services	Move-In/Move-Out Reads	Are move in/out reads due same day or next day?	Same day	Craig L. (Meter Ops)		
35	Meter Reading and Field Services	Move-In/Move-Out Reads	Which services are shut off for move out?	Services are not shut off for a simple move out. They are only shut off when there is usage on inactive and after 2 door hangers. The 2 Customer Service Field Inspectors do the turn offs. Note: turn offs were suspened due to COVID	Craig L. (Meter Ops)		
36	Meter Reading and Field Services	Move-In/Move-Out Reads	How many move-in/move-out reads are performed per day? Per month?	Approx. 300 final read requests/month. Last day of the month are the busiest. No area that experiences significant MIMO more than others, maybe Centerfell(?) due to population density. Could have 2-3 trips to the meter for MIMO	DSA Feasibility Study (Oct 2020)	Is there a prevailing area that experiences MIMO?	Athens incorporated in main response
37	Meter Reading and Field Services	Meter Population	Is the typical set location for water meters indoors? If not, where is it?	Most meters are at the edge off the parcel, near the road, in a meter box with a lid that is flush with the ground	Craig L. (Meter Ops)		
38	Meter Reading and Field Services	Meter Population	Are there any out of the ordinary water meter access issues?	Most are easly accessible but some are behind gates or fences. Some are in deep vaults that can be full of water depending on the time of year (rain) or affected by the tide. Some of the fireline detector check meters are behind locked doors in a building.	Craig L. (Meter Ops)		

Key ID	Operation	Function	Question	Response	Source	Follow Up	Additional Response
39	Meter Reading and Field Services	Meter Population	If you have deduct meters, are there any special reading requirements for deduct and master meters?	Yes, we have ~800 deduct (what we call "dedicated irrigaiton meters"). There are no special reading requirements although over 90% of these are included in our ~5,000 meter AMI pilot. Regarding master meters, we have a trailer park that has 18 master meters and downstream of that we have 396 meters feeding the individual trailers. All of these meters are read every 2 months but we subtract the total consumption from all the sub-meters from the total consumption of the 18 master meters and the trailer park entity pays the difference. All meters in trailer park are above ground - owned by MMWD. Manual read - ERT reads are not reliable anymore.Some irrigation meters are on residential but are being phased out.	Craig L. (Meter Ops)	The 396 meters - location - under trailers - nxt to road? Located in / out of meter pits? In any kind of ROW or easement? Require a reading on all 396 or estimates	Athens incorporated in main response
40	Meter Reading and Field Services	Meter Population	Do you have water (detect) meters on backflow assemblies?	Yes	Craig L. (Meter Ops)		
41	Meter Reading and Field Services	Meter Population	If backflow assemblies have water meters, are they read? If so, at what frequency?	They are part of the normal bi-monthly billing cycle.	Craig L. (Meter Ops)	Put on AMI?	
42	Meter Reading and Field Services	Meter Population	Who determines if there is inappropriate water use through a backflow detect meter and how?	Meter Ops will attempt to make contact (door hanger or phone call) if there is high use on detector meter. Marin Water Engineering dept also monitors use on detector meters and will send out letters letting cunsumers know that there shouldn't be use. Detect meters are billed by %. Engineering dept will perform periodic checks.	Craig L. (Meter Ops)	Are multiple months of usage identified and investigated?	Athens incorporated in main response
43	Meter Reading and Field Services	Meter Population	What actions are taken if inappropriate water use is detected on a backflow assembly?	Meter Ops will attempt to make contact (door hanger or phone call) if there is high use on detector meter. Marin Water Engineering dept also monitors use on detector meters and will send out letters letting cunsumers know that there shouldn't be use.	Craig L. (Meter Ops)		
44	Meter Reading and Field Services	Meter Population	What size water meters are classified as large water meters?	1.5" and larger	Craig L. (Meter Ops)		
45	Meter Reading and Field Services	Meter Population	What size water meters are classified as small water meters?	5/8"x3/4", 3/4" and 1"	Craig L. (Meter Ops)		
46	Meter Reading and Field Services	Large Meters	Is there a size of large water meters where test ports are required?	3"-8" (although many of our 1.5" and 2" also have test ports)	Craig L. (Meter Ops)		
47	Meter Reading and Field Services	Large Meters	What percentage of large water meters have test ports?	>90%	Craig L. (Meter Ops)		
48	Meter Reading and Field Services	Large Meters	Is there a size of large water meters where a by-pass (run around) is used?	We have run arounds on 1.5"-8" (but not all). In most cases the use (e.g. hospital) determines if there is a run around. Also, most 1.5-2" don't have a run around but most 3" and up do.	Craig L. (Meter Ops)		
49	Meter Reading and Field Services	Large Meters	What percentage of large water meters have a by-pass?	~10% have a bypass (SAP does not track this)	Craig L. (Meter Ops)		
50	Meter Reading and Field Services	Meter Population	Is there a program to update, rehab or replace large water meters?	Yes (it's more based on age than milage)	Craig L. (Meter Ops)		
51	Meter Reading and Field Services	Meter Population	Do large water meter sets have test ports or run arounds? Where are the test ports or runarounds located (i.e., inside or outside the vault)?	3" and up requires a test port and run around which are always in the vault. Depending on the use, some 1.5-2" will also have run arounds	Craig L. (Meter Ops)		
52	Meter Reading and Field Services	Meter Population	What is the construction material of a large water meter vault (e.g., concrete, brick, plastic, etc.)?	Mostly concrete or redwood, some brick	Craig L. (Meter Ops)		
53	Meter Reading and Field Services	Meter Population	What is the typical condition of a large water meter vault?	Good condition, although some meters in vaults are under water depending on the tide.	Craig L. (Meter Ops)		
54	Meter Reading and Field Services	Meter Population	What is the typical access to a large meter vault (e.g., access hatch, removable concrete cap, etc.)?	Most are steel or aluminum hinged plate. Some concrete lids.	Craig L. (Meter Ops)		
55	Meter Reading and Field Services	Large Meters	What is the typical condition of lids / access hatches or other large meter box / vault covers?	Good condition	Craig L. (Meter Ops)		
56	Meter Reading and Field Services	Large Meters	What percentage of valves on large meter sets will shut off?	>90%	Craig L. (Meter Ops)		
57	Meter Reading and Field Services	Large Meters	Are valves on large meter sets periodically exercised? How often?	Yes, annually for 3" and larger	Craig L. (Meter Ops)		
58	Meter Reading and Field Services	Large Meters	What is the typical depth of large water meter boxes / vaults?	Average is 3-4' but they can range from 1'-8'	Craig L. (Meter Ops)		
59	Meter Reading and Field Services	Large Meters	What is the deepest large water meter set?	8'	Craig L. (Meter Ops)		
60	Meter Reading and Field Services	Large Meters	What percentage of large water meters require confined space entry?	<1%	Craig L. (Meter Ops)		
61	Meter Reading and Field Services	Large Meters	Are large meter sets homogeneous or are there types or locations or characteristics where large meter installations are different from the rest of the population?	There are a varity of install scenerios	Craig L. (Meter Ops)		

Key ID	Operation	Function	Question	Response	Source	Follow Up	Additional Response
62	Meter Reading and Field Services	Meter Services	Do you use contractors to perform water meter maintenance/change-outs?	No, this is done in-house with Meter Ops staff	Craig L. (Meter Ops)		
63	Meter Reading and Field Services	Meter Services	Does the utility maintain water meter related service/work order statistics? If so, please provide them on a separate tab or document.	Although service/work orders are associated with most water meter related work, statistics are not maintainted. If there are some particular statistics that would be useful for E-Source, the data can be compiled	Craig L. (Meter Ops)		
64	Meter Reading and Field Services	Meter Services	Is there a scheduled water meter change out program currently in place? What is the replacement criteria?	Yes, in most cases it's based on age, >15years	Craig L. (Meter Ops)	Discuss meter age for replacement - need CIS meter info	
65	Meter Reading and Field Services	Meter Services	Who performs water meter changeouts? Does it depend on type or size?	This is done in-house with Meter Ops staff.	Craig L. (Meter Ops)		
66	Meter Reading and Field Services	Meter Services	How many water meters are changed out annually?	~3,400 per year	Craig L. (Meter Ops)		
67	Meter Reading and Field Services	Meter Services	For new service locations, who installs new water meters?	Usually Meter Ops staff or Marin Water crew, sometimes an outside contractor	Craig L. (Meter Ops)		
68	Meter Reading and Field Services	Meter Services	If a contracture installs a meter at a new location, are new water meter installations inspected?	Yes, Marin Water inspectors (not with meter shop) will perform the inspection. However, if an outside contractor is used for mass AMI installes our inspections may not be able to keep up with that.	Craig L. (Meter Ops)	E Source can provide full deployment installation QA/QC services	
69	Meter Reading and Field Services	Meter Services	Is there a system of record for meters/meter characteristics?	Yes, this data is stored in SAP	Craig L. (Meter Ops)		
70	Meter Reading and Field Services	Meter Services	What is the confidence level of water meter attribute data accuracy (e.g., size, type, brand, etc.) in utility systems (e.g., CIS, WOMS, etc.)?	>99% of size and ~95% on type, brand.	Craig L. (Meter Ops)		
71	Meter Reading and Field Services	Meter Services	Does the system of record house unique serial numbers or badge numbers that are found on the body of the water meter?	The system of record does not separately house a serial or badge number found only on the body. We only track the meter/serial # which is usually found on both the register and the body. In the event that a new register is added to an old body there would be a discrepency between the 2 numbers in the ground and SAP would only be aware of the new serial #.	Craig L. (Meter Ops)	Need to confirm - same meter and register # or different, but 1 record in SAP?	Most cases: meter serial# equals to register#. For register changeout, SAP stores the newer register#. Will need to figure out different install dates of meters and registers.
72	Meter Reading and Field Services	Meter Services	Does the system of record house separate register IDs for water meters?	The system of record does not separately house a serial or badge number found only on the body. We only track the meter/serial # which is usually found on both the register and the body. In the event that a new register is added to an old body there would be a discrepency between the 2 numbers in the ground and SAP would only be aware of the new serial #.	Craig L. (Meter Ops)		
73	Meter Reading and Field Services	Meter Services	Does the system of record house the number of registers for each water meter?	Yes, although we have <100 with 2 registers on 1 service. Meter readers read both registers, Billing combines them as 1 read. Large meters are now: Badger E-Series, Omni meters	Craig L. (Meter Ops)	Need to confirm - how compound records work	Athens incorporated in main response
74	Meter Reading and Field Services	Meter Services	Does the system of record house install date for water meters?	Yes	Craig L. (Meter Ops)		
75	Meter Reading and Field Services	Meter Services	Does the system of record house make/model for water meters?	Yes (although this data not ~95% accurate)	Craig L. (Meter Ops)		
76	Meter Reading and Field Services	Meter Services	Does the system of record house sizes of water meters?	Yes	Craig L. (Meter Ops)		
77	Meter Reading and Field Services	Meter Services	Does the system of record house lat/long coordinates for water meters?	Yes	Craig L. (Meter Ops)		
78	Meter Reading and Field Services	Meter Inventory	Who does the water meter purchasing?	Meter Ops Supervisor and Marin Water Buyer (Danelle Graham)	Craig L. (Meter Ops)		
79	Meter Reading and Field Services	Meter Inventory	What is the system of record for water meter inventory prior to installation?	When meters are received, they are "created" in SAP and the serial #, make, model and size are assigned to the meter. The status of these meters are "available" until they are installed.	Craig L. (Meter Ops)		
80	Meter Reading and Field Services	Meter Inventory	In which system are PO's generated to purchase new water meters?	In our SAP system there are trigger re-orders (depending on inventory counts) for the meters we stock in our warehouse (which are our most common meters). Other meters are ordered as needed by Meter Ops.	Craig L. (Meter Ops)		
81	Meter Reading and Field Services	Meter Inventory	How much water meter inventory do you keep on hand, by size?	We stock only Sensus meters in our warehouse in sizes ranging from 5/8"x3/4" to 4". We try to keep a 3-4 month supply. Marin Water does not have a water meter preference for mass replacements	Craig L. (Meter Ops)		
82	Meter Reading and Field Services	Meter Inventory	What is the lead time required for ordering new water meters?	It used to be 4-6 weeks but with the global supply chain issues it's been closer to 12-16 weeks.	Craig L. (Meter Ops)		
83	Meter Reading and Field Services	Delinquency	Which services are shut off for delinquent non-pay?	Usage on inactive meters are shut off for non-pay after a couple door hangers. However, turn offs have been suspended since COVID. A Customer Service Field Inspector handles turn-ons and offs (not Meter Ops).	Craig L. (Meter Ops)		
84	Meter Reading and Field Services	Delinquency	How many days per week are non-pay disconnects performed? If any days are excluded, which ones?	turn-offs for non-pay can happen Mon-Fri (5 days), however they have been suspended since COVID	Craig L. (Meter Ops)		

Key ID	Operation	Function	Question	Response	Source	Follow Up	Additional Response
85	Meter Reading and Field Services	Delinquency	Is there a minimum amount due before turn-off is initiated?	Yes, $60	Craig L. (Meter Ops)		
86	Meter Reading and Field Services	Delinquency	Are turn-offs scheduled and routed?	A service notification is generated by customer service as needed with no specifc schedule or route.	Craig L. (Meter Ops)		
87	Meter Reading and Field Services	Delinquency	Are delinquent turn-ons performed same-day?	Same day if before 4:30. If after hours it's handled by Operations/dispatch and a 24/7 valve tech is sent out to do the turn on if fees are paid	Craig L. (Meter Ops)		
88	Meter Reading and Field Services	Delinquency	Are delinquent turn-ons performed next-day?	Same day if before 4:30. If after hours it's handled by Operations/dispatch and a 24/7 valve tech is sent out to do the turn on if fees are paid	Craig L. (Meter Ops)		
89	Meter Reading and Field Services	Delinquency	Are delinquent turn-ons performed on weekends?	Yes, weekends are handled by Operations/dispatch and a 24/7 valve tech is sent out to do the turn on if fees are paid	Craig L. (Meter Ops)		
90	Meter Reading and Field Services	Delinquency	Are delinquent turn-ons performed after normal work hours? If so, who handles the turn-on?	Yes, if after hours it's handled by Operations/dispatch and a 24/7 valve tech is sent out to do the turn on if fees are paid	Craig L. (Meter Ops)		
91	Meter Reading and Field Services	Delinquency	Are there special handling procedures for delinquent turn-ons during holidays?	No, holidays are handled by Operations/dispatch and a 24/7 valve tech is sent out to do the turn on if fees are paid	Craig L. (Meter Ops)		
92	Meter Reading and Field Services	Delinquency	Is the customer required to be present during delinquent turn-on?	No, assuming the meter stops shorlty after turn-on. If the meter won't stop moving after a turn-on then we turn it back off. If we need to come back for a turn on, the customer is required to be present	Craig L. (Meter Ops)		
93	Meter Reading and Field Services	Delinquency	Is there a "verify off" for delinquent disconnects that haven't paid within a specified number of days? If so, is it part of meter reading or performed separately?	A Customer Service Field Inspector (not Meter Ops) handles turn-ons and turn-offs. If a meter is turned off for non payment than it is locked off. The next "verify off" will be part of the normal periodic read cycle which will show consumption if the meter has been unlocked by the consumer.	Craig L. (Meter Ops)		
94	Meter Reading and Field Services	Move-In/Move-Out Reads	Is service turned-off at move-out?	No, unless specifically requested by customer	Craig L. (Meter Ops)		
95	Meter Reading and Field Services	GPS	Does the utility keep a record of GPS coordinates for meters?	A majority (~99%) of meters have recorded GPS coordinates	District's GIS database		
96	Meter Reading and Field Services	GPS	What is the accuracy on coordinates for meters?	Most are within 10 feet	Craig L. (Meter Ops)		
97	Meter Reading and Field Services	Box and Lid Condition	Estimate percentage breakdown of meter boxes that are in good, average and bad conditions?	30% good, 65% avg, 5% bad. Use "bad" estimate for %replacement.	Craig L. (Meter Ops)	Can we assume "bad" meter boxes will need to be replaced during full deployment?	Athens incorporated in main response
98	Meter Reading and Field Services	Box and Lid Condition	Estimate percentage breakdown of meter box lids that are in good, average and bad conditions?	50% good, 49% avg, 1% bad. For residential they are mostly in soil/landscape. MMWD ordered Nicor lids, drill fiber-lite lids for the Badger pilot. %breakdown of lids: mostly concrete 50%, less than 10% are steel, 40% fiber-lite.	Craig L. (Meter Ops)	Craig to perform survey on lids material	Athens incorporated in main response
99	Meter Reading and Field Services	Pain Points	Time consuming, affect service to customer, causes of rework / redo, information / reports that are lacking, Meter reading, theft, access, large meters, ?	Detect meter use (Craig will perform research on annual fire meter use). Topography. Fairfax (3,294 meters) has a prohibition on smart meters (request to install AMI meter should come from the customer) can be motivated with policies & procedures.		Discuss	
100	Meter Reading and Field Services	Future Looking	What do you think an AMI system could do to relieve pain points?	Not having to perform manual reads, re-visit sites. GOAL: investigate pipe material when 3rd party MIV are changing out meters. Could involve digging = additional cost. Add to REQUIREMENTS?		Discuss	

Key ID	Operation	Function	Question	Response	Source	Follow Up	Additional Response	Column1
1	Water Operations	Sources and Treatment	Are there any raw water source(s)? How many and what is/are the name(s)?	Most of the District's water supply comes from a network of seven local, rain-fed reservoirs: Lagunitas, Bon Tempe, Alpine, Kent, Phoenix, Nicasio, and Soulajule. Total reservoir storage operated by the District is 79,566 acre-feet. This supply is supplemented with water imported from the Russian River and purchased from the Sonoma County Water Agency (SCWA or Sonoma Water). This is considered treated water, but it does go through our Ignacio Treatment Plant (straight to distribution line) before entering the District's distribution system. Not aware of any blended water quality issues - may have water odor issues	Urban Water Management Plan 2020			
2	Water Operations	Sources and Treatment	How many active ground water wells are there?	The District does not pump groundwater and does not plan to use groundwater as a supply source in the future	Urban Water Management Plan 2020			
3	Water Operations	Sources and Treatment	How many water treatment plant(s)?are there? What are the names? What is the capacity of each?	the District operates three water treatment plants, Bon Tempe Treatment Plant (BTTP) (20MGD) San Geronimo Treatment Plant (SGTP) (35 MGD) Ignacio treatment facility (16 MGD) These are nameplate capacities and there may be limitations to achieving these treatment capacities. SCWA: contractually deliveries limited to 23.1 million gallons per day (mgd) from December to March, 12.8 mgd from May to September, 20.1 mgd in April and November, and 17.1 mgd in October.	Urban Water Management Plan 2020 and Water Treatment Master Plan			
4	Water Operations	Sources and Treatment	What is the total production capacity?	BTTP, SGTP and Ignacio have a combined design capacity of 71 million gallons per day (mgd)	Urban Water Management Plan 2020			
5	Water Operations	Sources and Treatment	What is the average water treatment plant output (MGD)?	Tthe average production is 22.4 mgd (own supply + SCWA's) over the last 10 years. (2010 to 2020)	Urban Water Management Plan 2020	Does the 22.4 MGD average includes the SCWA supply?	Athens incorporated in main response	
6	Water Operations	Sources and Treatment	How many storage tanks are there? How many? What are the names? What is the capacity of each?	131 tanks (see tanks tab). Potentially yes, storage tanks can be leveraged for AMI network antennas	GIS	Review Tanks tab to confirm units. Can network antennas be installed on top of the storage tanks?	Athens incorporated in main response	
7	Water Operations	Sources and Treatment	Are there any underground storage tanks? If so, how many are there? What are the names? What is the capacity of each?	one buried tank, Marinship Tank (see tanks tab)	GIS	Review Tanks tab - confirm elevation		
8	Water Operations	Sources and Treatment	What is the capacity of Treatment Plant Storage?	7 million gallons (see clearwells on tanks tab)	GIS			
9	Water Operations	Sources and Treatment	What is the total distribution storage capacity?	81.9 million gallons of storage (includes clearwells)	GIS			
10	Water Operations	Sources and Treatment	How many raw water pumping stations are there?	5 raw water pump stations	GIS			
11	Water Operations	Sources and Treatment	How many pressure zones are there?	144	GIS	Kristin has provided additional information on pressure zones		
12	Water Operations	Sources and Treatment	How many pump stations (boosters) are there?	89 potable pump stations (does not include the 5 raw water pumps)	GIS			
13	Water Operations	Sources and Treatment	Is there pressure monitoring at all pump stations?	Not all pump stations, but a majority.	SCADA			
14	Water Operations	Sources and Treatment	Are there any PRV fed pressure zones or stations?	Yes	SCADA			
15	Water Operations	Sources and Treatment	Is there a water SCADA system? If there are PRV zones, are there monitors / controls for the PRV pressure? Does the SCADA have tank levels, pump pressure, pump on/off?	Yes, the District has a SCADA system, and it is used to monitor and controls PRVs. Yes, SCADA has tank levels and pump pressure and on/off controls.	SCADA			
16	Water Operations	Distribution	How many total miles of water mains are there?	886 miles	Urban Water Management Plan 2020			
17	Water Operations	Distribution	What material(s) is/are the water mains?	mainly welded steel, some HDPE, some old cast iron	GIS	Is there a program in place to replace water mains?		
18	Water Operations	Distribution	What material(s) is/are the service mains?	copper	GIS			
19	Water Operations	Distribution	Describe the distribution system metering capability. How many meters are there, what type are they, where are they located on the distribution system?	There are 98 potable distribution system meters, a few are meters for raw water. There are meters where water leaves the treatment plants, at many pump stations, and at some pressure reducing valves.	GIS and SCADA			
20	Water Operations	Distribution	Are the distribution system meters calibrated? If so, how often?	They are calibrated when installed and if they are removed and sent to the factory for a major repair.				

Key ID	Operation	Function	Question	Response	Source	Follow Up	Additional Response	Column1
21	Water Operations	Distribution	Do you meter gravity flow out of the treatment plant?	Yes	GIS and SCADA			
22	Water Operations	Distribution	Is there a formal leak detection program? Is there leak detection equipment?	Yes and Yes. Utility System Technicians use sonic leak detection equipment to find leaks that are hidden from view. From 2015 through 2020, the District surveyed 503 miles of pipeline and detected 791 customer leaks and 214 District services leaks. (UWMP) Leak detection program is led by Julian Barrolaza and Jesse Obrochta (2 full-time employees), under the direction of field supervisor Ben Bauer. The two-person crew surveys 20% of the system per year, good for one full “lap” of the system every five years.Surveys are accomplished using handheld listeners, amplifiers, correlators and automated loggers. Leaks detected on MMWD mains are given a triage score and repaired accordingly. All relevant data collected by the crew are stored in a GIS database; the crew generates a report on their findings annually. Leaks found by the LD crew represent about 5% of the leaks repaired by the District annually, according to Bauer. (AMI Feasability Study data request)				
23	Water Operations	Distribution	Are there any inter-ties with other water systems? Is so, are they metered? If they are metered, who owns the meter, and who reads the meters? How are the meters billed?	Yes, the District has an inter-tie with Sonoma County Water Agency. This intertie is metered at Ignacio (IGN) treatment facility with a District owned meter. SCWA also meters the water flow upstream of the IGN meter, and uses this flow data for billing.	MMWD Water Loss data collection CY 2020 spreadsheet			
24	Water Operations	Distribution	Is there any distinction between water main breaks and seepers for repair times, urgency, etc.?	The district only deals with potable water and not sewage, so are lines are pressurized and we do not have seepers. Main breaks and leaks are prioritized based on urgency and size.				
25	Water Operations	Distribution	Is the distribution system flushed? If so, at what frequency? Is the water use estimated?	The District has an annual water flushing program, we call it water main cleaning. To clean a water main, we turn on select hydrants along a section of the water main. Water comes out of the hydrants with enough velocity to clean the water main. Yes, we estimate the flows.	Marin Water Website			
26	Water Operations	Distribution	Is hydrant flushing performed with main breaks?	If a water main is shut down (or lowers in pressure to 5 psi or less) due to a main break, the water main is flushed through a hydrant or blow off.				
27	Water Operations	Distribution	How do you know about a water main break that is not reported by a customer?	Using the leak detection program. See leak detection program qutions.				
28	Water Operations	Distribution	Is there any distribution or pump station metering designed or used to identify high water use patterns?	At most pump stations we calculate a seven day average flow per day. Example; bhpqy0001 (SCADA database point) Bret Harte pump station is currently averaging 68,800 gallons per day. We do not alarm these for unusual demand.	Operations			
29	Water Operations	Distribution	What tools do you use to troubleshoot the distribution system? Are there any problems like low water pressure, low flows, low chlorine levels?	The Distrct uses a SCADA system to monitor the distribution system and treatment plants. Our water quality lab also collects and tests a large number of water samples continously from the distribution system. There are tanks with low chlorine issues and there are areas that have low pressures, we have low pressure agreements with customers in these areas.		Review/discuss low pressure agreements. Need to discuss w/ Lab	Relatively high pressures across the system but have to monitor a lot of pressure zones. Frequency of monitoring. Manual data collection and treatment (manual chlorine addition to the tanks, flush hydrants). No water quality analyzer/sensors on SCADA? Not much issues w/ THMs. Low chlorine due to water age/not moving. Frequency of chlorine addition 5-10 tanks/week in winter and 10-20 tanks/week in summer. Nice to have: mobile chlorine injection, chlorine analyzer for trending. Monitor nitrite to ensure no nitrification in the system. Any areas with water pressure <40 psi (typically 30-40 psi) are low pressure zones (not too many)	Get low chlorine areas - treat by adding chlorine to tanks, flush hydrants. Normally do about 5 tanks per week but can go up to 20 tanks per week in summer. Want chlorine analyzers on tanks - get data remotely so they can trend. A mobile chlorine injections could be helpfull. Use Bac-T samples. Historically less than 5 bad bac-t per year. Monitoring nitrite. Check Bac-T when pressure gets below 5 psi - awarness is for water main breaks, or overall awareness. Have high water pressure areas (~140psi). Backflow - customers required to test backflow assys
30	Water Operations	Meter Shop	What is the age of water meter test bench?	50+ years for the Meter Shop test bench for small meters. We have 2 mobile test meters that are ~2 years old.	Craig L. (Meter Ops)			
31	Water Operations	Meter Shop	What size meters is test bench / mobile platform capable of testing?	The Meter Shop test bench can test 5/8x3/4" to 1". The mobile test meters can test 5/8x3/4" to 8".	Craig L. (Meter Ops)			
32	Water Operations	Meter Shop	What type(s) of shutoff valve is/are on service lines?	Ball valves and gate valves. Gate valves can be before or after meter, pretty rare for residential (only if there's elevation). 98% of residential services do not have gate valves, just curb stop valve (plug valve). 95%+ clean shut off during the annual meter replacement (3,000-5,000 meters/year).	Craig L. (Meter Ops)	% and configuration - 2 valve per service line or 1?	Athens incorporated in main response	

Key ID	Operation	Function	Question	Response	Source	Follow Up	Additional Response	Column1
33	Water Operations	Meter Shop	Is there a formal meter testing program?	Yes, the meters for many of our highest users are tested annually. Some small meters are tested based on age and consumption.	Craig L. (Meter Ops)			
34	Water Operations	Meter Shop	Is meter testing performed upon receipt from supplier/manufacturer?	No	Craig L. (Meter Ops)			
35	Water Operations	Meter Shop	Upon meter removal, is there a meter proving requirement?	Not a formal program but some are tested at random, mostly the really old ones	Craig L. (Meter Ops)			
36	Water Operations	Meter Shop	What testing standards are used (e.g., AWWA for high, medium, low)?	AWWA for high, mid, low	Craig L. (Meter Ops)			
37	Water Operations	Meter Shop	If replaced meters are tested, do you have metrics on accuracy loss?	Yes, we do some testing on replaced meters. We started collecting detailed data in 2021 on small meter testing. See attached doc "Water Operations - row 38 - small meter testing data"	Craig L. (Meter Ops)			
38	Water Operations	Meter Shop	Do you have a mobile platform for meter tests performed in-place, and, if so, which sizes can be tested?	5/8"-8"	Craig L. (Meter Ops)			
39	Water Operations	Meter Shop	Is field meter testing performed in-house or outsourced?	in-house	Craig L. (Meter Ops)			
40	Water Operations	Meter Shop	Is there a meter proving requirement?	AWWA for high, mid, low	Craig L. (Meter Ops)			
41	Water Operations	Meter Shop	Do the meters have bar codes?	Most have bar codes on the meter body (not the older ones)	Craig L. (Meter Ops)			
42	Water Operations	Meter Shop	Do the registers have bar codes?	Many have bar codes on the register (not the older ones or 5/8-1" SRII's)	Craig L. (Meter Ops)			
43	Water Operations	Meter Shop	Do the shipment boxes have bar codes?	Yes	Craig L. (Meter Ops)			
44	Water Operations	Meter Shop	Are meters repaired in-house or scrapped (e.g., registers replacements, leaking meters, etc.)?	Scrapped for the most part. We do some chamber/register replacments on large meters with low battery	Craig L. (Meter Ops)			
45	Water Operations	Meter Shop	If you proceed with an AMI project, have you considered at what meter age you would replace meters vs. retrofit them? If so, what is your expectation?	At this point, meters >10 years (based on warranty) would be replaced but we're open to alternatives	Craig L. (Meter Ops)	Discuss meter age for replacement - need CIS meter info		
46	Water Operations	General	Describe the inventory control processes, including replenishment procedures and re-ordering.	Is ithis the inventory process for meters?		Yes meters - do you have guidelines for minimum stock / reorder points. Qtys normally bought of small meters. Do you stock large meters?		
47	Water Operations	General	Does utility have any major water system projects planned or currently underway?	The District continously has pipeline replacement projects in construction. We are in the design phase for relocating a large water tank, Pine Mountain Tunnel. Kastania Pump Station, a pump station that helps supply the District with additional water from SCWA, is under construction to be put back in service; however, this pump station is outside of our distribution system. We are in the design and environmental review phase to instal a pipeline across the Richmond/San Rafael Bridge to enhance our water supply during droughts.				
48	Water Operations	General	Do you have low water pressure areas? If so, how many?	Yes, there are numerous low pressure areas all over the distribution system. A map can be provided if needed. 849 meters has pressure<= 40psi. MMWD'd rules and regulations state Pressure will be deemed low to serve an area or any consumer therein if there is less than a normal minimum operating pressure of forty psi.		Would like to view the map and discuss		
49	Water Operations	General	Is hydraulic modeling performed in-house or by a consultant? Is the model calibrated periodically?	In house. The model has not been calibrated, however, we are working on a project to calibrate a skelitanized version of the model.				
50	Water Operations	General	Do you use certain performance measures? If so, please describe.	Please be more specific				
51	Conservation	Water Conservation	Is there a standard for conservation of water designated?	Please clarify question		State conservation requirements.		
52	Conservation	Water Conservation	Is per capita use measured and tracked?	Yes. This is reported to CA DWR monthly. A sample of per capita use is also tracked using approximately 2,000 Flume devices. Flume data updates daily	https://www.waterboards.ca.gov/water_issues/programs/conservation_portal/conservation_reporting.html			
53	Conservation	Water Conservation	What are the overarching goals related to water conservation efforts?	Long term demand reduction achieved through both restrictions, education, and incentives. Coming out of a historic drough conservation is a high priority for Marin Water and AMI will be instrumental in providing additional data, reducing water loss, and communicating with customers				
54	Conservation	Water Conservation	Describe the Water Conservation programs currently in place.	Enforcement via code, education through customer outreach, and incentives via rebate programs. Incentive programs are listed at https://www.marinwater.org/rebates	https://www.marinwater.org/rebates	Generous rebates are offered. What is the budget for these programs?	Grant opportunities	

Key ID	Operation	Function	Question	Response	Source	Follow Up	Additional Response	Column1
55	Conservation	Water Conservation	Are the conservation/rebate programs tracked in the CIS?	Yes, although to a limited extent. More detailed data is available in Water Conservation Access databases. Basic information is currently uploaded into SAP. Would like more information to be				
56	Conservation	Water Conservation	Have customers been conserving water? Is there a breakdown / analysis by customer class or usage type?	Yes. 2021 use was down significantly due to a severe drought. State data provides overall data. Flume data provides information for a sample of residential customers.	https://www.waterboards.ca.gov/water_issues/programs/conservation_portal/conservation_reporting.html			
57	Conservation	Water Conservation	Are your water conservation programs designed to penalize?	The forcus is on education and incentives. Enforcement is used as a last resort and during extreme times such as the 2021 drought. During this time water waste patrols were monitoring the district for violations such as irrigation runoff, watering on non-assigned days, and unresolved leaks.		Requires observation of the violation to prosecute?		
58	Conservation	Flushing	Is your distribution system flushed? If so, at what frequency? Is the water use estimated?	Duplicated question; answered above				
59	Conservation	Flushing	Hydrant flushing with main breaks?	Duplicated question; answered above				
60	Conservation	Flushing	Do you have any distribution / pump station metering designed / used to identify high water use patterns?	Duplicated question; answered above				
61	Conservation	Water Conservation	Do you have goals or metrics for indoor vs outdoor water use set for residential customers?	There are not currently any formal goals. Work is currently ongoing to establish water budgets for customers. Initially for information. Potentially for budget based billing in the future. It is likely that these goals will be broadly in-line with the statewide framework.				
62	Conservation	Water Conservation	Are there any programs targeting outdoor water use reductions of identification of high outdoor water use?	Outdoor incentive programs include Cash for Grass ($3/SF), graywater laundry-to-landscape ($100 discount), pool and spa covers ($100), smart irrigation controllers ($100), and rain cisterns and barrels ($0.50/gallon). Customers in the AMI pilot are sent high water use letters if use is significantly higher than the 2-year average.	https://www.marinwater.org/rebates			
63	Conservation	Water Conservation	Do you have meters with leak detection flags? If so, is there a method for feedback to the customer?	Customers in the AMI pilot are sent leak notifications and letters each week, as well as any notifications that they have setup within the customer portal, EyeOnWater. Meter readers also flag meter movement whilst taking bio-monthly reads.				
64	Conservation	Water Conservation	Describe any water conservation state reporting requirements.	Monthly DRINC reporting Annual MWELO reporting Electronic annual reporting (EAR)				
65	Conservation	Water Conservation	Do you have a customer web portal related to conservation? If so, are there any customer water use the awareness / goals provided?	Not currently. There is a payment site, but it is not linked in any way to conservation. Over time we'd like to incorporate water budgets, program participation, and other elements into a customer web portal.				
66	Conservation	Water Conservation	Are there internal goals that you are targeting?	Not formally. Areas we'd like to focus on include leak reduction and water use targets through a citizens advisory committee				
67	Conservation	Water Conservation	What is the funding source for rebate program(s)?	Rates and grant funds				
68	Water Operations / Conservation	Pain Points	Time consuming, affect service to customer, causes of rework / redo, information / reports that are lacking, meter reading, theft, large meters, deduct meters, high bill complaints, every other month billing, payment arrangements, conservation information / assessment, water loss in pressure zones?	Pressure zones/monitoring, cost-effective water quality monitoring - particularly at water tank locations. Demand discrepancies - distribution SCADA info vs consumption.		Need to include Lab in discussion RE: water quality	Tank sites are where they need more remote monitoring.	
69	Water Operations / Conservation	Future Looking	What do you think an AMI system could do to relieve pain points?	Interested in pressure monitoring capabilities (current or - down the road - need to be future proof). Data analysis (water consumption, trends - loss identification) - AMI-SCADA integration		Discuss		

Key ID	Operation	Function	Question	Response	Source	Follow Up	Additional Response
1	Policies and Fees	Billing	Are customers charged credit card service fees, or does the utility cover the cost?	The customer is not charged a credit card service fee.	Online Bill Pay system		
2	Policies and Fees	Billing	Are there fees associated with customer-initiated meter tests?	If a consumer questions the accuracy of a meter supplying his premises, the district will charge the customer the actual cost to have the meter tested. If the test shows the meter to be registering more than two percent in excess of the actual quantity of water passing through it, the overcharge resulting from the inaccuracy of the meter will be adjusted, the meter testing charge refunded, and another meter set at the service; provided, however, that such adjustment will be made to cover not more than a period of four months immediately preceding the date of the test. (11.20.050)	MMWD Rules and Regulations		
3	Policies and Fees	Billing	Do any customers currently self-report reads? If so, are there any fees to the customer involved, and who oversees the program?	Yes, some hydrant meter reads are customer reported. No fees to the customers are involved.	CS Staff		
4	Policies and Fees	Billing	Do tampering/theft charges increase based on repeat incidence?	see response to question 77			
5	Policies and Fees	Billing	Do you charge a late fee?	If full payment is not received by the close of business approximately thirty-six calendar days following the billing date shown on the bill, a late charge of three dollars ($3) per billing period and one percent (1%) of the of the past due amount will be assessed.	Marin Municipal Water District – Policy for the Termination of Water Service for Non-Payment		
6	Policies and Fees	Billing	Do you charge for customer-requested re-reads?	When a special meter reading is taken on an existing water service in between regular readings, a charge of $30 is made if the reading is taken between 8 a.m. to 4:30 p.m., Monday through Friday, and $80 if the reading is taken outside of these hours or on district holidays.	https://www.marinwater.org/sites/default/files/2020-12/FAQ%20Customer%20Service.pdf		
7	Policies and Fees	Billing	Do you have specific fees for tampering and/or theft? If so, how are these fees defined?	Yes; see response to question 77			
8	Policies and Fees	Billing	Does the organization have codified policies that specifically define: meter tampering, service theft, illegal consumption, and/or other similar terms?	Yes, under the following two rules and regulations 6.01.080 Rates for unauthorized use 11.32.020 Damage to district's meter	MMWD Rules and Regulations	What is the typical outcome? Are customers billed for theft / tampering	Rare to find and more rare to assess
9	Policies and Fees	Billing	What leak credit policies, if any, are currently in place?	Water bills may be adjusted in case of water loss due to circumstances beyond your control, such as a mechanical malfunction, blind leak, water theft, vandalism, unexplained water loss, or other unusual or emergency conditions. Adjustments will not be made for faucet leaks. Water loss or leak adjustment requests must be made in writing, and are limited to two billing periods, and one adjustment every 36 months. Corrective action must be taken within 48 hours of discovering or being notified of a leak, and the district requires proof of repairs within 30 days from the billing date when the water loss occurred.	MMWD Rules and Regulations	Cost to utility associated with this	
10	Billing	Billing Operations	Are only residential accounts billed for sewer, or other customer classes as well?	No, we do not handle sewer			
11	Billing	Billing Operations	Describe roles/responsibilities of those supporting the billing process.	See websites for job descriptions	https://www.marinwater.org/job-descriptions		
12	Billing	Billing Operations	Describe the current meter read to CIS transfer process. Note any file format requirements.	Meer shop uses Itron read system with an SAP upload.	AMI Feasibility Study Questionnaire		
13	Billing	Billing Operations	Do you bill using winter quarter averaging for sewer?	No, we do not handle sewer			
14	Billing	Billing Operations	Do you estimate bills? If so, how many bills do you estimate on a monthly basis? Is the estimate automatically calculated in the CIS?	Yes, some bills are estimated. An average of 83 bills are estimated everything month. The CIS automatically estimates the read. Skip codes entered in handheld, estimated data from 1 year average	CS Staff	Reason for estimates?	Athens incorporated in main response
15	Billing	Billing Operations	Do you print and mail bills in-house or outsource?	Outsource	CS Staff		
16	Billing	Billing Operations	Does the utility produce a single bill for all services?	We have three bill forms- one for standard accounts, one for combined bills, and another for Contempo, a complex combined bill (for trailer park w/ master meters and sub-meters billing). Misread is an issue for Contempo complex bills	CS Staff	What is Contempo	Athens incorporated in main response
17	Billing	Billing Operations	How many people support the utility billing process (not including meter readers)?	12; 1 Customer service Manager, 1 Business Analyst, 7 Customer Service Reps, 1 Office Assistant, 2 field inspectors	Org Chart	Percent of time for edits / high / low bill?	Estimate 20% time of senior CSR (Gloria)
18	Billing	Billing Operations	If winter quarter averaging is not performed, describe how sewer charges are determined.	No, we do not handle sewer			

Key ID	Operation	Function	Question	Response	Source	Follow Up	Additional Response
19	Billing	Billing Operations	If you bill using winter quarter averaging, over which months does it span?	No, we do not handle sewer			
20	Billing	Billing Operations	Is an estimation calculation based on a rule/regulation?	Estimation calculation is based on historical usage (same time period last year) for the service.	CS Staff		
21	Billing	Billing System	Does the utility offer autopay? In what forms?	Yes; checking account or credit card	MMWD website		
22	Billing	Billing System	Does the utility offer online bill pay?	Yes	MMWD website		
23	Billing	Billing System	Does the utility offer web-based bill presentation?	Yes	MMWD website		
24	Billing	Billing Timeline	Are residential and commercial accounts billed at the same frequency?	Some high volume commercial accounts are bill monthly, otherwise all accounts are billed on a bi-monthly cycle.	CS Staff	Is MMWD looking to change bi-monthly billing to monthly billing?	Craig indicates MMWD may stick to bi-monthly billing.
25	Billing	Billing Timeline	How frequently are bills produced?	Every two months	MMWD website		
26	Billing	Billing Timeline	How long is a billing cycle (from read to bill due date)?	95 days, from prior read on bill to due date	From bill		
27	Billing	Billing Timeline	How many bills are processed/month?	Average 32,000 bills generated and delivered to customers per month	MMWD AMI Feasibility Study Draft Information Request		
28	Billing	Billing Timeline	How many days after the payment due date will the final notice prior to disconnect be sent?	The District shall not discontinue water service for non-payment until payment by the customer has been delinquent for at least 60 calendar days. The District will make a reasonable, good faith effort to contact the customer in writing at least 7 business days before discontinuation of water service for non-payment	Marin Municipal Water District – Policy for the Termination of Water Service for Non-Payment	Follow up with Coleen: These are customer generous policies - Pre-Covid bad debt write off amount?	
29	Billing	Billing Timeline	How many days are between a meter reading and when the bill is sent?	3 days	From bill		
30	Billing	Billing Timeline	How many days does the customer have to pay their bill after it's sent?	30 days	From bill		
31	Billing	Billing Timeline	How many days following the last notice would the customer be disconnected?	7 business days	Marin Municipal Water District – Policy for the Termination of Water Service for Non-Payment		
32	Billing	Billing Timeline	How many days following the payment due date does the customer receive a delinquent notice if unpaid?	As a courtesy, the District will make a reasonable, good faith effort to notify the customer by automated phone call at the customer provided telephone number for billing purposes and by written notice mailed to the billing address on the account that the payment remains past due and further collection action will be forthcoming, if the past due balance is not paid in full or an alternative, deferred or reduced payment arrangement is not made prior to the date of termination	Marin Municipal Water District – Policy for the Termination of Water Service for Non-Payment		
33	Billing	Billing Timeline	How many days of usage are typically found on a bill?	58 to 62 days	MMWD Rules and Regulations		
34	Billing	Disconnect Process	Are disconnects generated as a work order?	They are generated as a service investigation.	CS Staff		
35	Billing	Disconnect Process	Are there Black-out dates/times when disconnects are not done?	Currently, no disconnects are occurring because of covid	MMWD Website		
36	Billing	Disconnect Process	Do you have any remote disconnect meters in the field?	No	CS Staff		
37	Billing	Disconnect Process	Is a "verify off" service order done if payment is not received within a specified period of time? If so, how many occur per month?	No	CS Staff		
38	Billing	Disconnect Process	Is there a minimum dollar limits or other limits set for disconnects?	$45	CS Staff		
39	Billing	General	Does your service area have any areas of high move in / move out (such as around a university)?	No	CS Staff		
40	Billing	General	How is a "commercial" vs "industrial" customer determined?	There no billing difference between commercial and industrial customers.	CS Staff		
41	Policies and Fees	Meter Installation	Do customers have to provide accuracy results on customer-owned deduct meters?	There are no customer owned deduct meters in service.	CS Staff		
42	Policies and Fees	Meter Installation	Do you conduct meter tests at customer request?	Yes			
43	Policies and Fees	Meter Installation	What requirements/proof are necessary to establish meter tampering and/or theft of service?				
44	Billing	Metering	Do you have deduct meters? If so, how many and why are they used?	Yes, we have ~800 deduct (what we call "dedicated irrigation meters"). There are no special reading requirements although over 90% of these are included in our ~5,000 meter AMI pilot. Regarding master meters, we have a trailer park that has 18 master meters and downstream of that we have 396 meters feeding the individual trailers. All of these meters are read every 2 months but we subtract the total consumption from all the sub-meters from the total consumption of the 18 master meters and the trailer park entity pays the difference.	Craig L. (Meter Ops)		

Key ID	Operation	Function	Question	Response	Source	Follow Up	Additional Response
45	Billing	Metering	Do you meter wastewater accounts?	MMWD does not charge for waste water but does provide data to municipal entities.	AMI Feasibility Study Questionnaire		
46	Billing	Metering	Do you sell recycled water? If recycled water is sold, is it metered? If metered, are the meters read the same as potable water meters?	Yes to all three. 3,720 meters for recycled meter (most are 1.5" and 2"). Plan to include with AMI project. Purple color for lids/meters on recycled water line (add to procurement requirement).	AMI Feasibility Study Questionnaire	Recycle to go on AMI?	Athens incorporated in main response
48	Billing	Metering	How are multiple meters at a single service location handled?	Each meter has a separate service number	GIS		
49	Billing	Metering	How are multiple meters for a single customer handled?				
50	Billing	Metering	How many meters are "discovered" annually?	~5 (but most of these are new services and are discovered within 2 months of being installed). It's very rare to discover a meter that was installed years ago.	Craig L. (Meter Ops)		
51	Billing	Metering	If you have deduct meters, do they need any special processing or does the CIS manage all calculations?	The deduct (dedicated irrigation meters) do not need special processing. However, we have a trailer park that has 17 master meters (+1 8" fire line w/ 5/8" detect meter) and downstream of that we have 396 meters feeding the individual trailers. All of these meters are read every 2 months but we subtract the total consumption from all the sub-meters from the total consumption of the 17+1 master meters and the trailer park entity pays the difference. Someone in customer services does do some special/manual processing on this account every 2 months for billing. This used to be a manual process in spreadsheet but has been an integrated process in SAP for the last 15 years.	Craig L. (Meter Ops)	Describe manual process a little more. Is deduction done on spreadsheet or ? How are readings entered into SAP?	Athens incorporated in main response
52	Billing	Metering	If you have deduct meters, how are they reconciled against the master meter(s)?	There are no deduct (dedicated irrigation meters) associated with master meters.	Craig L. (Meter Ops)		
53	Billing	Metering	is any meter/service billed outside of the CIS?	No	Craig L. (Meter Ops)		
54	Billing	Metering	What are the metering units of measure for water? Any dependence on meter size or customer type?	hundred cubic feet (ccf); no	Bill		
55	Billing	Metering	What is the unit of measure for billing water? Any dependence on meter size or customer type?	hundred cubic feet (ccf); no	Bill		
56	Billing	New Service Install	Describe the process for a new service location.	To apply for a new water service connection, complete and submit the Project Information Form (PIF). Your form will be reviewed by Marin Water's Engineering, Water Conservation and Backflow Departments. Please allow 10-14 business days for this review. Marin Water will then provide all requirements, fees, and forms required for the new connection. For a step-by-step guide to the water service application process, please refer to the Water Service Checklist. Dedicated Irrigation Meters for Commercial Properties Commercial customers who want to install a new dedicated irrigation meter need to complete and pass Marin Water's Landscape Plan Review process prior to payment of the installation and connection fees.	MMWD Website		
57	Billing	New Service Install	How is the meter size and type determined?	Customer requests size and Dev Services confirm using WSFU count – size may be needed for fire protection as well	Development Services		

Key ID	Operation	Function	Question	Response	Source	Follow Up	Additional Response
58	Billing	New Service Install	What information is entered into CIS?	New services are created in SAP with minimal info, just service address for the most part. Through the process more information will be entered by various departments. Below are some of the fields for a Service in SAP. SAPID: Installation Id: Description: Start-up date: Main Size: Main Type: Meter to Main: Main Cover: Pipe Size: Pipe Type: Service Pressure: Pressure Code: Job Drawing: Drop Sheet: Meter Number: Meter Size: Meter Type: Meter Location: Customer Name: Customer Phone: Backflow: Route # Parcel No: Resi Code: Pressure Zone:	Development Services	For accounts initially entered, assume this is prior to meter install for tracking purposes? Are aging reports run from this? If we looked today, about how many "aged" installs might we see?	New services start with Development Services, identifies meter size, addressing. MMWD can't bill customer before meter installed in the ground. MMWD need tenant owner to contact MMWD to open a new account.
59	Billing	New Service Install	What triggers the first bill?	based upon meter reading route and would be automated.	Development Services	When is the account added to a route? With minimal info as described above or not until meter install?	Customer name / account information added to turn on tag and billing starts when meter is installed.
60	Billing	New Service Install	When and how does customer service/billing receive information about the new customer (location)?	Meter shop performs SAP move-in following installation in field connecting customer to service/meter.	Development Services		
61	Billing	New Service Install	When is meter installed versus when information is entered into the CIS?	Service is created in SAP upon customer completing application process online. Can be weeks until physically installed in field and then “moved-in” by Meter Shop.	Development Services		
62	Billing	New Service Install	Which department signs up the customer?	Development Services section of the Engineering Department	MMWD Website		
63	Billing	Receivables/Collections	Are delinquent notices mailed?	Yes	Marin Municipal Water District – Policy for the Termination of Water Service for Non-Payment		
64	Billing	Receivables/Collections	Are there any standalone systems that support the billing, disconnect, or payment arrangement processes (i.e., spreadsheet, access database, etc.)?	No, all processes listed are incorporated in the CIS.	CS Staff		
65	Billing	Receivables/Collections	Do you offer Budget/levelized billing?	MMWD offers amortization agreements, alternative, payment schedules and plans for deferred or reduced payments	Marin Municipal Water District – Policy for the Termination of Water Service for Non-Payment		
66	Billing	Receivables/Collections	Do you offer Master billing?	We assume this means when we use a master meter and then we have sub-meters downstream of that. If this is the case the only example we have is 18 large meters for the Contempo trailer park in San Rafael and downstream of that we have 396 meters feeding the trailers.	Meter Shop		
67	Billing	Receivables/Collections	Does the utility collect Late Fees? How much annually?	Due to Covid-19 pandemic, dunning was disabled for 2021 and no late fees were assessed or collected.	CS Staff		
68	Billing	Receivables/Collections	Does the utility use door hangers?				
69	Billing	Receivables/Collections	Does the utility utilize phone call notifications?	Yes	Marin Municipal Water District – Policy for the Termination of Water Service for Non-Payment		

Key ID	Operation	Function	Question	Response	Source	Follow Up	Additional Response
70	Billing	Receivables/Collections	Does utility offer payment arrangements? Approx. how many per month?	Yes. Approximately 70 per month.	CS Staff		
71	Billing	Receivables/Collections	Is the disconnect for non-pay process (i.e., which service(s) to shut off, number of days, notices, etc.) stipulated in the rules/regulations?	Marin Water has a Policy for the Termination of Water Service for Non-Payment	https://www.marinwater.org/sites/default/files/2020-09/Nonpayment%20Policy%20English.pdf		
72	Billing	Receivables/Collections	Which services are shut off for delinquent non-pay?				
73	Billing	Receivables/Collections	Who manages/sets up payment plans?	Customer Service			
74	Billing	Receivables/Collections	Who produces delinquent notices?	Customer Service	CS Staff		
75	Billing	Reconnect Process	Are reconnects scheduled and routed, or on-demand?	On-demand	CS Staff		
76	Billing	Reconnect Process	Can reconnect money be collected at the customers premise?	Yes	CS Staff		
77	Billing	Reconnect Process	Can reconnect money be collected at the payment office?	Yes	CS Staff		
78	Billing	Reconnect Process	Do reconnects occur same-day or next day?	Same day	CS Staff		
79	Billing	Reconnect Process	Is it required for an individual to be present for reconnect, or is a "turn on without person present" authorization required?	An individual does not need to be present for a reconnect.	CS Staff		
80	Billing	Reconnect Process	Is Partial payment allowed for reconnect or full payment only?	Full payment or payment arrangement.	CS Staff		
81	Billing	Re-Reads	Are re-read business practices/business rules based on a rule/regulation?	yes. If a consumer questions the accuracy of a meter supplying his premises, the district will charge the customer the actual cost to have the meter tested. If the test shows the meter to be registering more than two percent in excess of the actual quantity of water passing through it, the overcharge resulting from the inaccuracy of the meter will be adjusted, the meter testing charge refunded, and another meter set at the service; provided, however, that such adjustment will be made to cover not more than a period of four months immediately preceding the date of the test.	MMWD Rules and Regulations		
87	Policies and Fees	Termination and Restoration of Service	Do you charge a disconnect fee?	To resume or continue service that has been terminated for non-payment, the customer must pay both a turn-on and turn-off fee of $50 during normal business hours and $100 outside of normal business hours. T	Marin Municipal Water District – Policy for the Termination of Water Service for Non-Payment		
88	Policies and Fees	Termination and Restoration of Service	Do you charge a reconnect fee?	To resume or continue service that has been terminated for non-payment, the customer must pay both a turn-on and turn-off fee of $50 during normal business hours and $100 outside of normal business hours. T	Marin Municipal Water District – Policy for the Termination of Water Service for Non-Payment		
89	Policies and Fees	Termination and Restoration of Service	Is there a different after hours reconnect fee?	Yes, $100	Marin Municipal Water District – Policy for the Termination of Water Service for Non-Payment		
90	Policies and Fees	Pain Points	Time consuming, affect service to customer, causes of rework / redo, information / reports that are lacking, Meter reading, theft, access, large meters, deduct meters, High bill inquiry, Every other month billing? Rate determination with bi-monthly billing data - Annual water budget determination (for C&I + single-family irrigation)?	Contempo billing (deduct meters/master meters). Billing re-work (misreads causing high consumption bill or implausables) - a lot of time involved from billing personnell, inspector etc. Double skips - that gets held from billing until read is acquired. Issues with misreads/estimates - especially when customers are in higher billing tiers. Leak adjustments (1 FTE handles this, ~$1M. averages 10 requests/day)		Discuss	Skips are sent through but double skips are worked till they get a reading. SAP calculates the baseline
91	Policies and Fees	Future Looking	What do you think an AMI system could do to relieve pain points?	If AMI data integrity is good/can be trusted, confidence in information will reduce billing efforts in re-work/implausibles. Knows ahead of billing time when meters are not communicating that trigger investigation. Requirement: customer portal (for leak alerts, etc.). Nice to have: customer portal integrated with the payment bill portal.		Discuss	Ideally, portal would allow customer to manage their own account by setting their own alert levels for consumption or bills.

Key ID	Operation	Function	Question	Response	Source	Follow Up	Additional Responses
1	Customer Service	Customer Service	How many Customer Service Reps (CSRs) does the utility have?	7	Org chart		
2	Customer Service	Customer Service	Describe CSR roles/responsibilities.	On Marin Water Website	https://www.marinwater.org/job-descriptions		
3	Customer Service	Customer Service	Are CSRs shared with other city entities or utility-only? If shared, how much of their time is allocable to the utility?	Marin Water is a special District; we are not connected to the city/town and county.			
4	Customer Service	Customer Service	Do you track customer call types? If so, please provide statistics.	Yes; see Calls tab for 2019 data and statistics.	AMI Feasibility Study Questionnaire	Review Calls tab	
5	Customer Service	Customer Service	What are the top 3 customer calls/ typical complaints?	Misc. payments, collection calls, and misc. information requests	See calls tab	Discuss further - high bill complaints / inquiries?	
6	Customer Service	Customer Service	What is the average call length?	Approximately 5 minutes	call reports		
7	Customer Service	Customer Service	Does the utility have a walk in facility for customer inquiries and bill pay? More than one?	Yes, one location at our main office for bill-pay and inquires. We also have an office on our watershed where people could go in and ask questions, but there are no bill pay options here. The watershed office may still be closed due to covid.			
8	Customer Service	Customer Service	How many walk in customers does the utility typically experience?	CY2019 data. Telephone=38,325. Web=5,496, Written=8,710. Walk-in=7,814	AMI Feasibility Study Questionnaire		
9	Customer Service	Customer Service	Do you have a customer web portal?	We have an online payment system - View, print, or pay bill online, and customers can email questions to customer service. On our website we also offer start/stop services, new service connection services, and other services.	website		
10	Customer Service	Customer Service	What type of functionality does the web portal provide to customers?	View, print, or pay bill online	website		
11	Customer Service	Customer Service	Can the customer web portal support interval data presentation?	The web portal displays the periodic customer bill, which are updated bi-monthly with interval consumption data.	https://mmwd.billonline.com/login.aspx		
12	Customer Service	Customer Service	If you have a customer portal, are there customer Portal traffic metrics available?	The customer portal does not current support traffic metrics	https://mmwd.billonline.com/login.aspx		
13	Customer Service	Customer Service	If you have a customer portal, can it accept other customer feedback (pilot or otherwise)?	Customers can submit feedback via the Contract us form on the portal.	https://mmwd.billonline.com/ContactUs/ContactUsTabs.aspx		
14	Customer Service	Customer Service	What payment types are accepted via Customer Portal?	Auto pay, credit card, checking account			
15	Customer Service	Customer Service	Describe all methods and locations where a customer can pay their bill.	Automatic Bill Payments (EasyPay), Online payments, pay-by-phone, mail payments, pay in person	https://www.marinwater.org/ways-to-pay		
16	Customer Service	Customer Service	Describe the percentage of each payment type.	Automatic Bill Payments (EasyPay):8%, Online payments:60%, pay-by-phone:2%, mail payments:29%, pay in person:1%	CIS		
17	Customer Service	Customer Service	Describe any water rebate programs.	Cash for grass, mulch program, greywater: Laundry to landscape, flume smart meters, high efficiency toilets, hot water recirculating systems, pool and spa covers, smart irrigation meter, clothes washer, rain barrel program.	https://www.marinwater.org/rebates		
18	Customer Service	Customer Service	If you have any water rebate programs, are they tracked in the CIS?	We track rebates and incentives in an Access database. Data is exported and uploaded into SAP. However, the level if detail available in SAP is fairly limited, and it's difficult to access. It's sufficient to see that they've participated in the program with a date and the program type. The Access database includes more information	Water Efficiency Department	Any desire to perform analysis on rebate program?	
19	Customer Service	Customer Service	Do you have subsidized utilities for disadvantaged residents?	Yes, we have waiver programs based on income, medical disability discounts, capital maintenance fee reduction program, tier 4 exemption program, and a super save program. See website for descriptions.	https://www.marinwater.org/discounts		
20	Customer Service	Customer Service	If you have subsidy programs, are they tracked in the CIS?	Yes, program such as the medical waiver and low-income are tracked in the CIS.	CS Staff	Note (not follow up): Integration to MDMS opportunity for reporting / evaluation of effectiveness	
21	Customer Service	Customer Service	Describe any other offerings in Pilot (Zigbee radios, etc.). Discuss effectiveness of such programs from customer engagement standpoint. Any key findings during pilot?	See pilot tab			

Key ID	Operation	Function	Question	Response	Source	Follow Up	Additional Responses
22	Customer Service	Customer Service	Does the utility foresee any problems with customer perceptions with the deployment of Smart meters or other smart grid technology?	Possibly, but it might be a really small minority. We've had some public comments at the board meetings that AMI would invade on customer privacy, will be used as an enforcement mechanism, and is government overreach. Someone also thought thinks this is a financial waste; and will be used to spy on customers. There is also a small group concerned and the RF emissions from smart meters.		Discuss Public Outreach / customer programs. Fairfax area (3,294 customers) smart meter prohibition (request to install AMI meter must come from the customer) - does this apply to all AMI networks (not limited to PG&E)? Need to investigate further.	
23	Customer Service	Customer Service	What percent of re-reads validate the original read (i.e., original read was accurate)?	No statistics available.	CIS		
24	Customer Service	Customer Service	Provide customer web portal traffic statistics, if available.	No statistics available.	https://mmwd.billonline.com/		
25	Customer Service	Pain Points	Time consuming, affect service to customer, causes of rework / redo, information / reports that are lacking, meter reading, theft, large meters, deduct meters, high bill complaints, every other month billing, payment arrangements?	Refer to Billing tab - same pain points. There may be an increase of customer inquiries in beginning of AMI deployment but will decrease along with time.		Discuss	
26	Customer Service	Future Looking	What do you think an AMI system could do to relieve pain points?			Discuss	

Key ID	Operation	Function	Question	Response	Source	Follow Up
	Information Technology	Servers	Are any servers or network elements at or nearing capacity? (including processor, memory, pipe/bandwidth, and SAN utilization)? Are any server or network upgrades planned or needed?	We are in the middle of a major upgrade of our server and SAN infrastructure. We will have adequate and expandable capacity as needed for AMI going forward.		
	Information Technology	Servers	Do you have a server type/manufacturer preference?	Dell		
	Information Technology	Servers	Is third party software hosting an option? Is it preferred?	Yes, and Yes		
	Information Technology	Staffing	Are IT or aspects of IT outsourced to a third party or organization (e.g., contract with City/County/other entity)? Please provide a list of current technology vendors and their responsibilities.	We currently do not outsource any major system at MWD but I see that changing in the future.		
	Information Technology	Staffing	Have you implemented Service Level Agreements (SLAs) for external IT services? If so, please provide.	Not at this time.		
	Information Technology	Staffing	Are IT resources available to act in an administrator role for an AMI/MDM system? If so, who? If not in IT, then which group has responsibility?	Answer is yes, depending on the technology task at hand. We do employ consultants to help out with advanced technology systems. So if we need to outsource resources we have those relationships in place.		
	Information Technology	General	Please describe any shared IT resources (e.g., staff, physical assets, network) between utility and other organizations.	Currently share GIS information with County of Marin.		
	Information Technology	General	Please provide project plans for any in-process or planned technology projects.	Not available at this time.		
	Information Technology	General	How formalized is your software procurement process?	Depends on the size and scope of the project. Small acquisitons are handled by IT Manager. Larger project would require formal RFP process and Board level involvement.		
	Information Technology	General	Are standard, utility-issued mobile devices used by field staff, or does staff use their own personal devices?	Both. We have a flexible approach to allow both use plans.		
	Information Technology	Software Developmen	Do you differentiate between development, test/QA, and production environments? Have you implemented similar environments for current software systems?	Yes and Yes.		
	Information Technology	Software Support	Does the utility currently have a helpdesk for technology support?	Yes		
	Information Technology	Software Support	If the utility has a helpdesk, which applications and databases does the helpdesk support?	Desktop/Laptops. Mobile devices. Citrix our remote access system. Content Server our Intranet system.		
	Information Technology	Software Support	Do you use a ticket management system?	No. Email only currently.		
	Information Technology	Software Support	Are active tickets cases managed until closure?	Yes, via email as mentioned above		
	Information Technology	Software Integration	Please provide a logical and physical diagram of the software applications for the utility, noting any shared apps with utility and noting all integration/interfaces.	We currently do not have these requested documents available. I am happy to discuss via phone call in detail.		
	Information Technology	Data Management	Do you conduct test backups/restores on a regular basis?	No. Not feasible at this time. New system(s) will provide these capbiliites.		
	Information Technology	Security	Do you have Agreements or Memorandum of Understanding (MOUs) with each software provider, which cover their treatment of Personally Identifiable Information (PII) and following of industry security standards?	Yes, in most cases.		
	Information Technology	Security	Do you currently have a Contingency Plan including Disaster Recovery Plan for each IT application owned by the utility, and systems that the utility relies on which are owned by the utility?	In the works as part of previously mentioned infrastructure upgrade.		
	Information Technology	Security	Do you conduct regularly-scheduled penetration testing?	Yes		
	Information Technology	Security	Do you have a security plan or roadmap?	Yes but not formalized. IT Manager can discuss as necessary.		
	Information Technology	Security	Are security requirements integrated into all development, project, and support initiatives?	Yes, but not formalized.		
	Information Technology	Security	Do you have security controls in place to protect customer Personally Identifiable Information (PII), both at rest and in transit?	Yes		

Key ID	Operation	Function	Question	Response	Source	Follow Up
	Information Technology	Communications Asse	Any existing towers that can be utilized for the AMI network? If so what are the antenna heights?	MWD owns faclities dispersed geographically which could be used for network services, but no towers to my knowledge		
	Information Technology	Communications Asse	Are there any local jurisdictional or utility limits on antenna heights?	Not familiar with local jurisdictional ordinances.		
	Information Technology	Communications Asse	Please provide a diagram (if available) for any data networks that are in place for SCADA and/or field/OT systems.	Can provide when requested via email.		
	Information Technology	Data Management	Do you have any analytics software that is used? (PowerBI, Tableau, Qlik, etc.)? If so, what? Is it consultant-managed or in-house development?	IT does not have responsibility with analytical systems at MWD.		
	Information Technology	Data Management	Are there any "large" data applications / data repositories currently in use? If so, please describe.	SAP for meter data, billing, accounting, budgets, work orders, and work order GIS integration. ESRI's GIS system.		
	Information Technology	Data Management	Is there a data governance entity established?	No		
	Information Technology	Pain Points	Time consuming, affect service to customer, causes of rework / redo, information / reports that are lacking?			Discuss
	Information Technology	Future Looking	What do you think an AMI system could do to relieve pain points?			Discuss

Appendix 1 - Marin Water Current State of Discovery

IT Systems Matrix

Commodity	Function	Name of Application	Manufacturer	System Interfaces	Hosted / In House?	System Owner	Notes	Install Year	eplaceme? roductio	Test	Dev	QA	Other
All	Accounting/Financial/Purchasing	SAP Finance	SAP										
All	AMI (Pilot)	Badger Beacon	Badger										
Water	Backflow Prevention	Tokay	Tokay										
All	CIS/Billing/Service Orders	SAP Finance	SAP										
All	Call Center Software	CUCM	CISCO										
All	Conservation Portals												
All	Customer Web Portal												
All	Customer Web Bill Pay Portal												
All	GIS	ESRI	ESRI										
All	Interactive Voice Response (IVR)	CUCM	CISCO										
Water	Meter Reading	ITRON	ITRON										
Water	Outage Mgt (OMS)												
Water	SCADA	OASyS	Schneider										
All	Work Order Management System	SAP WORK MGMT	SAP										
All	Emergency Notification System												
All	Automatic Vehicle Location (AVL)												
Water	Hydraulic Modeling	Infowater	Innovyze										
All	BI/Reporting Software												
	Enterprise Service Bus (?)												

Key ID	Function	Question	Response	Source	Follow Up
		What was the AMI Pilot vendor?	Badger Meter, cellular network		
		Please provide a brief overview of the AMI Pilot (e.g. scope of the AMI pilot, results of the AMI pilot)	Funded by CA DWR grant. RFP issued Jan 2017. Focus on irrigation meters, high water users, and hard to access meter reading routes. Installed in 3 phases: 1,960 in Q12018 (1,250 residential, 710 irrigation); 1,522 in Q12020, 750 in Q22020. 2,000 of them are 5/8" meters - 40% of customers have signed up for the customer portal, EyeOnWater. - 3,200 leak letters sent by Water Efficiency team > 200 gallons per day - 1,200 high water use letters > 3x 2-year avg - Large leaks > 3,000 gallons per day monitored daily Phase 1 water savings much higher than expected due to identification of leaks. 46 leaks > 3,000 GPD. >20% of customer		Urban Water Management Plan: 62 participants in AMI leak notifications program analysis. Estimated savings: 29,023 gals/account/year (highest among the selected conservation programs)
		How many water meters are/were connected to the AMI Pilot network? Is the AMI Pilot currently still active?	4,974 total, 3,796 residential, 742 irrigation, 203 CII, some multi-family. Still active		
		Is the AMI Pilot head-end integrated to any other IT systems at Marin Water (e.g. CIS)?	There is some integration. We regularly export a file from SAP and upload it to Beacon (Badger AMI portal) which keeps all the customer info current (e.g. names, account #'s). Endpoint serial # and read resolution are also stored in SAP. Regarding uploading reads to SAP. A model for this has been created and tested in the SAP sandbox. Meter Ops was working with someone in Customer Service IT to move this into SAP production but the IT staff went out on a 6 month leave before the process could be completed. Meter Ops is currently printing reads for AMI routes for the readers to enter directly into the handhelds, which is then uploaded to SAP. The reads are in route order so the entry goes pretty quick, about 20X faster then reading the route manually in the field. Obviously, full integration is essential in the long run.	Meter Operations	
		Was the meter reading data from the AMI Pilot utilized by Marin Water (e.g. for Billing, Customer inquiry purposes)?	See above response for billing use. The data has been used extensively for customer inquiries. Also used to generate leak and high water use letters, sent to customers weekly		
		Any Marin Water conclusions/decisions made based on the AMI Pilot?	The recent historic drought clearly demonstrated the importance of AMI for Marin Water. The AMI pilot data was used extensively during this time to monitor trends, assist customers, and identify issues.		Celluar preference? Thoughts on Badger, billing issues, installation issues, Fail rates?
		Any feedback from Marin Water customers RE: AMI Pilot?	Customers find the data extremely useful and frequently provide positive feedback.		
	Pain Points	Time consuming, affect service to customer, causes of rework / redo, information / reports that are lacking? What was your experience with the PILOT?			Discuss
	Future Looking	What would you want a future AMI system to do?			Discuss

Appendix 1 - Marin Water Current State of Discovery Calls

Activity	Count	2019 Total Calls
MISC- PAYMENTS	6,280	38,325
COLLECTION CALL	4,501	
MISC - INFORMATION REQUEST	4,472	
NEW CUSTOMER MOVES IN	3,482	
LEAK ADJUSTMENT	2,815	
ACCOUNT BALANCE	2,389	
CUSTOMER REPORTS MOVE-OUT	1,935	
HIGH CONSUMPTION	1,584	
INQUIRY	1,536	
MOVE-OUT RESULTING FROM MOVE-IN	1,259	
PAYMENT BLOCK	1,060	
EXPLANATION OF BILL	870	
MMWD WEBSITE	781	
EXPLANATION OF RATES	598	
CHANGE CUSTOMER ADDRESS	573	
SERVICE CHARGE WAIVER	488	
MAILING PAYMENT	365	
MAILED DUPLICATE BILL/STATEMENT	265	
RATE CHANGE	248	
CHANGE CUSTOMER NAME	247	
MISC - INVESTIGATION	234	
RECEIVED PAYMENT	220	
RAPID PAY	211	
RETURNED MAIL	199	
PERSONAL DATA CHANGED	198	
INSTALLMENT PLAN CREATED	170	
PAYMENT INFORMATION	165	
EASYPAY APPLICATION	156	
NO WATER	111	
LATE PAYMENT WAIVER	81	
CHANGED MOVE OUT DATE	73	
MISAPPLIED PAYMENT	68	
WEB PAY RETURN	55	
MEDICALLY DISABLED	51	
REQUEST FOR EASYPAY	39	
TRANSFERRED ITEMS	38	
BANK DATA CHANGED	36	
HIGH CONSUMPTION - CUSTOMER REPS	35	
PAYMENT MAILED	30	
VERIFY NO METER MOVEMENT	29	
MOVE OUT REVERSED	26	
CHANGED MOVE IN DATE	24	
TOILET REBATE APPLICATION	24	
INCORRECT BILL	23	
EASY PAY RETURNS	21	
WATER CONSERVATION	20	

Activity	Count	2019 Total Calls
UPDATED EZPAY INFO	16	
FIRST COLLECTION LETTER	16	
MOVE IN REVERSED	16	
DEACTIVATE FROM EASY PAY	14	
MISCELLANEOUS	14	
INSTALLMENT PLAN CHANGED	13	
MMWD SERVICES	13	
COMPLAINT ABOUT BILL	12	
CASH PAYMENT	10	
CHECK PAYMENT	9	
HIGH CONSUMPTION - REPORT	9	
MOVE OUT	9	
RETURNED CHECK	8	
EASY PAY APPROVED	8	
CREDIT CARD PAYMENT	8	
SECOND COLLECTION LETTER	8	
CONSUMER LEAK ADJUSTMENT CREDIT	7	
TURNED OFF FOR NON PAYMENT	7	
MISC- COMPLAINT	6	
48 HOUR NOTICE	5	
INSTALLMENT LETTER MAILED	5	
INSTALLMENT PLAN DEACTIVATED	4	
PAYMENT REVERSED	3	
WATER WASTER	3	
COMPLAINT ABOUT EMPLOYEE	2	
CORRECT METER READING RESULTS	2	
CREATE BUSINESS PARTNER	2	
RETURN CHARGE WAIVER	2	
PAYMENT IN DROP BOX	2	
IVR PAYMENT	2	
SPECIAL READING WAIVER	1	
RETURN LETTER SENT	1	
PAYMENT POSTED	1	
LANDLORD TENANT AGREEMENT CANCELLED	1	
WRONG SERVICE ON BILL	1	

GIS discussion

SFTP site to download all Marin County database
Road centerline dataset are pretty accurate
Billing system has its own addressing
Water Assets
Ptoable and Recycled water network
Accuracy +/- 5-10 ft
Pressure zones defined at pipe level (not polygon boundary)
Color coded
Master data is in SAP - feeds GIS (copy of SAP)
  Data in SAP: Pipes, valves, fittings, services, hydrants, corrosion
GIS links to the document management sstem, pretty robust document drawings
Service pressure in GIS: calculated pressure from the hydraulic model (?)
If Backflow Hazard filled, assumption is Backflow device is available
Hydrant - calculated pressure, flow is from the hydraulic modeling system
Valves in pump stations, tanks are not represented in GIS
Confident with the accuracy of pipe lengths
Hydraulic model is an export from GIS, no data comes back to GIS except for the pressure and flow model info
No push to put SCADA information into GIS
Distribution meter

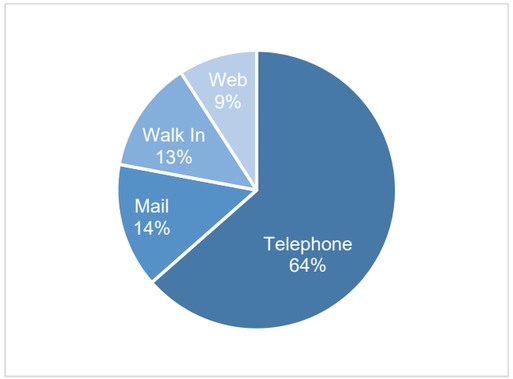
Description	Tank Use	Capacity	Work Order Id *	SAP Object Type	Top Elevation (ft above sea level)	Tank Height
Fire Road Pressure Tank	PRESSURE SYSTEM	1000	TK-195	Steel Tank	UNK	
FERN CANYON TANK	DISTRIBUTION	30000	TK-236	Bolted Steel Tank	1142.8	
MINE RIDGE TANK	DISTRIBUTION	220000	TK-183	Steel Tank	1120.2	
WOLFBACK RIDGE TANK #1	DISTRIBUTION	25000	TK-188	Steel Tank	998.1	
WOLFBACK RIDGE TANK #2	DISTRIBUTION	25000	TK-189	Steel Tank	998.1	
SLIDE GULCH TANK	DISTRIBUTION	97174	TK-214	Steel Tank	928.06	
SUMMIT TRAIL TANK	DISTRIBUTION	130000	TK-197	Bolted Steel Tank	916.6	
CONIFER WAY UPPER TANK	DISTRIBUTION	100000	TK-237	Steel Tank	892.25	
BUCKEYE CIRCLE TANK	DISTRIBUTION	30000	TK-139	Bolted Steel Tank	883	
SCOTT TANKS	DISTRIBUTION	60000	TK-199	Steel Tank	881.1	
SCOTT TANKS	DISTRIBUTION	60000	TK-198	Steel Tank	881.1	
LAGUNITAS PICNIC GROUNDS TANK	DISTRIBUTION	550	TK-241	Plastic Tank	869	
LONE TREE AVENUE TANK	DISTRIBUTION	100000	TK-191	Steel Tank	864.5	
KENT FIRE TRAIL TOP TANK	DISTRIBUTION	10000	TK-229	Steel Tank	853.8	
MEADOW CLUB UPPER TANK	DISTRIBUTION	300000	TK-015	Rivet Steel Tank	830	
MANZANITA TANK	DISTRIBUTION	60000	TK-187	Steel Tank	815.8	
BEACON HILL TANK	DISTRIBUTION	100000	TK-210	Steel Tank	804.5	
SUGARLOAF TANK #2	DISTRIBUTION	127000	TK-226	Steel Tank	745.6	
SUGARLOAF TANK #1	DISTRIBUTION	127000	TK-225	Steel Tank	745.6	
Kent Fire Trail Tank #2	DISTRIBUTION	100000	TK-212	Bolted Steel Tank	743.3	
Kent Fire Trail Tank #1	DISTRIBUTION	100000	TK-211	Bolted Steel Tank	743.3	
INDIAN FIRE TRAIL TANK	DISTRIBUTION	250000	TK-033	Steel Tank	739.6	
GOODHILL ROAD TANK	DISTRIBUTION	60000	TK-207	Steel Tank	739	
FAIRFAX MANOR TOP TANK	DISTRIBUTION	108000	TK-233	Steel Tank	737.67	
OAK MANOR TOP TANK	DISTRIBUTION	250000	TK-019	Steel Tank	727	
BON TEMPE WASHWATER TANK	DISTRIBUTION	200000	TK-180	Steel Tank	724.2	
FAIRHILLS TOP TANK #1	DISTRIBUTION	60000	TK-081	Bolted Steel Tank	711.3	
FAIRHILLS TOP TANK #2	DISTRIBUTION	60000	TK-209	Steel Tank	711.2	
REDWOOD DRIVE UPPER TANK	DISTRIBUTION	60000	TK-181	Steel Tank	680.2	
Summit Ave Upper Tank	DISTRIBUTION	120000	TK-240	Steel Tank	680	
SCENIC AVENUE TANK	DISTRIBUTION	20000	TK-074	Redwood Tank	664	
TAM WOODS TOP TANK	DISTRIBUTION	80000	TK-220	Steel Tank	662.5	
BON TEMPE CLEARWELL TANK	CLEARWELL	2000000	TK-156	Concrete Tank	654.5	
CONIFER WAY TANK	TRANSMISSION	500000	TK-131	Steel Tank	626	
H-LINE ROAD TANK	DISTRIBUTION	500000	TK-193	Steel Tank	612	
CASCADE TANK #2	DISTRIBUTION	60000	TK-224	Steel Tank	608	
CASCADE TANK #1	DISTRIBUTION	60000	TK-223	Steel Tank	608	
MONTE MAR VISTA TANK	DISTRIBUTION	60000	TK-203	Bolted Steel Tank	600.2	
RING MOUNTAIN TANK	DISTRIBUTION	150000	TK-166	Steel Tank	588.9	
MILL VALLEY TANK	TRANSMISSION	5000000	TK-055	Steel Tank	588	
CLOUDVIEW TANK	DISTRIBUTION	220000	TK-108	Rivet Steel Tank	585.7	
OAK MANOR FIRST LIFT TANK	DISTRIBUTION	100000	TK-219	Steel Tank	583.5	
FAIRVIEW PARK TANK	DISTRIBUTION	100000	TK-235	Steel Tank	576.7	
FAWN DRIVE TANK	DISTRIBUTION	90000	TK-158	Bolted Steel Tank	570	
CHULA VISTA TANK	DISTRIBUTION	250000	TK-078	Steel Tank	570	
COUNTYVIEW DRIVE TANK	DISTRIBUTION	150000	TK-118	Steel Tank	570	

Description	Tank Use	Capacity	Work Order Id *	SAP Object Type	Top Elevation (ft above sea level)	Tank Height
HIND TANK #1	DISTRIBUTION	100000	TK-085	Redwood Tank	561	
HIND TANK #2	DISTRIBUTION	200000	TK-086	Redwood Tank	561	
SUMMIT AVENUE LOWER TANK	DISTRIBUTION	100000	TK-221	Steel Tank	556.5	
ALTA AVENUE TANK	DISTRIBUTION	500000	TK-182	Steel Tank	553.5	
MESA VISTA TANK #1	DISTRIBUTION	500000	TK-117	Steel Tank	553.5	
SKY RANCH TANK	DISTRIBUTION	120000	TK-232	Steel Tank	548.6	
OAK AVENUE TANK	DISTRIBUTION	100000	TK-238	Bolted Steel Tank	548.6	
MOUNT TIBURON TANK #2	DISTRIBUTION	590000	TK-218	Steel Tank	547.4	
MOUNT TIBURON TANK #1	DISTRIBUTION	500000	TK-128	Steel Tank	547.3	
BOLSA TANK	GRAVITY	200000	TK-047	Redwood Tank	539	
ELINOR AVE TANK	DISTRIBUTION	113000	TK-239	Bolted Steel Tank	539	
BRET HARTE TANK	DISTRIBUTION	500000	TK-025	Steel Tank	536.8	
SMITH SADDLE TANK #2	TRANSMISSION	5000000	TK-148	Steel Tank	522.5	
SMITH SADDLE TANK #1	TRANSMISSION	5000000	TK-147	Steel Tank	522.5	
SWIG TANK	DISTRIBUTION	50000	TK-230	Steel Tank	521.1	
PINE MOUNTAIN TUNNEL TANK	TRANSMISSION	3000000	TK-155	Concrete Tank	518.5	
SCOTT HIGHLANDS TANK	DISTRIBUTION	250000	TK-060	Steel Tank	517	
RAFAEL HIGHLANDS TANK	DISTRIBUTION	500000	TK-097	Steel Tank	516	
RAFAEL HIGHLANDS (H/P) TANK	PRESSURE SYSTEM	2500	TK-153	Steel Tank	516	
MARINER HIGHLANDS TANK	DISTRIBUTION	60000	TK-243	Steel Tank	512.83	
TOMAHAWK DRIVE TANK	DISTRIBUTION	40000	TK-164	Bolted Steel Tank	506	
ELDA DRIVE TANK	DISTRIBUTION	150000	TK-068	Steel Tank	505.5	
KENT WOODLANDS 1ST LIFT TANK	DISTRIBUTION	100000	TK-217	Steel Tank	504.25	
SEQUOIA PARK TANK #1	DISTRIBUTION	110000	TK-215	Steel Tank	501	
SEQUOIA PARK TANK #2	DISTRIBUTION	50000	TK-216	Steel Tank	501	
MADERA PARK TANK #1	DISTRIBUTION	100000	TK-006	Redwood Tank	499	
MADERA PARK (H/P) TANK	PRESSURE SYSTEM	1500	TK-152	Steel Tank	499	
WILSON WAY TANK	DISTRIBUTION	100000	TK-196	Welded Steel Tank	496.7	
Bay Road Tank	DISTRIBUTION	120000	TK-204	Steel Tank	496.4	
OAK WOODLANDS TANK #2	DISTRIBUTION	115000	TK-201	Welded Steel Tank	495	
OAK WOODLANDS TANK #1	DISTRIBUTION	115000	TK-200	Welded Steel Tank	495	
LATTIE LANE TANK	DISTRIBUTION	250000	TK-119	Steel Tank	493	
Fairfax Manor 1st Lift Tank	DISTRIBUTION	20000	TK-202	Steel Tank	490.2	
VERNAL AVE TANK	DISTRIBUTION	300000	TK-192	Welded Steel Tank	490	
UPPER ROAD TANK	DISTRIBUTION	40000	TK-244	Steel Tank	484.25	
TAM WOODS FIRST LIFT TANK	DISTRIBUTION	85000	TK-234	Steel Tank	478	
GLENWOOD FOREST TANK	DISTRIBUTION	90000	TK-228	Steel Tank	477.3	
COURTRIGHT TANK	DISTRIBUTION	50000	TK-105	Redwood Tank	475	
HAWTHORNE HILLS UPPER TANK	TRANSMISSION	2000000	TK-069	Rivet Steel Tank	465.8	
HILL HAVEN TANK	DISTRIBUTION	165000	TK-126	Bolted Steel Tank	458.3	
MARIN CITY TANK	DISTRIBUTION	200000	TK-213	Steel Tank	431	
ROMER TANK	DISTRIBUTION	310000	TK-115	Rivet Steel Tank	429	
SAUSALITO BLVD. TANK	DISTRIBUTION	230000	TK-116	Rivet Steel Tank	415	
FAIRFAX GRADE TANK	GRAVITY	500000	TK-012	Steel Tank	411.8	
CANON VILLAGE TANK	GRAVITY	1500000	TK-011	Steel Tank	411.7	
LOS ALTOS TANK	DISTRIBUTION	60000	TK-150	Bolted Steel Tank	410.5	

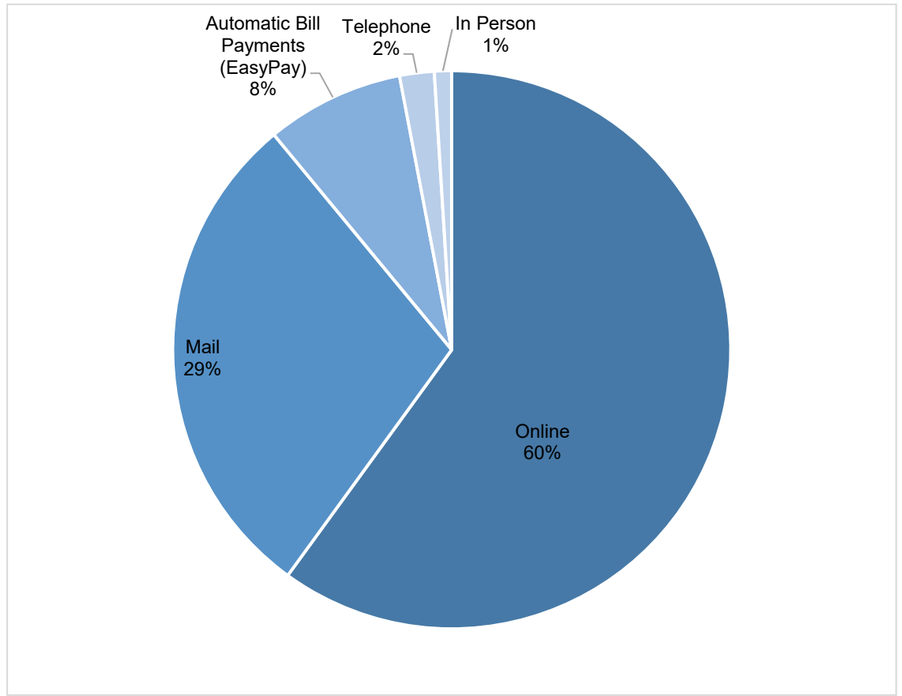
Description	Tank Use	Capacity	Work Order Id *	SAP Object Type	Top Elevation (ft above sea level)	Tank Height
SKYVIEW TERRACE TANK	DISTRIBUTION	150000	TK-100	Steel Tank	399.5	
ROSS RESERVOIR	RESERVOIR	1000000	TK-145	Concrete Tank	361	
SAN GERONIMO CLEARWELL TANK #1	CLEARWELL	2000000	TK-157	Concrete Tank	348	
SAN GERONIMO CLEARWELL TANK #2	CLEARWELL	3000000	TK-186	Concrete Tank	348	
SANTA MARGARITA TANK	GRAVITY	1500000	TK-098	Steel Tank	347.3	
LUCAS VALLEY TANK	GRAVITY	1500000	TK-106	Steel Tank	347	
PACHECO RIDGE TANK #1	TRANSMISSION	3000000	TK-184	Steel Tank	345	
PACHECO RIDGE TANK #2	TRANSMISSION	3000000	TK-185	Steel Tank	345	
FRIAR TUCK LANE TANK	DISTRIBUTION	125000	TK-222	Steel Tank	344	
ALTO TANK #2	TRANSMISSION	3000000	TK-165	Steel Tank	337.7	
MILLER CREEK TANK	GRAVITY	500000	TK-094	Steel Tank	337.6	
ALTO TANK #1	TRANSMISSION	3000000	TK-046	Steel Tank	337.2	
LOS RANCHITOS TANK	GRAVITY	1000000	TK-089	Steel Tank	336.7	
ESCALLE TANK	GRAVITY	1000000	TK-030	Steel Tank	336	
CREEKSIDE DRIVE TANK	DISTRIBUTION	180000	TK-167	Steel Tank	326	
INVERNESS DRIVE TANK	DISTRIBUTION	140000	TK-190	Steel Tank	325.5	
MARIN PROFESSIONAL CENTER TANK	GRAVITY	250000	TK-091	Steel Tank	322.8	
SPRING LANE TANK #1	GRAVITY	1500000	TK-130	Rivet Steel Tank	311.5	
SPRING LANE TANK #2	DISTRIBUTION	1500000	TK-208	Welded Steel Tank	310.3	
MARINWOOD TANK	GRAVITY	500000	TK-090	Steel Tank	305	
TENNESSEE VALLEY TANK	GRAVITY	1000000	TK-125	Steel Tank	302.5	
STRAWBERRY TANK	GRAVITY	1500000	TK-064	Steel Tank	296.5	
SAN CLEMENTE TANK	GRAVITY	1500000	TK-009	Steel Tank	293	
FORBES HILL RESERVOIR	RESERVOIR	4000000	TK-146	Concrete Tank	290	
SANTA VENETIA TANK	DISTRIBUTION	310000	TK-206	Steel Tank	290	
GREENBRAE TANK	GRAVITY	1500000	TK-027	Steel Tank	289.6	
MARINSHIP TANK	GRAVITY	1500000	TK-175	Concrete Tank	286	
PARADISE DRIVE TANK	GRAVITY	1000000	TK-127	Steel Tank	280	
PUERTO SUELLO TANK	GRAVITY	1500000	TK-096	Steel Tank	276.6	
SAUSALITO PUMP HOUSE TANK #2	GRAVITY	310000	TK-114	Rivet Steel Tank	249	
SAUSALITO PUMP HOUSE TANK #1	GRAVITY	310000	TK-113	Rivet Steel Tank	249	
LOCH LOMOND TANK	GRAVITY	1000000	TK-087	Steel Tank	242.5	
GLENWOOD TANK	GRAVITY	1500000	TK-083	Steel Tank	233.7	
MARIN BAY TANK	GRAVITY	120000	TK-160	Steel Tank	225.2	
PEACOCK GAP TANK	GRAVITY	500000	TK-159	Concrete Tank	225	
MCNEAR DRIVE #1 (H/P) TANK	PRESSURE SYSTEM	1000	TK-168	Steel Tank	210	
MCNEAR DRIVE #2 (H/P) TANK	PRESSURE SYSTEM	1500	TK-169	Steel Tank	210	
RICHARDSON DRIVE (H/P) TANK	PRESSURE SYSTEM	1000	TK-205	Steel Tank	196	
VIA MONTEBELLO (H/P) TANK	PRESSURE SYSTEM	3500	TK-174	Steel Tank	104	
		81899724 gal				
		81.899724 mg				

Graphs

Telephone	38,325	64%
Mail	8,710	14%
Walk In	7,814	13%
Web	5,496	9%
	60,345	



Online	60%
Mail	29%
Automatic Bill Payments (EasyPay)	8%
Telephone	2%
In Person	1%



AMI Water Meter Replacement Program: 2022

Questions	Answer	Notes	SME
IT Support			
Question	Answer	Notes	SME
Servers			
Please provide a logical and physical view of the server infrastructure noting virtualization, shared storage, and purpose. Please include both Utility servers, and City servers that the Utility depends on.	Water District - We currently have an HP server SAN system. Migrating to a Dell Hypervisor System for server/storage. We have VMWARE for server virtualization. We are a special District, so we are not connected to the City.		
Please provide a data network physical diagram. What peak processing and communications demand periods? ~~Please include both the Utility network and the City network.~~	N/A at this time. We have our consulting firm and SDWAN vendor working on diagrams. Peak processing times would be during regular business hours 5 days a week.		
Are any servers or network elements at or nearing capacity? (includes processor, memory, pipe/bandwidth, and SAN utilization) Are any server or network upgrades planned or needed?	As stated above, we are migrating off of older and at near capacity HP system to a new highly expandable Dell Hypervisor system. We recently completed a network upgrade also.		
Do you have a server type/manufacturer preference?	Yes, Dell.		
Is third party software hosting (SaaS) an option? Is it preferred?	It is an option and I would say preferred.		
IT Staff			
Are IT or aspects of IT outsourced to a third party? Please provide a list of current technology vendors and their responsibilities.	We have both in-house staff and outsource. ReDesign - network, hypervisor. Quintel, Y2B, and Epi-Use for SAP consulting. MIG - website hosting/maintenance.		
Have you implemented Service Level Agreements for external IT services? If so, please provide.	No		
Please provide the Utility ~~and City~~ IT Organizational Structure, including Job Titles and Role Descriptions. ~~Please state where IT resources are shared between the Utility and the City~~	IT Manager, 3 - HelpDesk staff including a supervisor, 2 - GIS employee's including a supervisor, 2 - SAP analysts/programmers.		
Are IT resources available as administrator for an AMI/MDM system? Who? If not in IT Dept, then which group has responsibility?	No, not at this time. TBD.		
General			
Please describe any shared IT resources (physical assets, network) between city and utility.	Some shared GIS data. Otherwise none.		
Do you have an IT system roadmap? , If so, please provide an copy	No		
Please provide project plans for any in process or planned technology projects.	Not available		
Please provide IT Performance statistics and/or IT systems usage data.	Not available		
Please describe any current application and/or network monitoring.	Not available		
Are standard, utility-issued mobile devices used by field staff, or do they use their own personal devices?	Mostly District issued mobile devices		
Software Development			
Is the bulk of software development done in house or is it outsourced or bought "off the shelf"?	Off the Shelf		
Please describe the software development standards that are employed by developers.	We have a multi-tiered development environment for sandbox, QA, and production migration. No other development standards in place.		
Do you differentiate between development, test/QA and production environments? Have you implemented a software development test environment? Please describe for both the Utility and the City.	Yes as stated above.		
Software Support			
Does the Utility and/or City currently have a helpdesk for technology support?	Yes		
If so, which applications and databases does the helpdesk support?	Desktops, Printers, IPADS, Content Server, Citrix		
Do you use a ticket management system?	No		
Are active tickets case managed until closure?	Not		

AMI Water Meter Replacement Program: 2022

Questions	Answer	Notes	SME
Software Integration			
Please provide a logical and physical diagram of the software applications for the utility, noting any shared apps with City and noting all integration/interfaces.	Not available		
Does the Utility ~~and the City~~ typically develop their own systems interfaces or outsource?	Outsource		
Do you have a defined systems architecture role within IT?	No		
How formalized is your software procurement process?	Not formalized. Standard RFP would be normal process		
Data Management			
Is there a data base administrator on staff at the Utility or City?	Sort of, We have one systems analyst that does backups, storage management, We use a consultant for any serious database problem(s)		
Do you have a database migration plan?	No, not at this time. TBD.		
Are utility specific databases and systems incorporated into the utility's ~~city's~~ backup strategy and/or failover strategy (i.e. disaster recover or high availability)?	Yes, all databases, file systems are daily backed up		
Do you conduct test backups/restores on a regular basis?	No		
Do your DBAs have access to a test and/or development environment?			
Security			
Please provide the date of the last Information Security audit and/or Information Security Assessment for each application owned by Utility, and applications owned by the City and depended on by the Utility.	We have not done a formal assessment. I have done informal assessment.		
Do you have Agreements or Memorandum of Understanding (MOUs) with each software provider, which cover their treatment of Personally Identifiable Information (PII) and following of industry security standards?	Yes, we have standard MSA with our vendor's which have the described language.		
Do you currently have a Contingency Plan including Disaster Recovery Plan for each IT application owned by the Utility, and systems that the Utility relies on which are owned by the City?	Currently in progress. Approximately, 6 months to completion.		
Do you conduct regularly-scheduled penetration testing?	Annual		
Do you have a security plan or roadmap?	Not formalized		
Do you have personnel devoted to security-specific tasks?	We have one staff member that handles access control, No other formal tasks.		
Are security requirements integrated into all development, project and support initiatives?	Yes, but not formalized.		
Do you have security controls in place to protect customer Personally Identifiable Information (PII), both at rest and in transit?	Yes		
Change Management			
Do you actively manage requests for changes to infrastructure and IT systems?	Yes		
Have you defined, documented and distributed your Change Management processes?	Not formalized.		
Are learnings from Change Management incorporated into future projects?	Yes, as needed		
Is there a formalized process for Change Management reporting?	Not really		

AMI Water Meter Replacement Program: 2022

Questions	Answer	Notes	SME
Project Management			
Does each IT application have a utility business owner, who approves enhancements requests and change management requests for that application?	Yes, in most cases.		
Do the Utility Business owner and the IT owner work together to set scope and timeline for IT projects? If not, who typically sets the scope and timeline set for IT projects, for both Utility and City IT projects?	Yes		
Who manages the IT projects within your organization?	In most cases. IT Manager		
Has your IT organization defined a manager for all IT PMs?	In most cases		
What software are you currently using to actively manage projects?	Not formalized		
What type of reporting structure is in place for in-progress projects?	Not formalized		
Do you conduct post-implementation reviews (PIRs)?	Yes as needed		
Are the results of your PIRs used as learnings for future projects?	Yes as needed		
Communications Assets			
Any City-owned Light Poles?	No		
Pole attachment agreement for non-City owned?	No		
Antenna heights of any existing RF Towers (incl. any water tanks ~~towers~~)?	We have over 100 radio antennas each at different elevations. The antenna's are located on our water tanks, at control valve pits, and pump stations.		
Any local Jurisdictional or utility limits on antenna heights?	Unknown		
Please provide a diagram (if available) for any data networks that are in place for SCADA and/or field/OT systems.	We do not have diagrams of our field networks		

Business Case Model

Prepared for: MARIN WATER

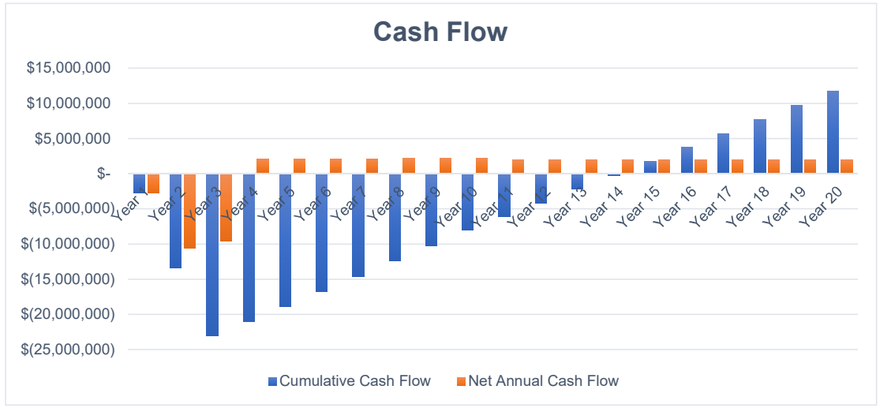
Prepared by: E Source

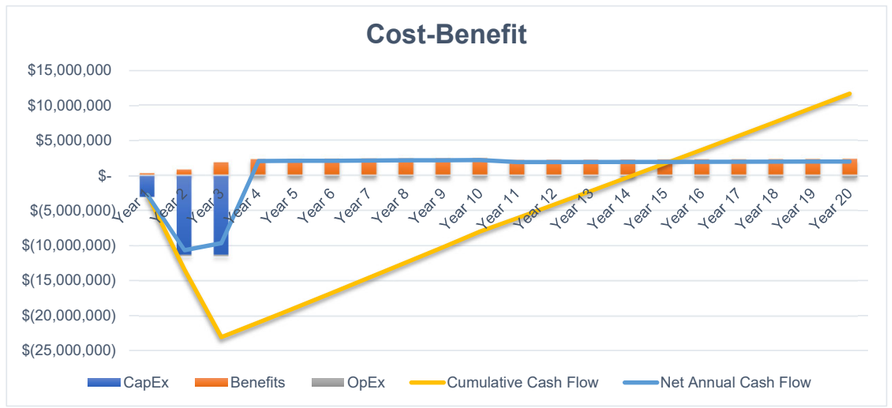
Business Case Results

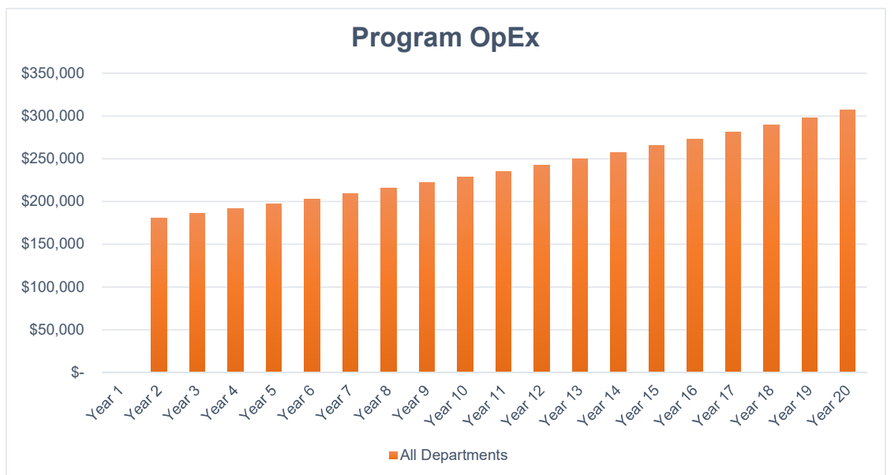
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Benefits																				
Water	$ 302,250	$ 813,510	$ 1,847,453	$ 2,283,869	$ 2,310,474	$ 2,337,079	$ 2,363,685	$ 2,390,290	$ 2,416,896	$ 2,443,501	$ 2,159,003	$ 2,176,843	$ 2,194,771	$ 2,212,786	$ 2,230,886	$ 2,249,072	$ 2,267,342	$ 2,285,695	$ 2,304,131	$ 2,322,648
Indirect	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Benefits	$ 302,250	$ 813,510	$ 1,847,453	$ 2,283,869	$ 2,310,474	$ 2,337,079	$ 2,363,685	$ 2,390,290	$ 2,416,896	$ 2,443,501	$ 2,159,003	$ 2,176,843	$ 2,194,771	$ 2,212,786	$ 2,230,886	$ 2,249,072	$ 2,267,342	$ 2,285,695	$ 2,304,131	$ 2,322,648
Operational Expense																				
All Departments	$ -	$ 180,461	$ 185,874	$ 191,451	$ 197,194	$ 203,110	$ 209,203	$ 215,479	$ 221,944	$ 228,602	$ 235,460	$ 242,524	$ 249,800	$ 257,294	$ 265,012	$ 272,963	$ 281,152	$ 289,586	$ 298,274	$ 307,222
Total OpEx	$ -	$ 180,461	$ 185,874	$ 191,451	$ 197,194	$ 203,110	$ 209,203	$ 215,479	$ 221,944	$ 228,602	$ 235,460	$ 242,524	$ 249,800	$ 257,294	$ 265,012	$ 272,963	$ 281,152	$ 289,586	$ 298,274	$ 307,222
Capital Expense																				
Water	$ 3,086,701	$ 11,288,268	$ 11,299,670	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
(blank)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total CapEx	$ 3,086,701	$ 11,288,268	$ 11,299,670	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Pro Forma Financials																				
Benefits	$ 302,250	$ 813,510	$ 1,847,453	$ 2,283,869	$ 2,310,474	$ 2,337,079	$ 2,363,685	$ 2,390,290	$ 2,416,896	$ 2,443,501	$ 2,159,003	$ 2,176,843	$ 2,194,771	$ 2,212,786	$ 2,230,886	$ 2,249,072	$ 2,267,342	$ 2,285,695	$ 2,304,131	$ 2,322,648
OpEx	$ -	$ 180,461	$ 185,874	$ 191,451	$ 197,194	$ 203,110	$ 209,203	$ 215,479	$ 221,944	$ 228,602	$ 235,460	$ 242,524	$ 249,800	$ 257,294	$ 265,012	$ 272,963	$ 281,152	$ 289,586	$ 298,274	$ 307,222
EBITDA	$ 302,250	$ 633,049	$ 1,661,578	$ 2,092,418	$ 2,113,280	$ 2,133,970	$ 2,154,482	$ 2,174,811	$ 2,194,952	$ 2,214,899	$ 1,923,543	$ 1,934,319	$ 1,944,971	$ 1,955,492	$ 1,965,874	$ 1,976,109	$ 1,986,190	$ 1,996,109	$ 2,005,857	$ 2,015,426
CapEx	$ 3,086,701	$ 11,288,268	$ 11,299,670	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Depreciation (Straight-Line)	$ 154,335	$ 718,748	$ 1,283,732	$ 1,283,732	$ 1,283,732	$ 1,283,732	$ 1,283,732	$ 1,283,732	$ 1,283,732	$ 1,283,732	$ 1,283,732	$ 1,283,732	$ 1,283,732	$ 1,283,732	$ 1,283,732	$ 1,283,732	$ 1,283,732	$ 1,283,732	$ 1,283,732	$ 1,283,732
Net Income	$ 147,915	$ (85,699)	$ 377,846	$ 808,686	$ 829,548	$ 850,238	$ 870,750	$ 891,079	$ 911,220	$ 931,167	$ 639,811	$ 650,587	$ 661,239	$ 671,760	$ 682,142	$ 692,377	$ 702,458	$ 712,377	$ 722,125	$ 731,694
Net Annual Cash Flow	$ (2,784,451)	$ (10,655,219)	$ (9,638,091)	$ 2,092,418	$ 2,113,280	$ 2,133,970	$ 2,154,482	$ 2,174,811	$ 2,194,952	$ 2,214,899	$ 1,923,543	$ 1,934,319	$ 1,944,971	$ 1,955,492	$ 1,965,874	$ 1,976,109	$ 1,986,190	$ 1,996,109	$ 2,005,857	$ 2,015,426
Cumulative Cash Flow	$ (2,784,451)	$ (13,439,670)	$ (23,077,762)	$ (20,985,343)	$ (18,872,063)	$ (16,738,094)	$ (14,583,612)	$ (12,408,801)	$ (10,213,849)	$ (7,998,950)	$ (6,075,407)	$ (4,141,088)	$ (2,196,117)	$ (240,625)	$ 1,725,249	$ 3,701,358	$ 5,687,548	$ 7,683,657	$ 9,689,514	$ 11,704,940
Teminal Value	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1
Total Value	$ (2,784,451)	$ (10,655,219)	$ (9,638,091)	$ 2,092,418	$ 2,113,280	$ 2,133,970	$ 2,154,482	$ 2,174,811	$ 2,194,952	$ 2,214,899	$ 1,923,543	$ 1,934,319	$ 1,944,971	$ 1,955,492	$ 1,965,874	$ 1,976,109	$ 1,986,190	$ 1,996,109	$ 2,005,857	$ 2,015,427

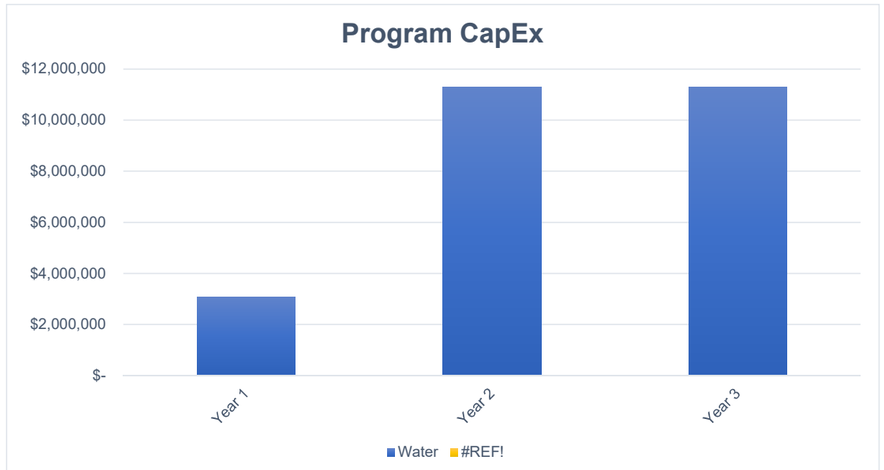
Financial Metrics		Base Case	CapEx Sensitivity +5%	CapEx Sensitivity -5%	OpEx Sensitivity +5%	OpEx Sensitivity -5%	Benefits Sensitivity +5%	Benefits Sensitivity -5%	Optimistic	Pessimistic
Net Present Value (NPV) with Discount Rate	**3.00%**	**$ 3,287,546**	**$ 2,052,686**	**$ 4,522,407**	**$ 3,121,102**	**$ 3,453,991**	**$ 4,853,228**	**$ 1,721,865**	**$ 6,254,533**	**$ 320,560**
Internal Rate of Return (IRR)		**4.7%**	**4.0%**	**5.4%**	**4.6%**	**4.7%**	**5.4%**	**3.9%**	**6.2%**	**3.2%**
Capital Expense (CapEx)		**$ 25,674,639**	**$ 26,958,371**	**$ 24,390,907**	**$ 25,674,639**	**$ 25,674,639**	**$ 25,674,639**	**$ 25,674,639**	**$ 24,390,907**	**$ 26,958,371**
CapEx per Meter		**$ 410.31**	**$ 430.83**	**$ 389.80**	**$ 410.31**	**$ 410.31**	**$ 410.31**	**$ 410.31**	**$ 389.80**	**$ 430.83**
Return on Investment (ROI)		**38.7%**	**33.1%**	**44.9%**	**37.7%**	**39.8%**	**45.7%**	**31.8%**	**53.4%**	**25.5%**
Payback Period (Years)		**15**	**15**	**14**	**15**	**15**	**14**	**15**	**13**	**16**

Summary Charts









Base Assumptions

Project Phases	Start Month	End Month	Notes
Initial Deployment Area (IDA)	1	12	Estimate 1 year
Full Deployment	13	36	Estimate 2 years
Steady-State Operations	37	240	

Utility Growth Category	Utility Growth Rate	Notes
Software	0.16%	
Equipment	0.16%	~100 meters added per year. Kristin to confirm w/ Engineering team
Labor	0.0%	
None	0.0%	
Other	0.0%	

***Replace meters older than: 10 years

Water Meter	Total	Replace	Retrofit	Notes
5/8" Meter	42,528	34,453	8,075	
3/4" Meter	3,886	2,316	1,570	
1" Meter	12,935	9,385	3,550	
1 1/2" Meter	2,323	1,308	1,015	
2" Meter	654	270	384	
3" Meter	186	117	69	
4" Meter	39	13	26	
6" Meter	17	7	10	
8" Meter	5	4	1	
	62,573	47,873	14,700	
		77%	23%	

Installation Rate		
Meter Replacement Rate	23,937	/year
	1,995	/month
	461	/week
Meter Retrofit Rate	7,350	/year
	613	/month
	142	/week
Total	31,287	/year
	2,608	/month
	603	/week

Water Meter Lid	Percentage	Notes
Replaced	48%	Estimate from Craig L: ~48% concrete, ~10% steel, ~42% plastic/fiberglass. Replace concrete lids
Not Replaced	52%	
Lids to be drilled	52%	

Reference Information below:

Water Meter Replacement Cutoff older than: 10 years

Water Meter	Total	Replace	Retrofit	Notes
5/8" Meter	42,528	34,453	8,075	
3/4" Meter	3,886	2,316	1,570	
1" Meter	12,935	9,385	3,550	
1 1/2" Meter	2,323	1,308	1,015	
2" Meter	654	270	384	
3" Meter	186	117	69	
4" Meter	39	13	26	
6" Meter	17	7	10	
8" Meter	5	4	1	
	62,573	47,873	14,700	
		77%	23%	

Water Meter Replacement Cutoff older than: 15 years

Water Meter	Total	Replace	Retrofit	Notes
5/8" Meter	42,528	22,932	19,596	
3/4" Meter	3,886	1,189	2,697	
1" Meter	12,935	6,377	6,558	
1 1/2" Meter	2,323	922	1,401	
2" Meter	654	125	529	
3" Meter	186	66	120	
4" Meter	39	6	33	
6" Meter	17	6	11	
8" Meter	5	4	1	
	62,573	31,627	30,946	
		51%	49%	

Water Meter Replacement Cutoff older than: 20 years

Water Meter	Total	Replace	Retrofit	Notes
5/8" Meter	42,528	10,036	32,492	
3/4" Meter	3,886	518	3,368	
1" Meter	12,935	2,996	9,939	
1 1/2" Meter	2,323	697	1,626	
2" Meter	654	86	568	
3" Meter	186	38	148	
4" Meter	39	2	37	
6" Meter	17	2	15	
8" Meter	5	2	3	
	62,573	14,377	48,196	
		23%	77%	

10
15
20

Appendix 3 - Marin Water Summarized AMI Financial Model

Meters by Size, Year

Row Labels	2000 & older	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Grand Total
5/8 "	**36**	**3,940**	**909**	**1,249**	**2,383**	**1,519**	**2,329**	**1,549**	**1,262**	**5,602**	**2,154**	**2,547**	**2,988**	**2,056**	**1,370**	**2,560**	**1,195**	**761**	**1,299**	**1,008**	**2,755**	**979**	**78**	**42,528**
Cell	-																	3	5	83	1,970	15	1	2,077
(blank)	36	3,940	909	1,249	2,383	1,519	2,329	1,549	1,262	5,602	2,154	2,547	2,988	2,056	1,370	2,560	1,195	758	1,294	925	785	964	77	40,451
3/4 "		**289**	**71**	**56**	**42**	**60**	**85**	**73**	**89**	**207**	**217**	**226**	**233**	**197**	**197**	**274**	**201**	**204**	**237**	**233**	**504**	**177**	**14**	**3,886**
Cell	-																		3	26	332	13		374
(blank)	-	289	71	56	42	60	85	73	89	207	217	226	233	197	197	274	201	204	234	207	172	164	14	3,512
1 "	**13**	**1,761**	**165**	**238**	**377**	**442**	**568**	**479**	**424**	**1,270**	**640**	**505**	**574**	**580**	**395**	**954**	**407**	**286**	**397**	**231**	**1,976**	**235**	**18**	**12,935**
Cell	-																	1	7	1	1,766	12	1	1,788
(blank)	13	1,761	165	238	377	442	568	479	424	1,270	640	505	574	580	395	954	407	285	390	230	210	223	17	11,147
1 1/2"	**13**	**499**	**29**	**53**	**36**	**67**	**56**	**55**	**45**	**34**	**35**	**71**	**52**	**100**	**80**	**83**	**63**	**104**	**114**	**89**	**518**	**123**	**4**	**2,323**
AMI	-																			6				6
Cell	-													4	5	6	2	4	2	21	460	8		512
(blank)	13	499	29	53	36	67	56	55	45	34	35	71	52	96	75	77	61	100	112	62	58	115	4	1,805
2 "	**3**	**69**	**7**	**-**	**1**	**6**	**4**	**2**	**8**	**7**	**18**	**22**	**31**	**39**	**23**	**30**	**11**	**42**	**46**	**36**	**174**	**74**	**1**	**654**
AMI	-																			2				2
Cell	-													1	2	1	1	1	2	3	144	5		160
(blank)	3	69	7		1	6	4	2	8	7	18	22	31	38	21	29	10	41	44	31	30	69	1	492
3 "	**3**	**3**	**-**	**-**	**-**	**32**	**3**	**7**	**10**	**5**	**3**	**7**	**6**	**13**	**21**	**4**	**8**	**8**	**5**	**5**	**31**	**11**	**1**	**186**
Cell	-														1						25	1		27
(blank)	3	3				32	3	7	10	5	3	7	6	13	20	4	8	8	5	5	6	10	1	159
4 "	**-**	**1**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**2**	**2**	**2**	**1**	**2**	**1**	**1**	**-**	**-**	**1**	**1**	**20**	**3**	**1**	**39**
Cell	-											1									20	1	1	23
(blank)	-	1				1				2	2	1	1	2	1	1			1	1		2		16
6 "	**-**	**1**	**-**	**-**	**-**	**1**	**-**	**-**	**3**	**-**	**1**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**9**	**-**	**-**	**17**
Cell	-								1		1										9			11
(blank)	-	1				1			2				1							1				6
8 "	**-**	**1**	**-**	**-**	**1**	**-**	**-**	**-**	**1**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**5**
(blank)	-	1			1				1		1								1					5
Grand Total	**68**	**6,564**	**1,181**	**1,596**	**2,840**	**2,128**	**3,045**	**2,165**	**1,842**	**7,127**	**3,071**	**3,380**	**3,886**	**2,987**	**2,087**	**3,906**	**1,885**	**1,405**	**2,100**	**1,604**	**5,987**	**1,602**	**117**	**62,573**

62,573

	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	years old by end of AMI deployment pro

replace ←←← →→→ **retrofit**

Type	CapEx	Quantity	Unit Cost	Total Cost	On or Off	owth Categ	Schedule	1	2	3
AMI Network	AMI Headend Software	62,573	$ 0.75	$ 46,930	On	Software	CapEx - IDA	$ 46,929.75	$ -	$ -
AMI Network	Network Infrastructure (Collectors and Associated Infrastru	1	$ 264,000.00	$ 264,000	On	Equipment	CapEx - IDA	$ 264,000.00	$ -	$ -
AMI Network	Network Installation Services	1	$ 264,000.00	$ 264,000	On	Equipment	CapEx - IDA	$ 264,000.00	$ -	$ -
MDMS	MDMS	62,573	$ 1.50	$ 93,860	On	Software	CapEx - IDA	$ 93,859.50	$ -	$ -
AMI Water Meters, Registers, Endpoints & Lids	5/8" Meter	34,453	$ 95.00	$ 3,273,035	On	Equipment	CapEx - Full Deployment	$ -	$ 1,639,132.87	$1,641,752.43
AMI Water Meters, Registers, Endpoints & Lids	3/4" Meter	2,316	$ 95.00	$ 220,020	On	Equipment	CapEx - Full Deployment	$ -	$ 110,185.81	$ 110,361.90
AMI Water Meters, Registers, Endpoints & Lids	1" Meter	9,385	$ 200.00	$ 1,877,000	On	Equipment	CapEx - Full Deployment	$ -	$ 939,999.85	$ 941,502.09
AMI Water Meters, Registers, Endpoints & Lids	1 1/2" Meter	1,308	$ 500.00	$ 654,000	On	Equipment	CapEx - Full Deployment	$ -	$ 327,522.59	$ 328,046.01
AMI Water Meters, Registers, Endpoints & Lids	2" Meter	270	$ 650.00	$ 175,500	On	Equipment	CapEx - Full Deployment	$ -	$ 87,890.24	$ 88,030.70
AMI Water Meters, Registers, Endpoints & Lids	3" Meter	117	$ 1,350.00	$ 157,950	On	Equipment	CapEx - Full Deployment	$ -	$ 79,101.21	$ 79,227.63
AMI Water Meters, Registers, Endpoints & Lids	4" Meter	13	$ 2,300.00	$ 29,900	On	Equipment	CapEx - Full Deployment	$ -	$ 14,973.89	$ 14,997.82
AMI Water Meters, Registers, Endpoints & Lids	6" Meter	7	$ 3,300.00	$ 23,100	On	Equipment	CapEx - Full Deployment	$ -	$ 11,568.46	$ 11,586.95
AMI Water Meters, Registers, Endpoints & Lids	8" Meter	4	$ 5,575.00	$ 22,300	On	Equipment	CapEx - Full Deployment	$ -	$ 11,167.82	$ 11,185.67
AMI Water Meters, Registers, Endpoints & Lids	Water Meter Lids, 5/8" and 3/4"	22,279	$ 40.00	$ 891,160	On	Equipment	CapEx - Full Deployment	$ -	$ 446,292.10	$ 447,005.33
AMI Water Meters, Registers, Endpoints & Lids	Water Meter Lids, 1"	6,209	$ 70.00	$ 434,630	On	Equipment	CapEx - Full Deployment	$ -	$ 217,662.30	$ 218,010.15
AMI Water Meters, Registers, Endpoints & Lids	Water Meter Lids, 1.5"	1,115	$ 100.00	$ 111,500	On	Equipment	CapEx - Full Deployment	$ -	$ 55,839.10	$ 55,928.33
AMI Water Meters, Registers, Endpoints & Lids	Water Meter Lids, 2"	340	$ 110.00	$ 37,400	On	Equipment	CapEx - Full Deployment	$ -	$ 18,729.89	$ 18,759.82
AMI Water Meters, Registers, Endpoints & Lids	Water Meter Endpoints	62,573	$ 85.00	$ 5,318,705	On	Equipment	CapEx - Full Deployment	$ -	$ 2,663,602.50	$2,667,859.29
AMI Water Meters, Registers, Endpoints & Lids	Registers - Residential	13,195	$ 67.00	$ 884,065	On	Equipment	CapEx - Full Deployment	$ -	$ 442,738.93	$ 443,446.48
AMI Water Meters, Registers, Endpoints & Lids	Registers - C&I	1,505	$ 90.00	$ 135,450	On	Equipment	CapEx - Full Deployment	$ -	$ 67,833.23	$ 67,941.64
AMI Water Meter Installation & Retrofit (Labor Cost)	Water Meter Exchange (5/8" - 1")	46,154	$ 40.00	$ 1,846,160	On	Labor	CapEx - Full Deployment	$ -	$ 923,080.00	$ 923,080.00
AMI Water Meter Installation & Retrofit (Labor Cost)	Water Meter Exchange (1 1/2")	1,308	$ 180.00	$ 235,440	On	Labor	CapEx - Full Deployment	$ -	$ 117,720.00	$ 117,720.00
AMI Water Meter Installation & Retrofit (Labor Cost)	Water Meter Exchange (2")	270	$ 245.00	$ 66,150	On	Labor	CapEx - Full Deployment	$ -	$ 33,075.00	$ 33,075.00
AMI Water Meter Installation & Retrofit (Labor Cost)	Water Meter Exchange (3")	117	$ 575.00	$ 67,275	On	Labor	CapEx - Full Deployment	$ -	$ 33,637.50	$ 33,637.50
AMI Water Meter Installation & Retrofit (Labor Cost)	Water Meter Exchange (4")	13	$ 700.00	$ 9,100	On	Labor	CapEx - Full Deployment	$ -	$ 4,550.00	$ 4,550.00
AMI Water Meter Installation & Retrofit (Labor Cost)	Water Meter Exchange (6")	7	$ 1,000.00	$ 7,000	On	Labor	CapEx - Full Deployment	$ -	$ 3,500.00	$ 3,500.00
AMI Water Meter Installation & Retrofit (Labor Cost)	Water Meter Exchange (8")	4	$ 1,000.00	$ 4,000	On	Labor	CapEx - Full Deployment	$ -	$ 2,000.00	$ 2,000.00
AMI Water Meter Installation & Retrofit (Labor Cost)	Water Meter Retrofit	14,700	$ 30.00	$ 441,000	On	Labor	CapEx - Full Deployment	$ -	$ 220,500.00	$ 220,500.00
AMI Water Meter Installation & Retrofit (Labor Cost)	Water Meter Lid Drilling	32,410	$ 18.00	$ 583,380	On	Labor	CapEx - Full Deployment	$ -	$ 291,690.00	$ 291,690.00
AMI Water Meter Installation & Retrofit (Labor Cost)	Water Meter Lid Replacement	29,943	$ 15.00	$ 449,145	On	Labor	CapEx - Full Deployment	$ -	$ 224,572.50	$ 224,572.50
Professional Services	CIS Integration	1	$ 100,000.00	$ 100,000	On	Labor	CapEx - IDA	$ 100,000.00	$ -	$ -
Professional Services	MDM Vendor	1	$ 250,000.00	$ 250,000	On	Labor	CapEx - IDA	$ 250,000.00	$ -	$ -
Professional Services	AMI Vendor	1	$ 400,000.00	$ 400,000	On	Labor	CapEx - Whole Project	$ 133,333.33	$ 133,333.33	$ 133,333.33
Professional Services	Customer Portal Vendor	1	$ 80,000.00	$ 80,000	On	Labor	CapEx - Whole Project	$ 26,666.67	$ 26,666.67	$ 26,666.67
Professional Services	Installation Contractor	10%	$ 3,708,650.00	$ 370,865	On	Labor	CapEx - Full Deployment	$ -	$ 185,432.50	$ 185,432.50
Professional Services	Warehousing Costs	0	$ 10,000.00	$ -	On	Other	CapEx - Full Deployment	$ -	$ -	$ -
Professional Services	Program Management	8%	$ 18,623,154.25	$ 1,489,852	On	Labor	CapEx - Whole Project	$ 496,617.45	$ 496,617.45	$ 496,617.45
Other Costs	Inflationary Consideration	5%	$ 21,313,871.59	$ 1,065,694	On	Labor	CapEx - Whole Project	$ 355,231.19	$ 355,231.19	$ 355,231.19
Other Costs	Performance Bond	2.50%	$ 3,708,650.00	$ 92,716	On	Other	CapEx - Full Deployment	$ -	$ 46,358.13	$ 46,358.13
Other Costs	Sales Tax	9%	$ 14,509,715.00	$ 1,305,874	On	None	CapEx - Whole Project	$ 435,291.45	$ 435,291.45	$ 435,291.45
Other Costs	Contingency	10%	$ 18,623,154.25	$ 1,862,315	On	None	CapEx - Whole Project	$ 620,771.81	$ 620,771.81	$ 620,771.81
				$ 25,640,471						
				$ 409.77 /meter						

Appendix 3 - Marin Water Summarized AMI Financial Model

OpEx

Category	Allocation	Type	OpEx	Quantity	Unit Annual Cost	Annual Cost	On or Off	Growth Cate	Annual Grov	Schedule	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
AMI Program	All Departments	AMI System	AMI Network	62,573	$ 0.40	$ 25,029.20	On	Software	3.0%	OpEx - From Full D	$ -	$ 25,780.08	$ 26,553.48	$ 27,350.08	$ 28,170.59	$ 29,015.70	$ 29,886.17	$ 30,782.76	$ 31,706.24	$ 32,657.43	$ 33,637.15	$ 34,646.27	$ 35,685.65	$ 36,756.22	$ 37,858.91	$ 38,994.68	$ 40,164.52	$ 41,369.45	$ 42,610.54	$ 43,888.85
AMI Program	All Departments	AMI System	AMI Headend	62,573	$ 1.30	$ 81,344.90	On	Software	3.0%	OpEx - From Full D	$ -	$ 83,785.25	$ 86,298.80	$ 88,887.77	$ 91,554.40	$ 94,301.03	$ 97,130.06	$ 100,043.97	$ 103,045.29	$ 106,136.64	$ 109,320.74	$ 112,600.37	$ 115,978.38	$ 119,457.73	$ 123,041.46	$ 126,732.70	$ 130,534.68	$ 134,450.73	$ 138,484.25	$ 142,638.77
AMI Program	All Departments	AMI System	MDMS	62,573	$ 0.60	$ 37,543.80	On	Software	3.0%	OpEx - From Full D	$ -	$ 38,670.11	$ 39,830.22	$ 41,025.12	$ 42,255.88	$ 43,523.55	$ 44,829.26	$ 46,174.14	$ 47,559.36	$ 48,986.14	$ 50,455.73	$ 51,969.40	$ 53,528.48	$ 55,134.34	$ 56,788.37	$ 58,492.02	$ 60,246.78	$ 62,054.18	$ 63,915.81	$ 65,833.28
AMI Program	All Departments	AMI System	Customer Portal	62,573	$ 0.50	$ 31,286.50	On	Software	3.0%	OpEx - From Full D	$ -	$ 32,225.10	$ 33,191.85	$ 34,187.60	$ 35,213.23	$ 36,269.63	$ 37,357.72	$ 38,478.45	$ 39,632.80	$ 40,821.79	$ 42,046.44	$ 43,307.83	$ 44,607.07	$ 45,945.28	$ 47,323.64	$ 48,743.35	$ 50,205.65	$ 51,711.82	$ 53,263.17	$ 54,861.07

Appendix 3 - Marin Water Summarized AMI Financial Model

Benefits

Category	Allocation	Benefit	Benefits Calculation Details	Annual Value	Notes/Source	On or Off	Growth Category	nual Growth R	Schedule	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
AMI Program	Water	Meter Reading Reduction		$ 225,995	<<--average value starting year 5 up to year 20	On	Labor	0.00%	Default Benefits	$ -	$ -	$ -	$ -	$ 26,587.68	$ 53,175.35	$ 79,763.03	$ 106,350.71	$ 132,938.38	$ 159,526.06	$ 186,113.74	$ 212,701.41	$ 239,289.09	$ 265,876.76	$ 292,464.44	$ 319,052.12	$ 345,639.79	$ 372,227.47	$ 398,815.15	$ 425,402.82
			Annual Meter Reading Expense	$ 903,981	This includes the labor cost for 8.5 meter readers spending 70% of their time reading. It also includes the average annual cost for 9 trucks, completing re-reads and supervisor time.																										
			Expense Reduction	Custom Value - See Notes	Starting year 5, reduction of 0.25 FTE/year due to attrition.																										
			Water Service Proportion	100%																										
AMI Program	Water	Meter Reading Equipment Cost Aversion		$ -		Off	Equipment	0.16%	Default Benefits	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
			Cost of an ERT	$ -	very few ERTS, 1.6% use ERTs, years since bought, maintain not buying new																										
			Total Number of Meters																										
			Percentage Reduction	100.0%																										
			Water Service Proportion by Total Meter Count	100%																										
AMI Program	Water	Meter Reading Software Cost Aversion		$ 11,000		On	Software	0.16%	Default Benefits	$ -	$ 2,634.64	$ 8,396.34	$ 11,052.82	$ 11,070.49	$ 11,088.18	$ 11,105.90	$ 11,123.65	$ 11,141.42	$ 11,159.23	$ 11,177.06	$ 11,194.93	$ 11,212.82	$ 11,230.74	$ 11,248.69	$ 11,266.66	$ 11,284.67	$ 11,302.70	$ 11,320.77	$ 11,338.86
			Cost of Meter Reading Software	$ 11,000.00	Just reaching end of life on the current manual read system, replacing with new product (Itron/Temetra) which will have an annual contract (~$60K for first year and ~$11K/yr for subsequent years). Source: Craig Lauridsen																										
			Percentage Reduction	100%																										
			Water Service Proportion by Total Meter Count	100%																										
AMI Program	Water	Customer Call Reduction		$ 15,639		On	Labor	0.00%	Default Benefits	$ -	$ 3,739.77	$ 11,899.26	$ 15,639.03	$ 15,639.03	$ 15,639.03	$ 15,639.03	$ 15,639.03	$ 15,639.03	$ 15,639.03	$ 15,639.03	$ 15,639.03	$ 15,639.03	$ 15,639.03	$ 15,639.03	$ 15,639.03	$ 15,639.03	$ 15,639.03	$ 15,639.03	$ 15,639.03
			Annual Customer Inquiry & Adj Expense	$ 104,260	Update: Inbound/avg. call time 34,901, 0:03:57 Outbound/avg. call time/max. call time 7,448, 0:00:53, 0:37:08 Source: Coleen Kanzaki, Colin Horton Calculation is based on CSR I $43.41/hour (email from Kristin 02/28/22)																										
			Expense Reduction	15%																										
			Water Service Proportion of Inquiries	100%																										
AMI Program	Water	Meter Re-Reading Reduction		$ 12,805		On	Labor	0.00%	Default Benefits	$ -	$ 3,062.07	$ 9,742.93	$ 12,805.00	$ 12,805.00	$ 12,805.00	$ 12,805.00	$ 12,805.00	$ 12,805.00	$ 12,805.00	$ 12,805.00	$ 12,805.00	$ 12,805.00	$ 12,805.00	$ 12,805.00	$ 12,805.00	$ 12,805.00	$ 12,805.00	$ 12,805.00	$ 12,805.00
			Annual Meter Re-Reading Expense	$ 13,000	We do about 512 re-reads (verifies) per year at a total cost of ~$13K. Source: Craig Lauridsen																										
			Expense Reduction	98.5%																										
			Water Service Proportion by Total Meter Count	100%																										
AMI Program	Water	Move-In/-Out Read Reduction		$ -		On	Labor	0.00%	Default Benefits	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
			Annual Move-In/-Out Read Expense	$ 72,000.00	Marin Water handles about 300 final read requests per month - DSA Feasibility Study (Oct 2020). Based on 300/month, the annual cost is ~$72K. Source: Craig Lauridsen																										
			Expense Reduction	0.0%	Captured under customer-generated service orders																										
			Water Service Proportion by Total Meter Count	100%																										
AMI Program	Water	Non-Pay Disconnect Labor Reduction		$ -		On	Labor	0.00%	Default Benefits	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
			Delinquent shut off/turn on expense	$ 17,728	In 2019, there were 219 shutoffs due to non-payment. Estimate of 1.5 hours per shutoff (1 hour field inspector time +20 minutes CSRII 10 minutes senior CSR). Estimated total of 329 hours. Source: Craig Lauridsen & Colleen Kanzaki Calculation is based on rate Field Inspector $53.32/hour, CSR II $50.17/hour and Senior CSR $65.44/hour (email from Kristin 02/28/22)																										
			Cut/Connect Non-Payment Reduction	0%																										
AMI Program	Water	Workers' Compensation Expense Reduction		$ -		Off	Other	0.00%	Default Benefits	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
			Annual Workers' Compensation Claims		Last 5 years 1 incident where someone had to miss work																										
			Annual Workers' Compensation Insurance Premiums																										
			Water Allocation	100%																										
			Reduction	30%																										
AMI Program	Water	Customer-Generated Service Order Reduction		$ 111,683		On	Labor	0.00%	Default Benefits	$ -	$ 26,706.75	$ 84,976.01	$ 111,682.76	$ 111,682.76	$ 111,682.76	$ 111,682.76	$ 111,682.76	$ 111,682.76	$ 111,682.76	$ 111,682.76	$ 111,682.76	$ 111,682.76	$ 111,682.76	$ 111,682.76	$ 111,682.76	$ 111,682.76	$ 111,682.76	$ 111,682.76	$ 111,682.76
			Cost of Customer-Generated Service Orders (investigations, testing, etc.)	$ 159,547	6,384 Customer generated Service Orders. Estimated total of 3,192 hours (2019 data) yearly at 30 minutes per service order (20 minutes field inspector and 10 minutes CSRI or CSRII). move-in reads: 4,786 verify no meter movement:575 high consumption investigation:1,023 Source: Colin Horton Calculation is based on rate Field Inspector $53.32/hour, CSR I $43.31/hour (email from Kristin 02/28/22)																										
			Expense Reduction	70%																										
			Water Service Proportion	100%																										
AMI Program	Water	Billing Exception Handling Expense Reduction		$ 15,304		On	Labor	0.00%	Default Benefits	$ -	$ 3,659.69	$ 11,644.45	$ 15,304.14	$ 15,304.14	$ 15,304.14	$ 15,304.14	$ 15,304.14	$ 15,304.14	$ 15,304.14	$ 15,304.14	$ 15,304.14	$ 15,304.14	$ 15,304.14	$ 15,304.14	$ 15,304.14	$ 15,304.14	$ 15,304.14	$ 15,304.14	$ 15,304.14
			Billing & Billing Exceptions Expense	$ 17,005	808 Billing reversal with reason 03 (incorrect meter read). 213 verify read investigations. Estimate of 202 hours of Senior CSR time(15 minutes per reversal) for billing reversals and 71 hours of field inspector time (20 minutes per verify) to verify reads in field. Estimate total of 273 hours yearly (2019 data). Source: Colin Horton Calculation is based on rate Field Inspector $53.32/hour, Senior CSR $65.44/hour (email from Kristin 02/28/22)																										
			Reduction of Exception Handling, Billing Issues	90%																										
			Water Service Proportion	100%																										
AMI Program	Water	Revenue from Theft Identification		$ 48,219		On	Other	0.00%	Default Benefits	$ -	$ 11,530.69	$ 36,688.55	$ 48,219.24	$ 48,219.24	$ 48,219.24	$ 48,219.24	$ 48,219.24	$ 48,219.24	$ 48,219.24	$ 48,219.24	$ 48,219.24	$ 48,219.24	$ 48,219.24	$ 48,219.24	$ 48,219.24	$ 48,219.24	$ 48,219.24	$ 48,219.24	$ 48,219.24
			Water Residential Revenue (Annual $)	48,219,237	Emailed from Finance Manager																										
			Total Impact on Consumption	0.10%																										
AMI Program	Water	Revenue from Recycled Meter Scraps		$ 74,687		On	Equipment	0.16%	CapEx - Full Deploym	$ -	$ 37,402.93	$ 37,462.70	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
			Total Residential Meters Replaced	47,462																										
			Percentage of Residential are Brass	100%																										
			Total Commercial Meters Replaced	411																										
			Percentage of Commercial are Brass	100%																										
			Residential Meter Weight (lbs)	3																										
			Commercial Meter Weight (lbs)	17																										
			Water meter scrap value per lb	$ 1.00																										
			Number of Years of Full Deployment	2.00																										
AMI Program	Water	Public Outreach Cost Reduction		$ -		Off	Other	0.00%	Default Benefits	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
			Annual Material Cost for Printing/Distribution of Public Outreach Documents	-	Inserts are included with bimonthly bill and would not change because of AMI																										
			Expense Reduction	2.55%																										
AMI Program	Water	Customer Leak Detection Savings		$ (236,875)	Negative impact to the business case	On	Other	0.00%	Default Benefits	$ -	$ (56,643.99)	$ (180,230.88)	$ (236,874.88)	$ (236,874.88)	$ (236,874.88)	$ (236,874.88)	$ (236,874.88)	$ (236,874.88)	$ (236,874.88)	$ (236,874.88)	$ (236,874.88)	$ (236,874.88)	$ (236,874.88)	$ (236,874.88)	$ (236,874.88)	$ (236,874.88)	$ (236,874.88)	$ (236,874.88)	$ (236,874.88)
			Average Annual Water Supplied (acre-feet)	25,871.00	3-year potable production average from 2019, 2020, 2021																										
			Cost per Unit ($/acre-feet)	$ 605.54	Email from Carrie Pollard and Paul Sellier. Value in 2020 water audit was missing the capital costs and maybe labor associated with O&M.																										
			Average Customer Charge per Unit ($/acre-feet)	$ 1,750.04	Provided by Kristin																										
			% Leak Detected	2%	Water Efficiency analyzed data from the pilot program and estimated an annual savings of about 500AF/year from detecting leaks quickly, which is 2% of the annual water supplied.																										
			% Participation (Customer Acting on Leak)	40%																										
AMI Program	Water	Leak Adjustments Reduction		$ 1,080,632		On	Other	0.00%	Default Benefits	$ -	$ 258,411.90	$ 822,219.67	$ 1,080,631.57	$ 1,080,631.57	$ 1,080,631.57	$ 1,080,631.57	$ 1,080,631.57	$ 1,080,631.57	$ 1,080,631.57	$ 1,080,631.57	$ 1,080,631.57	$ 1,080,631.57	$ 1,080,631.57	$ 1,080,631.57	$ 1,080,631.57	$ 1,080,631.57	$ 1,080,631.57	$ 1,080,631.57	$ 1,080,631.57
			Annual Leak Adjustments	$ 1,350,789	2019 data. Source: Colin Horton																										
			Leak Adjustments Reduction	80%																										
AMI Program	Water	Customer Engagement Savings		$ (8,883)	Negative impact to the business case	On	Other	0.00%	Default Benefits	$ -	$ (2,124.15)	$ (6,758.66)	$ (8,882.81)	$ (8,882.81)	$ (8,882.81)	$ (8,882.81)	$ (8,882.81)	$ (8,882.81)	$ (8,882.81)	$ (8,882.81)	$ (8,882.81)	$ (8,882.81)	$ (8,882.81)	$ (8,882.81)	$ (8,882.81)	$ (8,882.81)	$ (8,882.81)	$ (8,882.81)	$ (8,882.81)
			Average Annual Water Supplied (acre-feet)	25,871.00	3-year potable production average from 2019, 2020, 2021																										
			Cost per Unit ($/acre-feet)	$ 605.54	Email from Carrie Pollard and Paul Sellier. Value in 2020 water audit was missing the capital costs and maybe labor associated with O&M.																										
			Average Customer Charge per Unit ($/acre-feet)	$ 1,750.04	Provided by Kristin																										
			% Conservation	3%	AWWA - 6 to 12% savings, dependent on opt in/out features																										
			% Participation	1%																										
AMI Program	Water	System Loss Reduction		$ 46,651		On	Other	0.00%	Default Benefits	$ -	$ 11,155.58	$ 35,495.04	$ 46,650.62	$ 46,650.62	$ 46,650.62	$ 46,650.62	$ 46,650.62	$ 46,650.62	$ 46,650.62	$ 46,650.62	$ 46,650.62	$ 46,650.62	$ 46,650.62	$ 46,650.62	$ 46,650.62	$ 46,650.62	$ 46,650.62	$ 46,650.62	$ 46,650.62
			Total Real Water Losses (acre-feet)	2,567.99	CY 2020 Water Loss Audit																										
			Avoided Cost per Unit ($/acre-feet)	$ 605.54	Email from Carrie Pollard and Paul Sellier. Value in 2020 water audit was missing the capital costs and maybe labor associated with O&M.																										
			% Conservation	3%																										
AMI Program	Water	Annual Meter Replacement Budget Offset		$ 302,250		On	Other	0.00%	Older than 10 years	$ 302,250.00	$ 302,250.00	$ 302,250.00	$ 302,250.00	$ 302,250.00	$ 302,250.00	$ 302,250.00	$ 302,250.00	$ 302,250.00	$ 302,250.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
			Water Meter Replacement Budget ($)	$ 325,000	Source: Craig Lauridsen																										

Appendix 3 - Marin Water Summarized AMI Financial Model

Benefits

Category	Allocation	Benefit	Benefits Calculation Details	Annual Value	Notes/Source	On or Off	Growth Category	nual Growth R	Schedule	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
			Reduction Rate	93%																									
AMI Program	Water	Revenue Capture from Improved Meter Accuracy	*Revenue Residential*	$ 885,391	Custom benefit value, annual 1% decline year 11-20	On	Other	0.00%	Default Benefits	$ -	$ 211,724.00	$ 673,667.28	$ 885,391.29	$ 885,391.29	$ 885,391.29	$ 885,391.29	$ 885,391.29	$ 885,391.29	$ 885,391.29	$ 885,391.29	$ 876,537.37	$ 867,772.00	$ 859,094.28	$ 850,503.34	$ 841,998.30	$ 833,578.32	$ 825,242.54	$ 816,990.11	$ 808,820.21	$ 800,732.01
			Average Water Meter Inaccuracy	48,219,237	Emailed from Finance Manager																								
			Percentage Inaccurate Meters Replaced	4.0%	3% was used for the 2020 Water Loss Audit Report. The value was inferred from reference data, not derived from test data. Estimate 4% accuracy was used as older meters are targeted for replacement (>10 years)																						
			Accuracy Improvement (%)	77%																									
				60%																									
AMI Program	Water	Bad Debt Reduction		$		Off	Other	0.00%	Default Benefits	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
			Annual Write-off	$ 125,000	Averages around $100K-$150K. Source: Mikyung																								
			Annual Cost of Collections	$ -	We don't send to collections anymore																								
			Proportion of Revenue from Water	100%																									
			Estimated % of Customers on Remote Disconnect	0%																									
			Late Payment Reduction with Remote Disconnect	10%																									
AMI Program	Water	Pump Schedule Optimization		$ -		On	Other	0.00%	Default Benefits	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
			Annual Pumping Costs	5,197,415	FY 2021 Total Energy Costs (A majority of the energy costs are from pumps; it's very time consuming to separate out the pumps). Source: PG&E Data Spreadsheet (PGE22)																						
			Electricity Savings	0%	Since this requires additional analytics, suggesting it as a future benefit.																						

*Benefits /Savings from previous report: Annual Savings

Personnel Impact	$	952,962	Covered/considered in Meter Reading Reduction benefit
Vehicle Savings	$	30,100	
Other Savings: Leak Adjustments	$	675,000	Covered/considered in Leak Adjustments Reduction benefit
Other Savings: Cost of producing leak adju	$	87,000	
Deferred meter replcment prog labor annl.	$	86,684	Covered/considered in Annual Meter Replacement Budget Offset benefit
Under-Registration Recovery	$	981,288	Covered/considered in Revenue Capture from Improved Meter Accuracy benefit

Meter Reading, per Craig:
The current roster is:
1 – supervisor
2 – large meter techs
8 – full time permanent meter readers
2 – temp full time meter readers

I think the post AMI roster would look like:
1 – supervisor
2 – large meter techs (as AMI will have little impact on their work load)
4 – full time permanent meter readers (although their title might change)
2 – temp full time meter readers (although their title might change)

Upfront CapEx Estimate	Radio Unit Cost		Radio Total Cost	Cellular Unit Cost		Cellular Total Cost
Cost Differentiator: Upfront Network Equipment & Installation			$ 528,000	N/A	No upfront netwo	N/A
Cost Differentiator: Endpoint	$ 90.00	/endpoint	$ 5,631,570	$ 83.00	/endpoint	$ 5,193,559
Main CapEx Costs (Metering Equipment, Professional Services, Meter Installation Services, etc.). Same estimate for Radio & Cellular			$ 15,467,167			$ 15,467,167
Other CapEx Costs based on % (Inflationary Consideration, Performance Bond, Sales Tax, Contingency)			$ 4,428,087			$ 4,220,005
Total Upfront CapEx Estimate			**$ 26.05 M**			**$ 24.88 M**

Annual AMI OpEx Estimate	Radio (Software as a Service - SaaS Model)		Cellular (Network as a Service - NaaS Model)	
SaaS for Radio, Naas for Cellular	$ 0.18	/endpoint/month	$ 0.55	/endpoint/month
	$ 2.20	/endpoint/year	$ 6.60	/endpoint/year
AMI Network Backhaul	$ 21,600.00	/year	N/A	
Total Annual AMI OpEx for 20 Years Estimate		**$ 3.57 M**		**$ 9.49 M**
Total Annual MDMS OpEx for 20 Years Estimate		**$ 0.97 M**		**$ 0.97 M**
Total Annual Customer Portal OpEx for 20 Years Estimate		**$ 0.81 M**		**$ 0.81 M**
Radio NaaS alternative:				
$ 0.33	*/endpoint/month*			
$ 4.00	*/endpoint/year*			

Total 20 Year Lifecycle Cost Estimate		Radio	$ 31.41 M		Cellular	$ 36.15 M

***For radio SaaS consideration, Marin Water will be responsible for the:**
AMI network equipment, installation and maintenance
AMI network backhaul connectivitiy
Maintenance and management of AMI network
Necessary lease, permits to secure AMI network site

Appendix 3 - Marin Water Summarized AMI Financial Model

Radio v Cellular Lifecycle

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Endpoints Activated																				
Cumulative Endpoints		31,287	62,573	62,673	62,773	62,873	62,974	63,075	63,175	63,276	63,377	63,479	63,580	63,682	63,784	63,886	63,988	64,090	64,192	64,295
Annual OpEx Radio (/en	$ 2.20	$ 2.20	$ 2.20	$ 2.20	$ 2.20	$ 2.27	$ 2.33	$ 2.40	$ 2.48	$ 2.55	$ 2.63	$ 2.71	$ 2.79	$ 2.87	$ 2.96	$ 3.05	$ 3.14	$ 3.23	$ 3.33	$ 3.43
Total Annual OpEx Rad	$ -	$ 90,430	$ 159,261	$ 159,481	$ 159,701	$ 164,071	$ 168,580	$ 173,231	$ 178,030	$ 182,980	$ 188,087	$ 193,356	$ 198,791	$ 204,399	$ 210,184	$ 216,152	$ 222,308	$ 228,660	$ 235,213	$ 241,973
Annual OpEx Cellular (/e	$ 6.60	$ 6.60	$ 6.60	$ 6.60	$ 6.60	$ 6.80	$ 7.00	$ 7.21	$ 7.43	$ 7.65	$ 7.88	$ 8.12	$ 8.36	$ 8.61	$ 8.87	$ 9.14	$ 9.41	$ 9.69	$ 9.98	$ 10.28
Total Annual OpEx Cell	$ -	$ 206,491	$ 412,982	$ 413,642	$ 414,303	$ 427,414	$ 440,940	$ 454,894	$ 469,290	$ 484,141	$ 499,462	$ 515,268	$ 531,574	$ 548,396	$ 565,751	$ 583,655	$ 602,125	$ 621,180	$ 640,838	$ 661,118

1 CCF = 0.0023 Acre ft

Residential	Avg Rate per CCF (single family, duplex, multi-family)	Rate per Acre-Feet
Tier 1	$ 4.19	$ 1,825.17
Tier 2	$ 7.28	$ 3,171.17
Tier 3	$ 11.95	$ 5,205.43
Tier 4	$ 19.32	$ 8,417.26

Commercial	Avg Rate per CCF (CII, Single Family)	Rate per Acre-Feet
Tier 1	$ 4.68	$ 2,038.61
Tier 2	$ 8.64	$ 3,763.59
Tier 3	$ 13.70	$ 5,967.73

Authorized Co 24,534.18 acre-ft/year

RE: Latest Marin Water Financial Model

KA Kristin Arnold <karnold@marinwater.org>
To Athens Silaban; Dammie Godo
Cc Don Rankin

Reply | Reply All | Forward | Wed 5/25/2022 5:54 PM

You replied to this message on 5/26/2022 9:59 PM.
Click here to download pictures. To help protect your privacy, Outlook prevented automatic download of some pictures in this message.

Hi Athens,

Below in table 1 is a $/acre-feet for each tier. Table 2 shows the overall consumption % breakdown by tier and code (single family residential, duplex, multi-units, business, etc.).

When I multiplied the usage in table 2 by our rates, the cost that I calculated was greater than our 2021 revenue for water sales. Unfortunately, the data I have is the best I'm going to get without spending a significant amount of more time working on this. The numbers before should be good enough for this exercise.

So to get the $/acre-feet, I took the calculated revenue and calculated a percent cost for each tier. I then used the percent cost multiplied by the actual 2021 revenue for water sales and divided by usage in acre-feet to get the $/acre-feet. Please let me know if you have any questions.

Table 1 - Water Charges ($/Acre-feet)

	$/Acre-feet
Tier 1	$1,750.04
Tier 2	$2,301.68
Tier 3	$6,524.88
Tier 4	$8,160.18

Table 2 – Usage by Code and Tier	% Usage within Code	Usage (AF)	% Overall Usage
Single-Family Residential			
Tier 1	60%	9,230	37.1%
Tier 2	31%	4,707	18.9%
Tier 3	5%	813	3.3%
Tier 4	3%	513	2.1%
Duplex Residential			
Tier 1	74%	314	1.3%
Tier 2	19%	81	0.3%
Tier 3	4%	19	0.1%
Tier 4	2%	10	0.0%
Multi-Unit Residential			
Tier 1	11%	304	1.2%
Tier 2	8%	235	0.9%
Tier 3	8%	226	0.9%
Tier 4	74%	2,123	8.5%
Business, Institutional and Irrigation			
Tier 1	36%	1,856	7.5%
Tier 2	11%	585	2.4%
Tier 3	52%	2,689	10.8%
Single-Family Irrigation			
Tier 1	96%	18	0.1%
Tier 2	13%	2	0.0%
Tier 3	19%	3	0.0%
Raw Water			
Tier 1	100%	180	0.7%
Recycled Water			
Tier 1	75%	719	2.9%
Tier 2	10%	100	0.4%
Tier 3	15%	139	0.6%
	Total =	**24,867**	**100.0%**

Marin Water Rate Tables

RESIDENTIAL

	Single-Family			Duplex			Multi-Family		
	Rate per unit*	Dec-May (units)	Jun-Nov (units)	Rate per unit*	Dec-May (units)	Jun-Nov (units)	Rate per unit*	Dec-May (units)	Jun-Nov (units)
Tier 1	$4.19	0 - 21	0 - 26	$4.22	0 - 18	0 - 20	$4.16	0 - 10	0 - 10
Tier 2	$7.26	22 - 48	27 - 59	$7.38	19 - 35	21 - 45	$7.20	11 - 18	11 - 20
Tier 3	$12.25	49 - 80	60 - 99	$12.19	36 - 68	46 - 78	$11.41	19 - 26	21 - 28
Tier 4	$19.68	81+	100+	$19.13	69+	79+	$19.16	27+	29+

*1 unit or CCF (hundred cubic feet) = 748 gallons

Meter Size	Base Water Charge (Bimonthly)	Watershed Management Fee (Bimonthly)	Capital Maintenance Fee (Annual)	Meter Size	Private Fire Tap Service Charge (Bimonthly)
5/8"	$39.66	$10.29	$163.50	2"	$36.06
3/4"	$50.74	$12.30	$245.25	4"	$90.57
1"	$72.89	$16.30	$408.74	6"	$179.85
1 1/2"	$128.27	$26.31	$817.47	8"	$295.81
2"	$194.72	$38.32	$1,307.95	10"	$458.16
3"	$405.17	$76.36	$2,861.14		
4"	$715.30	$132.42	$5,150.05		
6"	$1,568.15	$286.57	$11,444.54		
8"	$2,675.75	$486.77	$19,619.21		
10"	$4,226.39	$767.05	$31,063.75		

COMMERCIAL, INSTITUTIONAL & IRRIGATION

	Commercial, Institutional & Irrigation		Single-Family Irrigation	
	Rate per unit*	Percent of Baseline (units)	Rate per unit*	Percent of Baseline (units)
Tier 1	$4.09	0 - 85	$5.27	0 - 50
Tier 2	$10.99	86 - 150	$6.29	51 -100
Tier 3	$16.46	Over 150	$10.94	Over 100

*1 unit or CCF (hundred cubic feet) = 748 gallons

Note: Unlike a residential account, whose water bill is determined by using a fixed, four-tiered billing structure, non-residential account bills are based on the meter's annual water budget. If the water use at a site exceeds the annual water budget, the water bill may increase drastically. Please see "Non-Residential Water Bills" for more information.

Meter Size	Base Water Charge (Bimonthly)	Watershed Management Fee (Bimonthly)	Capital Maintenance Fee (Annual)	Meter Size	Private Fire Tap Service Charge (Bimonthly)
5/8"	$39.66	$10.29	$163.50	2"	$36.06
3/4"	$$50.74	$12.30	$245.25	4"	$90.57
1"	$72.89	$16.30	$408.74	6"	$179.85
1 1/2"	$128.27	$26.31	$817.47	8"	$295.81
2"	$194.72	$38.32	$1,307.95	10"	$458.16
3"	$405.17	$76.36	$2,861.14		
4"	$715.30	$132.42	$5,150.05		
6"	$1,568.15	$286.57	$11,444.54		
8"	$2,675.75	$486.77	$19,619.21		
10"	$4,226.39	$767.05	$31,063.75		

	FY2021	FY2020	Increase/(Decrease) Amount	Increase/(Decrease) %
Operating Revenues:				
Water sales and service charges	$ **81,632,469**	$ **76,806,241**	$ 4,826,228	6.28%
Connection charges	**912,312**	**810,182**	102,130	12.61%
Capital management fee	**15,509,355**	**14,301,460**	1,207,895	8.45%
Watershed management fee	**4,572,006**	**4,545,973**	26,033	0.57%
Other operating revenue	**808,396**	**807,338**	1,058	0.13%
Total operating revenue	**103,434,538**	**97,271,194**	6,163,344	6.34%

Phasing

Schedule Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Default Benefits	0%	24%	76%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
CapEx - IDA	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CapEx - Full Deployment	0%	50%	50%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CapEx - Whole Project	33%	33%	33%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
OpEx - From IDA	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
OpEx - From Full Deployme	0%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Older than 10 years	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Older than 15 years	100%	100%	100%	100%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Older than 20 years	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Custom 4	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Custom 5	5%	20%	30%	45%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Business Process Impact Assessment

Chase Berenson and Dammie Godo

E Source
POWERING WHAT'S NEXT

MARIN WATER

Agenda

- Introductions
- Overview of Business Process Design
- AMI Business Process Impact Discussions
  - Billing
  - Customer Inquiry and Response
  - Field Activities
  - Move-In / Move-Out
  - Non-Pay Disconnect / Reconnect
- AMI Staffing Impact Discussions
- AMI Technology Impacts Discussions
- Conclusion

Introduction

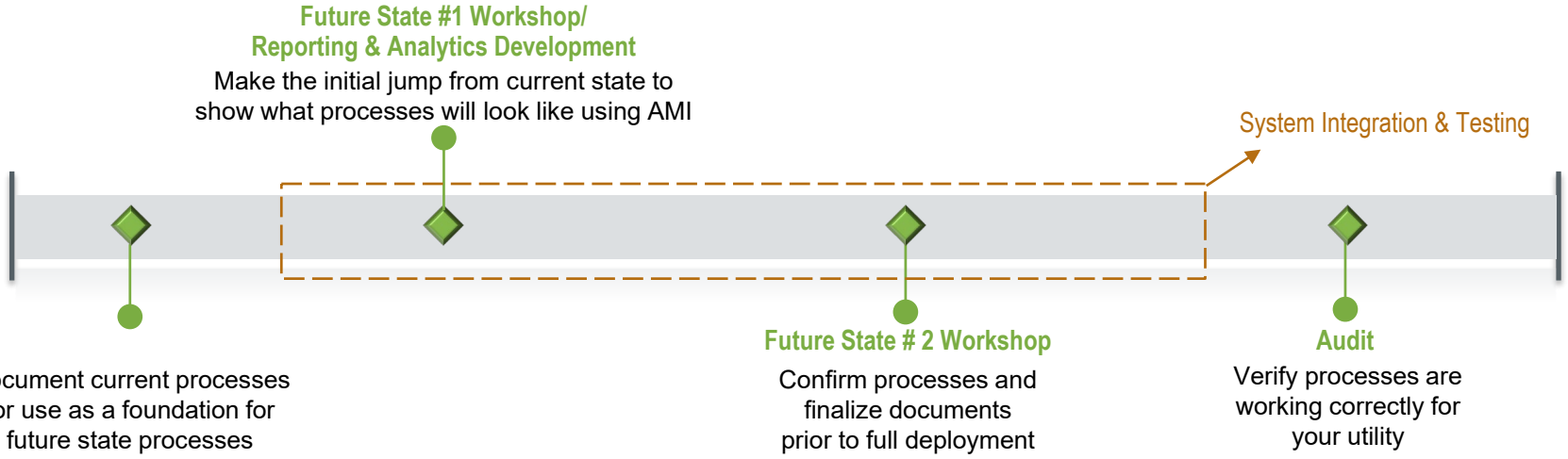
- Chase Berenson
  - Senior Consultant
  - Based in Girdwood, Alaska

Acronyms and Definitions

- AMI – Advanced Metering Infrastructure
- BPD – Business Process Design
- CEP – Customer Engagement Portal
- CIS – Customer Information System
- CSR – Customer Service Representative
- FTE – Full-Time Employee (or Full-Time Equivalent)
- MDMS – Meter Data Management System
- VEE – Validation, Estimation, and Editing

Overview of Business Process Design

- Business Process Design is a continuous task in the context of the AMI project.
- There are multiple iterations of BPD in an AMI project:
  - Current State Business Process
  - Future State # 1 Business Process
  - Future State # 2 Business Process
  - Business Process Audit



Business Process Impacts

Business Impacts

- AMI will have many operational impacts for Marin.
- Almost all of them will be positive, but Marin will have to be ready for the changes that would be approaching the utility.

- In this section there are two slides per process:
  - The first slide was compiled on the call from Marin staff contributions
  - The second slide features pre-prepared information from the E Source team
- There may be some duplication between the slides.

Billing

- What are some ways the Marin staff expect AMI may impact billing processes?
  - Fewer rereads and fewer meter investigations
  - Fewer skips and fewer estimated reads (due to no access, dog issue, etc.)
  - Remotely collecting move-in/move-out reads without rolling a truck

Billing

- E Source's expectations on how AMI may impact billing processes:
  - Meters will communicate reads to the utility rather than meter repair workers collecting reads in the field
  - Rather than one read per customer per billing period, Marin may have an interval read every hour and a register read every day per customer
    - From one data point per customer per billing period to up to 1,550 data points per customer per billing period
  - By performing VEE (Validation, Estimation, and Editing), Marin can proactively correct any meter issues throughout the billing period rather than reacting at the time of billing
  - Rereads will not need to be collected in the field since every day's reads will be collected in the meter data management system (MDMS)

Customer Inquiry and Response

- What are some ways the Marin staff expect AMI may impact customer inquiry and response processes?
  - Data will help with customers who have questions about high bills or leaks
  - Data removes speculation for why a customer has a high bill (i.e., checking the data to see patterns/trends, isolated incidents, etc.)

Customer Inquiry and Response

- E Source's expectations on how AMI may impact customer inquiry and response processes:
  - If customers can access a portal, they will be empowered to answer their own questions
  - More accurate bills will be generated, leading to fewer bill complaints
  - When customers ask questions, a wealth of information will be at the CSR's fingertips
  - Inquiries can be investigated remotely and most likely will not result in a truck roll
  - Marin will be aware of suspected leaks on the customer-side and can notify customers
    - Water Efficiency sends letters to customers to notify of suspected leaks if the customer has continuous usage (AMI pilot program) or higher usage than last year

Field Activities

- What are some ways the Marin staff expect AMI may impact field activities processes?
  - Marin staff/resources will no longer collect meter reads in the field
    - Staff will be available for performing more high-value activities
  - Marin plans to visit meters once a year to perform a visual inspection
  - Most metering work is during business hours, which is separate from the crew that does after-hours emergency work
  - Attrition may lead to department shrinkage, but at the same time there may be new tasks driven from AMI (tamper, low batteries, etc.)
  - Since reads are collected remotely there are reduced chances of misreads, which helps lead to fewer truck rolls resulting from customer inquiries

Field Activities

- E Source's expectations on how AMI may impact field activities processes:
  - Meter issues will be detected on the day of the issue by the AMI system and communicated to Marin using VEE
  - Marin will proactively correct issues when they occur
    - This may lead to better prioritization of field work
  - The AMI system may communicate the exact meter issue, reducing the time spend investigating issues
  - Marin can investigate (and sometimes correct) meter issues from the office prior to rolling a truck
    - There will be reduced FTEs needed in the field, but there may be more FTEs needed in the office (which may need a different skillset)
  - Metering equipment may become more complex as radios are added to meters

Move-In/Move-Out

- What are some ways the Marin staff expect AMI may impact move-in/move-out processes?
  - Move-in/move-out reads will be collected remotely
  - Integrations between utility systems will allow the reads to be captured automatically
    - For example, entering a move-in date in CIS would automatically pull the read from the MDMS for the date requested without CSR intervention

Move-In/Move-Out

- E Source's expectations on how AMI may impact move-in/move-out processes:
  - Start reads and final reads can be collected remotely without a need to roll a truck
  - Meters *may* be able to be disconnected and reconnected remotely
    - This would require meters featuring special technology
  - After a customer moves out, Marin will leave the water on and may be able to actively monitor usage on vacant properties
    - If the move-out read is collected remotely and no one visits the premises, how will a doorhanger be left for the new customer? Other forms of communication?
  - Marin will have reads from every day, so Marin will have the register read from any day that a customer moves in (even if he or she forgets to notify the utility)

Non-Pay Disconnect/Reconnect

- What are some ways the Marin staff expect AMI may impact non-pay disconnect/reconnect processes?
  - If Marin deploys remote disconnect meters and customers can be disconnected without a truck roll, how will Marin meet physical notification requirements?
    - Today there are three truck rolls: drop off notification, turn off meter, and turn on meter once customer pays
    - Even if a physical notification is still dropped off with AMI, that reduces the process from three truck rolls to one truck roll

Non-Pay Disconnect / Reconnect

- E Source's expectations on how AMI may impact non-pay disconnect / reconnect processes:
  - Customers may be able to better monitor their consumption throughout the billing period by using a customer portal, which can reduce the shock of high bills
  - Meters *may* be able to be disconnected and reconnected remotely
    - This would require meters featuring special technology
  - Marin can remotely monitor for meter tampering and unexpected consumption
  - Meters may have a "trickle" (flow restriction) setting in between on and off which can be activated remotely
  - Marin may be able to provide additional customer notifications through the portal
    - This wouldn't eliminate the need for the physical disconnect notice, but additional earlier notifications may reduce the number of customers who need the physical notice

Staffing Impacts

Staffing Impacts

- Marin management has already stated there will be no changes to staffing levels if AMI is deployed.
  - The vast majority of AMI projects that E Source has worked on have not experienced a reduction in staff.
- Some staff roles may change, or people may be reassigned as utility needs change.

Meter Readers and Repair Workers

- Meters will be communicating reads to the MDMS every day, eliminating the reliance upon meter readers and repair workers to collect bimonthly reads
- Without the task of meter reading, the Meter Reader and Repair Workers staff may transition to just Meter Repair Workers
  - This role may also include additional in-office tasks related to remote meter investigation

Customer Service Representatives

- With the installation of a customer portal, call volumes typically drop, often by up to 30%.
  - Marin's CSRs don't exclusively work the phones, and there should be other tasks for them to complete if phone calls drop.
- That change does not take effect until after AMI is deployed, after the portal is released, and all systems have reached steady state.
- During the deployment period there may be an increase in the number of calls, depending on how proactively Marin chooses to educate the public about the project.

AMI Administrator

- Many utilities create a role for an AMI administrator to oversee the system on a daily basis.
  - This person can act like a “digital traffic cop” to ensure that the correct information always gets to the correct person/department.
- It is better to have someone in this role as early as possible so the person can learn, grow, and absorb as much as possible while Marin is moving through the AMI project.
- There may not be existing bandwidth in Customer Service or Meter Ops for someone to take this role, and it may involve a different skillset than currently exists in job descriptions.

Technology Impacts

Technology Impacts

- There are many new systems, software, and hardware that Marin would need to implement for a successful AMI deployment
- There are two that factor prominently in the business process impact discussion:
  - Meter Data Management System (MDMS)
  - Customer Engagement Portal (CEP)

Meter Data Management System (MDMS)

- A MDMS contains all the information that meters communicate, including:
  - All interval and register reads
  - VEE, or automated exception handling
  - Meter events and alarms
- Even though the MDMS contains all the reads and consumption information, Marin's CIS is still the billing system
  - The MDMS doesn't contain customer account information
  - There will be a bimonthly billing interface run to move the billing register read from the MDMS to the CIS

Customer Engagement Portal (CEP)

- A CEP allows customers to see their consumption patterns and history.
- Some CEPs have additional features, including:
  - Pay bills
  - Receive notifications from the utility (i.e., suspected leak)
  - Include educational videos (i.e., how to look for leaks, etc.)
  - Set threshold notifications for consumption or spend during a billing period
  - Gamify conservation by comparing consumption data to similar, anonymized data (i.e., a house with similar size and similar number of occupants used more or less water than you did last month)

Conclusion

AMI Impacts to Marin's Operations

- AMI will have impacts to many of Marin's operations, and by preparing in advance for these impacts Marin will ensure the best response and highest return on the investment
- Process impacts will be seen in:
  - Billing; Customer Inquiry and Response
  - Field Activities
  - Move-In/Move-Out
  - Non-Pay Disconnect
- Staffing impacts may be seen in:
  - Meter readers
  - CSRs
  - AMI Administrator
- Technology impacts may be seen in:
  - Meter Data Management System (MDMS)
  - Customer Engagement Portal (CEP)

For Fun

- In March I was in the Bay Area visiting a different client, and one evening we caught sunset from the top of Telegraph Hill in San Francisco
- I wanted to share a photo I took across the Bay looking towards Marin County

Thank You!

Chase Berenson

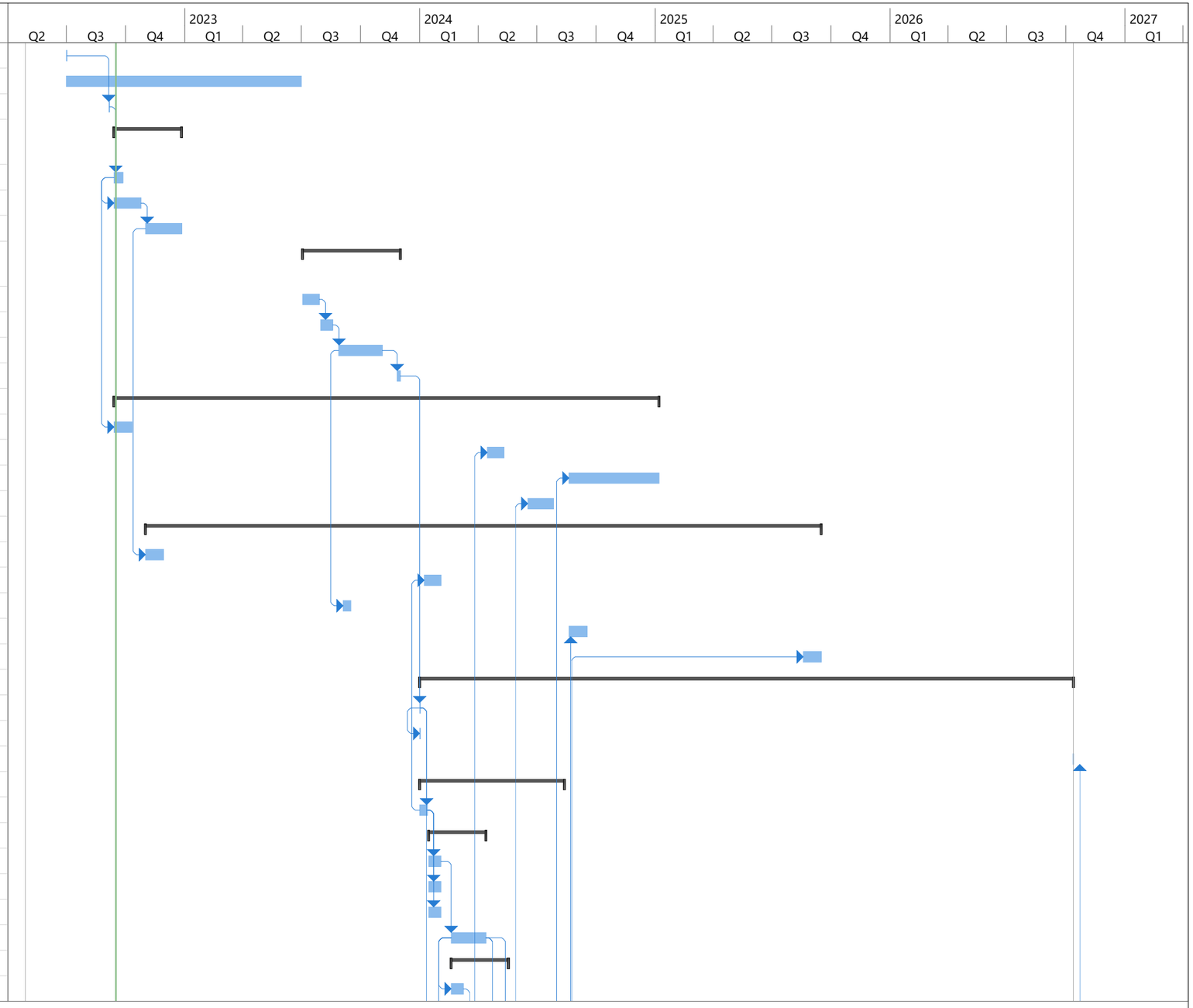
Senior Consultant

E Source Technology Planning and Implementation Division

(303) 345 - 9252

chase_berenson@esource.com

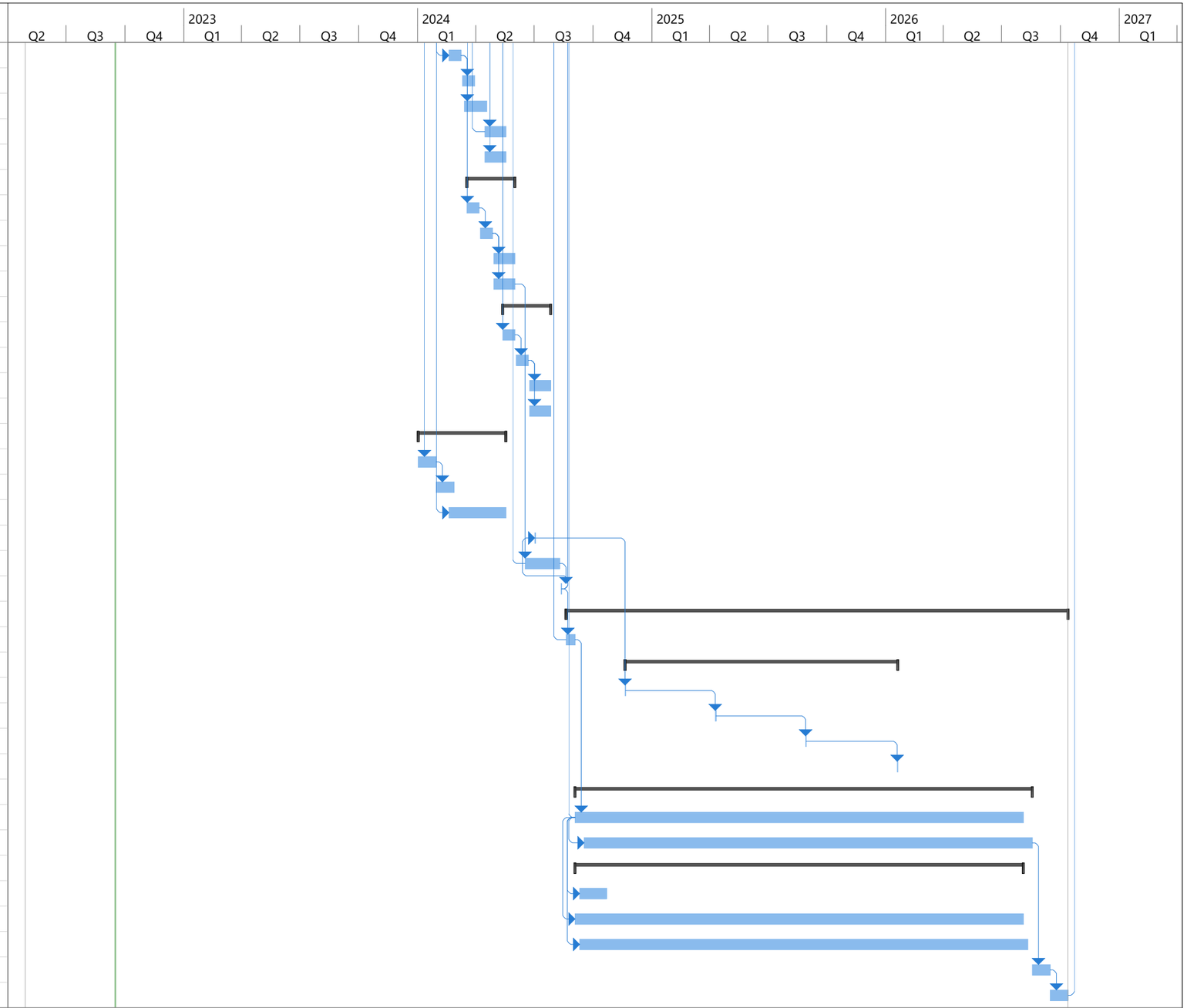
ID	Outline Number	Task Name	Duration	Start
1	1	Final AMI Assessment Report Approval	1 day	Fri 7/1/22
2	2	Secure Funding for AMI Project	261 days	Fri 7/1/22
3	3	Next Phase Board Approval	1 day	Mon 9/5/22
4	**4**	**Procurement: RFP Development & Administration**	**75 days**	**Tue 9/13/22**
5	4.1	Requirements and Procurement Strateg	10 days	Tue 9/13/22
6	4.2	RFP Draft Development	30 days	Tue 9/13/22
7	4.3	RFP Administration	40 days	Tue 11/1/22
8	**5**	**Procurement: RFP Evaluation, Vendor Selection & Contract Negotiations**	**110 days**	**Mon 7/3/23**
9	5.1	RFP Response Evaluation	20 days	Mon 7/3/23
10	5.2	Shortlist Presentation & Final Selection	15 days	Mon 7/31/23
11	5.3	Contract Negotiations	50 days	Mon 8/28/23
12	5.4	Contract Approval by Board	5 days	Mon 11/27/23
13	**6**	**Data Management**	**605 days**	**Tue 9/13/22**
14	6.1	Use Case Identification & Prioritization	20 days	Tue 9/13/22
15	6.2	Selected Use Case Development	20 days	Mon 4/15/24
16	6.3	Use Case Implementation	100 days	Tue 8/20/24
17	6.4	KPIs Tracking	30 days	Mon 6/17/24
18	**7**	**Business Process Design**	**750 days**	**Tue 11/1/22**
19	7.1	Current State Process Definition	20 days	Tue 11/1/22
20	7.2	Conceptual Future State Process Design	20 days	Mon 1/8/24
21	7.3	Staffing Planning	10 days	Mon 9/4/23
22	7.4	Future State Process Finalization	20 days	Tue 8/20/24
23	7.5	Business Process Audit	20 days	Tue 8/19/25
24	**8**	**AMI, MDMS, CEP Deployment**	**726 days**	**Mon 1/1/24**
25	8.1	AMI Deployment Project Kickoff	1 day	Mon 1/1/24
26	8.2	Overall Project Management Start	1 day	Mon 1/1/24
27	8.3	Overall Project Management Finish	1 day	Mon 10/12/26
28	**8.4**	**IDA Phase**	**161 days**	**Mon 1/1/24**
29	8.4.1	IDA Planning	10 days	Mon 1/1/24
30	**8.4.2**	**IDA Meters Deployment**	**65 days**	**Mon 1/15/24**
31	8.4.2.1	Meter Testing on Bench Test (~10-2	15 days	Mon 1/15/24
32	8.4.2.2	WOMS Configuration and Setup	15 days	Mon 1/15/24
33	8.4.2.3	WOMS - CIS Integration	15 days	Mon 1/15/24
34	8.4.2.4	Field Testing - IDA Meters Installati	40 days	Mon 2/19/24
35	**8.4.3**	**AMI Design, Implementation, Integra**	**65 days**	**Mon 2/19/24**
36	8.4.3.1	AMI Network Deployment	15 days	Mon 2/19/24



Project: E Source - Marin Water
Date: Fri 9/16/22

Task	Project Summary	Manual Task	Start-only	Deadline
Split	Inactive Task	Duration-only	Finish-only	Progress
Milestone	Inactive Milestone	Manual Summary Rollup	External Tasks	Manual Progress
Summary	Inactive Summary	Manual Summary	External Milestone	

ID	Outline Number	Task Name	Duration	Start
37	8.4.3.2	AMI HES Design, Configuration & S	15 days	Mon 2/19/24
38	8.4.3.3	AMI Integrations	15 days	Mon 3/11/24
39	8.4.3.4	AMI Testing - Network	25 days	Thu 3/14/24
40	8.4.3.5	AMI Testing - Meter Data (Accuracy	25 days	Mon 4/15/24
41	8.4.3.6	AMI Testing - Business Process (Bill	25 days	Mon 4/15/24
42	**8.4.4**	**MDMS Design, Implementation, Inte**	**55 days**	**Mon 3/18/24**
43	8.4.4.1	MDMS Design, Configuration & Sta	15 days	Mon 3/18/24
44	8.4.4.2	MDMS Integrations	15 days	Mon 4/8/24
45	8.4.4.3	MDMS Testing - Meter Data	25 days	Mon 4/29/24
46	8.4.4.4	MDMS Testing - Business Process	25 days	Mon 4/29/24
47	**8.4.5**	**CEP Design, Implementation, Integra**	**55 days**	**Mon 5/13/24**
48	8.4.5.1	CEP Design, Configuration & Standı	15 days	Mon 5/13/24
49	8.4.5.2	CEP Integrations	15 days	Mon 6/3/24
50	8.4.5.3	CEP Testing - Meter Data	25 days	Mon 6/24/24
51	8.4.5.4	CEP Testing - Business Process	25 days	Mon 6/24/24
52	**8.4.6**	**IDA Stakeholder Engagement**	**99 days**	**Tue 1/2/24**
53	8.4.6.1	Stakeholder Engagement Planning	20 days	Tue 1/2/24
54	8.4.6.2	Internal Stakeholder Education Ses	20 days	Tue 1/30/24
55	8.4.6.3	External Stakeholder Communicati	65 days	Mon 2/19/24
56	8.4.7	Full Deployment Procurement #1 (Qty	1 day	Tue 7/2/24
57	8.4.8	User Acceptance Testing	40 days	Mon 6/17/24
58	8.4.9	IDA Acceptance - Cutover to Producti	1 day	Mon 8/12/24
59	**8.5**	**Full Scale Meter Deployment Phase**	**560 days**	**Tue 8/20/24**
60	8.5.1	Field Deployment Planning	10 days	Tue 8/20/24
61	**8.5.2**	**Meter/Other Equipment Procuremer**	**304 days**	**Wed 11/20/24**
62	8.5.2.1	Procurement #2 (Qty: xxxx)	1 day	Wed 11/20/24
63	8.5.2.2	Procurement #3 (Qty: xxxx)	1 day	Thu 4/10/25
64	8.5.2.3	Procurement #4 (Qty: xxxx)	1 day	Fri 8/29/25
65	8.5.2.4	Procurement #5 (Qty: xxxx)	1 day	Mon 1/19/26
66	**8.5.3**	**Meter Deployment**	**510 days**	**Tue 9/3/24**
67	8.5.3.1	Meter Replacements/Retrofits	500 days	Tue 9/3/24
68	8.5.3.2	Installation QA/QC	500 days	Tue 9/17/24
69	**8.5.4**	**Full Deployment Stakeholder Engage**	**500 days**	**Tue 9/3/24**
70	8.5.4.1	External Stakeholder Communicati	30 days	Tue 9/10/24
71	8.5.4.2	Customer Inquiries Management	500 days	Tue 9/3/24
72	8.5.5	Data QA/QC	500 days	Tue 9/10/24
73	8.5.6	Final Acceptance Testing	20 days	Tue 8/18/26
74	8.5.7	Project Closeout	20 days	Tue 9/15/26



Project: E Source - Marin Water
Date: Fri 9/16/22

Task
Split
Milestone
Summary
Project Summary
Inactive Task
Inactive Milestone
Inactive Summary
Manual Task
Duration-only
Manual Summary Rollup
Manual Summary
Start-only
Finish-only
External Tasks
External Milestone
Deadline
Progress
Manual Progress