ORANGE WATER AND SEWER AUTHORITY

A public, non-profit agency providing water, sewer and reclaimed water services to the Carrboro-Chapel Hill community.

AGENDA
WORK SESSION OF THE OWASA BOARD OF DIRECTORS
THURSDAY, JANUARY 14, 2016, 6:00 P.M.
OWASA COMMUNITY ROOM

The Board of Directors appreciates and invites the public to attend and observe its meetings. For the Board's Work Session, public comments are invited on only items appearing on this agenda. Speakers are invited to submit more detailed comments via written materials, ideally submitted at least three days in advance of the meeting to the Clerk to the Board via email or US Postal Service (aorbich@owasa.org/400 Jones Ferry Road, Carrboro, NC 27510).

Public speakers are encouraged to organize their remarks for delivery within a four minute time frame allowed each speaker. Additional time may be allowed at the discretion of the Board of Directors.

The Board may take action on any item on the agenda.

Announcements

a. Announcements by the Vice Chair
   - Any Board Member who knows of a conflict of interest or potential conflict of interest with respect to any item on the agenda tonight is asked to disclose the same at this time.
   - Special Meeting of the Board of Directors to Continue Discussions on Potential Rate Structure Modifications will be held on Thursday, January 21, 2016, at 6:00 PM in the OWASA Board Room

b. Announcements by Board Members

c. Announcements by Staff
   - Eric Oldham, Maintenance Supervisor at the Water Treatment Plant, received the Safewater Maintenance Technologist of the Year Excellence Award at the NC American Water Works Association and Water Environment Association (AWWA-WEA) (Kenneth Loflin/Julie Hellmann, Chair, NC AWWA-WEA)

CONSENT AGENDA

Action

1. Resolution Creating a Solids Handling Supervisor Position for the Biosolids Management Program (Todd Taylor)
2. Fiscal Year 2017 Budget Calendar and Assumptions (Stephen Winters)
3. Approval of the Minutes of the October 22, 2015 Meeting of the Board of Directors (Andrea Orbich)
4. Approval of the Minutes of the November 4, 2015 Special Closed Session of the Board of Directors for the Purpose of Discussing a Personnel Matter (Robert Morgan)
5. Approval of the Minutes of the November 12, 2015 Closed Session of the Board of Directors for the Purpose of Discussing a Personnel Matter (Heather Payne)
6. Approval of the Minutes of the November 12, 2015 Work Session of the Board of Directors (Andrea Orbich)

REGULAR AGENDA

Discussion

7. Consider Approval of the Advanced Metering Infrastructure (AMI) Feasibility Study and Discuss Next Steps (Dan Przybyl/Todd Taylor)
8. Discuss Strategies for Employee Health Insurance for Fiscal Year 2017 (Stephanie Glasgow/Ellen Tucker, Hill Chesson & Woody)
9. Review Board Work Schedule (Robert Morgan/Ed Kerwin)
    a. Request(s) by Board Committees, Board Members and Staff
    b. 12 Month Board Meeting Schedule
    c. January 28, 2016 Board Meeting
    d. February 11, 2016 Work Session

Summary of Work Session Items

10. Executive Director will summarize the key staff action items from the Work Session

Agenda Item 1:

Resolution Creating a Solids Handling Supervisor Position for the Biosolids Management Program

Purpose

- To create a new full-time position, Solids Handling Supervisor, within the Wastewater Treatment and Biosolids Recycling Department.

- The creation of this position will support OWASA's recycling 75% of its liquid biosolids production on local farmland.

Action Requested

Staff recommends adoption of the Resolution of Orange Water and Sewer Authority to approve a new full-time position, Solids Handling Supervisor.

Information

- Staff Memorandum to Approve Solids Handling Supervisor Position
- Resolution of Orange Water and Sewer Authority to Approve a New Full-Time Position, Solids Handling Supervisor

ORANGE WATER AND SEWER AUTHORITY

A public, non-profit agency providing water, sewer and reclaimed water services to the Carrboro-Chapel Hill community.

MEMORANDUM

TO: Board of Directors

THROUGH: Ed Kerwin

FROM: Todd Taylor, P.E.

DATE: January 7, 2016

SUBJECT: APPROVE SOLIDS HANDLING SUPERVISOR POSITION

Background

During the October 8, 2015 Work Session, the Board of Directors directed staff to begin recycling 75% of liquid biosolids production to local farmland with the remaining 25% of dewatered biosolids to composting. The Board also directed staff to recruit and hire the necessary personnel to support this program. Staff will provide the Board a status report in January 2017 regarding the effectiveness of this approach to biosolids recycling.

Staffing

As presented at the October 8, 2015 meeting a total of four staff positions including a supervisor are needed to support this approach to biosolids management. Two of the Solids Handler positions are currently filled. One vacant, unfunded Solids Handler position will be filled and a Solids Handling Supervisor position must be created. The creation of this new position requires Board action.

Action Requested

Adoption of the Resolution of Orange Water and Sewer Authority to approve a new full-time position, Solids Handling Supervisor.

Todd Taylor, P.E.
General Manager of Operations

cc: Ed Kerwin

RESOLUTION OF ORANGE WATER AND SEWER AUTHORITY TO APPROVE A NEW FULL-TIME POSITION

WHEREAS, at the October 8th Board of Director's work session the Board directed staff to begin recycling 75% of liquid biosolids production to local farmland and sending 25% of dewatered biosolids to composting; and

WHEREAS, this approach to biosolids recycling will require additional supervision of staff; and

WHEREAS, the Executive Director recommends creating the full-time Solids Handling Supervisor position at a Grade 617 ($48,406 - $74,545) on the OWASA Schedule of Employee Classification and Authorized Compensation; and

NOW, THEREFORE, BE IT RESOLVED, BY THE BOARD OF DIRECTORS OF ORANGE WATER AND SEWER AUTHORITY:

1. That a full-time Solids Handling Supervisor position be created at a Grade 617 on the OWASA Schedule of Employee Classification and Authorized Compensation.

Adopted this the 14th day of January, 2016.

_____
Robert Morgan, Vice Chair

ATTESTED:

_____
Heather Payne, Secretary

Agenda Item 2:

Fiscal Year (FY) 2017 Budget Calendar and Assumptions

Purpose:

The following pages include:

- FY 2017 Budget Calendar – the proposed dates of Board meetings and work sessions at which budget matters are expected to be discussed. It also lists the dates by which major budget tasks are to be completed by staff.
- FY 2017 Budget Assumptions – a high-level list of assumptions that are planned to be considered in preparing the budget.

Action Requested:

We ask that Board Members review the budget calendar and list of assumptions and provide feedback to staff as necessary.

Information

- Fiscal Year 2017 Budget Calendar and Assumptions

Budget Calendar

The following is a schedule of the key dates related to developing the budget for Fiscal Year (FY) 2017.

December 2015	Distribute templates for the preparation of operating expense appropriations, capital equipment requests and departmental budget narratives.
January 25, 2016	Submission of Capital Equipment Request Forms, Budget Narratives and Departmental Operating Budget Requests to Budget Officer.
January 28, 2016	**Board of Directors Meeting** – review FY 2016 financial report for the six month period ended December 31, 2015 and discuss CIP investment practices.
February 25, 2016	**Board of Directors Meeting** – discuss financial reserves policy.
March 10, 2016	**Board of Directors Work Session** – discussion of *Draft Annual Budget* and, if available, staff recommendation of rate adjustment. Set date for public hearings on budget and rates.
March 24, 2016	**Board of Directors Meeting -** discussion of *Draft Annual Budget* and staff recommendation of rate adjustment, as necessary.
April 14, 2016	**Board of Directors Work Session** – discussion of *Draft Annual Budget* and staff recommendation of rate adjustment, and authorize staff to publicize draft budget and rate information.
April 28, 2016	**Board of Directors Meeting** – review FY 2016 financial report for the nine month period ended March 31, 2016.
May 26, 2016	**Board of Directors Meeting** – Public Hearing on the *Draft Annual Budget, Capital Improvements Budget* and proposed adjustments to rates, fees, and charges.
June 9, 2016	**Board of Directors Work Session** – adoption of *FY 2017 Annual Budget* and adoption of *Schedule of Rates, Fees and Other Charges*.
July 2016	Distribute *FY 2017 Annual Budget*.

Budget Assumptions

The following are key issues and assumptions that we expect to consider in developing the FY 2017 Budget.

Strategic Plan

The organization will continue to focus on addressing our Strategic Plan Initiatives. The following is a brief summary of our expectations for existing initiatives in FY 2017. The Board plans to update the Strategic Plan during FY 2017; however, the process and timetable for that effort has not yet been determined.

Initiative	Goals	FY 2017 Plans
Provide reliable and high quality supply of water for the next 50 years	• Optimum mix of technically, environmentally, economically, and socially feasible water supply and demand management alternatives that meet projected demands and level-of-service objectives under a range of future conditions and uncertainties. • Enhanced water supply reliability, reduced energy use, and reduced long-term life-cycle costs of water and sewer service through cost-effective water use efficiency, conservation, and reclaimed water strategies.	• We have begun the process of updating our long-range water supply plan and expect to have the draft completed in FY 2018. It is expected that our water supply will be sufficient to meet the community's needs for the next 50 years in most scenarios. • While demand management alternatives will be evaluated in the update of the Long-Range Water Supply Plan, no changes in the scope or approach to our water conservation program will be made until we have completed the update of the Plan.
	• Maintain our Jordan Lake water supply allocation. • New or amended water transfer agreements with Town of Cary and City of Durham for OWASA to access our Jordan Lake water supply allocation through those entities when needed.	• We have submitted our allocation application to the state of North Carolina and await the decisions for the Round 4 Jordan Lake water supply allocation process.

Initiative	Goals	FY 2017 Plans
Engage the Community	• Engage stakeholders to understand their perceptions and expectations so that we make well-informed decisions about our services and maintain their trust. • Empower stakeholders with information so they use water wisely and protect water quality through proper use of our wastewater system. • Provide stakeholders with timely information about projects, programs, and policies that are important to them and offer them meaningful opportunities to give feedback so that we can continue to improve.	• We have guidance and plan to complete a community engagement process for use in conjunction with all of our major initiatives. • We plan to analyze responses from the FY 2016 customer satisfaction survey and develop an action plan, as appropriate, to address issues raised. • No major changes are proposed to the scope and approach to our general public information and outreach program; however, supplemental resources may be required for major project-specific community engagement efforts.
Implement a new customer billing and financial management system	• Select new customer billing and financial management system which effectively meets business requirements. • Implement new customer billing and financial management system.	• Not applicable – task complete.
Adopt financial management policies and budget decision processes to ensure affordable services and fiscal sustainability	• Financial reserve funds set at appropriate level. • Efficient process which provides opportunities for stakeholder input and allows the Board of Directors to make well-informed budget and rate decisions. • Affordability target set at appropriate level. • The right investments at the right time to sustain the community's essential water, wastewater, and reclaimed water assets.	• We have completed tasks related to the budget process and affordability target. • Depending on Board guidance in FY 2016, work on financial reserve and asset investment policy decisions may continue in FY 2017.
Implement an Energy Management Plan	• Cost-effective measures to reduce our use of energy, related energy costs, and associated greenhouse gas (GHG) emissions.	• We expect to complete an Energy Management Plan in FY 2017.
Implement Advanced Metering Infrastructure (AMI)	• Cost-effective, accurate, reliable and timely water metering information for enhanced customer service.	• We expect to complete the AMI feasibility study in FY 2016. Work in FY 2017 will depend on guidance from the Board.
Develop a plan and policy framework for long-term management and disposition of OWASA lands	• Land assets provide the expected value to fulfill OWASA's mission and the assets are effectively managed.	• A time-frame for this initiative has not been determined.

Additional assumptions

- The FY 2017 Budget will be developed in order to meet all of the financial performance objectives stipulated in our Financial Management Policy.
- Current service levels will be maintained.
- The Board is considering making modifications to OWASA's rate structure. Any changes adopted will be designed to be revenue neutral.
- Drinking water and reclaimed water sales are not expected to increase or decrease significantly.
- Our biosolids program will be operated in accordance with the Board's guidance that we should recycle approximately 75% in liquid form on approved farmland and 25% in dewatered form through a private composting facility (depending on weather and other factors).
- Wastewater treatment nutrient removal requirements in the Jordan Lake Rules have been delayed by the NC General Assembly until at least 2021.
- The Total Compensation Study will continue into FY 2017; however, we do not anticipate changing our approach to budgeting for compensation and employee-related expenses in the FY 2017 Budget.

ORANGE WATER AND SEWER AUTHORITY

MEETING OF THE BOARD OF DIRECTORS

OCTOBER 22, 2015

The Board of Directors of the Orange Water and Sewer Authority (OWASA) held a regular business meeting on Thursday, October 22, 2015, at 7:00 PM in Council Chambers at the Chapel Hill Town Hall, 405 Martin Luther King Jr. Boulevard.

Board Members present: Robert Morgan, Vice Chair; Terri Buckner; Jeff Danner; Barbara Foushee; David (Dave) Moreau; and Ruchir Vora. Board Members absent: John A. Young, Chair; Heather Payne, Secretary; and Quinton Harper.

OWASA staff present: Ed Kerwin; Denise Battle; Mary Darr; Patrick Davis; Vishnu Gangadharan; Stephanie Glasgow; Andrea Orbich; Ruth Rouse; Kelly Satterfield; Todd Taylor; Mary Tiger; Stephen Winters; and Robert Epting, Epting and Hackney.

Others present: Ben Poulson, Associate Director of Energy Services and Meg Holton, Water, Wastewater, and Stormwater Manager, University of North Carolina (UNC) at Chapel Hill; Don Schlenger and Kevin O'Connor, Don Schlenger and Associates; and Pamela Tekumalla, Manager of Booker Creek Apartments.

There being a quorum present, Vice Chair Robert Morgan called the meeting to order.

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MOTIONS ACTED UPON

1. Dave Moreau made a motion to approve the Minutes of the September 24, 2015 Annual Meeting of the Board of Directors; second by Jeff Danner and unanimously approved.

2. Dave Moreau made a motion to approve the Minutes of the September 24, 2015 Closed Session of the Board of Directors; second by Jeff Danner and unanimously approved.

3. Dave Moreau made a motion to approve the Minutes of the October 8, 2015 Work Session of the Board of Directors; second by Jeff Danner and unanimously approved.

4. Terri Buckner made a motion that the Board of Directors approve the proposed Affordability Outreach Program Plan (Year 1) and authorize staff to proceed to implement the program in accordance with the approach described in the proposed plan; second by Barbara Foushee and unanimously approved.

5. BE IT RESOLVED THAT the Orange Water and Sewer Authority Board of Directors adopts the Resolution Awarding a Construction Contract for the Purefoy Road Water Main Replacement Project. (Resolution so titled attached hereto and made a part of these minutes. Motion by Dave Moreau, second by Barbara Foushee and unanimously approved.)

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ANNOUNCEMENTS

Conflict Of Interest

Robert Morgan said any Board Member who knows of a conflict of interest or potential conflict of interest with respect to any item on the agenda tonight is asked to disclose the same at this time. There were none.

Carrboro Board of Aldermen Meeting

Robert Morgan said that as requested by the Town of Carrboro, Mary Darr, Director of Engineering and Planning, made a brief presentation at the October 20th Board of Aldermen's meeting regarding the design for a sewer system to serve the Historic Rogers Road Area. Mr. Morgan said the presentation was well received by the Aldermen.

Special Closed Session

Mr. Morgan said that the Board of Directors will hold a Special Closed Session on Wednesday, November 4, 2015 at 6:00 PM in the OWASA Board Room to continue discussions regarding the Executive Director's annual review.

Meetings

Dave Moreau, Chair of Natural Resources and Technical Systems (NRTS) Committee, said the Committee met on October 20, 2015 to discuss Orange County's Historic Rogers Road Area sewer project. The NRTS Committee received information regarding: OWASA's policies and practices for developing new water and sewer systems; the history of the Rogers Road area; the schedule for completion of final design of the sewer system to serve the Rogers Road Area; and that the final design should be complete in September 2016, although it is subject to change. Mr. Moreau said the next NRTS Committee meeting will be on a date to be determined in December and the topic will either be Advanced Metering Infrastructure or the energy management plan.

Terri Buckner said that the Inter-Local Energy Collaboration Working Group will meet Wednesday, October 28, 2015 at 5:30 PM in the OWASA Board Room to discuss next steps for considering five collaboration initiatives (biogas to energy at the Mason Farm Wastewater Treatment Plant; technical evaluation of solar photovoltaic (PV) opportunities on public facilities and land tracts; outdoor facility lighting; fleet management efficiencies; and joint energy/carbon tracking reporting). The Group will meet again on Wednesday, December 2, 2015 at 5:30 PM in OWASA's Board Room.

Ruchir Vora, Chair of the Community Engagement Committee, said the Committee met on October 13, 2015 to review and discuss the Affordability Outreach Program Plan which will be

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discussed in more detail later tonight. The Committee also discussed next steps in defining OWASA's overall community engagement approach.

OWASA Employee Service Awards

Ed Kerwin recognized OWASA employees who have served for 10, 15, 20, 25, 30 and 40 years at OWASA. The following employees received service awards:

10 Years: Derrick Burton
15 Years: LeMarcus Fuller, Nicholas Rogers and Ronnie Weed
20 Years: Dale Lovely, Greg Monschein and Andrea Orbich
25 Years: Stephanie Glasgow, David Moriarty and Maxine Rich
30 Years: Sherman Betts, Melvin Markley, Angie Smith and Michael Wolfgang
40 Years: Randy Horton

The Board thanked and appreciated staff for their service to OWASA and the community.

2015 Customer Survey

Greg Feller said that on October 15, 2015 OWASA began publicizing the 2015 Customer Survey through the following:

- Blue Thumb customer newsletter to be distributed from mid-October to early November to all accountholders.
- A link to the survey as the first item under Welcome to OWASA on the website homepage.
- A news release to media, community organizations, etc. which will remain under Latest News on the homepage for the survey duration.
- E-mails to about 12,500 customers (electronic bills with the survey link from October 15 to November 5).
- A letter/e-mail to managers of multi-family residential properties which are master-metered. The letter/e-mail will ask the property managers to share information electronically and/or in a paper notices to residents.
- A letter with information in Spanish for local organizations such as El Centro which serve Spanish-speaking residents. The on-line survey will be available in Spanish through a separate link.
- A Twitter message.

Mr. Feller said that the survey is expected to cost less than $2,000.

PETITIONS AND REQUESTS

Robert Morgan asked for petitions and requests from the public; there were none.

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Ruchir Vora, Chair of the Community Engagement Committee, requested the Board's support for the Committee to work with staff on community engagement. The Board requested that a statement of proposed work for the Committee be prepared for the Board's review at the November 12, 2015 meeting.

Stephen Winters, Director of Finance and Customer Service, requested the Board's preference on when to schedule a discussion of the results of a cost allocation study, an initial phase of the Board's consideration of making modifications to OWASA's rate structure. The Board agreed to discuss the results of the cost allocation study on December 10, 2015.

ITEM ONE: QUARTERLY REPORT ON ATTENDANCE AT BOARD AND COMMITTEE MEETINGS

The Board received this report as an information item.

ITEM TWO: MINUTES

Dave Moreau made a motion to approve the Minutes of the September 24, 2015 Annual Meeting of the Board of Directors; second by Jeff Danner and unanimously approved. Please see Motion No. 1 above.

ITEM THREE: MINUTES

Dave Moreau made a motion to approve the Minutes of the September 24, 2015 Closed Session of the Board of Directors; second by Jeff Danner and unanimously approved. Please see Motion No. 2 above.

ITEM FOUR: MINUTES

Dave Moreau made a motion to approve the Minutes of the October 8, 2015 Work Session of the Board of Directors; second by Jeff Danner and unanimously approved. Please see Motion No. 3 above.

ITEM FIVE: REVIEW ADVANCED METERING INFRASTRUCTURE (AMI) PRELIMINARY ECONOMIC AND FINANCIAL ANALYSIS

Todd Taylor, General Manager of Operations, provided an update on the AMI Feasibility Study (Study). He said that the complete Study will be ready for the Board's review in November and that no formal Board action is requested tonight, however staff is seeking the Board's feedback on the following aspects of the Study:

- Preliminary economic evaluation of alternatives;
- Preliminary list of proposed non-economic factors to be evaluated, keeping in mind that the detailed economic analyses will be in the draft Study;

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- Determine if the Board's Natural Resources/Technical Systems (NRTS) Committee should meet to discuss the economic models in more detail; and
- Board concurrence on amending the AMI project schedule one month.

Dr. Don Schlenger, Don Schlenger and Associates, presented additional details on the Study's analyses and assumptions regarding the preliminary economic evaluation of alternatives as well as the preliminary list of proposed non-economic factors to be evaluated as part of the Study.

Following the presentation and discussion, the Board agreed that a NRTS Committee meeting to further discuss the draft Study was not required. The Board asked staff to provide a list of utilities in North Carolina using AMI. There was also Board concurrence to amend the AMI project schedule by one month and that the draft Study will be distributed to the Board by mid-November 2015.

ITEM SIX: PROPOSED AFFORDABILITY OUTREACH PROGRAM PLAN (YEAR 1)

Patrick Davis, Sustainability Manager, presented a plan for implementing the Affordability Outreach Program Plan (Plan) in the next year as an ongoing initiative. Mr. Davis summarized the 10 proposed strategies for the Plan which are included in the agenda item.

Terri Buckner made a motion that the Board of Directors approve the proposed Affordability Outreach Program Plan (Year 1) and authorize staff to proceed to implement the program in accordance with the approach described in the proposed plan; second by Barbara Foushee and unanimously approved. Please see Motion No. 4 above.

ITEM SEVEN: ANNUAL REVIEW AND UPDATE OF STRATEGIC TRENDS AND UTILITY PLANNING ISSUES

The Board received this report as an information item and suggested next year's review include trend information regarding the causes of sewer overflows. The Board also requested that updates include changing State and Federal regulations that may impact any aspect of OWASA's operations and business practices.

ITEM EIGHT: RESOLUTION AWARDING A CONSTRUCTION CONTRACT FOR THE PUREFOY ROAD WATER MAIN REPLACEMENT PROJECT

Barbara Foushee said she would like to review the contract; staff will follow up.

Dave Moreau made a motion to approve the resolution; second by Barbara Foushee and unanimously approved. Please see Motion No. 5 above.

ITEM NINE: FINANCIAL REPORT FOR THE THREE MONTH PERIOD ENDED SEPTEMBER 30, 2015

The Board received this report as an information item.

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ITEM TEN: EXECUTIVE DIRECTOR WILL SUMMARIZE THE KEY ACTION ITEMS FROM THE BOARD MEETING AND NOTE SIGNIFICANT ITEMS FOR DISCUSSION AND/OR ACTION EXPECTED AT THE NEXT BOARD MEETING

Ed Kerwin summarized the meeting as follows:

- Ruchir Vora and staff will prepare a statement of proposed work for the Community Engagement Committee for the Board's review at the November 12, 2015 meeting;
- The Board agreed to discuss the results of the Cost Allocation Study on December 10, 2015;
- The Board agreed that a Natural Resources and Technical Systems Committee meeting to further discuss the draft AMI Study is not required, agreed to amend the AMI project schedule by one month, and that the draft Study will be distributed to the Board by mid-November 2015;
- Staff will provide trend information regarding the causes of sewer overflows;
- Staff will include changing regulations that may impact any aspect of OWASA's operations and business practices in the Annual Review and Update of Strategic Trends and Utility Planning Issues;
- Staff will follow up with Barbara Foushee regarding her questions on the Purefoy Road Water Main Replacement Project contract;
- The November 12, 2015 Work Session will include the following;
    - Discuss Total Compensation Philosophy; and
    - Discuss Board Fiduciary Duties

The meeting was adjourned at 9:15 PM.

Respectfully submitted,

Andrea Orbich
Executive Assistant/Clerk to the Board

Attachments

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ORANGE WATER AND SEWER AUTHORITY

SPECIAL CLOSED SESSION OF THE BOARD OF DIRECTORS

NOVEMBER 4, 2015

The Board of Directors of Orange Water and Sewer Authority met in a Special Closed Session on Wednesday, November 4, 2015, at 6:00 PM in the OWASA Board Room.

Board Members present: John A. Young, Chair; Robert Morgan, Vice Chair; Heather Payne, Secretary; Terri Buckner; Jeff Danner; Barbara M. Foushee; and David (Dave) Moreau. Board Members absent: Quinton Harper and Ruchir Vora.

Staff present: Ed Kerwin, Executive Director.

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ITEM ONE

The Board of Directors and Executive Director met in Closed Session to discuss his annual performance review.

No official action was taken at the meeting.

The meeting was adjourned at 7:40 PM.

_____

Robert Morgan, Vice Chair
Board of Directors

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ORANGE WATER AND SEWER AUTHORITY

CLOSED SESSION OF THE BOARD OF DIRECTORS

NOVEMBER 12, 2015

The Board of Directors of Orange Water and Sewer Authority met in a Closed Session on Thursday, November 12, 2015, at 5:30 PM in the OWASA Board Room.

Board Members present: Robert Morgan, Vice Chair; Heather Payne, Secretary; Terri Buckner; Jeff Danner; Barbara M. Foushee; Quinton Harper; David (Dave) Moreau; and Ruchir Vora. Board Member absent: John A. Young, Chair.

Staff present: none.

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ITEM ONE

The Board of Directors met in Closed Session to discuss the annual performance review of the Executive Director.

No official action was taken at the meeting.

The meeting was adjourned at 5:55 PM.

_____

Heather Payne, Secretary
Board of Directors

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ORANGE WATER AND SEWER AUTHORITY

WORK SESSION OF THE BOARD OF DIRECTORS

NOVEMBER 12, 2015

The Board of Directors of the Orange Water and Sewer Authority (OWASA) held a Work Session on Thursday, November 12, 2015, at 6:00 PM in the OWASA Community Room, 400 Jones Ferry Road in Carrboro.

Board Members present: Robert Morgan, Vice Chair; Heather Payne, Secretary; Terri Buckner; Jeff Danner; Barbara Foushee; Quinton Harper; David Moreau; and Ruchir Vora. Absent: John A. Young, Chair.

OWASA staff present: Ed Kerwin; Mary Darr; Patrick Davis; Greg Feller; Stephanie Glasgow; Adam Haggerty; Kenneth Loflin; Andrea Orbich; Todd Taylor; Stephen Winters; and Robert Epting of Epting and Hackney.

Others present: Ben Poulson, Associate Director of Energy Services and Meg Holton, Water, Wastewater, and Stormwater Manager, University of North Carolina (UNC) at Chapel Hill; John Anzivino and Ann Antonsen, Springsted Incorporated.

MOTIONS ACTED UPON

1. Heather Payne made a motion to increase the Executive Director's base pay by 3% effective November 1, 2015; second by Quinton Harper and the motion passed with a vote of seven to one with Barbara Foushee opposed.

ANNOUNCEMENTS

Mr. Morgan said any Board Member who knows of a conflict of interest or potential conflict of interest with respect to any item on the agenda tonight is asked to disclose the same; there were none.

Terri Buckner said the Inter-Local Energy Collaboration Working Group met on October 28, 2015, to continue discussing and receiving updates on the four potential projects (vehicle fleet efficiencies and alternative fuel strategies; potential opportunities for solar photovoltaic system development at public facility sites; developing a consistent energy and greenhouse gas emission data management and reporting approach; and evaluating options for beneficially using biogas produced at the Mason Farm Wastewater Treatment Plant). Ms. Buckner said the group is scheduled to meet again on Wednesday, December 2, 2015 at 5:30 PM in the OWASA Board Room.

Jeff Danner said that Ed Kerwin and he attended the Orange County Living Wage kickoff event on November 6, 2015 at Steel String Brewery in Carrboro. The event was also attended by several elected local leaders.

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Heather Payne said that the Board of Directors held a Closed Session prior to the Board Work Session tonight to discuss the annual performance review of the Executive Director.

Heather Payne made a motion to increase the Executive Director's base pay by 3% effective November 1, 2015; second by Quinton Harper and the motion passed with a vote of seven to one with Barbara Foushee opposed. Please see Motion No. 1 above.

INFORMATION AND REPORTS

ITEM ONE: PRESENTATION ON OWASA'S CANE CREEK RESERVOIR AND UNIVERSITY LAKE DAM EMERGENCY ACTION PLANS

The Board received and discussed a presentation by Adam Haggerty, Asset Management Facilities Engineer, regarding OWASA's Cane Creek Reservoir and University Lake Dam Emergency Action Plans.

The Board requested additional information from staff regarding Orange County Emergency Management's distribution methods for evacuation notices in the event of a dam failure; and a summary of the design criteria for renovations in the 1990s for University Lake. Staff will follow-up.

DISCUSSION

ITEM TWO: DISCUSSION OF EMPLOYEE TOTAL COMPENSATION PHILOSOPHY

The Board received information from Stephanie Glasgow, Director of Human Resources and Safety, and John Anzivino and Ann Antonsen of Springsted Incorporated regarding the results of an employee survey. Ms. Antonsen also provided the elements of a compensation philosophy as a starting point for the study of employee compensation.

The Board requested the following information for further discussion on December 10, 2015: provide the questions and key comments made by Ms. Antonsen regarding employee total compensation philosophy; and separate employee responses to the survey question number six (6 - rank order of reasons employees stay at OWASA), by gender, race, supervisor and non-supervisor. Staff will follow-up.

ITEM THREE: DISCUSSION OF THE FIDUCIARY DUTIES OF OWASA BOARD MEMBERS

The Board received and discussed information from Robert Epting, OWASA's General Counsel, on the nature and meaning of the fiduciary responsibilities of Board Members as set forth in the oath of office.

The Board requested that this new document be added the new Board Member orientation packet.

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ITEM FOUR: REVIEW BOARD WORK SCHEDULE

Todd Taylor said that the Advanced Metering Infrastructure (AMI) Feasibility Study would be provided to the Board by November 20, 2015. The AMI Study will be discussed at the Board's December 10, 2015 meeting. The Board requested a list of water utilities using AMI for future reference checks.

The Board agreed that the Community Engagement Committee and staff will work together to develop a recommended process to set the overall expectations for our Community Engagement program.

ITEM FIVE: EXECUTIVE DIRECTOR WILL SUMMARIZE THE KEY STAFF ACTION ITEMS FROM THE WORK SESSION

Ed Kerwin summarized the key action items for staff as follows:

- Staff will seek additional detail from Orange County Emergency Management regarding distribution methods for evacuation notices in the event of a dam failure and a summary of the design criteria for renovations in the 1990s for University Lake.
- Staff will provide the questions and key comments made by Ann Antonsen, Springsted Incorporated, regarding the employee total compensation philosophy.
- Staff will separate employee responses to employee survey question #6 (rank order of reasons employees stay at OWASA), by gender, race, supervisor and non-supervisor and distribute this information to the Board.
- The new Fiduciary Duties document will be part of the new Board Member orientation packet.
- The Community Engagement Committee will schedule meetings to work with staff in developing a process to set the overall expectations for OWASA's community engagement program.
- Staff will provide a list of North Carolina water utilities using AMI for reference checks.
- Staff will distribute the draft AMI Feasibility Study by November 20th for the Board's discussion on December 10, 2015.

The work session was adjourned at 7:55 PM.

Respectfully submitted by:

Andrea Orbich
Executive Assistant/Clerk to the Board

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Agenda Item 7:

Consider Approval of the Advanced Metering Infrastructure (AMI) Feasibility Study and Discuss Next Steps

Purpose:

- To submit the revised AMI Feasibility Study and supplemental information to the Board.

- Discuss the proposed schedule of next steps for the AMI project.

Action Requested:

- Staff recommends the Board accept the AMI Feasibility and supplemental information as complete.

- Staff recommends the Board approve the schedule regarding next steps for the AMI project (as suggested by Ms. Terri Buckner and reflected in the current OWASA Board of Directors – 12 Month Board Meeting Schedule).

Information

Attachments:

1. Relative Comparison of Alternative Metering System Technologies Against Evaluation Criteria
2. AMI Feasibility Study and Supplemental Information
3. Lessons learned from utilities that have AMI

ORANGE WATER AND SEWER AUTHORITY

A public, non-profit agency providing water, sewer and reclaimed water services to the Carrboro-Chapel Hill community.

MEMORANDUM

TO: Board of Directors

THROUGH: Ed Kerwin

FROM: Todd Taylor and Daniel Przybyl

DATE: January 8, 2016

SUBJECT: **Consider Approval of the Advanced Metering Infrastructure (AMI) Feasibility Study and Discuss Next Steps**

PURPOSE

The AMI Feasibility Study seeks to identify the optimal technology for reading meters in OWASA's service area. Historically meter reading has been a labor intensive manual process. However, technological advances have opened the door to automation. Automated Meter Reading (AMR) (short range drive-by system) and AMI (fixed network) systems can collect meter readings via radio, significantly reducing the time and effort required to obtain this data. OWASA has been in the process of slowly converting to an AMR system. However, the industry is trending towards AMI technology and OWASA has been unable to fully capture the benefits of AMR with our current implementation strategy.

BACKGROUND

During the September 25, 2014 Board meeting, the Board authorized staff to issue a request for qualifications and to select the best qualified firm for consulting services for the potential implementation of an AMI system. Don Schlenger and Associates (DS&A) was selected for this project through a nationwide, qualifications based selection process and began their work in July 2015. DS&A's first task is to prepare a Feasibility Study, which the Board will consider prior to deciding whether to move ahead with system procurement. The draft AMI Feasibility Study was presented to the Board at the December 10, 2015 work session. Based upon the Board's review and comment, DS&A and staff have revised the Study and prepared supplemental information which includes the following:

- Sensitivity analysis of the return on investment in AMI to some key variables
- Analysis of Alternative 0 (our current AMR implementation strategy)
- AMI unit cost trend
- Evaluation of Customer Service Representative compensation relative to the additional job requirements for AMI
- Proportional components of project cost (e.g., meters, labor, software, etc.)

- Head-to-head comparison of the key benefits (both financial and non-financial) of all Alternatives
- Summary of lessons learned from other utilities

Next Steps

Staff recommends the following schedule regarding next steps for the AMI project (as suggested by Terri Buckner and reflected in the current OWASA Board of Directors – 12 Month Board Meeting Schedule):

- February 25, 2016 Board Meeting - Receive public feedback on the meter technology alternatives. We will draft an engagement plan to inform stakeholders well before February 25 about the options including their advantages, disadvantages, costs and savings; make the feasibility study available for people who want detailed information; and invite comments and questions before, during and after the February 25 meeting.
- March 10, 2016 Board Work Session - Discuss public feedback received on AMI on February 25, 2016.
- March 24, 2016 Board Meeting - Make decision to proceed or not with AMI (or other option).

Action Requested

1. The Board accepts the AMI Feasibility and supplemental information as complete.
2. The Board approves the schedule regarding next steps for the AMI project (as suggested by Terri Buckner and reflected in the current OWASA Board of Directors – 12 Month Board Meeting Schedule) or provide alternative direction to staff.

Todd Taylor, P.E.
General Manager of Operations

Daniel Przybyl
Director of Information Technology

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RELATIVE COMPARISON OF ALTERNATIVE METERING SYSTEM TECHNOLOGIES AGAINST EVALUATION CRITERIA

ATTACHMENT 1

Relative comparison of performance to each other (only applicable to the objective for that row)

Key to Cell Shading:	UNACCEPTABLE	ACCEPTABLE	BETTER	BEST

		METERING TECHNOLOGIES AND IMPLEMENTATION STRATEGIES EVALUATED				
	EVALUATION CRITERIA	**BASELINE (Existing Program) Slow Deployment of HotRod AMR System**	**Rapid Deployment of HotRod AMR System**	**Rapid Deployment of New AMR System**	**Rapid Deployment of AMI System**	**Rapid Deployment of Hybrid Systems (AMI in Limited Portion of Service Area)**
SOCIAL PERFORMANCE	**Service to Our Customers**	Unequal benefits for customers until full deployment; usage data typically retrieved on monthly basis; customers do not have direct access to data; service connects/disconnects and re-reads are be done manually	Equal, but less powerful benefits for customers; usage data typically retrieved on monthly basis; customers do not have access to data; service connects/disconnects and re-reads would be done manually	Equal, but less powerful benefits for customers; usage data typically retrieved on monthly basis; customers do not have access to data; service connects/disconnects and re-reads would be done manually	Equal benefits for customers; customer service team (and potentially the customer) has "on-demand" access to water use data; proactive notification of customes of leaks and potential high bills; more efficient and enhanced level of customer service including first-call resolution; more uniform reading/billing cycles; fewer estimated reads; "virtual" service connects/disconnects; tamper/intrusion/reverse flow notification	Unequal benefits for customers as only some would have AMI meters; access to real-time data and related benefits and customer service improvements would be available only for portion of customer base; service connects/disconnects and re-reads would still be done manually for AMR metered customers
		Lowest concern about privacy, data security, and safety of technology	Lowest concern about privacy, data security, and safety of technology	Lowest concern about privacy, data security, and safety of technology	Greatest concern about privacy, data security, and safety of technology	Moderate concern about privacy, data security, and safety of technology
	Service to Our Community	AMR system could not be used to support other services/partners	AMR system could not be used to support other services/partners	AMR system could not be used to support other services/partners	AMI infrastructure could potentially benefit our partners (control of local street lighting, monitoring of facilities served by UNC Energy Services, etc.)	AMI infrastructure could potentially benefit our partners (control of local street lighting, monitoring of facilities served by UNC Energy Services, etc.), but less than full AMI option
	Employee Health and Safety	Over time, reduces employee safety risks since fewer vehicle trips and miles driven are needed, there is less need for accessing meters in difficult to read locations, and there is less potential for injury from dog bites, exposure to inclement weather, etc.	Reduces employee safety risks since fewer vehicle trips and miles driven are needed, there is less need for accessing meters in difficult to read locations, and there is less potential for injury from dog bites, exposure to inclement weather, etc.	Reduces employee safety risks since fewer vehicle trips and miles driven are needed, there is less need for accessing meters in difficult to read locations, and there is less potential for injury from dog bites, exposure to inclement weather, etc.	Substantial reduction in employee safety risks since fewer vehicle trips and miles driven are needed, there is less need for accessing meters in difficult to read locations, and there is less potential for injury from dog bites, exposure to inclement weather, etc.	Moderate reduction in employee safety risks since fewer vehicle trips and miles driven are needed, there is less need for accessing meters in difficult to read locations, and there is less potential for injury from dog bites, exposure to inclement weather, etc.
	Work Effect on Employees (Program Staff and Managers)	No changes in staffing levels or stress levels associated with major changes in business processes. Eventual reduction meter reading staffing.	Meter reading efficiency increases with full deployment, enabling some reduction in meter reading staffing	Some near-term stress due to conversion to new technology; meter reading efficiency increases with full deployment, enabling some reduction in meter reading staffing	Some near-term stress due to conversion to new technology; meter reading efficiency increases significantly with full deployment, enabling reduction in meter reading staffing; enhanced staff technical capacity and training required	Some near-term stress due to conversion to new technology; meter reading efficiency increases thereby enabling some reduction in meter reading staffing; enhanced staff technical capacity and training required
ENVIRONMENTAL PERFORMANCE	**Sustainable Water Management**	Enables access to water use data upon site visit and download, and provides basic level of support for conservation efforts but over extended time period; does not support district metering, system monitoring and leak detection	Enables access to water use data upon site visit and download; provides basic level of support for conservation efforts; does not support district metering, system monitoring and leak detection	Enables access to water use data upon site visit and download; provides basic level of suppot for conservation efforts; does not support district metering, system monitoring and leak detection	Real-time usage data supports conservation program, pricing, drought response, etc.; enables timely detection and response to leaks; supports distribution system modeling and planning efforts; can support real-time and time-synchronized water usage and system monitoring (acoustic leak detection, district metering, etc.)	Enables access to water use data in real-time for AMI meters, but only upon site visit and download for AMR meters; provides moderate level of support for conservation efforts, and for district metering, system monitoring and leak detection
	Energy Use and Greenhouse Gas Emissions	Over time, a moderate reduction in vehicle miles driven and associated fuel use and GHG emissions	Moderate reduction in vehicle miles driven and associated fuel use and GHG emissions	Moderate reduction in vehicle miles driven and associated fuel use and GHG emissions	Substantial reduction on vehicle miles driven and associated fuel use and GHG emissions	Moderate reduction in vehicle miles driven and associated fuel use and GHG emissions
FINANCIAL PERFORMANCE	**NPV - 15 years @ 3.5%** **Simple Payback** **IRR**	($1.37 million) 39.5 years -7.3%	($0.20 million) 13.6 years 2.5%	($1.02 million) 21.1 years -0.8%	$0.44 million 9.9 years 4.8%	($2.10 million) 34 years -4.3%
	Initial Capital Costs & Contingency	$3.93 million	$3.88 million	$5.05 million	$6.00 million	$6.01 million
	Operating and Maintenance Costs	$0.03 million	$0.03 million	$0.03 million	$0.15 million	$0.12 million
	Annual Savings	$0.17 million	$0.15 million	$0.14 million	$0.47 million	$0.22 million
	Existing Program Costs Offset	N/A	$1.96 million	$2.47 million	$2.47 milliion	$2.47 million
	Major Project Risk Factors	Lowest risk; we are very familiar with the technology, data collection process, and related aspects; however, AMR technology could become obsolete	Lowest risk; we are very familiar with the technology, data collection process, and related aspects; however, AMR technology could become obsolete	Slightly greater risk; we are very familiar with the primary technology, data collection process, and related aspects; however, switching to new AMR technology could present some challenges and risks	Moderate risks, such as signal interference/quality; failure to change business processes to take advantage of technology; loss or corruption of data; security breaches; inadequate battery life; etc. Risks can be minimized through risk management plan (including staff training and development)	Moderate risks, such as signal interference/quality; failure to change business processes to take advantage of technology; loss or corruption of data; security breaches; inadequate battery life; etc. Risks can be minimized through risk management plan (including staff training and development)

DS&A
Don Schlenger and Associates, LLC

DATE: January 7, 2016

TO: Ed Kerwin, Todd Taylor

FROM: Don Schlenger

SUBJECT: Revised Report and Supplement

Attached please find the revised Advanced Metering Infrastructure (AMI) Feasibility Study report for Orange Water and Sewer Authority.

When we originally built the economic model, we were trying to look at the incremental costs over the existing meter replacement and HotRod installation program, but we determined that some meters could be left in longer and only their registers replaced, since results of testing a sample of existing meters did not indicate a significant loss of accuracy. We also ascribed lid replacement to the existing program. Therefore, we did not include those costs in the top line capital cost. However, we realized that to be consistent with our assumptions about the cost offset of suspending the existing meter replacement and HotRod installation program, we had to add these costs: about $265K each for replacement registers and new lids. The report numbers have been revised to reflect this.

Also attached is Report Supplement B, in which we endeavor to address many of the questions raised at the December, 2015 Board meeting.

Don Schlenger and Associates, LLC

DS&A

Report to

Orange Water and Sewer Authority

OWASA

Advanced Metering Infrastructure (AMI) Feasibility Study

Rev. January, 2016



Orange Water and Sewer Authority
AMI Feasibility Study

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Acronyms Used in this Report

ALD -	Acoustic Leak Detector
AMI -	Advanced Metering Infrastructure
AMR -	Advanced Meter Reading
CIS -	Customer Information System
CSR -	Customer Service Representative
DCU	Data Collector Unit
DS&A -	Don Schlenger and Associates
EMF -	Electric and Magnetic Field
FTE	Full-time Equivalent
GIS -	Geographic Information System
IVR -	Interactive Voice Response
IRR -	Internal Rate of Return
IT -	Information Technology
KPI -	Key Performance Indicator
MDMS -	Meter Data Management System
MHz	Megahertz
MIU -	Meter Interface Unit
NaaS -	Network as a Service
NPV -	Net Present Value
OWASA -	Orange Water and Sewer Authority
SaaS -	Software as a Service
TBL -	Triple Bottom Line
UNC	University of North Carolina

Section 1. Executive Summary

Orange Water and Sewer Authority's (OWASA) approximately 21,300 water meters are read monthly using a combination of manual reading and mobile automatic meter reading (AMR). For several years, OWASA has been installing AMR devices (Mueller HotRod radios) for all new meters, including those installed under its small meter 20-year age changeout program or in conjunction with other meter replacements, and those installed in new developments. Continuing this approach would result in the eventual saturation of OWASA's meters with AMR; however, at the recent rate of installation, this would take about 12 to 14 more years.

OWASA has been concerned that the current AMR system implementation strategy is likely not the most cost-effective or best long-term metering solution for the utility and its customers. As part of a strategic initiative included in the OWASA Board of Directors' *Strategic Plan for Fiscal Years 2014 – 2017*, OWASA decided to undertake a study of the feasibility of implementing an advanced metering infrastructure (AMI) system as an alternative to the current approach. AMI technology enables meters to be read frequently over a fixed radio network. Many utilities now have or are considering deploying AMI systems. AMI would enable OWASA to obtain hourly readings from customers' meters and make this data available to OWASA employees and customers. AMI can provide near real-time reads for transfer of service and alerts about usage on vacant accounts, and possible leaks and wastage. This can increase the effectiveness of customer service representatives (CSRs) and reduce the volume of customer calls and the number of field visits while enhancing customer service. AMI could also augment OWASA's non-revenue water management.

OWASA retained Don Schlenger and Associates (DS&A) to complete the AMI feasibility study. The study evaluated three key alternatives: (1) AMR (either using a new system or continuing with the HotRod system), (2) AMI, and (3) a hybrid solution consisting of a limited AMI network covering the meters of the UNC main campus and medical institutions as well as the Chapel Hill/Carrboro central business district. (Under the hybrid alternative, the remaining meters not covered by this network would be converted to AMR.) The alternatives were evaluated in comparison to OWASA's current extended meter changeout and AMR deployment program.

DS&A developed discounted cash flow models to evaluate the key alternatives. The models incorporate the cost of AMI/AMR capable meters, radio transmitters and data collectors, software to store the data and make it available to users, project management, and operation and maintenance. A new project would replace OWASA's existing program for meter replacement and AMR deployment, so there would be an offset to capital cost. Savings from an AMI system would come primarily from reductions in personnel and vehicle costs (mainly by reassigning Utility Mechanics who read meters to other tasks and other existing or future vacant positions). A new metering system would require 3-6 months of preparation, and one year of deployment. The models calculate the net present value (NPV) of the costs and savings for each alternative over 15 years using a discount rate tied to OWASA's borrowing costs, as well as the internal rate of return (IRR). Summary results of the analyses are as follows:

Table 1. Summary of Costs and Benefits of AMR and AMI Scenarios

	AMR New AMR (New)	AMR Hot Rod AMR (w/HotRod)	AMI AMI	Hybrid (new AMR) Hybrid
Capital Cost, $M*	5.05	3.88	6.00	6.01
Existing Program Offset, $M	2.47	1.96	2.47	2.47
Annual O&M, $M	0.03	0.03	0.15	0.12
Annual Savings, $M	0.14	0.15	0.47	0.22
NPV 15Yr@3.5%, $M	(1.02)	(0.20)	0.44	(2.11)
IRR	-0.8%	2.5%	4.8%	-4.3%

*including 5% contingency

The economic analysis indicates that full deployment of AMI throughout OWASA's service area has the greatest NPV and IRR.

While economic analysis of AMI deals with hard, direct costs and benefits, other factors (economic benefits and costs that accrue to others and/or are difficult to quantify, as well as social and environmental impacts) were considered. For example, when compared to AMR, AMI enables much more timely identification, notification, and reduction of leaks in customers' premises, which can enhance OWASA's sustainable water management and service affordability efforts. By reducing the number of vehicles used for meter reading and field service, OWASA would reduce related greenhouse gas emissions. By providing more timely and actionable information to customers, OWASA can alleviate stressful situations for certain customers and increase overall satisfaction and goodwill among its customers. These and other non-economic factors were enumerated, weighted and scored on a relative basis for each of the alternatives by OWASA staff and DS&A. As with the economic evaluation, the relative scores of the non-economic factors also strongly favor AMI over the alternatives. On the basis of the economic analyses and the consideration of non-economic factors, DS&A recommends that OWASA implement an AMI system instead of continuing its current slow AMR conversion.

AMI and AMR projects entail some risk. Technology risks include premature equipment obsolescence, excessive or premature component failures, incompatibility with future meter registers, inadequate performance of the system, insufficient safeguards to secure customer (and utility) information, and loss or corruption of critical data. Business risks include instability of vendors, issues related to moving employees to other positions in the organization, lack of employee and customer buy-in, business case assumptions that change or fail to materialize, unanticipated cost increases, lack of ongoing system support and maintenance, and failure to integrate the system with other utility information systems and change processes to completely take advantage of the technology.

Most of these risks can be prevented or mitigated through careful planning, good leadership, stakeholder engagement, well-written requests for proposals and contracts, thorough due diligence on vendors, and adequate OWASA staffing and support. Continuing risk assessment and management is an essential dimension of AMI project success. If OWASA decides to proceed with implementation of AMI, it should develop and continuously update a risk register to identify and prioritize AMI-related technological risks and business risks, and a risk management plan to prevent or mitigate risks.

AMI is a major investment. To be successful in implementing AMI, OWASA should prepare itself in several ways. It should adopt best customer service practices as a foundation for

effectively using AMI. In addition to surveying and understanding contributions and barriers to satisfaction, OWASA should establish and measure process-oriented key performance indicators (KPIs), such as first call resolution percentage, related to the customer experience and efficiency of operations. OWASA managers need to be responsible for performance against KPI targets.

There needs to be close collaboration and communication among OWASA's Information Technology (IT), Customer Service and Distribution Operations field staff. OWASA managers should adopt policies that leverage AMI to help cost-effectively deliver customer service, and cost-based charges for service that could more effectively be handled by using the AMI system.

If OWASA were to deploy AMI, it should streamline its business processes where possible. AMI will produce huge volumes of information that if properly managed, can provide many benefits to the utility and its customers. OWASA must ensure its customer and field service staff are sufficiently computer-literate and trained in maximizing the value of the information provided by the AMI system. They need to be confident in their ability to assist customers (including customers who are not computer-literate) and resolve billing and other service issues using system data. Customer Service Representatives (CSRs) need to be empowered and encouraged to try to resolve problems without "rolling a truck." Both office and field personnel need to be adequately monitored and supervised to ensure they are being effective.

To leverage an AMI investment, OWASA must rely on other technologies, such as its outbound phone system, and keeping customer contact information (cellphone numbers, email addresses, etc.) up to date. To prepare for AMI, OWASA should develop a comprehensive implementation plan, which would consist of various sub-plans covering network deployment, IT integration, installation control, stakeholder communications, human resources planning and change management.

DS&A and OWASA did not engage with OWASA customers during the feasibility study. Given the potential benefits, costs, and implementation requirements for AMI, and the potential for AMI to transform OWASA's relationship with and services for its customers, it is essential that as it decides whether or not to implement an AMI system, and then proceeds with such a project, OWASA develop and implement a community engagement plan to ensure a successful project.

Section 2. Introduction

Orange Water and Sewer Authority (OWASA), a public, non-profit water, sewer, and reclaimed water agency, provides service to residential and commercial customer accounts over an approximately 35 square mile area through approximately 20,800 small (⅝" through 2" diameter) and about 240 large (3" - 8" diameter) water meters.

Starting around 2005, OWASA has installed approximately 8,400 Mueller Systems Hersey® meters with encoder registers capable of being read by AMR or AMI technology. The remaining meters are a mix of multi-jet and positive displacement meters from various manufacturers including AMCO, Rockwell/Sensus, Neptune, and Master Meter. OWASA's large meters are primarily turbine meters with single registers, although there are some compound (multiple register) meters in the system. OWASA has also installed approximately 8,400 Mueller Systems HotRod® AMR transmitters. OWASA's non-AMR meters have straight odometer-style registers that must be read manually.

In addition to age, OWASA's meter replacement program has been prioritized based upon safety concerns, accessibility difficulty, new construction, and labor efficiency improvements. AMR units are installed when meters are changed out and when new meters are installed. At OWASA's recent rate of meter replacement, it would take 12-14 more years to replace all the meters in the system with AMR/AMI capable meters. Moreover, meter replacement and AMR installation is not strictly tied to saturating existing meter reading routes. As a result, some meter reading routes contain a mix of visually read and AMR-equipped meters, which is less efficient than if routes were homogenous. OWASA has a number of AMR-equipped meters that are read manually because they are on manually read routes.

OWASA's normal meter reading methods typically provide a "snapshot" of the total registration on the meter, which when compared to a previous snapshot yields the total volume of consumption over the intervening period. Meters are currently read to the 1,000's place and customers are billed for use in 1,000 gallon units. Normal meter reading does not provide customers with any additional information. Human error occasionally leads to mistakes in some manual readings and potentially the related bills. OWASA's current meter reading methods, coupled with its existing customer service processes and policies, require numerous field visits for rereads, investigations, initiation and termination of service, collections, and other issues.

Many utilities around the country have implemented or are considering AMI technology as a way to improve the quality and efficiency of their meter reading, billing, and related customer service functions, and to support more sustainable management of their water resources. AMI uses a network of fixed data collectors to remotely read the meters throughout the service area. With AMI, meters are typically read hourly and the data transmitted to the utility's offices from one to several times per day, with this information available to employees and customers. AMI could enable OWASA to greatly increase the cost effectiveness of its reading, billing, customer service and collections processes while enhancing customer service and providing valuable information for distribution system operation and planning.

OWASA recognizes the potential benefits that AMI technology can provide, and is concerned that the current AMR system implementation strategy is likely not the most cost-effective or best long-term metering solution for the utility and its customers. As part of a strategic initiative included in the OWASA Board of Directors' *Strategic Plan for Fiscal Years 2014 – 2017*, OWASA decided to undertake a study of the feasibility of implementing an AMI system as an alternative to the current approach.

Following a qualifications-based consultant selection process, OWASA retained Don Schlenger and Associates (DS&A) to complete the AMI feasibility study. This report presents the study results, and includes a thorough analysis of the feasibility of AMI (taking into consideration the full costs and benefits associated with acquiring, deploying, operating and maintaining, and using a system) that addresses OWASA's current and future needs in meter reading, customer service and water use efficiency. The information presented should enable the OWASA Board and staff to understand the resources and factors critical to successful implementation, the business process and organizational changes that would enable smooth installation and realization of the potential benefits of the investment, and the risk factors associated with full-scale AMI and how to avoid or mitigate them.

This report evaluates the feasibility of converting all of OWASA's meters to AMI in a short period of time (perhaps one year), converting all of its meters to AMR or converting to an AMR/AMI hybrid system. It provides estimates of the capital requirements and the impact on net operating costs of key metering system alternatives over the next twenty years. The report also attempts to catalog non-monetary benefits and costs related to these alternatives, as well as risks and other procurement issues.

In preparing this report, the DS&A team interacted extensively with OWASA's managers and staff. This was accomplished through a series of workshops focused on the customer service and metering related business processes that would change with AMI. In addition, there was follow-up correspondence, discussions and work sessions. DS&A also considered the feedback and guidance received from the OWASA Board of Directors at the September 24, October 26, and December 10, 2015 Board meetings.

Section 3. AMR/AMI Technology and Its Benefits

Advanced metering systems provide information from water meters and other devices to a remote central location. Today's advanced metering systems available to OWASA are exclusively radio based. Decreasing costs and advances in encryption technology allow multiple devices to share common frequencies. Different radio based products operate on either licensed or unlicensed frequencies. A license covers the use of a specific frequency in a given area. The licensed band normally permits a higher power signal, which enables greater distance between the transmitter and receiver units. Unlicensed radio frequency systems operate under greater government-imposed frequency and power level constraints. Moreover, since the same band is shared by other applications (cordless telephones, security systems, etc.), specialized modulation and encryption techniques are incorporated in most unlicensed systems to minimize interference.

Advanced metering systems are typically characterized by the technology and reading method used to get the data from the transmitter at the meter, known as a meter interface unit (MIU)[1], to a nearby data collection unit (DCU); this is known as the "first hop." For example, if data is captured by a 900 MHz low-power one-way transmission from an MIU to a local fixed data collector, then that is used to characterize the system, regardless of how data collectors communicate with the utility's offices or with each other. It is the combination of technology (hardware and software) in the meter, the MIU and the network infrastructure that creates functionality.

3.1 Mobile AMR

AMR allows meters to be read from handheld or vehicle-mounted DCUs that are in relatively close proximity to the meter. Mobile reading systems can be cost effective for normal on-cycle meter reading. Data is retrieved from a handheld unit either by placing it in a data cradle or removing a storage device (typically a memory card). Data is typically retrieved from the mobile unit by a similar medium, or a laptop computer is connected to the mobile DCU in the vehicle to store the readings.

Normally, a vehicle-mounted AMR data collector can capture all readings within proximity of its antenna while driving at a rate of 25-35 miles per hour. The number of vehicle-mounted collectors needed is a function of how the driving routes are configured, the frequency of reads desired, the need for backup units, etc. Figure 1 depicts a typical mobile AMR receiver.

[1] Each manufacturer has its own name acronym for the MIU (e.g., MXU, NTU, MTU, ERT).



Figure 1. Mobile AMR data collector

3.2 AMI

AMI systems use fixed location DCUs and a communications network to transfer accumulated data from MIUs, located at the meters to a control computer at the utility's offices or the vendor's facilities. Meter readings, obtained as often as hourly from each meter, are typically sent to a meter data management system (MDMS), from which they may be accessed by the utility's customer information system (CIS) and other systems, and made available to customers through a web portal. Ancillary devices, such as acoustic leak detectors or remote controlled shut-off valves, may be connected to the MIUs. The components of an AMI system are shown in Figure 2.

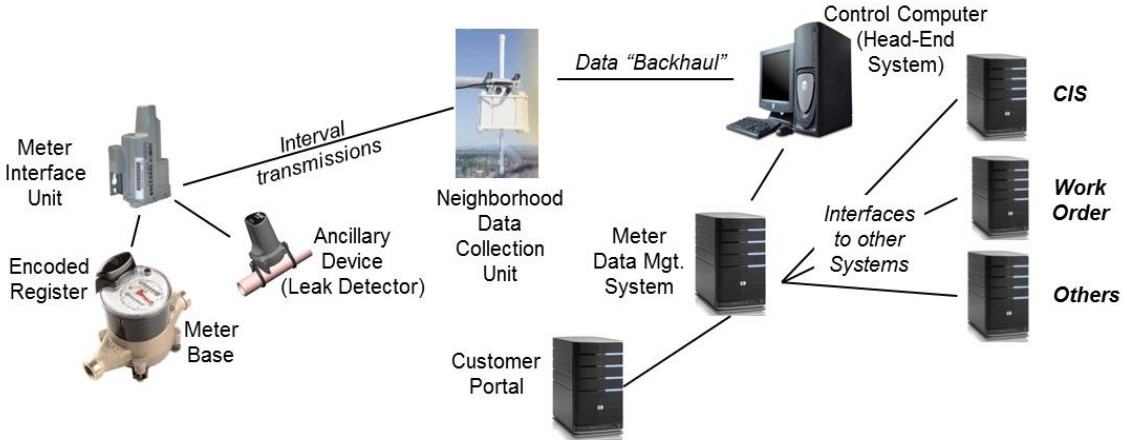


Figure 2. Advanced metering infrastructure components

While some AMR systems collect a single read from the MIU upon query from a nearby DCU, or simply when the DCU is within radio range proximity, many AMR systems and all AMI systems collect interval (e.g., hourly) data. The interval data may be synchronized (that is, all readings are taken at the same time).

AMI systems may be characterized as "one-way" or "two-way." Most AMR systems, such as the one used by OWASA, are "one-way" while many AMI systems may be characterized as

"two-way." One-way systems simply collect signals sent at intervals from the MIUs. Other sensors, such as acoustic leak detectors, can passively gather information and send it along periodically. Two-way systems are capable of sending signals from the control computer ("headend system") to the MIUs as well, enhancing functionality. For example, two-way systems enable the system to obtain "near" on-demand reads, as well as send control signals, firmware updates and time synchronization signals to the MIUs. Actuators, such as remote shut-off valves, behave in response to instructions sent from the AMI system's headend computer. Most of a water utility's needs for an AMI system can be provided by one-way systems providing frequent readings. However, two-way systems enhance some functions, such as "on-demand" reads.

3.3 AMR and AMI Deployments among Water Utilities

AMI systems tend to cost 10% to 20% more than AMR systems since the former require a fixed network of data collectors, more complex software and backhaul communications. The costs of MIUs for mobile AMR and fixed AMI systems have become nearly identical. AMR has higher operating costs, since meter readers must still drive the routes. While an AMR system can provide tamper and leak flags, and even consumption history, this information is obtained only when the meter reader drives by, or stops to upload data from a specific meter.

Because of the greater capabilities of AMI systems, and the decreasing cost differential between AMR and AMI, North American water utilities are increasingly choosing AMI over AMR. Between 2005 and 2014, sales of water AMI MIUs grew from less than one third to more than two-thirds of total units sold, and the percentage of meters on fixed AMI radios grew from 6% to 38%, as shown in the following two figures (Source: *The Scott Report on AMR and AMI Deployments*, 2015).

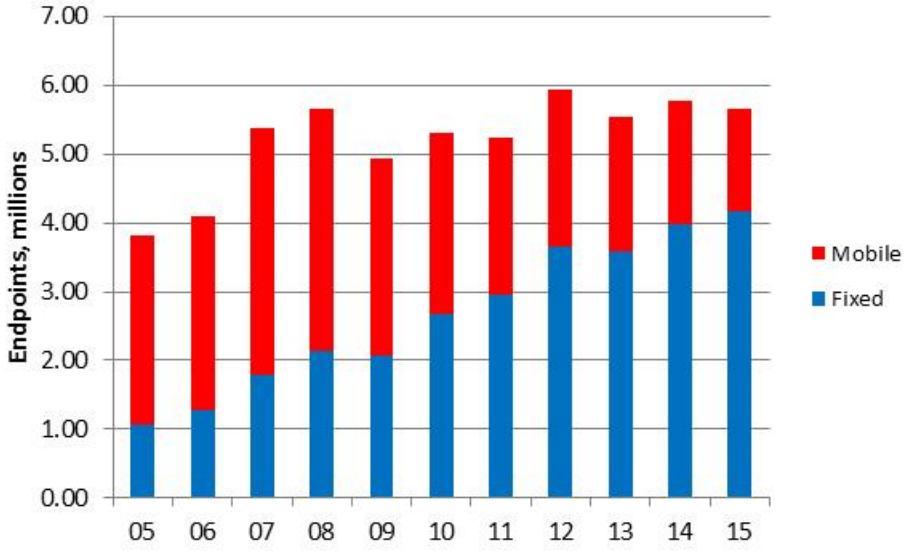


Figure 3. Annual shipments of AMR (mobile) and AMI (fixed) endpoints (MIUs) to North American water utilities

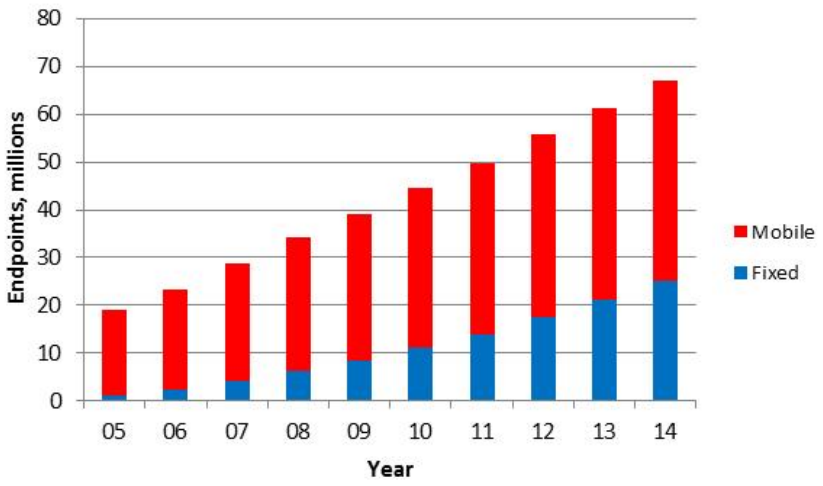


Figure 4. Numbers of AMR (mobile) and AMI (fixed) endpoints (MIUs) installed among North American water utilities

3.4 Benefits of AMI

The primary objectives for acquiring an AMI system would include reducing the cost and improving the effectiveness of its metering and customer service operations as well as improving customer satisfaction by streamlining and enhancing service. An AMI system would enable OWASA to accomplish these objectives by:

- Providing OWASA personnel with more detailed and timely information about what is taking place at customers' meters, including usage on inactive accounts and evidence of possible leaks and wastage. This information is generated close to when it occurs, as opposed to weeks later when the meter reader drives by with an AMR receiver or walks by with a handheld data entry device.

- Providing customers easy access to their consumption data through a web portal. This can reduce the volume of calls to OWASA Customer Service related to meter readings and concerns about high bills.

- Improving the effectiveness of OWASA customer service representatives (CSRs) in dealing with customers by providing them with detailed consumption histories and better analytical tools, so they can informatively discuss issues with customers, possibly resolving the concerns without costly field visits.

- Significantly reducing the number of visits made by OWASA field service personnel (Utility Mechanics), since many are related to reading verifications, requests for investigations, checking for consumption on inactive accounts, initial and final readings, and other issues related to meter readings and billing. With AMI, readings are automatically obtained by the system, as needed, without truck rolls.

- Reducing employee safety risks, as there would be far fewer truck rolls and vehicle miles driven, and there would be much less need for field personnel to enter large meter vaults.

- Enabling proactive customer service practices. For example, with AMI, OWASA could detect unusually high consumption that might be due to leaks or wastage and could notify customers before they get the bill.

- Improving cash flow by reducing arrears, bad debts and collection efforts, to the extent that these are caused by "surprise" high bills. Detailed consumption information could also potentially reduce the opportunities for customers to dispute bills.

- Reducing high bill adjustments, since with AMI customers can be held responsible for excessive consumption as soon as OWASA has identified it and notified them.

- Reducing theft of service by enabling OWASA to observe evidence of possible theft (tamper flags, sudden decrease in consumption between regular billing dates, etc.) and monitor accounts that have been shut off to ensure they stay off.

- Supporting more flexibility in meter reading cycles. For example, customers on fixed incomes could be offered the opportunity to be billed at the beginning of the month, since their reading and billing dates would not be constrained to geographic sequence. This might help reduce arrears.

- Helping OWASA more efficiently manage its meters. For example, by analyzing the consumption patterns through meters, the system could help identify meters that may be under-registering before normal change-out or servicing, or meters that may be oversized.

- Managing non-revenue water ("NRW") more effectively, by enabling the deployment of acoustic leak sensors in the distribution system, facilitating close-to-real-time comparisons of the water delivered to the distribution system compared to the water being consumed over the same time period, and streamlining the calculation of non-revenue water percentages.

- Helping OWASA monitor backflow. High resolution meters and frequent monitoring can detect small and large backflow events in real time. Small events might indicate marginal pressure problems or even main breaks. Large events might indicate problems that could affect distribution system water quality.

- Providing better demand data for improved forecasting, facilities planning, rate setting, etc.

3.5 Indirect Benefits

AMI can provide external and "softer" benefits, such as:

- Improving overall equity among customers by eliminating the extra expense to read, bill and service some customers at the expense of others.

- Helping OWASA detect distribution system losses sooner, thereby reducing the inconvenience to customers and the general public related to leak repair, the costs of leak repair, and the cost of treating and pumping non-revenue water. AMI supports more

sustainable water management, and can serve as the backbone for implementation of system-wide smart water and wastewater utility monitoring and control technologies.

- Reducing traffic congestion and greenhouse gas emissions from OWASA's vehicles by reducing the number of required field service visits.

- Increasing job satisfaction among OWASA staff by providing them with continuous, current information that should enable them to be more insightful, proactive, productive and effective.

- Increasing the confidence of customers and other stakeholders in OWASA and its operations, and enhancing OWASA's public perception.

Section 4. Alternative Metering System Strategies for OWASA

OWASA is currently deploying HotRod AMR devices in conjunction with meter changeout for age and failure at a rate of about 1,000 per year. At the time this report was prepared, there were about 13,000 meters still without AMR MIUs. Therefore, under OWASA's current strategy (referred to hereinafter as "Alternative 0"), it will saturate its service area with AMR after about 13 years. The HotRod MIUs are expected to last 15 years, so during this 13-year period it will also have to replace older MIUs. While this approach enables some economies of scale in installing AMR units in conjunction with meter changeouts and avoids the "disruption" of a large-scale deployment project, it creates inefficiencies in meter reading and customer service associated with mixed meter reading methods on meter reading routes, results in some customers being provided a different level of service (e.g., the ability to obtain detailed consumption profile data) than others for many years, and puts OWASA in the mode of perpetually installing AMR equipment.

Based on the data provided by OWASA staff, the results of employee interviews during the study, further discussions with OWASA managers and the OWASA Board of Directors, as well as DS&A's own experience, three alternative metering system scenarios were identified for evaluation. Each scenario has certain advantages and disadvantages, benefits and costs.

4.1 AMR Deployed throughout OWASA's Service Territory

OWASA would deploy an AMR system throughout its service territory (Alternative 1), either a new system (Alternative 1a) or its current HotRod system (Alternative 1b). Existing AMR/AMI-compatible meters would be left in service. Newer manually read meters would have their registers replaced with AMR/AMI-compatible encoder registers (see Figure 1). Older manually read meters would be completely replaced. The advantages of this option are:

- It would require no network of data collection units, nor the cost of installation, operating and maintaining those units
- It would require little or no additional software development to interface to OWASA's billing system
- It would require no additional staff, and could reduce the number of meter reading positions and their expense
- It would provide some additional data for OWASA customer service staff and customers, since historic data could be retrieved on-site from meters in the field, as needed.

The disadvantages of this option are:

- An AMR system would provide no real time information, such as leak or tamper detection, and would do little to enhance customer service, such as averting high bills. OWASA would still be dealing with "after the fact" reactionary rather than proactive customer and meter management.

- OWASA staff would still have to drive routes and make field visits for billing and off-cycle meter reads.

Completing the HotRod deployment as opposed to acquiring a new AMR system would avoid prematurely scrapping AMR radios, and would have lower capital costs. Replacing the existing system with a new one in a short time period will capture economies of scale and ensure a uniform age and version of components, but will become part of capital spending and will entail retiring some existing assets prematurely. Some major brands of AMR equipment are convertible to AMI should OWASA later decide to install a fixed data collection network and software.

A mixed system consisting of two different (and incompatible AMR technologies) is generally inferior to a homogenous system. A system deployed over several years results in a poorer payback period compared to deploying a system rapidly (that is, in one year or less). This is because of better price points with larger component order quantities, economies of scale in installation mobilization, and capturing savings sooner.

4.2 AMI Deployed throughout OWASA's Service Territory

OWASA would deploy AMI throughout its service area (Alternative 2). This would require deploying a set of fixed data collectors, as well as more sophisticated software (a meter data management system and customer portal), and integrating these systems with OWASA's CIS and Geographic Information System (GIS). New MIUs would be required. Software deployment and integration as well as network installation would probably take six months, and field deployment twelve months. OWASA's meters would be upgraded similarly to the AMR scenario. This option would provide all the benefits of AMI enumerated in Sections 3.4 and 3.5.

The disadvantages of this option include:

- It is the most expensive of the alternatives.

- It requires the highest level of effort on the part of OWASA staff to integrate the system with OWASA's other IT system, adopt new customer service processes and policies, and operate the system.

- It requires more OWASA employees be reassigned to other functions and vacant positions.

4.3 AMI Deployed over a Portion of OWASA's Service Area; AMR Elsewhere

OWASA would deploy a limited AMI network covering the meters of the UNC main campus and medical institutions as well as the Chapel Hill/Carrboro central business district (Alternative 3). This network would encompass most of the high cost-to-read water meters as well as meters of many (student) rental housing units, which tend to require more field visits by OWASA service representatives. The remaining meters not covered by this network would be converted to AMR. The advantages of this option include:

- It captures the benefits of AMI in the most meter-dense part of the service area, where there are the greatest ratios of meters to DCUs.

- It captures the benefits of AMI for the vast majority of OWASA's vault meters, which require two-person reading crews and are more expensive to read, and for many of OWASA's service locations that involve the highest customer service cost (for example, high turnover properties).

The disadvantages of this option are:

- AMR MIUs are similar in cost to AMI MIUs, so customer service benefits and operational efficiencies would go uncaptured at no great savings.

- OWASA would be providing two different levels of service to customers.

- Business processes for CSRs and Utility Mechanics could be confusing.

Section 5. Potential Impact on Customer Service Operations

As with most water utilities, OWASA routinely performs several customer service functions that involve a visit to the customer's premises to read the meter as well as perform other functions. The key processes include: on-cycle reading for billing, move-outs and move-ins (that is, final reads and terminating and initializing service for a customer at a location), billing disputes, and delinquencies. With an AMI system, OWASA would have a meter reading from each customer's meter from one to several times per day, thereby enabling it to revise its procedures, reducing calls to customer service, field visits and clerical time. It could improve its responsiveness to customers and resolve issues faster by providing timely information. It could reduce some customer problems, such as "surprise" high bills.

5.1 Meter Reading for Billing

OWASA's small meters are typically housed in below-grade polymer or concrete meter boxes. Large meters are typically either housed below-grade in concrete vaults, located inside buildings, or installed above-ground. All meters are read monthly by six meter readers, and about 5% must be reread due to abnormal readings or customer requests. OWASA uses handheld and vehicle-deployed Mueller EZReader® devices for AMR meter reading. OWASA uses a Cogsdale Corporation customer service and utility billing system.

A small percentage of reads cannot be obtained by meter readers, because the meter can't be located or the meter is blocked from visual or AMR read. There is a 9-10 day interval between when meter readings for billing are obtained and when the bills for those readings are generated. During this period, OWASA's billing clerks run routines in the billing system to flag accounts with consumption significantly greater than last month's or last year's consumption. Where there are large variances, they will create service orders for Utility Mechanics to re-read the meters and leave high consumption door tags at the customers' premises. The billing clerks will also run an application on OWASA's PhoneTree interactive voice response (IVR) system to call these customers about high consumption.

OWASA's billing clerks also run a report to identify accounts designated as "Vacant" that have water use. These are used to generate service orders for Utility Mechanics to hang a blue disconnection warning tag on the customer's premises. If the customer whose premises was tagged with the disconnection warning doesn't respond by the next day, the billing clerk will create a disconnect service order to shut off the service.

Once the bills are computed, billing clerks will review very high and low bills. They can hold individual bills until a reread service order is completed. Reread service orders may be issued if the previous and current bills are estimated, the previous read was very low and the current read is unusually high, or for other anomalies.

With AMI, the number of skipped reads and rereads should be substantially reduced. With AMI, there is virtually no chance that the meter would have been read incorrectly. The pre-bill audit processes can be streamlined and made more effective, and the workload volume reduced. There is little reason to reread the meter before billing, unless the consumption or the bill was absurdly

high. Reading dates can be moved closer to billing dates. With AMI, high consumption can be monitored for all accounts on a continuous basis by the MDMS, and customers notified as soon as high consumption is detected, as opposed to after the reading for billing (which could be many days after the occurrence of high consumption) which would result in a high bill. The number of bills that are kicked out for review can be reduced since the number of situations that would create a high bill in the first place would be reduced.

With AMI, the IVR high consumption notification process would be tied to the high use detection algorithm in the MDMS. OWASA should ensure that customers realize they are responsible for providing current contact information (telephone number, cellphone number for text message or email address for email notification) to enable OWASA to notify them of leaks or high consumption. With this process in place, there is little reason for Utility Mechanics to tag houses about high consumption.

With AMI, detecting usage on vacant accounts doesn't have to wait until the next normal reading cycle. The AMI MDMS can flag the account after a set number of days, catching these situations and enabling OWASA to respond sooner.

If OWASA decides to implement AMI, it should consider adopting a policy that customers are responsible for providing up-to-date contact information so that OWASA can notify them of a leak or high consumption; for customers that don't provide it, OWASA might choose to have a policy of not adjusting a subsequent high bill for which OWASA provided prior notification.

With AMI, OWASA could notify customers of leaks and high bills following the process suggested in Figure 5 and Figure 6. A potential process for handling consumption-related billing disputes is shown in Figure 7.

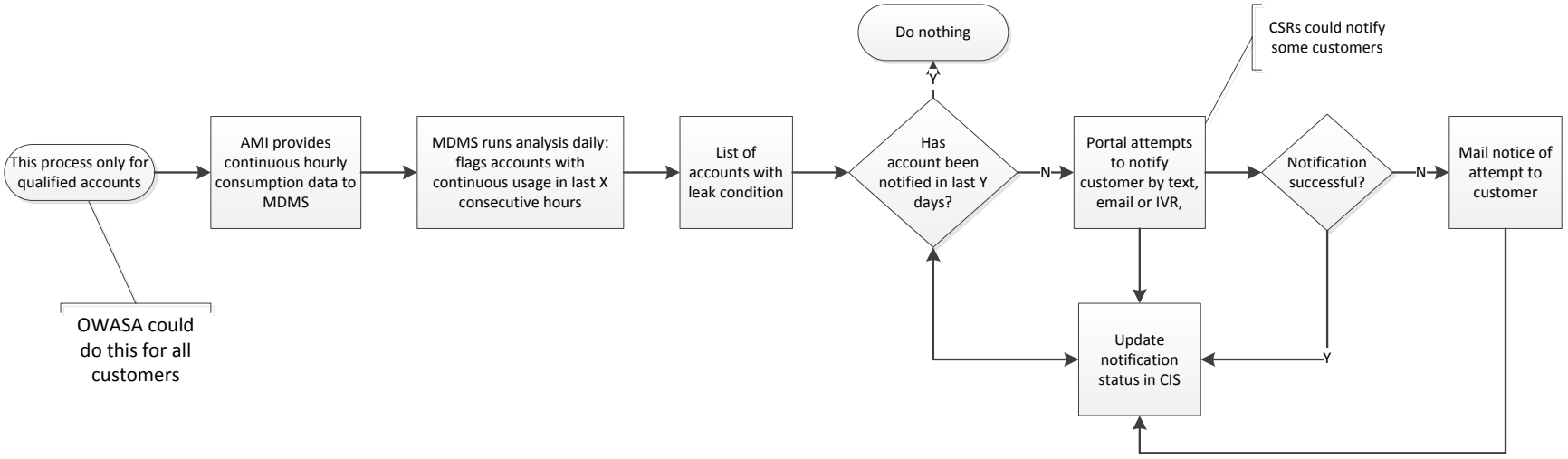


Figure 5. Suggested leak notification process with AMI

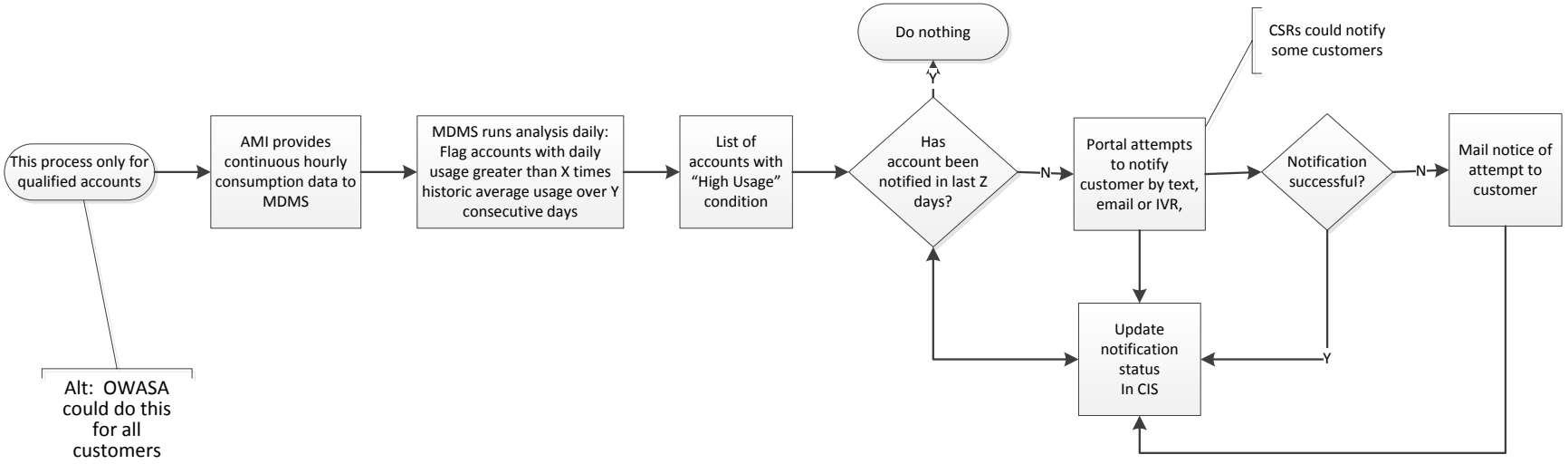


Figure 6. Suggested high usage notification process with AMI

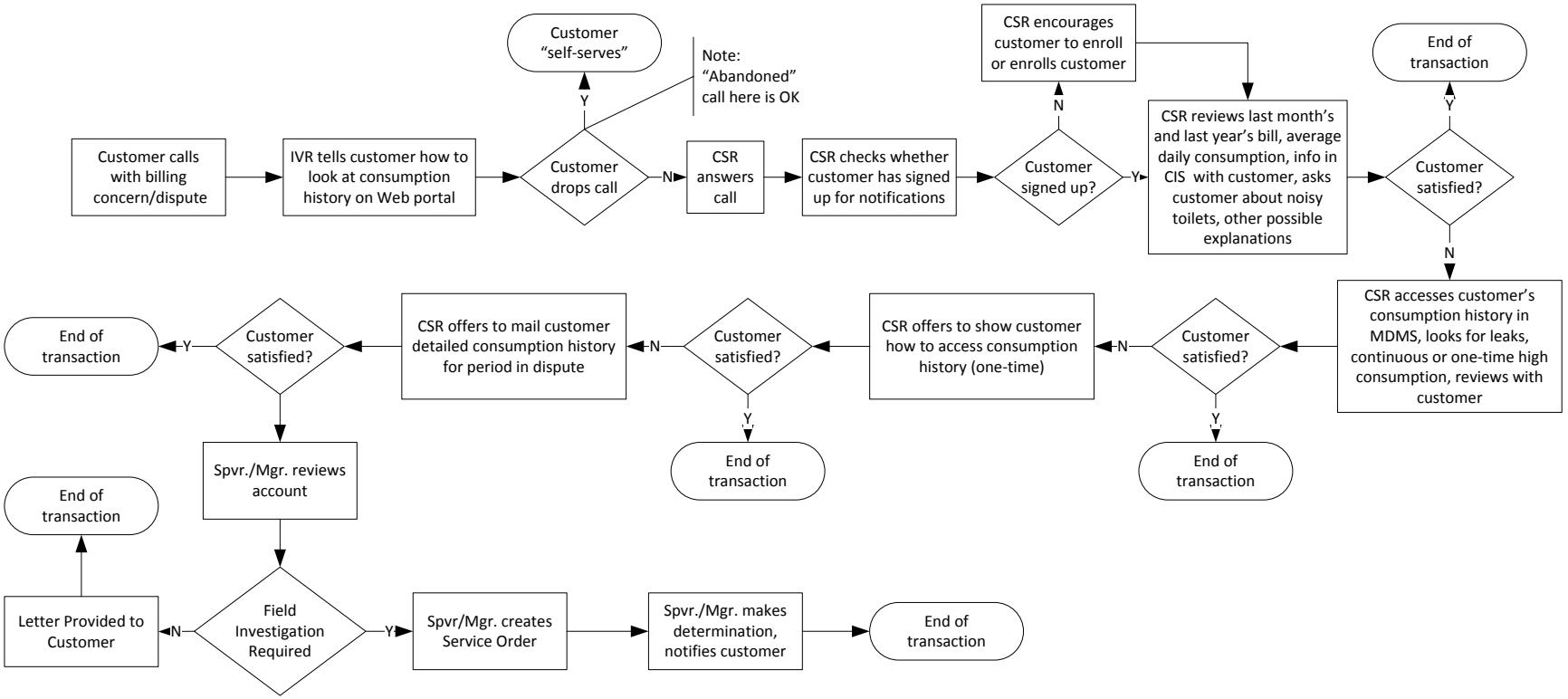


Figure 7. Suggested consumption dispute call scenario with AMI

5.2 Transfer of Service

OWASA handles about 3,000-3,500 requests to connect service per year (about 15% of customer accounts, which is a high percentage compared to other water utilities). The number of requests per month can vary by a factor of 5. This is not unusual considering OWASA serves a large college community with a highly transient customer base.

Generally, in every case where OWASA has a disconnection order but no corresponding order to start a new account at the same location for a different customer, the service would be shut off. When OWASA sets up a move-in customer account, it ends the previous customer's account, updates the move-out customer's billing address details, issues a final bill and collects a payment as needed. A transfer of service when OWASA has information about both the move-out and move-in customers triggers a service order to read the meter.[2]

Without an application from a new customer, the water service is transferred to "Vacant" status when the move-out customer terminates service. When the property is in Vacant status, no monthly service charge is collected. OWASA still reads the meter on its normal schedule to check for theft or to deal with the customer that has moved in and failed to call. OWASA obtains a report from the billing system that identifies usage on Vacant accounts. If there has been usage, an OWASA Utility Mechanic will go back out and shut-off and lock the meter service.

When a customer applies for service, the CSR sets up the account and creates a service order to turn on the service. A Utility Mechanic will read the meter, turn on the service, and wait to be sure there is no water running through the meter. If the meter flow indicator is not moving, the Utility Mechanic checks the meter box, makes notes of any issues, and closes the service order. If the meter flow indicator is moving, the Utility Mechanic knocks on the door. If there is no answer, the Utility Mechanic turns the service back off and leaves a tag on the door telling the customer to call the Customer Service Office. When the service order is returned, the CSR enters the reading in the CIS. Closing the service order transfers the service to the new customer from either the account of the move-out customer or from Vacant status.

In cases where the old customer was a tenant, the service might be transferred to the account of the property manager/owner if OWASA has a property management agreement on file indicating that the property manager wants the service kept on.[3] Otherwise, the account is disconnected. In cases where a tenant moves out and OWASA is not informed, the bill may go unpaid. The service will eventually be transferred to Vacant status and a shutoff service order created.

In FY 2015, a total of 3,725 "Transfer and Connect" service orders were generated, requiring field visits. Customer Service also generated 814 "Disconnect" service orders and 1,162 "Just Connect" service orders issued. There were about 2,240 service orders for obtaining transfer meter readings without the need for service disconnect.

[2] If a customer calls and says, "I've already moved in," OWASA would bill the new customer from the last regular reading obtained.
[3] OWASA has about 1,000 such agreements.

Under OWASA's current policy, monthly service charges do not apply during periods when an account is in Vacant status. As a result, OWASA loses about $178,000 per year in service charge revenues from services that were transferred to Vacant status.

AMI would allow OWASA to significantly streamline the move-out/move-in processes. With AMI, OWASA would be able to eliminate most of the service orders to obtain transfer readings. CSRs would save time creating service orders and entering the data from completed service orders into the billing system. Instead, they would simply request a reading from the AMI system for a particular date. OWASA could pass these savings onto customers through reduced charges for transferring services. Figure 8 suggests a potential new transfer of service process.

For situations where a customer wished to terminate service and OWASA does not have information about an incoming customer, it could leave the service on for several days, particularly during the busy student housing turnover season, since it would have a meter reading every day. If no one requested service initiation at that address, after a period of time, a Utility Mechanic could then shut the water off.[4] Using this approach, OWASA could eliminate a significant percentage of the "just disconnect" service orders.

Taking advantage of the AMI system's ability to provide daily readings, OWASA could tighten its policies on allowing customers to vacate an account. For many utilities, as long as service is being delivered to the property, the owner of the property is responsible for all charges, including any applicable fixed monthly charges. If it adopted such a policy, OWASA would be able to assign responsibility for the charges before and after a transfer of service based on the meter reading on the day the property ownership changed (that is, when the deed was recorded). With this policy, OWASA would be able to eliminate many "just disconnect" and "just connect" service orders. The service would be left on unless a customer specifically wanted it turned off, and a service disconnect/connect fee covering the cost of the field visit could be charged. Neither the old nor new customers would have to worry about being charged for water for which the other party was responsible. Taken together, these policies could reduce OWASA's loss of service charge revenues, as well as the CSR time required for these tasks.

Some utilities require a landlord-tenant agreement for all situations where the landlord wants the tenant to pay the bill; the landlord is responsible for the bill if the tenant moves out without paying it. Having tenants pay the bill for the water and sewer service they receive helps them better understand the value and cost of those services, and provides a financial incentive to use water wisely. However, since tenants do not own on the property, landlords are responsible for fixing leaks and plumbing problems, with the expectation that tenants will provide the landlord with timely notification of a leak or potential problem with their water service. With AMI, OWASA could provide both the tenant and the landlord leak and high usage notification alerts in close to real time.

[4] During the winter months when there is a possibility of freezing water lines, OWASA could revert to the "immediate shut-off if vacant policy."

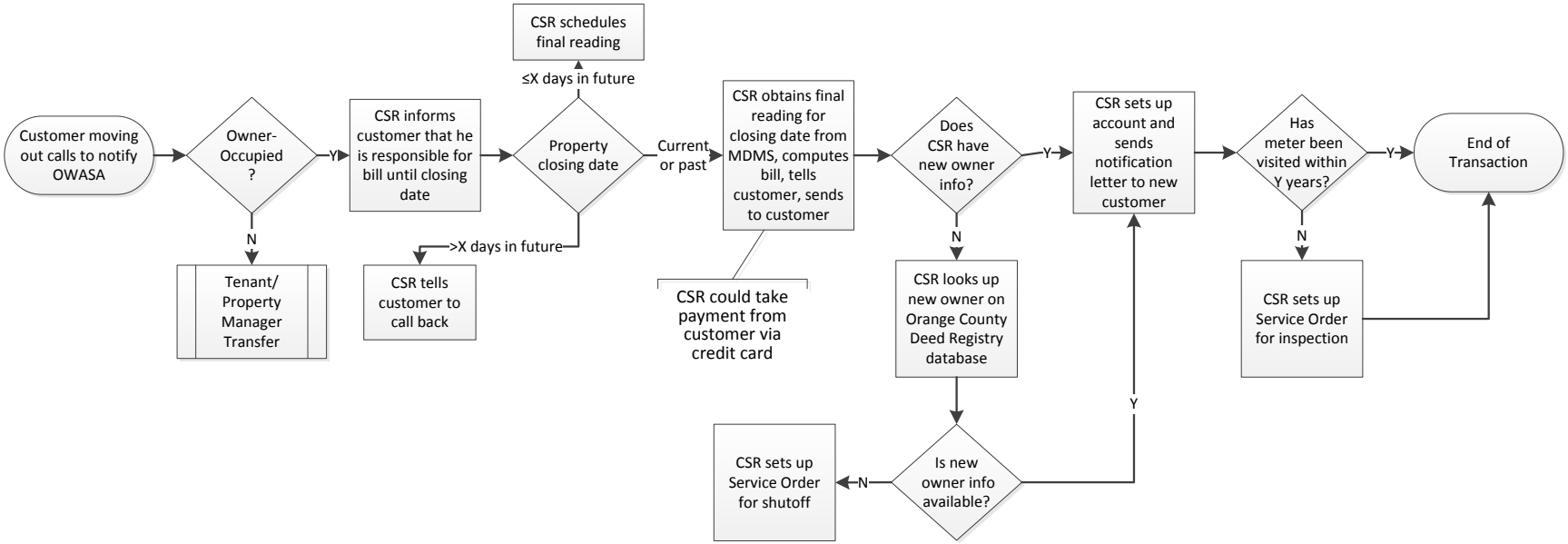


Figure 8. Suggested transfer of service process with AMI

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5.3 Arrears, Shutoffs and Collections

For accounts that go into arrears, OWASA commences a dunning, shut-off and collections process. OWASA starts by sending a late payment reminder notice, and The Customer Service Staff regularly runs a collections processing report in the CIS of accounts in arrears. A CSR then creates a file for the IVR system, which calls the customer on the same day that a late payment reminder notice is mailed. Usually this generates the greatest response from customers. Many customers pay their past due balance upon receipt of the notice.[5] If the customer's telephone number is not in service or OWASA doesn't have it, the receptionist will research the account and try to contact the customer.

About 175 collections notices are generated for each bill cycle. OWASA performs almost 100 disconnects per month. If a customer pays the outstanding amount, the account will be turned back on the same day. If the customer pays before the Utility Mechanic arrives at the location, the service order is canceled and the water is not disconnected; however, the customer still incurs a service charge. Restorations of service are usually performed during normal business hours. OWASA dispatch personnel at the water plant can pull up a report to tell a customer who calls after hours what they need to pay to get turned back on, and what it would cost to get water turned back on after hours.

If the arrears are not resolved within 7 days after shutoff, the account is "finaled," and another service order is issued to read the meter. OWASA Utility Mechanics make about 75 field visits per month to monitor meters for accounts where the water service is still shut off. If the Utility Mechanic finds the water turned on, he will shut off and lock the service. However, the Utility Mechanic doesn't have a meter reading from the time the water was shut off, as it is not posted to the billing system or CityWorks, so he doesn't know if there was water use. If OWASA Customer Service determines there is usage on a vacant or shutoff property, a Utility Mechanic has to go out again to disconnect and lock the meter.

The Bad Debt Collections process starts after 90 days. Bad debts are turned over to collection agencies. Annual write off of uncollectible revenue is around $50,000.

In the case of a tenant who doesn't pay the bill, the tenant may still be in residence and the landlord may not want to be responsible for the water use, so any property management agreement (making the owner or property manager responsible for paying the bill) does not kick in. When a tenant is evicted, the property owner must notify OWASA.

With AMI, OWASA could notify customers of high usage before they received a high bill they could not afford to pay. However, high bills are probably responsible for 10% or less of arrears and collection activities.

With AMI, once a service was turned off, OWASA could monitor it every day without the need to send a Utility Mechanic out to read the meter. OWASA would know about the water usage as

[5] If a customer is having difficulty paying the bill, OWASA offers Deferred Payment Agreements and offers suggestions of local agencies who may offer emergency assistance.

soon as it occurred. This might reduce the number of field service truck rolls. If there was water use, someone would still have to go out to shutoff and lock the service. If it had the reading from the time of shutoff, OWASA could hold the occupant responsible for paying for that usage.

5.4 Impact on Staffing

As a result of deploying AMI and implementing most of the business process changes discussed above, OWASA would be able to reassign six Utility Mechanic positions that are responsible for regular meter reading, as well as one crew chief position, to other functions or vacant positions. In addition, it could save about a third of a full-time equivalent (FTE) among the Utility Mechanic positions responsible for rereads, investigation and collations efforts, as well as maintenance of the AMI system. This allows for periodic inspection of meter settings that have not otherwise been visited for any reason with a couple of years.

Because of the reduced workload, OWASA could be expected to reduce the number of positions in Customer Service by one.

As is the common practice among utilities that have implemented AMI, OWASA would handle these staffing changes by reassigning staff to other functions and existing or future vacant positions, as well as normal attrition. These changes would not be expected to occur until the project has been largely completed.

Should OWASA decide to deploy AMI, DS&A recommends that it hire an additional person who would serve as AMI System Manager as well as Business Analyst. This person would be responsible for

- the operation of the AMI system to ensure it performed to expected levels, including routine software and database maintenance
- training and mentoring OWASA staff in the use of the AMI system information
- developing simple applications and reports from the MDMS
- tracking and analysis of customer service performance metrics

Should OWASA deploy full-scale AMR, it could be expected to save two Utility Mechanic positions. Under the hybrid AMI/AMR scenario, it could be expected to save four Utility Mechanic positions.

Section 6. Benefit/Cost Analysis of Metering System Alternatives

Economic benefit/cost analyses were developed in Excel for four metering strategy alternatives to OWASA's current practice of continued gradual AMR HotRod deployment and manual reading of non-AMR meters. These are:

- Alternative 1a: Rapid deployment of mobile AMR technology throughout OWASA's service area. This approach would replace the existing HotRod devices installed on nearly 8,400 meters with MIUs that could be converted from AMR to AMI if an AMI infrastructure is deployed in the future. This alternative also includes the costs of retrofitting existing newer meters with AMR/AMI-compatible registers. The estimated costs of installing new AMR hardware and software and interfacing it to the CIS are included.

- Alternative 1b: Rapid deployment of the existing Mueller HotRod technology to the remaining nearly 13,000 meters currently read manually. (The HotRod AMR technology cannot be converted to AMI.) Existing meter reading hardware and software is assumed to be used, although another mobile DCU is added.

- Alternative 2: Rapid deployment of AMI throughout OWASA's service area. The estimated cost of installing the headend software, a MDMS and a web-based customer portal, and integrating those applications to the Cogsdale CIS, are included. The model incorporates calculations for OWASA-owned and operated software as well as vendor hosted and managed software.

- Alternative 3: Deployment of a limited AMI network covering the meters serving UNC and UNC Health Care facilities on the main campus, as well as the Chapel Hill/Carrboro central business district. The remaining meters not read by AMI would have new AMR technology installed. The total number of meters that would be read by AMI would be nearly 5,400, including most of the high cost-to-read meters. The remaining nearly 16,000 meters would be read by AMR. As with the rapid deployment of new AMR technology, AMR devices deployed under this scenario could be converted to AMI in the future. The estimated cost of installing the headend software, a MDMS and a web-based customer portal, and integrating those applications to the Cogsdale CIS, are included. The estimated costs of installing new AMR hardware and software and interfacing it to the CIS are included in this scenario.

Appendix A contains meter tables that show how the above-mentioned meter quantities were determined. Each scenario assumes that all Rockwell, Sensus and Master meters up to 2″ diameter and any other meters up to 2″ diameter installed prior to 1999 would be replaced (about 7,100 meters). Of the remaining approximately 14,200 meters, about 8,400 are AMR/AMI capable, and about 5,800 would be retrofitted with new registers. This approach aligns somewhat with OWASA's long term meter replacement strategy of having meters in the field that fall within a 20 year life.

The economic models were designed to easily facilitate examination of different strategies and facilitate changes in assumptions (for example, unit prices of components, and changes in project duration). The models incorporate several tables for capital costs, operating and maintenance costs, staffing and other savings, cash flow and savings projections over the planning horizon, and return on investment calculations. Key assumptions and highlights of the analysis for full AMI deployment are presented in the following paragraphs. The tables for full-scale AMI deployment (Alternative 2) themselves are in Appendix B.[6] Differentiations between the AMI scenario and the other three scenarios are noted where appropriate. All costs are in current (2015) dollars, with adjustments for inflation in future years.

The economic model assesses hard costs and benefits that can be quantified in monetary terms. Operational savings in meter reading, call center operations, billing and field service are incorporated, as are OWASA's avoided costs for ongoing implementation of a meter replacement/HotRod installation program (because the AMI contractor would have performed this work, and at the conclusion of the project all the meters would be relatively new).

6.1 Meter Populations with AMI

Table B1 of the AMI model identifies by size and type the meters that would be replaced, retrofitted with a new AMR/AMI-capable register, or that are already AMR/AMI capable. It is assumed that the 3-conductor wiring between the meters currently on AMR and the existing HotRod MIUs can be reused, thus saving the cost of a new register. For all meters not currently on AMR, it is assumed that the existing meter box lid will be replaced with a new composite to minimize RF signal blockage.

The quantities of meters replaced, retrofitted or left alone would be the same for each of the technology alternatives being evaluated.

6.2 Meter and MIU Costs

Tables B2 and B3 show the cost of the major AMI system components. Total endpoint and meter costs (Table B2), including MIUs, registers, replaced meters, and composite lids, are estimated to be about $2,170,000. For AMI, all approximately 21,300 meters will have new a MIU installed. All meters except compound meters have one register, and need an MIU with one "port" to connect to the meter register. Some manufacturers offer a two-port MIU to handle compound meters for a marginal additional cost. The unit costs for meters, MIUs and lids are extrapolated from recent bids at other utilities, conversations with vendors, unsolicited proposals to OWASA, and DS&A's experience.

Of the other alternatives, the only scenario with a different set of values in Table B2 is the AMR scenario in which existing HotRod MIUs are used. This results in 8,400 fewer MIUs being purchased during implementation.

[6] The economic analyses tables for the other scenarios have been provided to OWASA.

Table B3 presents the expected meter, lid and AMI endpoint installation costs, expected to total about $880,000. Recent bids at utilities similar in size to OWASA were used to estimate unit prices.

The only scenario with a different set of values in Table B3 is the AMR scenario in which existing HotRod components are used. This results in 8,400 fewer MIUs being installed during implementation.

6.3 Avoided Costs Associated with OWASA's Existing Program

Table B4 estimates the costs that OWASA would avoid by not replacing meters for age and other reasons for ten[7] years following the start of the AMI project, as well as not replacing HotRod MIUs which would exceed their expected battery lives during that period. These items would otherwise be replaced by an installation contractor as part of the AMI project, and all new MIUs would have an expected life in service of 15 years.

Should OWASA decide not to implement AMI or a rapid deployment of AMR, it is assumed to continue its program of changing its meters for age and converting them to AMR at a presumed rate of about 1,000 meters per year. The meters that would be replaced first under this program are assumed to include the approximately 7,100 meters that would be replaced as part of an AMI or rapid AMR implementation. Another approximately 3,000 of OWASA's manually read meters would have been converted under OWASA's program over the following three years. The cost of composite lids would also be avoided. These meters would be converted to Mueller HotRod AMR, bringing the total of meters on HotRod to about 18,400 by 2026/2027. (OWASA's remaining 2,900 meters would be converted after the ten year period, and are not included in the cost offset calculation.)

HotRod MIUs are expected to have a life in service of 15 years. Therefore, were OWASA to continue with its meter replacement and AMR conversion program, approximately 2,440 HotRod units would have to be replaced at some point during the ten year period following the date an AMI project would have started, at a total material and labor cost of about $244,000.

With a new system, OWASA would also avoid additional capital outlays for HotRod meter reading equipment. Unit costs for meters, registers, other equipment and installation are based on what OWASA is currently paying and its estimates of labor costs. Total avoided costs over the ten year period under these assumptions would be about $2,465,000. For the economic analyses, these costs are assumed to be distributed evenly over the period.

Tables B4a and B4b show the quantities of meters and HotRod MIUs that OWASA would not have to replace should it decide to implement AMI or a new AMR system, based on the age distribution of OWASA's existing meters and MIUs.

The rapid deployment of HotRod AMR units entails less avoided cost, since replacing older HotRod MIUs would then be part of OWASA's HotRod system maintenance cost during the 15-

[7] Even though new MIUs should last 15 years, a ten-year savings offset period is used to account for the fact that AMR technology may change earlier than that, and might OWASA replace its HotRod system sooner.

year economic evaluation period. Total cost avoidance in the HotRod AMR rapid replacement scenario would be $1,950,000 or approximately $195,000 per year.

6.4 Salvage on Replaced Old Meters

Table B5 presents the salvage value that the replaced meters are assumed to have in the metals recovery market. The dollar values used are based on recent proposals from other AMI and AMR projects. They could change in the future based upon metal pricing at the time of implementation. Any salvage value obtained would be used to offset the new meter cost.

6.5 Network Hardware, Software and Vendor Project Management Costs

Table B6 presents the implementation cost to deploy an AMI network (DCUs and repeaters), hardware cost to program equipment in the field, a mobile collector to read meters on the network fringe or if the network should be down due to loss of power or other conditions, software and hardware associated with the fixed network headend, a MDMS, a customer web portal, and integration of these to the Cogsdale billing system.

The AMI scenario assumes an 18 month implementation. Estimated vendor project implementation cost (labor and expenses) as well as training for OWASA staff has also been included in this table. Total vendor project implementation cost for AMI is estimated to be about $1,475,000. Opting for vendor-supplied managed and hosted software services might enable OWASA to reduce these capital costs by about $200,000 while slightly increasing its annual operating costs.

For the Hybrid AMI/AMR scenario, the total network, hardware, software integration and vendor project management costs are estimated to be about $1,250,000, because fewer DCUs and repeaters would be deployed.

The two scenarios evaluating AMR rapid deployment differ from AMI because (1) a shorter time period is required to prepare for deployment, reducing the overall project length from 18 months to 15 months; (2) there are no network hardware costs; (3) software cost is limited to installing a more robust headend control system (in the case of a new AMR system).

Table B7 presents OWASA's cost to support the AMI project, consisting of staffing, vehicles, community engagement, legal, purchasing, and consulting assistance. The total cost is estimated to be about $800,000. The AMR scenarios have lower OWASA cost due to the shorter duration and lower legal, consulting, and community outreach costs.

6.6 AMI Operation & Maintenance Costs

After installation, AMI components will require routine maintenance, and a small percentage of the installed devices can be expected to fail each year. Table B8 addresses certain annual service costs to operate the AMI system. Communications between DCUs and the AMI headend system are typically operated over a cell phone network, entailing monthly communication fees. Essential AMI software requires annual service and licensing fees. Hardware servers need to be

replaced every few years. DCUs and repeaters may be powered by AC (assumed in the model) or solar panels. Operating costs are expected to be around $110,000 per year.

The Hybrid AMI/AMR alternative would have slightly lower operating costs since less network equipment is deployed. AMR system operating cost is lower due to less software maintenance, and no network equipment. The labor cost for driving AMR meter reading vehicles is already accounted for in staffing savings.

Table B9 reflects the cost associated with the failure of system components, including encoded register meters, wiring, handheld programmers, MIUs and DCUs, as well as normal DCU battery replacement. Some components such as DCUs could be covered under maintenance agreements with the vendor; however, some utilities purchase spare DCUs. MIUs are typically covered by extended warranties, with full-cost replacement during the first ten years and pro-rata replacement during the next ten years. Total labor, materials, and incidentals to maintain the system are expected to cost approximately $41,000 per year. The other scenarios have slightly lower maintenance costs due to fewer network components.

6.7 Staff, Vehicle and Other Cost Savings

AMI implementation will enable savings in staffing costs, as discussed in Section 5.4. The day-to-day office-side operation of the AMI system for regular periodic billing is not dissimilar from the operation of OWASA's current handheld meter reading system and would continue to be handled by a billing clerk or CSR. With AMI, OWASA should add a full-time position responsible for AMI system operation and management, business analysis, application development and user training. Table B10 presents the anticipated net annual staffing cost savings, which is estimated to be approximately $350,000 once the system is completely deployed.

Anticipated savings would be lower for the other alternatives since less data and automated functions would be available to support customer service functions, thus requiring more truck rolls and larger staff to respond to actual and/or perceived issues.

Estimates of vehicle and other cost reductions are shown in Table B11. Annual vehicle costs include depreciation, operating and maintenance. Vehicle count is tied to staffing; OWASA could reduce its fleet by seven Utility Mechanic vehicles with AMR. Reduction in vehicle costs leak adjustments, lost revenue due to theft and tampering, and bad debt write-off are estimated to total about $125,000 per year.

6.8 Under-Registration Recovery from Meters

Table B12 calculates the revenue to be recovered from replacing old meters with new meters as part of an AMI project. OWASA tested a sample of its older small meters and found that the meters had not appreciably lost any accuracy. Based on OWASA's water sales and production numbers, meter performance testing results completed before and for this study, and the expectation that many of OWASA's existing meters will continue to be used regardless of the scenario selected, there is very limited potential for increased water sales associated with any of

the alternatives evaluated in this report. Therefore, for the purposes of this analysis, the models conservatively assume no recovery of under-registration from the replacement of meters.

6.9 Multi-Year Discounted Cash Flow Analysis

Table B13 summarizes the cost and projected savings before applying contingency, inflation and spreading these costs over the planning horizon. The total capital cost of the AMI system net of salvage, and before adding a 5% contingency, would be about $5,700,000. The salvage value of replaced meters, and discontinuance of the current meter replacement and future HotRod MIU replacement reduces the net project cost to about $3,200,000. Annual O&M cost for the AMI system is estimated to be about $150,000. Net annual savings is estimated to be about $325,000 per year, resulting in a simple payback (net project cost divided by net annual savings) of about 10 years.

Tables B14 through B19 support the calculation of discounted cash flow, net present value, and internal rates of return for 15 and 20 year planning horizons. For the purposes of computing net present value and internal rate of return for the project, all capital costs are increased by a 5% contingency factor. Any labor related costs and savings are assumed to inflate at 2% per year. A multi-year installation period results in a "phasing in" of both costs and savings. Prior to the commencement of installation, there are project start-up efforts, such as interface programming and testing. The model assumes that network and software costs are all incurred in the second year of the planning horizon (2017) and that 75% of all the meters and MIUs are installed in that year and the remainder installed the following year. The full extent of savings would not occur until the year after that.

Over 15 years (the minimum expected life of the MIUs), on a cash-for-cash basis, without taking into account financing or depreciation costs, the internal rate of return (IRR) on the discounted net costs and savings for the AMI project is about 4.8 percent. At a discount rate of 3.5%, the 15 year net present value (NPV) of the project, is about $435,000.

The analyses of the other alternatives follow the same methodology. Table 1, repeated below, summarizes the economic cost and benefits of the scenarios.

Table 2. Summary of Costs and Benefits of AMR and AMI Scenarios

	AMR New AMR (New)	AMR Hot Rod AMR (w/HotRod)	AMI AMI	Hybrid (new AMR) Hybrid
Capital Cost, $M*	5.05	3.88	6.00	6.01
Existing Program Offset, $M	2.47	1.96	2.47	2.47
Annual O&M, $M	0.03	0.03	0.15	0.12
Annual Savings, $M	0.14	0.15	0.47	0.22
NPV 15Yr@3.5%, $M	(1.02)	(0.20)	0.44	(2.11)
IRR	-0.8%	2.5%	4.8%	-4.3%

*including 5% contingency

Section 7. Non-Economic (Triple Bottom Line) Benefits and Costs

In addition to understanding the hard, direct costs and benefits of alternative metering technologies, OWASA recognizes the importance of also considering the soft and indirect costs and benefits of those technologies. In accordance with OWASA's guidance, this feasibility study includes a Triple-Bottom-Line ("TBL") assessment[8] which encompasses the economic implications to all stakeholders, as well as a general, relative comparison of the environmental and social benefits and drawbacks of the various alternatives. Environmental concerns include impacts on natural systems, while social concerns include impacts on the public such as health, labor practices, human rights, etc.

Encompassing TBL factors in an AMI business case entails considering, in addition to the "hard" (that is, readily measurable in dollars) and internal (that is, able to be captured by OWASA) benefits and costs that are incorporated in the benefit/cost model, both: (1) hard benefits and costs to other external stakeholders; and (2) "soft" benefits and costs to the utility, other stakeholders and to the environment. In some cases, such soft benefits and costs can be estimated quantitatively. For example, the tons of greenhouse gas emissions (in carbon dioxide equivalents) reduced by having fewer vehicles on the road can be estimated, or improvements in customer satisfaction can be measured by surveys.

The social and environmental impact of the project depends on the utility's approach. For example, if OWASA takes longer to implement the project, or budgets and spends more to ensure successful retraining and/or to obtain temporary help during implementation, the adverse impact on employees will likely be lessened.

Virtually every impact has benefit or cost implications for different stakeholders, and the effects ripple through the economy, society and the environment. For example, increased and proactive leak detection enabled by an AMI system might result in more work for plumbers and cash outlays for repairs, but ultimately lower costs to customers. Because OWASA is a public utility, net savings created as a result of an AMI system would eventually be passed back to customers in the form of lower bills, or bills that increase less than would otherwise occur without the project. Social and environmental impacts are difficult to separate, and it is difficult to avoid double-counting impacts.

TBL evaluations help an organization improve and maintain its sustainability. For an organization, sustainability can be defined as meeting the challenges and satisfying the changing demands placed on it to ensure its long term viability (which includes investing in infrastructure and human resources) while maintaining sociological, economic and environmental integrity. This is especially important for an organization such as OWASA, whose mission statement includes "responsible and creative stewardship of the resources we manage" and whose stated values call out environmental responsibility, customer service excellence, employee welfare, and "environmental, social and economic sustainability."

[8] Kenway, S, C. Howe and S. Maheepala. Triple Bottom Line Reporting of Sustainable Water Utility Performance. Water Research Foundation. 2007,

A few soft benefits and costs sometimes raised among water utilities and their associated stakeholders are discussed in the following paragraphs.

Environmental Impacts.

- Leak identification. Proactive identification and reduction of leaks in customers' premises can reduce the amount of water withdrawn from local reservoirs, and treated and pumped for use by OWASA customers. It can also help reduce the volume of unused water that is unnecessarily discharged to the sewer system, which in turn can help reduce wastewater collection and treatment costs and related capacity requirements. Leak reduction programs can also help reduce OWASA's energy and chemical requirements and costs. Reducing the demand for electricity required to treat and pump water that is essentially wasted (even if captured by meters) would reduce the carbon footprint of OWASA and its customers.
- MIU/battery/meter disposal. Most purchased products do not include the full cost of environmental impacts to produce them. In addition to any external environmental costs of producing the MIUs and their lithium batteries, this equipment must be disposed of at the end of its life.

  While other types of batteries include toxic metals such as cadmium, the metals in lithium ion batteries—cobalt, copper, nickel and iron—are considered safe for landfills or incinerators (the batteries contain an ionic form of lithium but no lithium metal). Lithium ion batteries are classified by the US government as non-hazardous waste and are safe for disposal in the normal municipal solid waste stream.

  The water meters that might be scrapped are made of brass (which contains some lead) and plastic components. While the metal would be recycled (which supplants mining and processing of new ores, and therefore is environmentally friendly), the disposal of the plastic could have an environmental impact.

- Greenhouse gas reduction. By reducing the number of vehicles needed for meter reading and field service, OWASA would lower its greenhouse gas emissions (CO2, CO, ozone and hydrocarbons) which have been linked to air pollution and climate change.

Social Impacts

- Privacy. Concerns have been raised in some part of the United States (notably among electric customers) about the vast amount of discrete data that can be collected from AMI meters. AMI systems could log hourly data, allowing someone to discern customer consumption patterns or know when the premises were vacant. While AMI systems encrypt data and impose security to prevent unauthorized persons from accessing such information, these systems can raise sensitivities among OWASA's customers and other stakeholders.
- Reduction in vehicle miles driven reduces air pollution. By reducing the number of vehicle miles driven for meter reading, field investigations and field service, OWASA would reduce vehicle exhaust gases and particulate emissions, which have been linked to illnesses such as cardiovascular disease, asthma, chronic obstructive pulmonary disease, lung and other forms of cancer, and diabetes. All vehicles, especially diesel engines, emit

very fine particles that deeply penetrate lungs and inflame the circulatory system, damaging cells and causing respiratory problems. Children and the elderly are especially vulnerable to these diseases.

By reducing the number of vehicles on the road in its service area, OWASA would also contribute (albeit to a very minor degree) to a reduction in traffic congestion. Congestion contributes to vehicle pollution, costs the economy many dollars in lost productivity, and reduces the quality of life of local residents.

- Electric and magnetic field (EMF) radiation. While few scientific studies have specifically focused on water meter AMI technology, the available studies come to the same conclusions as the many peer-reviewed studies of similar technologies using radio frequencies (low-level wireless): no adverse health impacts. For example, a World Health Organization survey of published research concluded that there is no convincing scientific evidence that the weak RF signals from base stations and wireless networks cause adverse health effects. Although there is anecdotal information that some individuals may be hypersensitive to radio frequencies, there is no definitive evidence linking such symptoms to low-level wireless transmissions like those associated with smart meters; the majority of studies indicate that supposedly hypersensitive individuals cannot detect EMF exposure any more accurately than anyone else can.
- Enhanced customer service. By providing better information to customers about their consumption, including leaks and wise water use, and minimizing problems with billing due to estimated bills, OWASA can alleviate stressful situations for certain customers, reduce the number of collections problems, and increase overall satisfaction among its customers.
- Reduced injuries among OWASA field personnel. Injuries affect not only the quality of life of the injured, but also their families and everyone else that contributed to medical insurance premiums. Reducing activities related to meter reading will reduce the potential for injuries to OWASA field personnel.
- Increased customer goodwill. By providing better and timelier information to customers, and notifying customers of potential leaks and high bills, OWASA might improve customer goodwill, an asset it can draw from when it has to inconvenience customers for events such as line repairs, service outages, or rate increases to cover capital investments and increased operating costs, etc.
- Liability of information. By having information that could enable proactive identification of potential leaks at customers' premises, OWASA might be considered to have an obligation to analyze that information and notify customers of potential leaks in a timely manner. Failure to do so could be a potential risk to OWASA.
- Customer interaction. By reducing the number of field personnel interacting with customers and reading their meters, OWASA might lose some "personable-ness" and opportunities to visually inspect its assets and services status (e.g., noticing that a property appears vacant).

Economic Impacts

- Improved capital and operating efficiency. By having more discrete and real-time consumption data for its hydraulic model, OWASA might be better able to plan distribution component placement and expansion. It might also be able to further optimize its pumping regimes to reduce energy costs and better manage distribution system water quality. It could calculate accounted-for water ratios in real time, providing better tools to monitor anomalies that might indicate significant leaks in the distribution system. It could also use AMI technology to help manage customer demand during times of peak water use or drought (such as monitoring compliance with day of week watering restrictions or daily water use allocations, if applicable).
- System-wide field audit. In conjunction with AMI installation, OWASA will essentially obtain a complete field audit of its service connections and meter assets. Discrepancies between meter numbers and associated accounts would be discovered; however, those are expected to be very minor. Installation contractors often go door to door, and might discover service connections that are not being billed.
- Better rate design. Using more discrete consumption data, OWASA could fine tune its water rates to better reflect the actual cost of service, providing more accurate price signals to customers while managing revenue stability.

Translating soft benefits and costs into dollars is difficult and imprecise. Environmental and social factors are not generally traded in the market, which eliminates a ready and reliable methodology for valuation. In the absence of an actual marketplace that establishes value, valuation is otherwise based on subjective factors. For example, in the absence of an actual market, dollar values ascribed to a ton of CO2, one of the more readily calculable effects, vary significantly.

Quality of life benefits, such as improved health or reductions in vehicle congestion, are also difficult to precisely quantify in terms of accurate economics and generally require regional studies. Consequently, such determinations are outside of the scope of this evaluation. Further, such benefits would also not directly accrue to OWASA. Therefore, while addressed qualitatively herein, this study does not attempt to quantify or include them in the economic models used to evaluate the AMI and AMR scenarios.

However, the social and environmental impacts of alternatives can be considered relatively using value modeling. Impact areas can be identified and weighted according to their relative importance. Alternative projects can be scored on the extent they positively or negatively affect impact areas. The weighted scores can be added to create a total impact score. Different projects can be compared to each other by considering the net present value of each project to its social and environmental impact score.

As part of this study, DS&A conducted a workshop with OWASA managers, during which a number of potential triple-bottom-line criteria were identified. Staff scored each criterion with regards to importance (1 to 9, indicating low to high importance, respectively) and together with the DS&A team assigned an impact score for each of the three major scenarios—AMR everywhere, AMI everywhere, and AMI for only a portion of the service territory, with AMR everywhere else—using a range from -10 to +10 (indicating major drawback to major benefit, respectively). Table 2 shows the tabulated results.

Table 3. Triple Bottom Line Scores for Metering System Alternatives

OWASA AMR/AMI Triple Bottom Line Impacts						
S=Social, E=Economic, N=Environmental			Imptnc	Impact (-10...+10)		
TBL Issue	DIM	Impacts	1 3 5 7 9	AMI	AMR	Mixed
Detailed, timely water use info	S/E/N	Customers	5	10	4	6
First call resolution. Proactive service. Reduce high bills. Support affordability.	S	Customers, OWASA	9	8	0	3
More satisfying work. More data available.	S	Employees	7	2	1	1
More work, stress of managing new system, interfaces	S	Employees	5	-2	-1	-1
Stress of learning new system. Longer phone calls.	S	Call Center employees	5	-2	-1	-1
Fear of job loss; stress of transition	S	Employees (Cus. Serv., MRs)	7	-2	-1	-1
Reduced greenhouse gas emissions	N	Environment	3	2	1	1
Reduced traffic congestion	S	Local Population	1	2	1	1
Loss of "eyes and ears" on system, customers	E/N/S	OWASA	5	-6	-2	-3
Reduced OWASA employee visibility	S	Customers, OWASA	3	-3	-1	-2
Better NRW calcs, audit capability	E	OWASA	3	7	0	0
Better info for planning system and CIP	E	OWASA	3	8	0	0
Better info for demand mgt, drought mgt.	S/E/N	OWASA, Customers	5	9	2	3
Improved safety: reduced accidents, dog bites, snakes, bees, threats, etc.	S	OWASA, employees	9	2	1	1
Full field audit of accounts, connections, meters	E	OWASA	7	2	2	2
Concerns about privacy, EMF health effects	S	Customers	7	-2	-1	-2
Supporting alt. rate structures (tailored rates, individualized budget rates, time of use)	E/N/S	Customers/OWASA	3	9	3	0
Billing in finer resolution	S/E	Customers/OWASA	7	2	1	1
Facilitation of potential OWASA role in submetering	E/N/S	Customers/OWASA	5	5	4	4
Potential to support smart system management		OWASA	5	1	0	0
Potential to enhance community services (e.g., street light control)	S/E	Community	3	1	0	0
Potential to provide additional services to largest customers	E	Customers	5	5	2	4
Innovation, best in class	S	OWASA, Customers	5	2	0	1
Perception of reliabillty, customer confidence	S	OWASA, Customers	9	3	2	2
Customer perception of unnecessary expense	S	OWASA, Customers	9	-4	-4	-4
Equitable service to customers	S	Customers	9	0	0	-6
Potential to reduce distribution system leaks	E	OWASA, environment	5	3	0	0
			Total Score	223	54	4

The total project TBL score is determined by adding up issue scores, which can be considered the product of importance and impact. This methodology results in TBL scores (sum of benefit scores, net of drawback scores) of 223, 54 and 4, respectively, for the AMI, AMR and “hybrid” scenarios.

Were OWASA to assign a weight to the net present value of the projects relative to the TBL scores, an overall total score for each scenario could be determined. However, because both the net present value and TBL score of the AMI alternative are greater than that of the AMR alternatives, DS&A believes there is no need to undertake a more formal weighting and scoring evaluation to help inform a decision as to the preferred alternative.

Section 8. Risk Assessment

An AMI (or AMR) project for OWASA would require significant capital investment. The new metering system must reliably deliver mission-critical information over its 15-20 year service life, during which circumstances (e.g., personnel, economics, technology) can change. An AMI project would impact a large number of stakeholders, including OWASA customers and employees. Even more than AMR, it would rely extensively upon radio communications, computer software and hardware, and interfaces between information systems. OWASA is not experienced in AMI project execution. The project would require the coordination of a number of key players: the technology vendor, the installation contractor, information system integrators, and OWASA's meter reading/ field service, customer service, procurement, community outreach and IT staff. All of these aspects create risks, and risk assessment should be part of any feasibility study.

AMI project risks fall into two broad but interrelated categories:

- Technology risks such as equipment obsolescence, excessive or premature component failures, flaws in AMI project software and control systems, radio interference, incompatibility with future meter registers, inadequate system performance, cybersecurity breaches, and loss or corruption of critical data.
- Business risks such as vendor instability, lack of stakeholder buy-in, business case assumptions that change or fail to materialize, unanticipated increases in certain costs, inadequate system support and maintenance by either OWASA staff or the vendors, poor installation quality, poor integration with existing systems, failure to change business processes to take advantage of the technology, failure to reduce staffing and other costs where the system enables it, and reduced visual inspection by OWASA staff of the meters and services.

Risk is the product of probability and impact. A high probability of failure with a very low impact would carry little risk. A very low probability of failure with a high impact may also carry little risk, but caution is advised in reaching such a conclusion since probability is often much more difficult to estimate than impact.

Careful planning is an essential dimension of AMI project success, and risk assessment and management is an active and very important part of good project management practice. As part of project procurement and planning, the risks of an AMI implementation should be identified, their likelihood and potential impact for OWASA assessed, the potential approaches to prevent or mitigate them evaluated, contingency plans developed where appropriate, and responsibility for risk mitigation implementation assigned.

Where significant risks exist, potential mitigation measures should be identified and those measures that are reasonably cost-effective in comparison to the risk should be implemented. The utility may develop preventive measures (e.g., go/no go decision points), mitigation (e.g., changes in the plan if aspects of it do not have the desired results), or decide to simply accept certain outcomes and their attendant cost or delay. Mitigation may entail putting the burden on another party (e.g., the AMI vendor), but assignment of risk is not always effective, particularly

if the assignee is unable to control the conditions that could lead to the potential failure, or if the risk is too great in comparison to the project benefits for the assignee.

Table 3 lists major AMI and AMR project risk factors identified and rated in a workshop between OWASA and DS&A staff, as well as potential mitigation measures. The table is largely based on DS&A's experience as well as the experiences of utilities that have had problems with AMI deployments. Risks that could more seriously compromise the ability of the system to perform properly over its life or are more likely to prevent the system from being accepted and used are assigned a higher impact rating. Probability and impact for AMR, where significantly different, are noted.

AMI project risk management starts with the feasibility study and should continue throughout the steps leading up to deployment. Risk mitigation measures include: soliciting expertise; involving all stakeholder groups; following a thorough and unbiased selection process; developing robust contracts and performance measures; establishing quality assurance and rigorous testing protocols at each step of project development and deployment, with strict acceptance "gates" for continuance; providing appropriate safeguards to secure sensitive customer and utility information; establishing and maintaining schedules for visual inspections of installations; implementing detailed project control procedures; and adopting comprehensive project management and communications plans.

Other important risk minimization measures for OWASA include providing leadership and vision surrounding the project, ensuring there are adequate resources to support the deployment and maintenance of the system, and ensuring that employees are trained and motivated to use the system.

Risk management is an active part of sound project implementation. During the course of a project, the project team should keep a risk register, adding risk factors and prevention or mitigation measures as they come up, while some risks will fade away as the project progresses.

Table 4. AMI Project Risk Factors and Mitigation Measures

Technology Risks	Probability AMI	Probability AMR	Impact	Comment	Potential Mitigation
Equipment obsolescence	M	M/H	M/H	Market moving toward AMI	Vendor contracts; homogenous deployment
Excessive or early failures of system components	L	L	H	Vendor could have manufacturing batch problems	Strong warranty provisions, regular monitoring, including vendor analysis of returned units
Inadequate system performance (e.g., read success rate)	L	L	M		Specific performance provisions in contract; relocating or adding more collectors
Incompatibility with future meter registers	L	M	L	Firmware can be updated over network	Require standards in RFP and contract; no untested changes allowed
IT interfaces don't work properly	L/M	L	H		Acceptance testing, with specific acceptance threshold requirements, before any installation
Cybersecurity breaches	L	L	L	Water data provides low target value	Encryption; audit trails; role based passwords and access; data firewalls
Loss or corruption of critical data	L	L	M	Several day window for reads for billing	Require network redundancy; maintain backup procedures
Business Risks					
Vendor instability	L	L/M	M		Due diligence in vendor selection; contract provisions
Inadequate utility staffing during project	L	L	H		Dedicated staff; leadership; use consultant or contractor
Inadequate system maintenance by utility staff	L	L	H		Documented protocols; system "ownership;" managerial accountability
Inadequate vendor support	L	L	H		Contract provisions; "ownership" at utility
Loss of key project team members	L/M	L/M	M		Cross train staff; document of processes and procedures; lean on consultant, vendor
Poor installation quality	L	L	L/M		Qualifications-based selection; installation control system; inspections; contract and warranty provisions
Customers do not make needed installation appointments	L/M	L	M		Good public outreach program; manage customer expectations; educate employees; astute policies; effective communications
Employee or customer lack of confidence in system	M	L/M	H		Good public outreach program; educate employees; installation control system; audit procedures
Increased tampering or theft of service	L	M	L	Tampering is not a big issue	Develop system tools and diagnostics; adequate staffing; enforce policies
Reduced visual inspection of meter assets	M/H	M	L		Adequate staffing; enforce procedures
Business case assumptions invalid	L/M	L	M	Could put pressure on rates	Conservative business case; participation by all affected staff
Unanticipated increases in labor rates, other costs	L	L	M		Understand rates before contracting; effective contract terms; hold vendor accountable; contingency budget
Failure to integrate system with other IT systems	M	L	M	Integration important to generate savings, enhancements w/AMI	Integration plan; leadership; adequate staffing (IT support)
Failure to redeploy staffing	M	L	M	Could put pressure on rates	Leadership; managerial accountability; human resources plan
Business processes do not change to take advantage of system	M	L	M	AMR won't require much change, AMI will	Leadership; involvement of managers and employees; change management plan
Customer expectations too high/not met	L/M	L	M		Manage expectations in outreach and "selling" of features
Customer concerns about health, privacy, etc.	L/M	L	L	Issues tend to be leveraged by poor customer relations, mistrust	Education and outreach
Change in Board direction, strategy, support	L	L	M		Broad support among all stakeholders
Lack of buy-in from stakeholders about project	L	L	M		
Lack of cooperation for DCU location	M	L	M	Could raise system costs (not relevant for AMR)	Vendor selection
Inadequate knowledge, skills or ability of individual employees to succeed in available positions	L	L	M		Change management, leadership and training

L=Low, M=Medium, H=High

Section 9. Organizational Readiness

AMI is a major investment, and to be worthwhile both requires and enables OWASA to change the way it interacts with customers. An AMI system installed on all of OWASA's customers' meters would produce almost 200 million hourly meter readings per year, plus tamper flags and other information related to consumption anomalies as well as meter and system performance. Capturing, storing, analyzing and using this information to deliver more cost-effective and enhanced customer service entails changes in related areas. The following paragraphs contain observations and recommendations for OWASA that are important precedents or adjuncts to a successful AMI investment.

Leadership and culture. OWASA counts excellence in customer service as a core value, and goes to great lengths to engage customers. However, as OWASA operates in the information age, and has a relatively sophisticated customer base, it is important to adopt where appropriate the customer service practices of organizations it would in theory have to compete with "were its customers able to choose" among them. In addition to surveying and understanding contributions and barriers to satisfaction, this includes establishing and measuring ***process-oriented*** (as distinguished from task-oriented) KPIs related to the customer experience and efficiency of operations. Process-oriented KPIs often include percentage first call resolution, time to problem resolution, arrears percentages, percentage of bills based on actual reads that are rendered with X days of reading date, dollar amounts of adjustments, etc. (Task oriented KPIs might include call waiting time, number of field work orders performed in a day, percentage meter readings obtained, etc.). OWASA managers need to be responsible for performance against KPI targets. The objectives should be to deliver the most cost-effective service to customers (that is, balancing high levels of service with low operating costs).

There needs to be close collaboration and communication among OWASA's IT, Customer Service and Distribution Operations field staff, including opportunities to observe or experience what employees in other areas do.

Policies. OWASA should adopt and promote customer service policies that leverage AMI to help cost-effectively deliver customer service, provide information to help customers use water wisely, minimize cross-subsidization among customers, and provide a safety net for disadvantaged customers while minimizing abuse. For example, OWASA might adopt policies designed to minimize accounts in Vacant status, or encouraging customers to enroll in leak and high use notification before they are eligible for waste adjustments. It might adopt cost-based charges for field visits demanded by customers that could be more effectively handled by using the AMI system data.

Business processes. In connection with AMI/AMR, OWASA should review and revise its customer service business processes, streamlining them where possible. At present, no one is responsible in most cases for the whole process. Rather, staff in Customer Service and Water Distribution are responsible for discrete tasks and sub processes. It may sometimes be expedient for some employees to forward issues to other sections rather than trying to resolve the problem themselves. To encourage closer collaboration, managers in different areas might be jointly

assigned responsibility for the performance of processes such as billing dispute resolution against KPIs.

Training, empowerment and supervision. For smaller water/wastewater utilities like OWASA, it can be difficult to find opportunities to train customer service staff – both those in the office and those responsible for field services. The Utility Mechanic position that is responsible for meter reading is considered an entry level position, and subject to a relatively high rate of turnover. As a result, at any one time, some meter readers/field service technicians may be under-trained and/or inexperienced. It is important that all staff involved in customer-facing activities using AMI are reasonably computer-literate and well-trained in using the basic functions of the AMI system. They need to be rehearsed and confident in their ability to assist customers with meter related transactions and resolve billing and other service issues using the AMI-based data. For example, CSRs should be able to diagnose some problems (like an intermittent running toilet that would result in a high bill). They need to be empowered and encouraged to try to resolve problems without "rolling a truck." In addition to training, both office and field personnel need to be adequately monitored and supervised to ensure they are being effective. As new features are added, applications rolled out, or because some operations are used infrequently, some or all may need retraining.

Other technologies. While AMI can provide an indication of potential high consumption before a customer gets a high bill, this is only effective if the customer can be notified. This requires maintaining customer contact information (cellphone numbers for text messages, email addresses for emails, or phone numbers for auto-dialer outbound messaging). Efficiently using AMI data requires integration of the AMI and MDMS with OWASA's work order management system, GIS and other systems.

Section 10. Procurement and Implementation Considerations

If OWASA decides to move ahead with AMI, the next steps would consist of additional planning and analysis to ensure that the solicitation, acquisition, and implementation of a system are adequately defined. OWASA would need to ensure that the solicitation focused the vendor proposals on the system features most important to it, while being cognizant of and managing the risks associated with large-scale technology implementation and integration. DS&A recommends that OWASA consider using a best value approach for vendor selection, incorporating a weighted evaluation of the services and features required and desired by OWASA, and the costs proposed by various vendors compared to their systems' features.

OWASA would need to negotiate a strong contract with its AMI provider, project management contractor, and installation contractor. The risks associated with an AMI implementation should be understood and controlled by appropriate contract language. AMI implementation is not a typical capital budget construction project, and some contract language is unique.

10.1 Managed Services

In addition to the option to purchase the AMI system and its software, some AMI vendors today offer software hosting, comprehensive software management, software as a service ("SaaS," in which the utility doesn't purchase the software), network monitoring, and network as a service ("NaaS," in which the utility doesn't purchase the network). The elements incorporated in each of these options vary from vendor to vendor.

Hosted, managed services and SaaS can cover the headend system, the MDMS and customer portal. The vendor can provide both operational and development/testing environments. The software operates on servers at the vendor's network operations center or data center, and the utility's users have web access. The vendor will maintain the servers, install patches and upgrades, back up data, and provide disaster recovery.

With SaaS and NaaS, the vendor owns and operates the software or network, respectively; the utility makes no capital outlay for these components, but will pay setup fees, integration costs, and monthly usage fees based on the number of meters on the system or the number of data collections.

Network management can include monitoring network performance, identifying "missing" or malfunctioning MIUs, and even maintenance of DCUs. NaaS covers the data collectors, site licenses and backhaul communications.

AMI headend systems have comprehensive diagnostic software, and DCU maintenance is relatively straightforward. Interfaces between AMI software and other systems can also be straightforward. However, utilities lacking sufficient technical resources to manage AMI systems, or whose managers are uncomfortable with one or more aspects of AMI system management, may opt for some form of managed services. Managed services options typically offer lower capital costs in return for higher operating costs. OWASA managers need to understand the operating and maintenance requirements of AMI systems, particularly the

software and interfaces, and evaluate the Authority's own resources, to determine the suitability of managed services.

10.2 Implementation Planning

A poorly planned or poorly executed implementation plan (e.g., problems with data conversions that affect bills, or quality assurance problems in the field that affect customer property) could not only fail to yield all of the benefits anticipated, it could also hurt OWASA's reputation with its customers, member governments, bondholders, and other stakeholders. Successful AMI implementation planning consists of several coordinated "sub-plans," which typically include:

1. a comprehensive project schedule and management plan to govern contract management, field inspection, troubleshooting, data audit and acceptance testing;

2. a network (DCUs and possibly repeaters) deployment plan;

3. an installation control system to ensure contractor work is coordinated with OWASA resources and schedules, data is captured correctly and vendor invoices are correct;

4. a human resources plan to manage the changes in job content and reassigning staff during and after the project;

5. a project staffing plan to ensure enough of the right people are supporting each dimension and phase of the deployment, and positions from which people have been "borrowed" are back-filled;

6. a budget and financing plan to fund the project and cover invoices as the project is deployed;

7. a materials handling plan for managing the inventory of new equipment and the scrapping of old equipment;

8. a meter reading transition plan to ensure all meters are read smoothly as routes are converted to AMI, including "blackout windows" to avoid installations on or near reading days;

9. an outreach and communications plan for customers, employees and the general public;

10. an IT integration plan for creating, documenting, and testing interfaces between the AMI system and OWASA's CIS, GIS, and work order management systems;

11. an acceptance test plan for software, components and overall system performance;

12. procedures for identifying and correcting system problems, such as "missing" MIUs;

13. a preventive and corrective maintenance plan;

14. a policy and procedure review plan, to ensure OWASA has the polices needed to support effective AMI deployment, such as reconciling consumption concerns as old meters are

replaced, and to govern the rights and requirements of customers when AMI data is available;

15. a training plan for all utility employees involved in installation, managing contractors, operating and maintaining the system, dealing with customers during installation and using the system data;

16. an application development roadmap, including staffing support; and

17. stakeholder coordination for DCU installations.

Some key AMI planning considerations are discussed briefly in the following paragraphs.

10.2.1 Staffing and Organizational Planning

OWASA's customer service and meter maintenance staff are organized to accommodate the current volume and flow of information and transactions. The flow of work would change to accommodate the process of installing AMI, and again as meters are put on the system and call volumes and field work orders decline with the decrease in meter-related billing and customer service issues. OWASA would need a plan for modifying its organization structures and reassigning staff, as well as identifying training needs related to modified job requirements and assignments.

10.2.2 Policy and Procedure Review

OWASA would need to review and revise its policies and procedures to ensure the success of the implementation and to make the best use of the new AMI system functionality. For example, with AMI, OWASA might require customers to provide up-to-date contact information in order to be eligible for leak adjustments, and those adjustments might be limited by the date of notification by OWASA of a leak or high consumption. Since it can obtain more accurate and timely information from the AMI system, OWASA should discourage no-cost field investigations. To maximize the economies obtainable from an AMI investment, it should discourage anyone from "opting out" of having an AMI meter (some utilities impose a manual read charge reflecting the full cost of a field visit).

DS&A recommends that OWASA review and revise its policies and procedures concerning leak allowances, turn-ons and turn-offs, final reads, limits for billing exceptions, high bill investigations, etc., in connection with AMI. Certain policy revisions may need the Board of Directors' approval. Policies and procedures should be addressed prior to the commencement of an AMI installation.

10.2.3 Project Management and Implementation Planning

A large-scale AMI installation would require dedicated project management resources. OWASA would require staff or contracted resources with the appropriate skills to:

- Manage the technology and implementation contractor(s).

- Oversee acceptance testing of software and network components.

- Track and facilitate the redesign and implementation of processes and systems that are involved in implementation.

- Manage the IT interfaces used to transfer and update meter and AMI system component data.

- Manage inspections to ensure contractor work quality.

- Design and manage communications with all project stakeholders, including customers, staff, and civic leaders.

- Manage and facilitate the redesign and implementation of reengineered business processes that would use the AMI data to provide new levels of service, including policy changes, data analysis, and staff training and assignment.

Many sub-projects need to be planned, integrated, and completed on schedule if the AMI implementation is to be accomplished efficiently and without undue disruption to customers. OWASA needs to evaluate its project management and other resources available to take on a new major initiative, and determine the extent to which it would supplement its staff with contracted resources.

10.2.4 Communications and Community Engagement

Successful AMI projects require carefully planned and executed communications and engagement with customers, employees, community leaders, and others during the implementation phase.

- Employees should understand the project, and be trained in characterizing the project in response to customer inquiries. Employees could have concerns about the implications of the project for their own jobs, and their concerns should be addressed early and often.

- OWASA staff and community leaders could receive questions about the program. Educating them could help develop support for the program, including any policy enhancements OWASA might need to ensure successful implementation and the full benefit of an AMI system.

- OWASA managers not directly involved in the project should understand its importance and help in the executive sponsorship of the project.

- Customers should be adequately informed in order to minimize the volume of inquiries into the call center, and to control the growth of inevitable rumors about the program.

10.2.5 Information Technology Planning

AMI systems entail several interfaces to other OWASA information systems. During installation, "from host" files are passed from the CIS or a work order management system to the contractor's work order system. Completed work orders, with new information about MIUs and meters, constitute a "to host" file. For meter reading, a request file may be passed from the CIS to the MDMS. Typically, access to the web portal by customers is through a landing page on the utility's website, with single sign-on so that customers don't have to log in again.

IT planning for AMI includes identifying the business processes and use cases that will use AMI data, defining the information required, establishing data definitions and standards, determining which systems will store master data for MIUs, meters, etc., and defining the system architecture. Protocols for synchronizing databases, handling and resolving data anomalies, ensuring cybersecurity, backing up and archiving data, installing and testing software patches and upgrades, developing and testing new applications, and maintaining operating systems and servers, are all part of IT planning for AMI.

10.2.6 Installation Control

Ensuring that the data related to meter and AMI equipment installation is accurately recorded in OWASA's information systems is critical to the success of the project. Without rigorous procedures for managing and controlling the accuracy of the information, critical data related to meters, MIUs, premises addresses and account numbers can be miscoded or mismatched, resulting in potential billing and customer service problems. For example, if a MIU is inadvertently associated with the wrong customer's premises, one or more customers may receive erroneous bills, possibly for several years. The discovery of data discrepancies can color customers' and utility employees' faith in the reliability of the system, even if it is otherwise performing flawlessly. CSRs will be less likely to assure customers that the reading is correct and the bill should be paid, and may be more apt to send someone to the field to obtain or verify a meter reading. This can greatly reduce the savings from the system.

An AMI installation control system is used to capture information about installed equipment, record inspections of installations, return improper installations to the contractor, authorize payment for completed work, and update the CIS. The installation control system entails electronic work orders and data capture (using bar code scanners), filters to verify the validity of data, photographs of old meter registers and potential installation problems, and component performance requirements before installations can be accepted and included on contractors' invoices.

10.2.7 Change Management

AMI should precipitate significant changes in organization and processes for OWASA. While many of the elements of change management are incorporated in AMI implementation planning discussed above, OWASA should establish a formal change management plan around AMI.

Change is a constant for most organizations, and the ability to manage and adapt to organizational change is a requirement in today's successful workplaces. A change management

plan embodies a structured approach. It entails securing employee buy-in to ensure that changes are smoothly and successfully implemented and achieve lasting benefits. A change management plan typically encompasses goals and strategies; an analysis of the current situation, leadership styles, culture, stakeholder drivers, and group dynamics; a gap analysis; metrics to assess progress; a communications element to align expectations; orientation and training; personal counseling and attention as needed; and monitoring and feedback.

Section 11. Recommendations

Based on an analysis of OWASA's meter-related operating and customer service processes and performance data, an assessment of OWASA's existing meter reading methods, and an evaluation of key technology alternatives, DS&A recommends the following:

1. OWASA should discontinue its program of installing more AMR meters, and instead acquire a new AMI system to replace its existing AMR and manual read system. The results of the Triple Bottom Line evaluation – including both the economic and non-economic considerations – are more favorable for this strategy than continuing to slowly deploy AMR, rapidly deploying AMR, or deploying a hybrid system (that is, AMI installed to cover only the UNC campus and medical institutions and the Chapel Hill/Carrboro central business districts).

2. Based on OWASA's existing populations of different makes of small meters, their ages, their performance and their compatibility with AMR and AMI systems, were OWASA to move ahead with a new metering system, it should replace its small Rockwell, Sensus, and Master meters (about one-third of OWASA's total number of small meters). It should keep its straight register Badger and Neptune meters, retrofitting them with new AMR/AMI compatible registers. It should keep its Hersey meters equipped with AMR/AMI compatible registers. It should keep all its large meters, retrofitting them with new AMR/AMI compatible registers.

3. To ensure that an investment in AMI is cost effective, OWASA managers should: embrace a culture of customer service improvement based on process-oriented key performance measures; revamp policies to increase the cost-effectiveness of customer service and minimize cross-subsidization among customers for services; ensure that data from the AMI system is used; streamline inefficient customer service business processes across OWASA; enhance the training and empowerment of CSRs; and adopt and enhance related technologies and information systems needed to achieve the benefits of AMI.

4. AMI installation should be completed over a period of approximately one year following approximately six months for implementation planning, installing (or setting up, in the case of managed services) headend hardware, a meter data management system and a customer portal, and developing and testing interfaces and procedures before any endpoint installations.

5. Should OWASA decide to acquire an AMI system, it should develop an IT integration plan, a customer and community outreach and engagement plan, a human resources plan to deal with reassigning staff, an AMI-based application development plan, and an AMI change management plan, among other sub-plans. OWASA should hire a business analyst to support customer service and help manage the AMI system and its data.

6. OWASA should create a comprehensive risk management plan to anticipate and actively manage both technological and business risks associate with this important and complex project.

Appendix A. Meter Summary Tables

Based on an analysis of OWASA's meter populaton by meter size, type, manufacturer, date installed, and whether the meter has a register capable of being read by an AMR or AMI MIU, DS&A developed tables of "action" for each meter size and type depending on the technology strategy. Older meters, as well as meters size and make which were relatively few in number, were identified for replacement. The tables are shown below.

Table A1. Full-scale AMI and AMR deployment impact on meter population

Size	Type	Replace	Retrofit	AMI/AMR Ready	Total
.625"	PD	6717	4869	7881	19467
.75"	PD	0	0	76	76
1"	PD	198	346	61	605
1.5"	PD	158	142	127	427
2"	PD	0	0	134	134
2"	Comp	36	106	0	142
2"	Mag	0	2	0	2
2"	Turbine	12	143	0	155
3"	Comp	0	54	0	54
3"	Turbine	0	39	40	79
4"	Comp	0	46	1	47
4"	Mag	0	2	0	2
4"	Turbine	0	25	22	47
6"	Comp	0	22	2	24
6"	SRM	0	9	2	11
6"	Turbine	0	8	7	15
8"	Comp	0	7	1	8
8"	Turbine	0	16	1	17
	Totals	7121	5836	8355	21312

(Note: PD=positive displacement; Comp=two-register compound; Mag=magnetic; SRM=single register compound)

Table A2. Hybrid AMR/AMI alternative impact on meters in area covered by the AMI network

Size	Type	Replace	Retrofit	AMI/AMR Ready	Total
.625"	PD	868	1323	2453	4644
.75"	PD	0	0	0	0
1"	PD	67	61	87	215
1.5"	PD	57	50	63	170
2"	PD	0	0	58	58
2"	Comp	30	22	0	52
2"	Mag	0	0	0	0
2"	Turbine	6	38	0	44
3"	Comp	0	28	0	28
3"	Turbine	0	21	26	47
4"	Comp	0	34	0	34
4"	Mag	0	2	0	2
4"	Turbine	0	16	17	33
6"	Comp	0	6	2	8
6"	SRM	0	9	2	11
6"	Turbine	0	3	6	9
8"	Comp	0	0	1	1
8"	Turbine	0	12	1	13
	Totals	1028	1625	2716	5369

Table A3. Hybrid AMR/AMI alternative impact on meter in area not covered by the AMI network

Size	Type	Replace	Retrofit	MI/AMR Read	Total
.625"	PD	5849	3546	5428	14823
.75"	PD	0	0	76	76
1"	PD	131	184	75	390
1.5"	PD	100	93	64	257
2"	PD	0	0	76	76
2"	Comp	22	68	0	90
2"	Mag	0	2	0	2
2"	Turbine	6	105	0	111
3"	Comp	0	26	0	26
3"	Turbine	0	18	14	32
4"	Comp	0	12	1	13
4"	Mag	0	0	0	0
4"	Turbine	0	9	5	14
6"	Comp	0	16	0	16
6"	SRM	0	0	0	0
6"	Turbine	0	5	1	6
8"	Comp	0	7	0	7
8"	Turbine	0	4	0	4
	Totals	6108	4095	5740	15943

Table B1. AMI Meter Population

Meter Size	Type*	Ttl in Service	To Be Replaced	To Be Retrofitted	AMR/AMI Ready	Lids Needed	Mtrs Getting New MIUs
.625"	PD	19,467	6717	4869	7881	11586	19,467
.75"	PD	76	0	0	76	0	76
1"	PD	605	198	346	61	544	605
1.5"	PD	427	158	142	127	300	427
2"	PD	134	0	0	134	0	134
2"	Comp	142	36	106	0	142	142
2"	Mag	2	0	2	0	2	2
2"	Turbine	155	12	143	0	155	155
3"	Comp	54	0	54	0	54	54
3"	Turbine	79	0	39	40	39	79
4"	Comp	47	0	46	1	46	47
4"	Mag	2	0	2	0	2	2
4"	Turbine	47	0	25	22	25	47
6"	Comp	24	0	22	2	22	24
6"	SRM	11	0	9	2	9	11
6"	Turbine	15	0	8	7	8	15
8"	Comp	8	0	7	1	7	8
8"	Turbine	17	0	16	1	16	17
TOTAL		21,312	7,121	5,836	8,355	12,957	21,312
Up to 2"		21,008	7,121	5,608	8,279	12,729	21,008
3" and up		304	0	228	76	228	304

*PD=positive displacement; Comp=compound, Mag=magnetic;
SRM=single register compount

Table B2. AMI Endpoint Components

		MIU Unit Cost:			1-port	$75	2-port	$95							
Meter		---------- MIUs ----------			--------- Mtr Registers ----------				--------- Meters ----------			---------- Lids ----------			
Size	Type	Number	Unit Cost	Total Cost	Number	Unit Cost	Total Cost		Number	Unit Cost	Total Cost	Number	Unit Cost	Ttl Cst	Total Cost
.625"	PD	19,467	$75	$1,460,025	4,869	$46	$223,974		6717	$75	$503,775	11586	$22	$254,892	$2,442,666
.75"	PD	76	$75	$5,700	0	$46	$0		0	$75	$0	0	$22	$0	$5,700
1"	PD	605	$75	$45,375	346	$46	$15,916		198	$0	$0	544	$22	$11,968	$73,259
1.5"	PD	427	$75	$32,025	142	$46	$6,532		158	$325	$51,350	300	$40	$12,000	$101,907
2"	PD	134	$75	$10,050	0	$46	$0		0	$460	$0	0	$40	$0	$10,050
2"	Comp	142	$95	$13,490	106	$46	$4,876		36	$460	$16,560	142	$40	$5,680	$40,606
2"	Mag	2	$75	$150	2	$46	$92		0	$460	$0	2	$40	$80	$322
2"	Turbine	155	$75	$11,625	143	$46	$6,578		12	$460	$5,520	155	$40	$6,200	$29,923
3"	Comp	54	$95	$5,130	54	$46	$2,484		0	$2,150	$0	54	$40	$2,160	$9,774
3"	Turbine	79	$75	$5,925	39	$46	$1,794		0	$2,150	$0	39	$40	$1,560	$9,279
4"	Comp	47	$95	$4,465	46	$46	$2,116		0	$3,500	$0	46	$40	$1,840	$8,421
4"	Mag	2	$75	$150	2	$46	$92		0	$3,500	$0	2	$40	$80	$322
4"	Turbine	47	$75	$3,525	25	$46	$1,150		0	$3,500	$0	25	$40	$1,000	$5,675
6"	Comp	24	$95	$2,280	22	$46	$1,012		0	$4,800	$0	22	$40	$880	$4,172
6"	SRM	11	$75	$825	9	$46	$414		0	$4,800	$0	9	$40	$360	$1,599
6"	Turbine	15	$75	$1,125	8	$46	$368		0	$4,800	$0	8	$40	$320	$1,813
8"	Comp	8	$95	$760	7	$46	$322		0	$6,700	$0	7	$40	$280	$1,362
8"	Turbine	17	$75	$1,275	16	$46	$736		0	$6,700	$0	16	$40	$640	$2,651
TOTAL		21,312		$1,603,900	5,836		$268,456		7,121		$577,205	12,957		$299,940	$2,749,501
														Materials related to AMI	2,172,296
														Materials related to meters	577,205

Table B3. Installation Costs

		-----MIU Only -----			-----MIU and Register -----			-----MIU and Meter-------			----------Lids----------			Total	Alloc. To	Alloc. To
Meter	Type	No.	Unit Cost	Ttl Cst	No.	Unit Cost	Ttl Cst	No.	Unit Cost	Ttl Cst	No.	Unit Cost	Ttl Cst	Cost	Meters	Electronics
.625"	PD	7,881	$30	$236,430	4,869	$35	$170,415	6,717	$50	$335,850	11586	$1.00	$11,586	$754,281	$201,510	$552,771
.75"	PD	76	$30	$2,280	0	$35	$0	0	$50	$0	0	$1.00	$0	$2,280	$0	$2,280
1"	PD	61	$30	$1,830	346	$50	$17,300	198	$55	$10,890	544	$1.00	$544	$30,564	$7,425	$23,139
1.5"	PD	127	$30	$3,810	142	$50	$7,100	158	$55	$8,690	300	$2.00	$600	$20,200	$5,925	$14,275
2"	PD	134	$50	$6,700	0	$50	$0	0	$150	$0	0	$2.00	$0	$6,700	$0	$6,700
2"	Comp	0	$50	$0	106	$80	$8,480	36	$150	$5,400	142	$2.00	$284	$14,164	$5,400	$8,764
2"	Mag	0	$50	$0	2	$50	$100	0	$150	$0	2	$2.00	$4	$104	$0	$104
2"	Turbine	0	$50	$0	143	$50	$7,150	12	$150	$1,800	155	$2.00	$310	$9,260	$1,800	$7,460
3"	Comp	0	$125	$0	54	$150	$8,100	0	$0	$0	54	$2.00	$108	$8,208	$0	$8,208
3"	Turbine	40	$100	$4,000	39	$125	$4,875	0	$0	$0	39	$2.00	$78	$8,953	$0	$8,953
4"	Comp	1	$125	$125	46	$150	$6,900	0	$0	$0	46	$2.00	$92	$7,117	$0	$7,117
4"	Mag	0	$100	$0	2	$125	$250	0	$0	$0	2	$2.00	$4	$254	$0	$254
4"	Turbine	22	$100	$2,200	25	$125	$3,125	0	$0	$0	25	$2.00	$50	$5,375	$0	$5,375
6"	Comp	2	$200	$400	22	$250	$5,500	0	$0	$0	22	$2.00	$44	$5,944	$0	$5,944
6"	SRM	2	$175	$350	9	$200	$1,800	0	$0	$0	9	$2.00	$18	$2,168	$0	$2,168
6"	Turbine	7	$175	$1,225	8	$200	$1,600	0	$0	$0	8	$2.00	$16	$2,841	$0	$2,841
8"	Comp	1	$200	$200	7	$250	$1,750	0	$0	$0	7	$2.00	$14	$1,964	$0	$1,964
8"	Turbine	1	$200	$200	16	$200	$3,200	0	$0	$0	16	$2.00	$32	$3,432	$0	$3,432
TOTAL		8,355		$259,750	5,836		$247,645	7,121		$362,630	12,957		$13,784	$883,809	$222,060	$661,749

Table B4. Existing meter replacement and HotRod installation deferrals

Meter Size	Type	Meters to Replace	Cost per MIU+Mtr	Labor Cost	Total Cost	HotRod Rplcmnts	MIU Cost	Labor Cost	Total Cost	No. Lids Required	Lid Unit Cost	Total Lid Cost	Total Cost
.625"	PD	9384	$134	$45	$1,679,736	2311	$65	$35	$231,100	9384	$22	$206,448	$2,117,284
.75"	PD	0	$182	$45	$0	0	$65	$35	$0	0	$22	$0	$0
1"	PD	320	$240	$45	$91,200	28	$65	$35	$2,800	320	$22	$7,040	$101,040
1.5"	PD	228	$444	$90	$121,752	31	$65	$35	$3,100	228	$40	$9,120	$133,972
2"	PD	46	$566	$90	$30,176	46	$65	$35	$4,600	46	$40	$1,840	$36,616
2"	Comp	53	$566	$90	$34,768	0	$65	$35	$0	53	$40	$2,120	$36,888
2"	Mag	0	$566	$90	$0	0	$65	$35	$0	0	$40	$0	$0
2"	Turbine	16	$566	$90	$10,496	0	$65	$35	$0	16	$40	$640	$11,136
3"	Comp	0	$2,244	$90	$0	0	$65	$35	$0	0	$40	$0	$0
3"	Turbine	0	$2,219	$90	$0	15	$65	$35	$1,500	0	$40	$0	$1,500
4"	Comp	0	$3,552	$150	$0	0	$65	$35	$0	0	$40	$0	$0
4"	Mag	0	$3,527	$150	$0	0	$65	$35	$0	0	$40	$0	$0
4"	Turbine	0	$3,527	$150	$0	5	$65	$35	$500	0	$40	$0	$500
6"	Comp	0	$4,885	$150	$0	0	$65	$35	$0	0	$40	$0	$0
6"	SRM	0	$4,860	$150	$0	5	$65	$35	$500	0	$40	$0	$500
6"	Turbine	0	$4,860	$150	$0	0	$65	$35	$0	0	$40	$0	$0
8"	Comp	0	$6,775	$150	$0	0	$65	$35	$0	0	$40	$0	$0
8"	Turbine	0	$6,750	$150	$0	1	$65	$35	$100	0	$40	$0	$100
TOTAL		10,047			1,968,128	2,442			244,200	10,047		227,208	$2,439,536

All meters <=2" installed 1998 or earlier will be replaced
All Master, Rockwell and Sensus meters will be replaced
All others will be retrofitted or are already AMR/AMI capable

Total meter repair/replacement savings:	$2,439,536
Other avoided capital costs	27,000
Total avoided costs	2,466,536
Over how many years	10
Savings per year	$246,654

Table B4a. Meters replaced over 10 years with current program

Year Installed	size 0.625"	1"	1.5"	2.0"	Quantity
Pre 1999[1]	6,717	198	158	48	7121
1999	36	2	11	4	53
2000	800	19	30	23	872
2001	729	22	11	23	785
2002	1102	79	18	17	1216
Total	9384	320	228	115	10047
					10,047

[1] All meters <=2" installed 1998 or earlier will be replaced
All Master, Rockwell and Sensus meters will be replaced

Table B4b. Number of HotRod MIUs reaching life expectancy over next 10 years

Year to be	Size .625"	1.0"	1.5"	2.0"	3.0"	4"	6"	8"	Quantity
2016	2	1	0	0	0	0	0	1	4
2020	1			1					2
2021	25		2	2		1			30
2022	1105	5	1	4			1		1116
2023	382	7	7	8	1				405
2024	218	8	10	15	6	3	2		262
2025	578	7	11	16	8	1	2		623
Total	2311	28	31	46	15	5	5	1	2442

Table B5. Salvage on replaced old meters

Meter Size	Type	No. Meters Replaced	Salvage Value	Total Salvage
.625"	PD	6,717	$3.50	$23,510
.75"	PD	0	$5.00	$0
1"	PD	198	$11.00	$2,178
1.5"	PD	158	$31.00	$4,898
2"	PD	0	$75.00	$0
2"	Comp	36	$75.00	$2,700
2"	Mag	0	$75.00	$0
2"	Turbine	12	$75.00	$900
3"	Comp	0	$82.00	$0
3"	Turbine	0	$82.00	$0
4"	Comp	0	$178.00	$0
4"	Mag	0	$178.00	$0
4"	Turbine	0	$178.00	$0
6"	Comp	0	$196.00	$0
6"	SRM	0	$196.00	$0
6"	Turbine	0	$196.00	$0
8"	Comp	0	$212.00	$0
8"	Turbine	0	$212.00	$0
TOTAL		7,121		$34,186

Table B6. AMI data collection hardware, software, and vendor project management fees

Project Duration (Months)		18				
			Own/Operate			
Item		Units	Unit Cost	Total		
Data Collection Units		10	$5,000	$50,000		
DCU Installation		10	5,000	50,000		
Repeaters		50	3,500	175,000		
Repeater Installation		50	3,000	150,000		
	Network			$425,000		
Mobile Collector Hardware		1	$30,000	$30,000		
Handheld programmers for staff		5	5,500	27,500		
	Other Hardware			$57,500		
				Own/Operate	Managed Service	
				Unit Cost	SetUp Fee	Ann/Meter
Control system hardware				$50,000	$0	
Control system software				50,000	25,000	$0.50
Meter Data Mgt. System, Cust. Portal hardware				50,000	0	
Meter Data Mgt. System				100,000	50,000	$2.50
MDMS Integration to billing system				50,000	50,000	
Customer portal software				50,000	25,000	$1.50
Customer E-Portal Integration				50,000	50,000	
	System Software, Hardware, Integration		Subtotal	$400,000	$200,000	
Professional Services Project Management				$560,625	560,625	
Training				30,000	30,000	
	Pjt. Management and Training			590,625	590,625	
			TOTAL	$1,473,125	$1,273,125	

Table B7. OWASA project management costs

Project Management Duration		18	months
		Annual	Total
Project Staff	Number	Salary	Annual Cost
Project Manager	1	$70,000	$70,000
Asst Project Mgr.	0	$65,000	$0
Project Administrator	1	$46,000	$46,000
Field Inspectors	1	$52,000	$52,000
Total Salaries			$168,000
Benefits at		43.9%	$73,769
Annual Salary and Benefits			$241,769
		Unit Cost	Total Cost
Vehicles	2	$5,800	$11,600
Total Annual Expense			$253,369
Total Over Project Mgt Duration			$380,053
One-Time Expenses			
Community Engagement			$75,000
Purchasing, Legal and Consulting Fees			$350,000
		Total	$425,000
TOTAL PROJECT MANAGEMENT			$805,053
		Initial	$300,000
		Ongoing	$505,053

Table B8. Annual operating costs

Annual HW,Software Maintenance (O/O)	20%	$400,000	$ 80,000
Optional Annual Hosting Cost (Services)			
Head-end software	$0.50	21,312	10,656
MDMS	$2.50	21,312	53,280
Portal	$1.00	21,312	21,312
		Subtotal	85,248
Annual Application Software Development			$ -
Annual DCU maintenance agreement	$0.00	10	$ -
System monitoring service/yr			$ -
DCU Communications Costs			
No. of DCUs	10		
Avg. mo. communications cost/DCU	$50		
Total Annual Communications cost			$ 6,000
Power costs			
DCU power, reqd, KWH/yr	70	10	
Repeater power reqd, KWH/yr	60	50	
$ per KWH	$0.15		
Total running power costs			$ 555
DCU Site lease costs/mo.	300	5	$18,000
Total Annual Operating Cost Without Hosting			$ 104,555
Total Annual Operating Cost With Hosting			$ 109,803

Table B9. Annual maintenance costs

Total Number of AMR/AMI in Service			21,312		
Hardware Malfunction			Pct/Year	No. Problems	
MIU Failures			1.50%	320	
Other Problems (wiring, fittings)			0.25%	53	
		Total	1.75%	373	
Hand-held failures	5	units	20%	1.0	
Data Collection Unit and Repeater Failu	60	units	10%	6.0	
Personnel Time Required to Correct Malfunctions			Technical	Clerical	
Average Repair Time, except for DCUs, min.			45	10	
Person-hrs for Hand-helds			2	1	
Person-hrs for Data Collector Problems			8	2	
Person Hours Required per year			330	75	
No. of People Required*			0.20	0.05	
Hourly Labor Rate			$19.50	$19.50	
Labor Cost			$6,430	$1,466	
Labor Plus Benefits at		44%	$9,253	$2,109	
	Total Annual Labor Cost:			$11,362	
Transportation Costs for Repairs					
No. of Vehicles (1 per technician)			0.2		
Annual vehicle capital and operating Cost			$5,800		
	Total Annual Vehicle Cost:		$1,160		
Annual Equipment Repair Costs		DCU	Repeater	MIU**	Handheld
Percent of capital cost	50%				
Expected Avg. Manuf. Rpr/Rplcmnt Cost		$2,500	$1,750	$37.50	$500
Malfunctions per Year		1	5	320	1
Total Repair/Replacement Cost		$2,500	$8,750	$11,988	$500
Annualized Battery Replacement Costs					
No. of collectors and repeaters		60			
Cost per battery		$200			
Labor cost per change		$200			
Replacement interval, yrs		5			
Total annualized cost		$4,800			

TOTAL LABOR, VEHICLE COSTS	$12,522
TOTAL EQUIPMENT REPAIR COSTS	$28,538
TOTAL MAINTENANCE COSTS	$41,060

Assumes 1645 working hours per person per year

Table B10. Personnel impacts

								Overhead	44%		
Customer Service	Auth.	Vcnt	Act.	w/AMI	Savd	Avg Sal	Total Direct	Overtime	Overhead	Total	Savings
Customer Service Manager	1	0	1	1	0	$62,881	$62,881	$0	$27,611	$90,492	$0
Billing Supervisor	1	0	1	1	0	$55,777	$55,777	$0	$24,492	$80,269	$0
Senior Customer Service Representative	1	0	1	1	0	$50,770	$50,770	$0	$22,293	$73,063	$0
Customer Service Representative	3	0	3	2	1	$40,670	$122,010	$0	$53,575	$175,585	$58,528
Clerk/Cashier	2	1	1	1	0	$33,000	$33,000	$0	$14,490	$47,490	$0
Administrative Assistant	1	0	1	1	0	$40,154	$40,154	$0	$17,632	$57,786	$0
Subtotal	9	1	8	7	1		$364,592	$0	$160,092	$524,684	$58,528
Distribution and Collections	Auth.	Vcnt	Act.	w/AMI	Savd	Avg Sal	Total Direct	Overtime	Overhead	Total	Savings
Warehouse-Cross Connection Coordinator	1	0	1	1	0	$42,288	$42,288	$0	$18,569	$60,857	$0
Utility Mechanic I	23.0	2.0	21.0	16.5	6.5	$33,177	$696,717	$7,000	$305,928	$1,009,645	$317,343
Utility Mechanic II	10	3	7	10	0	$40,650	$284,550	$0	$124,946	$409,496	$0
Utility Mechanic III	3	0	3	3	0	$44,414	$133,242	$0	$58,507	$191,749	$0
Crew Leader	6	0	6	6	1	$51,813	$310,878	$0	$136,507	$447,385	$74,564
Asst.Distr./Collct.System Mgr	1	0	1	1	0	$72,000	$72,000	$0	$31,615	$103,615	$0
Distr./Collct.System Mgr	1	0	1	1	0	$98,680	$98,680	$0	$43,330	$142,010	$0
Subtotal	45	5	40	38.5	7.5		$1,638,355	$7,000	$719,402	$2,364,757	$391,907
Information Systems	Auth.	Vcnt	Act.	w/AMI	Savd	Avg Sal	Total Direct	Overtime	Overhead	Total	Savings
Information Service Technical Specialist	1	0	1	1	0	$56,898	$56,898	$0	$24,984	$81,882	$0
AMI System Manager/Business Analyst	0	0	0	1	-1	$70,000	($70,000)	$0	($30,737)	($100,737)	($100,737)
Network Administrator	1	0	1	1	0	$69,628	$69,628	$0	$30,574	$100,202	$0
Database Administrator	1	0	1	1	0	$79,532	$79,532	$0	$24,821	$81,347	$0
Director of IT	1	0	1	1	0	$111,866	$111,866	$0	$55,394	$181,548	$0
Subtotal	4	0	4	5	-1		$247,924	$0	$105,035	$344,241	($100,737)
Total	58	6	52	51	8		$2,250,871	$7,000	$984,529	$3,233,682	$349,698
										% Pos. Reduction	12.9%

Table B11. Vehicle and other savings

Avg. Ann. cost per Vehicle (incl. depreciation)				$5,800	
Vehicles		Number Before	Number After	Number Saved	Total Savings
Meter readers, crew chief		7	0	7	$40,600
Field service investigators		2	2	0	$0
	Total	9	2	7	$40,600
Other Cost Savings		Before	Reduction	After	Savings
Vacant Account		$170,000	0%	$170,000	$0
Leak Adjustments		$260,000	25%	$195,000	$65,000
Theft		15,000	50%	$7,500	$7,500
Bad Debt Write-off		$120,000	10%	$108,000	$12,000
	Total				$84,500
				Total Vehicle and Other Savings	$125,100

Table B12. Revenue recovery from meter replacement

Total Annual Revenues (FY 14)	Small	Large
Water Commodity Revenues	7,883,570	4,563,418
Sewer commodity revenues	8,734,722	4,804,810
Total	16,618,292	9,368,228
Water consumption, small meters, MGD		
Water consumption, large meters, MGD		
	Total Small	- Large
Ttl Wtr Cons., CCF	-	-
No of meters	21,008	304
No. of meters to be replaced	7,121	0
Revenue through meters to be replaced	$5,633,038	0
Pct rcvry for mtrs to be rplcd	0.00%	0.01%
Revenues recovered through replacement	$0	0
Total Increase in annual revenues	$0	
Annual Loss in Meter Accuracy	0.25%	0.25%

Table B13. Summary of non-discounted costs and benefits

		All Meters: 21,312	
Capital Cost		Total Cost	Cst/Unit
Meters & Assoc. Misc. Mat'ls.		$877,145	$41.16
Installation Costs Allocable to Meters		$222,060	$10.42
Endpoints (MIUs) & Assoc. Mat'ls.		$1,872,356	$87.85
Installation Costs Allocable to Endpoints		$661,749	$31.05
Data Collection HW/SW, Vendor Pjt Mgt.		$1,273,125	
OWAWA Project Mgt. Initial Costs		$300,000	$14.08
OWASA Project Mgt. Ongoing Costs		$505,053	
Grand Total System Cost		$5,711,488	$267.99
Salvage on Old Meters		$34,186	$1.60
Savings on normal meter turnover, HotRod		$2,466,536	$115.73
Net Total System Cost		$3,210,767	$150.66
Annual System O&M Costs			
Operating Costs		$109,803	$5.15
Maintenance and Repair		$41,060	$1.93
Total Annual O&M Cost		$150,863	$7.08
Annual Operating Costs/Savings			
Personnel Savings	$	349,698	$16.41
Vehicle and other savings		125,100	
Other Savings		0	
Total Annual Savings	$	474,798	$22.28
Under-Registration Recovery		$0	$0.00
Total Revenue Plus Savings		$474,798	$22.28
Net Annual Savings		$323,935	$15.20
* Unadjusted for inflation or discounting			
Simple Payback Period Calculation		9.9	

Table B14. Factors for multi-period analysis

Input Data		Cost Item	Total Cost	Number of Units	Average Cost	Contin-gency	W/ Cntngy Cost (000s)	Inflation Factor
Default Inflation Factor	2.00%	Meters & Assoc. Misc. Mat'ls.	$877,145	21,312	$41.16	5.0%	$921	2.0%
Discount Rate*	3.50%	Meter Installation	$222,060	21,312	$10.42	5.0%	$233	2.0%
Current Year	2016	Electronics & Assoc. Mat'ls.	$1,872,356	21,312	$87.85	5.0%	$1,966	0.0%
Installation Start	2017	Electronics Installation	$661,749	21,312	$31.05	5.0%	$695	2.0%
Years Until Start	1	Data Collection HW/SW	1,273,125	21,312	$59.74	5.0%	$1,337	2.0%
Years of Installation	2.0	Project Mgt Initial	$300,000	21,312	$14.08	5.0%	$315	2.0%
Meter Service Life	25	Project Mgt Ongoing	$505,053	21,312	$23.70	5.0%	$530	2.0%
Endpoint Service Life	15	Salvage Value	$34,186	21,312	$1.60		$34	2.0%
Savings Delay, yrs	0	Normal meter turnover savings	$2,466,536	21,312	$115.73		$2,467	2.0%
		Annual O&M	$150,863	21,312	$7.08		$151	2.0%
		Annual Operating Cost Savings	$474,798	21,312	$22.28		$475	2.0%
		Under-Registration Recovery	$0	21,312	$0.00		$0	0.0%
*Reflecting cost of capital					Total Capital Cost w/Cont		$5,997	

Table B15. Cumulative installations, cost savings and inflation factors used for multi-period analysis

Year	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Project Time Horizon	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Install? Yes=1, No=0	FALSE	TRUE	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
Installation Curve	0	0.50	0.50	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Installed in Year	0.0%	75.0%	25.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Cumulative Installation	0.0%	75.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Cost Savings Factor	0.00	0.38	0.88	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
No. meters chngd	0	5,341	1,780	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No. AMI Installations	0	15,984	5,328	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cum.AMI Installs	0	15,984	21,312	21,312	21,312	21,312	21,312	21,312	21,312	21,312	21,312	21,312	21,312	21,312	21,312	21,312	21,312	21,312	21,312	21,312
Inflation Factor	1.00	1.02	1.04	1.06	1.08	1.10	1.13	1.15	1.17	1.20	1.22	1.24	1.27	1.29	1.32	1.35	1.37	1.40	1.43	1.46
Rate Increase per Year	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02
Cumulative Rate Increase	1.02	1.04	1.06	1.08	1.10	1.13	1.15	1.17	1.20	1.22	1.24	1.27	1.29	1.32	1.35	1.37	1.40	1.43	1.46	1.49

Table B16. Distribution of administrative and start-up costs

Year	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Project Management	$0	$580	$265	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Data Collection HW/SW	0	1,339	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table B17. Savings over planning horizon

Year	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Annual Operating Cost Savings	$0	$178	$415	$475	$475	$475	$475	$475	$475	$475	$475	$475	$475	$475	$475	$475	$475	$475	$475	$475
Normal meter turnover savings	0	244	244	244	244	244	244	244	244	244	244	0	0	0	0	0	0	0	0	0
Under-registration recovery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Placeholder	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table B18. Costs and savings over planning horizon, including deprecation calculations

Year	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	
Planning Horizon	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total
Meters & Misc. Matls.	0	691	235	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	927
Meter Installation	0	175	59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	234
Meter Salvage Value	0	(26)	(9)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	(34)
Subtotal	$0	$840	$286	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1	$1	1,127
Endpoints	0	1,474	491	0	0	0	0	0	0	0	0	0	0	0	0	0	1,474	491	0	0	3,932
Endpoint Installation	0	521	177	0	0	0	0	0	0	0	0	0	0	0	0	0	701	238	0	0	1,638
Data Collection HW/SW	$0	$1,337	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	1,337
Subtotal	0	3,332	669	0	0	0	0	0	0	0	0	0	0	0	0	0	2,176	730	0	0	6,907
Project Start-up & Admin.	0	580	270	0	0	0	0	0	0	0	0	0	0	0	0	0	781	364	0	0	1,995
Normal meter turnover savin	$0	($247)	($252)	($257)	($262)	($267)	($272)	($278)	($283)	($289)	($295)	$0	$0	$0	$0	$0	$0	$0	$0	$0	(2,701)
Total Capital Costs	$0	$4,753	$1,225	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,957	$1,094	$1	$1	10,029
Operating Cost Savings	$0	$425	$675	$751	$766	$781	$797	$812	$829	$845	$862	$579	$590	$602	$614	$626	$639	$652	$665	$678	13,188
Under-registration Recovery	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	0
System O&M Costs	$0	($113)	($154)	($157)	($160)	($163)	($167)	($170)	($173)	($177)	($180)	($184)	($188)	($191)	($195)	($199)	($203)	($207)	($211)	($215)	(3,408)
Net Operating Savings	$0	$312	$521	$594	$606	$618	$630	$643	$655	$669	$682	$395	$403	$411	$419	$427	$436	$445	$454	$463	9,780

Table B19. Discounted cash flow and return on investment calculations

Year	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Cash on Cash	Residual value hardware included																			
Capital Investment (20yr)	$0	($4,753)	($1,225)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($2,957)	($1,094)	($1)	$1,578
Capital Investment (15yr)	0	(4,753)	(1,225)	0	0	0	0	0	0	0	0	0	0	0	435					
Net Operating Savings	$0	$312	$521	$594	$606	$618	$630	$643	$655	$669	$682	$395	$403	$411	$419	$427	$436	$445	$454	$463
Net Cash (20yr)	0	(4,441)	(703)	594	606	618	630	643	655	669	682	395	403	411	419	427	(2,521)	(649)	453	2,040
Net cash (15 yr)	0	(4,441)	(703)	594	606	618	630	643	655	669	682	395	403	411	854					

20 Year Horizon				
Discount Rate	2.00%	3.50%	6.00%	5.00%
Net Prsnt Val, 000s	$ 442	(69)	(710)	(481)
Internal Rate of Return	3.28%			

15 Year Horizon				
Discount Rate	2.00%	3.50%	6.00%	8.00%
Net Prsnt Val, 000s	$ 1,025	437	(319)	(769)
Internal Rate of Return	4.84%			

Advanced Metering Infrastructure (AMI)
Feasibility Study
Report Supplement B

Orange Water and Sewer Authority

Don Schlenger and Associates, LLC

January, 2016



Orange Water and Sewer Authority
AMI Feasibility Study

Contents

B.1 Sensitivity Analysis for Key AMI Model Variables 3
B.2 Proportional Contributions to Project Cost of Major Components 4
B.3 Continuing OWASA's Existing Metering System Deployment Strategy 5
B.4 AMI Unit Cost Trends 6
B.5 Changing Customer Service Representative Compensation as a Result of AMI 7

This supplement to the December 2015 AMI Feasibility Study contains answers to questions raised by the OWASA Board of Directors.

B.1 Sensitivity Analysis for Key AMI Model Variables

The economic analyses in Excel facilitate examining the sensitivity of the net present value or internal rate of return to various input variables. The changes in values of variables that have the greatest impact on the financial outcome are related to items that are multiplied by the total number of meters (such as MIU prices or unit installation labor costs) or are incurred annually over the expected life of the system (such as personnel savings). Figure 1 shows the impact on the internal rate of return of the AMI alternative of changes in MIU price.

The AMI benefit/cost analysis described above incorporated a 5% contingency on all capital costs, based on the principles that project component performance is relatively independent, the AMI system has considerable redundancy built in, and there is little uncertainty in the design and deployment of the system. Figure 2 indicates the impact on the internal rate of return of the AMI alternative of varying the contingency allowance.

The return on an investment in AMI (or any alternative) is dependent on realizing the savings in meter reading staffing costs. Figure 1 shows the impact on the internal rate of return of the AMI alternative of the number of Utility Mechanic positions redeployed from meter reading to other tasks.

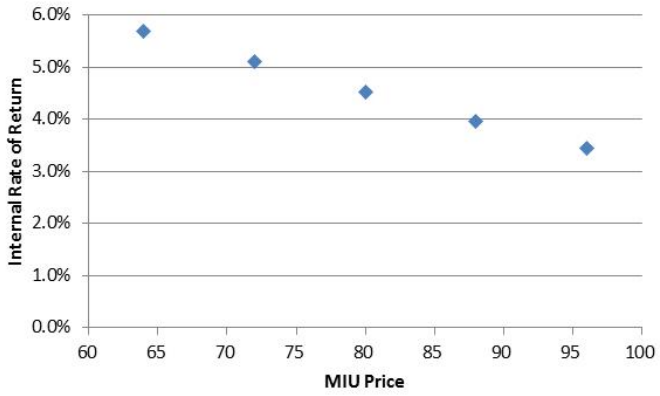


Figure 1. Impact on internal rate of return on investment in AMI of MIU price

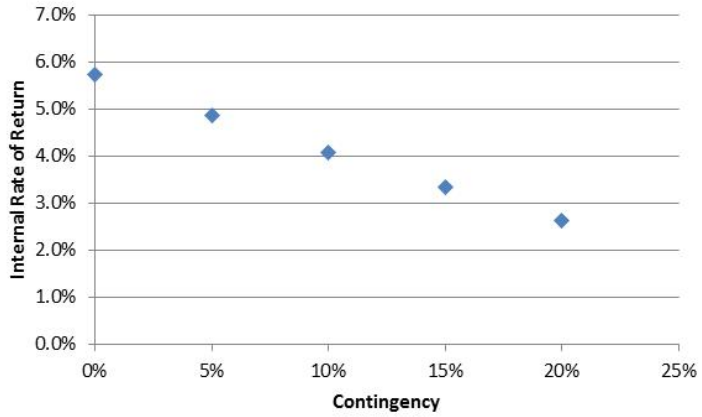


Figure 2. Impact on internal rate of return on investment in AMI of contingency allowance

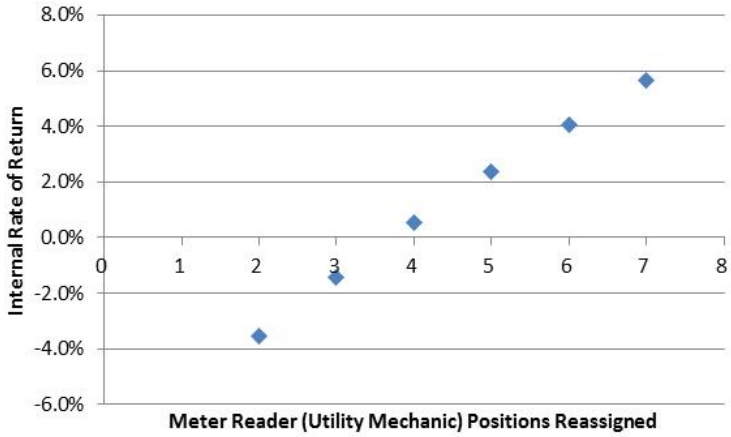


Figure 3. Impact on internal rate of return on investment in AMI of meter reading staff savings

B.2 Proportional Contributions to Project Cost of Major Components

The proportional costs of major project components are shown in the following chart. AMI MIUs and retrofit AMI-compatible registers constitute about one-third of project capital costs. AMI network hardware and software together constitute about 12%, while project management and vendor professional services constitute about 24%. Note that this chart does not take into account the offset from suspending OWASA's current HotRod AMR deployment.

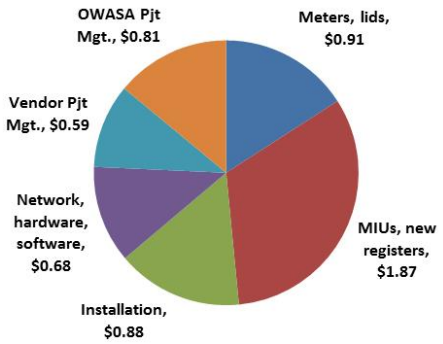


Figure 4. Proportional cost of AMI project components ($millions)

B.3 Continuing OWASA's Existing Metering System Deployment Strategy

OWASA is currently deploying HotRod AMR devices in conjunction with meter changeout for age and failure at a rate of about 1,000 per year. At the time the AMI Feasibility Study was undertaken, there were about 13,000 meters still without AMR MIUs. Therefore, under OWASA's current strategy, it will saturate its service area with AMR after about 13 years. The HotRod MIUs are expected to last 15 years, so during this 13-year period it will also have to replace approximately 8,000 older MIUs installed from 2006 onward. The advantages of the current strategy are:

- It captures some economies of scale in installing AMR units in conjunction with meter changeouts
- It incorporates AMR conversion in operating costs rather than capital costs
- It avoids the "disruption" of a large-scale deployment project

The disadvantages of this strategy are:

- It perpetuates inefficiencies in meter reading and customer service associated with mixed meter reading methods on meter reading routes
- It results in some customers are provided a different level of service (e.g., the ability to obtain detailed consumption profile data) than others for many years
- It puts OWASA in the mode of perpetually installing AMR equipment
- It locks OWASA into an older technology that cannot be migrated to fixed network AMI.

Under its current program, using current meter and MIU prices, OWASA will spend approximately $2,300,000 on replacement meters, AMR MIUs, additional reading equipment and new non-ferrous (radio-friendly) meter box lids over the next 13 years. Large meters are regularly serviced and calibrated, so OWASA would only convert any meters not already on AMR with new registers and MIUs. Using its estimates for labor costs, OWASA will also spend

about $600,000 on labor to install this equipment. It will also have to spend about $800,000 on materials and labor to replace existing HotRod AMR radios that reach the end of their service lives during that period. The grand total cost would be about $3,740,000 over the 13-year period. Since there are relatively few meters scrapped each year, no salvage value has been included in the analysis. OWASA would also have to maintain and regularly replace existing handheld and mobile meter reading hardware, as well as the HotRod meter reading server.

By completely converting its system to AMR, OWASA should eventually be able to reduce its meter reading staffing by three positions and associated vehicles by the end of the 13-year period. Since OWASA is presumed to operate under its current customer service processes and policies, no reductions are assumed in leak adjustments, theft, vacant account fees or bad debt write-offs. Net annual savings by the end of the period would have reached approximately $140,000 per year.

Allowing a 5% contingency and 2% per year inflation on capital costs would result in a net present value of approximately -$1,665,000 over a 15-year planning horizon, with an internal rate of return of approximately -9.8%.

Note that this cost is higher than the avoided cost assumed when evaluating alternative metering system strategies, which only assume ten years of savings, under the presumption that after that, technologies would have changed.

B.4 AMI Unit Cost Trends

The prices for AMI system hardware and software components have declined significantly since the start of the industry, and are still declining, but at a much slower rate. This is typical of the price behavior of electronic components. The features and capabilities of hardware components have been relatively stable, with some embellishments, over the last 5-10 years.

Water AMI pricing offered by vendors in response to competitive solicitations depends on many factors, including the size of the project and the number of units required per year, whether the project is bid directly or through a distributor, the particular RFP requirements and contract provisions, and the perceived competitiveness of the procurement. Proposers with the lowest prices have not always won projects.

While there are thousands of AMI projects in the United States, many are small and unit prices are often confidential. Figure 5 shows the AMI MIU prices offered by two major vendors in several proposals for projects ranging in size from around 10,000 to more than 400,000 units.

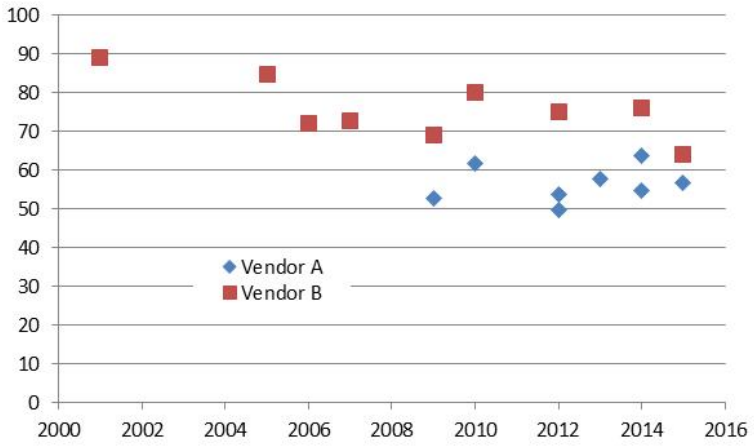


Figure 5. MIU prices from two major vendors

Costs of network components (data collectors and repeaters), as well as prices for AMI system software, have been stable or slightly declining for several years; meanwhile, capabilities and features have expanded. Prices per meter for managed and hosted services, a recent offering, started out widely variable, and are in the process of settling down as vendors get more experience and competitive intelligence through various procurements. Network components and software constitute relatively small portions of total system cost compared to MIUs, meters and installation labor.

Newer AMI technologies, such as "network-less" cellular telephone-based systems, have to date been proposed at significantly higher total costs than "mainstream" AMI systems. We do not anticipate significant cost reduction in AMI systems in the next several years.

B.5 Changing Customer Service Representative Compensation as a Result of AMI

An informal survey was taken of utilities that converted to AMI to determine whether they increased the salaries of customer service representatives as a result. The majority of utilities interviewed said they did not. One utility manager said, "It's comparable to installing a new high tech photocopier in the office; it's a new tool with new functions to help you better perform your work. You don't get a pay rise because of the new copier, do you?" In some cases, the vacancies created by AMI in customer service were lower level positions, so the average departmental salary would be effectively higher.

Lessons learned from utilities that have AMI

- Team effort and commitment are required for success. The Team includes customers, the Board, staff, consultants, and contractors.
- The services of a highly qualified consultant must be retained. Few Utilities have the requisite knowledge on staff.
- A communications plan to make customers aware of the project and its benefits and to address their concerns, must be developed and implemented. This plan is typically implemented during the procurement phase and continues throughout implementation.
- An open, competitive procurement process must be used; however price should not be the sole determining factor in vendor selection.
- Deployments with larger quantities per year result in lower unit prices for equipment and lower fixed costs (e.g., for project management).
- Strong contract documents must be developed to ensure optimal contractor and system performance and minimize risks.
- An effective project management team must be established.
- An internal change management plan must be developed and implemented. Multiple areas within the organization will be directly impacted.
- Processes and policies must be adapted to take full advantage of the new meter reading technology.
- Extensive staff training must be provided.
- Staff must be afforded time to become proficient with the new system before allowing customers access to it.
- Cast iron meter box lids, flooded meter boxes/vaults, and landscaping (i.e. dirt, mulch, etc.) can interfere with the transmitter signals.
- The number and location of data collection units (DCUs) proposed for service area coverage may require adjustment as the project is deployed; the vendor should be held responsible for this.
- Changing to more accurate meters may result in higher bills for some customers.
- Lawnmower decks can damage transmitters that protrude thru the lid.
- Meter boxes/vaults, setters, and/or yokes may not accommodate the new meters and transmitting equipment.
- Transmitter battery life is the critical life cycle component. Most will last 15-20 years under “normal” operating conditions. Manufacturers typically warranty transmitters for 10 years at full replacement value plus ten years pro-rata.
- Extended or phased deployments are typically done in-house. Balancing workloads can be an issue.
- Rapid deployments are done by contractors. The utility must provide adequate oversight and use an installation control process.
- Increasingly, utilities are opting for “managed” or “hosted” system software.
- Installation control system and procedures are required to ensure confidence in the system.
- Successful deployment requires adherence to the principles of good project management
- Once installed, the system must be monitored and maintained to ensure performance levels are sustained.

Agenda Item 8:

Discuss Strategies for Employee Health Insurance for Fiscal Year (FY) 2017

Purpose:

Information and presentation by staff and Hill, Chesson and Woody to generate Board discussion and guidance to staff regarding Employee Health Insurance beginning July 1, 2016.

Background:

The Orange Water and Sewer Authority began using the firm of Hill, Chesson and Woody in April 2014 to manage benefit plans and negotiate premiums for Employee Health, Dental, Life, Dependent Life, Accidental Death and Dismemberment (AD&D) and Long Term Disability (LTD) Insurance.

The current Employee Health and Dental Insurance plans along with Life, Dependent Life, AD&D and LTD contracts expire on June 30, 2016.

A representative from Hill, Chesson and Woody will be presenting the following information on January 14, 2016:

- Healthcare Reform Update
- OWASA Executive Summary/Data
- Benchmarking
- Renewal Expectations and Strategy Options

Information:

- Staff Memorandum – Strategies for Employee Health Insurance for FY 2017

ORANGE WATER AND SEWER AUTHORITY

A public, non-profit agency providing water, sewer and reclaimed water services to the Carrboro-Chapel Hill community.

MEMORANDUM

TO: Board of Directors

THROUGH: Ed Kerwin

FROM: Stephanie S. Glasgow

DATE: January 8, 2016

SUBJECT: **Strategies for Employee Health Insurance for Fiscal Year 2017**

Purpose

OWASA's health, dental, accidental death and dismemberment and group life insurance plans expire on July 1, 2016. Before the plans expire, the Board will need to make decisions on a variety of related issues. The purpose of this discussion is to provide the Board with:

- Current year claim trends
- Coverage renewal options to consider

Claims Trends

OWASA's costs of providing health-related insurance coverage for employees is likely to increase significantly.

As you know, health insurance providers receive premiums from employers and pay out claims of employees and covered dependents. Health insurance providers profit (or lose money) from the difference between premiums received, claims paid and administrative cost.

Due to OWASA's claims vs. premiums experience, our health insurance premium increase for FY 2016 was 21.4%. Unfortunately, our claims for FY 2017 are once again trending high.

Renewal Options to Consider

Feedback from employees indicates that health insurance coverage is one of the most important benefits OWASA provides. Employees appreciate and value the quality of the coverage and services provided. Our challenge is to provide this coverage at a reasonable cost.

If current trends continue and we are faced with significant cost increases, the Board may wish to implement changes to certain aspects of our approach to health insurance coverage. The following explains various types of changes available to us that could help reduce the amount of a cost increase.

Plan Design – Changing aspects of our health insurance coverage such as the amount of the deductible, out of pocket maximum, emergency room copayment, etc.

Dual Option – Provide a new "base" plan for employees that would be less expensive and provide lower benefits. However, we would also retain the current plan (or similar) and allow employees to buy-up by paying the additional cost.

Health Insurance Changes to Employee Contribution Amounts – OWASA currently pays 100% of the cost of covering employees and 50% of the cost of covering dependents. The percentage of OWASA's contributions could be reduced or eliminated by increasing the amount employees pay toward coverage.

Dental Coverage Changes to Employee Contribution Amounts - We spend approximately $60,000 per year toward employee dental insurance. OWASA currently pays 100% of the cost of covering employees and 40% of the cost of covering dependents. The percentage of OWASA's contributions could be reduced or eliminated by increasing the amount of employees pay towards coverage.

Vision Coverage Changes to Employee Contribution Amounts - We spend approximately $40,000 per year to provide an in-house vision coverage program. OWASA's contributions could be reduced or eliminated by increasing the amount employees and dependents pay toward coverage.

Spousal Surcharge – As mentioned above, OWASA pays 50% of the cost of providing health insurance coverage for an employee's spouse. In some cases, the employee's spouse may be eligible to be covered by his or her employer. OWASA could implement a financial disincentive that would discourage employees in these situations from having their spouse covered by OWASA's plan.

Pay to Waive – Employees opt out of coverage on the health plan if they show proof of coverage on their spouse's plan. They would be paid an amount less than what OWASA pays for employee only coverage, generating saving to OWASA. Employees cannot be paid to waive coverage to go on the Marketplace, Medicare or TriCare.

Market our Plan – We could seek proposals from other insurance providers. However, as discussed, the cost of health insurance is directly tied to the relationship of premiums received vs. claims paid. Our claims experience may make it difficult to obtain an attractive quote. As renewal approaches, and more information is provided, Hill, Chesson and Woody will be able to provide more guidance on marketing our plan.

Funding Type - OWASA could explore changing to a self-funded arrangement or a hybrid funding arrangement. This is where OWASA pays the claims with a stop-loss protection for high claimants or where OWASA takes on more claims risk.

Action Requested

Staff requests guidance regarding which renewal options the Board would like to consider if we are faced with another significant increase in the cost of providing health insurance benefits to employees. Based on this guidance, staff will work with Hill, Chesson and Woody to be prepared to provide more information on the options as it becomes available.



Stephanie S. Glasgow, MESH, MPM, PHR
Director of Human Resources and Safety

Agenda Item 9:

Review Board Work Schedule

Purpose:

a) Request(s) by Board Committees, Board Members and Staff
b) Review and update the 12 Month Board Meeting Schedule
c) Review the draft agenda and discuss expectations for the January 28, 2016 meeting
d) Review the draft agenda and discuss expectations for the February 11, 2016 work session

Information:

- Draft 12 Month Board Meeting Schedule
- Draft agenda for the January 28, 2016 meeting
- Draft agenda for the February 11, 2016 work session

OWASA Board of Directors – 12 Month Board Meeting Schedule (January 14, 2016)

Month	Board Meetings		Committee & Other Meetings
	Work Session	Business Meeting	
January 2016	***Consider Approval of AMI Feasibility Study and discuss Next Steps*** Approve Solids Handling Supervisor Position Discuss Strategies for Employee Health Insurance FY 17 Budget Calendar and Assumptions () *1/14/2016*	***Discuss potential rate structure modifications*** *(if needed)* Discuss 2015 Customer Survey Results & Action Plan Discuss CIP Investment Practices Annual Lakes Recreation Report () Q2 Financial Report () CIP Semiannual Report () *1/28/2016*	***Special Meeting of the Board on Potential Rate Structure Modifications (1-21-2016)***
February 2016	***Discuss Draft Employee Compensation Philosophy*** ***Discuss potential rate structure modifications*** *(if needed)* CS - General Counsel Interim Review () *2/11/2016*	***Receive public feedback on AMI*** (if applicable) Community Engagement Approach/ Process Discuss Financial Reserves Policy Discuss Review & Update of Strategic Plan CS - General Counsel Interim Review () *2/25/2016*	***NRTS - Energy Plan – Strategy Evaluation (TBD)***
March 2016	***Discuss public feedback received on AMI on 2/25/16*** *(if applicable)* ***Approve Employee Total Compensation Philosophy*** ***Review Energy Plan – Strategy Evaluation*** Review findings of Easement Pilot FY 17 Draft Budget and Rates () Set date for Public Hearings – FY 17 Budget and Rates () CS – ED Interim Review () *3/10/2016*	***Make decision to proceed or not with AMI*** (if applicable) Discuss Potential Process to Update Strategic Plan FY 17 Draft Budget and Rates () CS – ED Interim Review () *3/24/2016*	***CEC – Draft CE Plan (TBD)***
April 2016	***Review Consultant Contract for AMI Procurement Services*** (if needed) Review Employee Health and Dental Insurance Renewal () FY 17 Draft Budget and Rates () Authorize staff to publish proposed rates () *4/14/2016*	***Approve/Disapprove Consultant Contract for AMI Procurement Services*** (if needed) Award the Rosemary, Henderson, and Hillsborough St. Water Main Project Contract Q3 Financial Report () Appoint Audit Firm () *4/28/2016*	***NRTS – Draft Energy Plan (TBD)***
May 2016	***Discuss LRWSP – Goals and Metrics*** Award the Cane Creek Permanganate Facility Project Contract Discuss Employee Health and Dental Insurance Renewal (if needed) () Discuss Employee Merit Pay for FY 17 () Appointment of Nominating Committee () *5/12/2016*	Public Hearings – FY 17 Budget and Rates () Approve Employee Health and Dental Insurance () Approve LRWSP – Goals and Metrics *5/26/2016*	
June 2016	***Review Draft Energy Plan*** Approve Employee Merit Pay for FY 17 () Approve FY 17 Budget and Rates () Election of Officers () *6/9/2016*	To Be Determined *6/23/2016*	
July 2016	***Public Comment on Draft Energy Plan*** ***Discuss LRWSP - Demands and Yield*** *7/14/2016*	To Be Determined *7/28/2016*	
August 2016	CS – General Counsel Review () *8/11/2016*	12 Month Financial Report () CIP Semiannual Report () CS – General Counsel Review () *8/25/2016*	
September 2016	CS - General Counsel Review () CS – ED Review ()	***Approve Energy Plan*** Annual Report and Financial Audit ()	

Current and Pending Key Projects and Stages – in ***bold italics***

OWASA Board of Directors – 12 Month Board Meeting Schedule (January 14, 2016)

Month	Board Meetings		Committee & Other Meetings
	Work Session	Business Meeting	
	9/8/2016	Approve General Counsel Engagement ↻ CS – ED Review ↻ *9/22/2016*	
October 2016	Review AMI System Procurement Contract *10/13/2016*	Q1 Financial Report ↻ Strategic Trends Report ↻ *10/27/2016*	
November 2016	Approve AMI System Procurement Contract *11/10/2016*	*Holiday - no meeting*	
December 2016	TBD *12/8/2016*	*Holiday - no meeting*	

The 12 Month Board Meeting Schedule shows Strategic Plan initiatives and other priority efforts that the Board and staff plan to give greatest consideration to during the next twelve months. The schedule also shows major recurring agenda items that require Board action, or items that have been scheduled in response to the Board's prior standing request. This schedule does not show all the items the Board may consider in a work session or business meeting. It also does not reflect meetings at which the Board will discuss and act on the update of the Strategic Plan.

The 12 Month Board Meeting Schedule will be reviewed and updated at each monthly work session and may also be discussed and updated at the Board's business meetings.

In addition to the initiatives shown in this schedule, staff will be working on other Strategic Plan and organizational priorities that are not expected to require major additional discussion with the Board except as part of budget deliberations (e.g., continuing our comprehensive asset management work).

The schedule implies that the following Strategic Plan initiatives would be addressed beyond the 12 month period. The Board may conclude that one or more of the following initiatives are higher priority. The schedule will be revised as needed to reflect the Board's priorities, and any additional initiatives that the Board may decide to address.

- Development of a plan and policy framework for OWASA lands is considered a longer-term priority.
- Improve effectiveness as a learning organization is considered a longer-term priority.
- Water Conservation Plan will be prepared concurrent with update of the Long-Range Water Supply Plan.

The OWASA Board determines which topics it wants to explore as a full Board (potentially in a work session format) and which topics it wants to assign to Board committees or committee chairs for further analysis and development of recommendations. Board also determines priorities and desired timeframes for addressing topics. Committee meetings will be updated on the schedule routinely.

Abbreviations Used in Draft Schedule:

↻	Recurring agenda item (generally these are "required" items)
AMI	Advanced Metering Infrastructure
CE	Community Engagement
CIP	Capital Improvements Program
COLA	Cost of Labor Adjustment
CS	Closed Session of the Board
CY	Calendar Year
ED	Executive Director
FY	Fiscal Year
JLP	Jordan Lake Partnership
LRWSP	Long-Range Water Supply Plan
NRTS	Natural Resources/Technical Systems
Q	Quarter
TBD	To Be Determined
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

Current and Pending Key Projects and Stages – in ***bold italics***

OWASA Board of Directors – 12 Month Board Meeting Schedule (January 14, 2016)

Current and Pending Key Projects and Stages

Project	Strategic Initiative	Project Lead	Jan-16	Feb-16	Mar-16	Apr-16	May-16	June-16	July-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16
AMI	6	Przybyl	Determine Next Steps			If needed	If needed If needed					If needed	If needed	If needed If needed
Total Compensation Study		Glasgow				*Schedule To Be Determined*								
Rate Structure Study	4	Winters												
LRWSP	1	Rouse					Goals & Metrics	Goals & Metrics	Demands & Yields					
Energy Plan	5	Tiger/ Davis		NRTS	Strategy Evaluation	NRTS		Draft Plan						

Stages	Committee Discussion	Feasibility Study	Board Review	Community Engagement	Action	Procurement	Implementation

AGENDA
MEETING OF THE OWASA BOARD OF DIRECTORS
THURSDAY, JANUARY 28, 2016, 7:00 P.M.
CHAPEL HILL TOWN HALL

In compliance with the "Americans with Disabilities Act," interpreter services are available with five days prior notice. If you need this assistance, please contact the Clerk to the Board at 919-537-4217 or aorbich@owasa.org.

The Board of Directors appreciates and invites the public to attend and observe its meetings. Public comment is invited either by petition upon topics not on the Board's agenda, or by comments upon items appearing on the Board's agenda. Speakers are invited to submit more detailed comments via written materials, ideally submitted at least three days in advance of the meeting to the Clerk to the Board via email or US Postal Service (aorbich@owasa.org/400 Jones Ferry Road, Carrboro, NC 27510).

Public speakers are encouraged to organize their remarks for delivery within the three-to-five minute time frame allowed each speaker. Additional time may be allowed at the discretion of the Board of Directors.

Announcements

1. Announcements by the Chair
   A. Any Board Member who knows of a conflict of interest or potential conflict of interest with respect to any item on the agenda tonight is asked to disclose the same at this time.
2. Announcements by Board Members
3. Announcements by Staff
   A. Mason Farm Wastewater Treatment Plant Awards: 1) Platinum Performance Award for Five Years of Excellence in Permit Compliance and 2) Operations & Maintenance Excellence Award (John Kiviniemi/Julie Hellman, President of the North Carolina American Water Works Association-Water Environment Association)

Petitions and Requests

1. Public
2. Board
3. Staff

CONSENT AGENDA

Information and Reports

1. Quarterly Report on Attendance at Board and Committee Meetings (Andrea Orbich)
2. Semiannual Status Report for Various Capital Improvement Projects including the Semiannual Report on Communication Plans for Capital Projects (Vishnu Gangadharan)
3. 2015 Lake Recreation Report (Kenneth Loflin)

Action

4. Approval of the Minutes of the December 10, 2015 Work Session of the Board of Directors (Andrea Orbich)
5. Approval of the Minutes of the January 14, 2016 Work Session of the Board of Directors (Andrea Orbich)

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REGULAR AGENDA

Discussion

6. (If Needed) Discuss Potential Rate Structure Modifications (Stephen Winters)
7. Discuss 2015 Customer Survey Results (Greg Feller)
8. Review of OWASA's Capital Improvement Program Investment Practices (Adam Haggerty/ Vishnu Gangadharan)

Information and Reports

9. Financial Report for the Six-Month Period Ended December 31, 2015 (Stephen Winters)

Summary of Board Meeting Action Items

10. Executive Director will summarize the key action items from the Board meeting and note significant items for discussion and/or action expected at the next meeting

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AGENDA
WORK SESSION OF THE OWASA BOARD OF DIRECTORS
THURSDAY, FEBRUARY 11, 2016, 6:00 P.M.
OWASA COMMUNITY ROOM

The Board of Directors appreciates and invites the public to attend and observe its meetings. For the Board's Work Session, public comments are invited on only items appearing on this agenda. Speakers are invited to submit more detailed comments via written materials, ideally submitted at least three days in advance of the meeting to the Clerk to the Board via email or US Postal Service (aorbich@owasa.org/400 Jones Ferry Road, Carrboro, NC 27510).

Public speakers are encouraged to organize their remarks for delivery within a four minute time frame allowed each speaker. Additional time may be allowed at the discretion of the Board of Directors.

The Board may take action on any item on the agenda.

Announcements

a. Announcements by the Chair
   - Any Board Member who knows of a conflict of interest or potential conflict of interest with respect to any item on the agenda tonight is asked to disclose the same at this time.

b. Announcements by Board Members

c. Announcements by Staff

Discussion

1. Discuss Draft Employee Compensation Philosophy (Stephanie Glasgow/John Anzivino, Senior Vice President at Springsted Incorporated)
2. (If Needed) Discuss Potential Rate Structure Modifications (Stephen Winters)
3. Review Board Work Schedule (John Young/Ed Kerwin)
   a. Request(s) by Board Committees, Board Members and Staff
   b. 12 Month Board Meeting Schedule
   c. February 25, 2016 Board Meeting
   d. March 10, 2016 Work Session

Summary of Work Session Items

4. Executive Director will summarize the key staff action items from the Work Session

Closed Session

5. The Board of Directors will convene Board to go into a Closed Session for the purpose of discussing a personnel matter (Robert Morgan)

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