Attachments:

3n East Orosi Kenneth Schmidt Letter Report

3o East Orosi Safe Drinking Water Project Report

3p Fresno Residential Meter Implementation Plan

3q Fresno Initial Study/Negative Declaration

3r Fresno Meter Installation Plans

3s Bakman Project Vicinity Map

3t Bakman Regional Groundwater Contamination Map

KENNETH D. SCHMIDT AND ASSOCIATES
GROUNDWATER QUALITY CONSULTANTS
600 WEST SHAW SUITE 250
FRESNO, CALIFORNIA 93704
TELEPHONE (559) 224-4412

October 28, 2009

Mr. Paul Boyer
Self-Help Enterprises
8445 West Elowin Court
Visalia, CA 93291

Re: East Orosi Wells

Dear Paul:

Pursuant to your request, I have reviewed the information on the two East Orosi Wells. Drillers logs indicate that the East Well is screened from 220 to 360 feet in depth and has an annular seal from 200 feet in depth to the surface. The West Well is screened from 205 to 320 feet in depth and has an annular seal from 200 feet in depth to the surface. The periodic exceedences of the MCL for nitrate raise several issues. One of these is clearly demonstrated by the March 2005 TV survey of the East Well. That is, the well screen was highly encrusted, and most of the screen openings were plugged. When perforations plug, they usually do so initially farthest from the pump (i.e., in the lower part of the well). If the well is continued to be pumped at the same rate after a substantial part of the screen openings are plugged, the resulting drawdown is much greater. That is, the specific capacity is much less. More downward leakage of shallow high nitrate groundwater can be included. If enough screen openings are plugged, the drawdown could be so great that the pumping level becomes near the bottom of the annular seal, rendering it ineffective. After the new wells were tested, I recommended a pumping rate of no more than 220 gpm for the East Well and no more than 300 gpm for the West Well. The pumps were to be set above the tops of the well screens. Another possible issue to address for the West Well is whether or not there are any openings in the casing above the well screen.

Recommendations

East Well

The well cleaning (brushing, acidification, and airlifting) as proposed by Belknap Pump Co. should be done, then a TV survey be done to determine the effectiveness of the cleaning. Once the well is appropriately cleaned, it should be pumped and surged and a 24-

KENNETH D. SCHMIDT AND ASSOCIATES
GROUNDWATER QUALITY CONSULTANTS

hour step drawdown and constant discharge test would be done. We would oversee the well cleaning and make the drawdown and recovery measurements for the pump test. We would collect water samples for nitrate analyses at the end of each step and at about four-hour intervals during the rest of the pumping period. I would review this information and recommend the optimal pumping rate and pump setting. The rest of the work proposed by Belknap Pump Co. would also be done. We would prepare letter reports as necessary.

The estimated costs are:

Pump Company	$47,000
Hydrogeologic Services	7,000
Contingency	8,000
Total	$62,000

West Well

A TV survey of the well would be done. If any holes are present in the casing above the well screen, these would be patched by swaging in a liner or liners, as necessary. If the screen openings are plugged, which is likely, the same operations would be conducted as recommended for the East Well. We would observe the TV survey, oversee the well repair and cleaning as necessary, make the pump test measurements, collect the water samples, have them analyzed for nitrate, recommend the pumping rate and pump setting, and prepare letter reports as necessary.

The estimated costs are:

Pump Company and Repair Service	$57,000
Hydrogeologic Services	9,000
Contingency	9,000
Total	$75,000

The estimated total cost for both wells would be $137,000.

Please call me if you have any questions.

Sincerely Yours,

Kenneth D. Schmidt

KDS/pe

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH

SAFE DRINKING WATER STATE REVOLVING FUND PROGRAM

PROJECT REPORT

EAST OROSI SAFE DRINKING WATER PROJECT

for the

EAST OROSI COMMUNITY SERVICES DISTRICT
TULARE COUNTY, CA.

October 2008

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Appendix B – Sanitary Survey Report
Appendix C – Notices of Violation
Appendix D – Groundwater Levels in well approximately 1 mile southeast of East Orosi
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Appendix F – Preliminary Cost Estimates for Surface Water Treatment in Cutler-Orosi Area

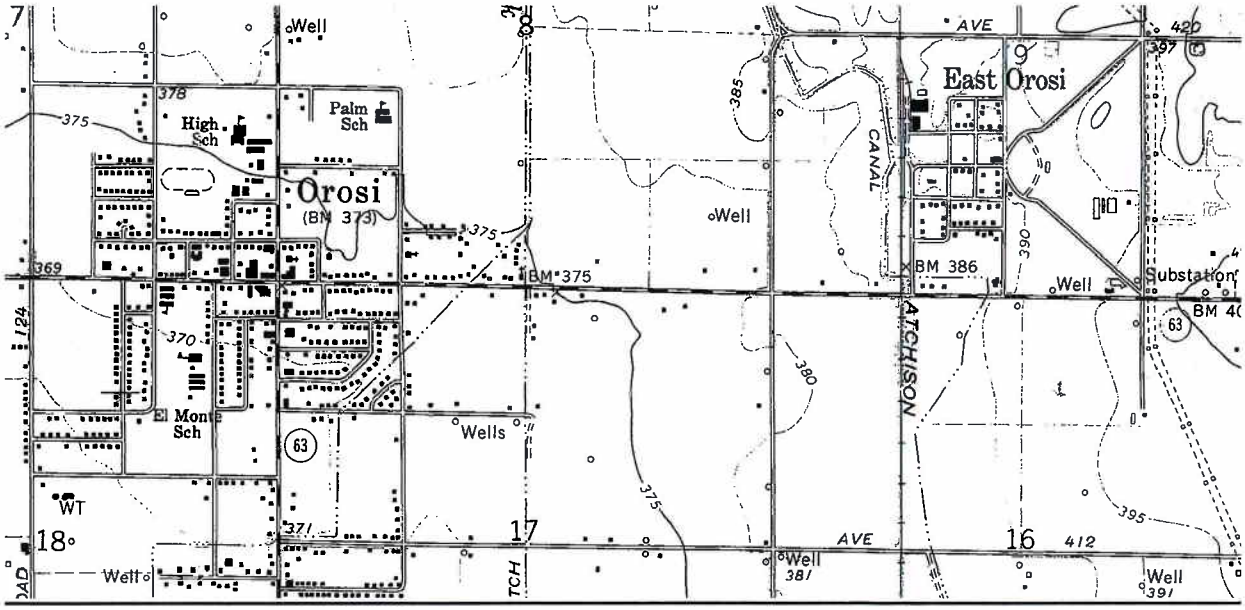
Introduction

At the request of the East Orosi Community Services District (District) this report was prepared for the mitigation of nitrate in the potable water supply. This report is in compliance with the requirements of the Safe Drinking Water State Revolving Fund Loan Program Guidelines - Application for Construction Funds 2008/2009.

Community of East Orosi

The community of East Orosi is located in the northern portion of Tulare County, California, approximately one mile east of the community of Orosi as shown in the vicinity maps in Figures 1 and 2. The community is situated within Section 9 of Township 16S, Range 25E M.D.B.&M. at an elevation of approximately 385 feet as shown on the USGS Vicinity Map that is a portion of the Orange Cove South Quadrangle Figure 1.

Figure 1

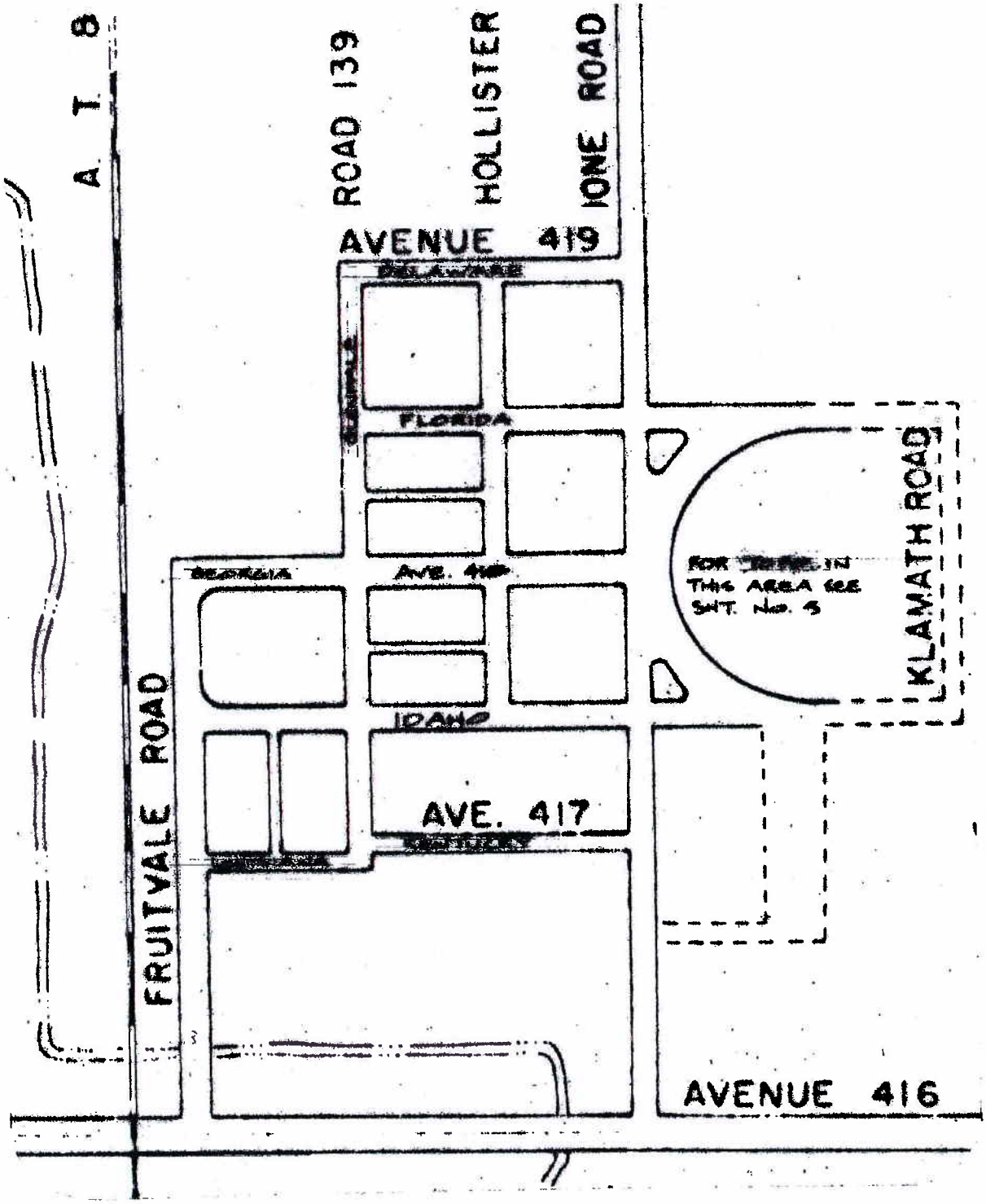


Per the 2000 Census, the population was 426 when there were 105 dwellings in the community and the 1999 median household income was $26,071 (see US Census Bureau data attached as Appendix A).

The East Orosi Community Services District provides domestic water and wastewater services to approximately 105 residential properties, a church and a store in the community as shown in the attached service area map, Figure 2.

Figure 2

East Orosi Community Services District Service Area



Background/History of the Project

The East Orosi Community Services District (District) desires to correct their nitrate contamination problem. Two earlier District wells were destroyed in the early 1980's because of high nitrate concentrations. Well #3 was shut down years ago due to nitrate contamination. The nitrate level in the District's two active wells varies, but is often over the Maximum Contaminant Level (MCL). Over the past several years, the nitrate levels in the remaining active Wells #1 and #2 have ranged from 24 to 61 ppm exceeding the nitrate MCL 3 and 4 times respectively (see Table 1A below).

Table 1A

EOCSD Nitrate Levels in Active Wells

Nitrate MCL = 45 ppm

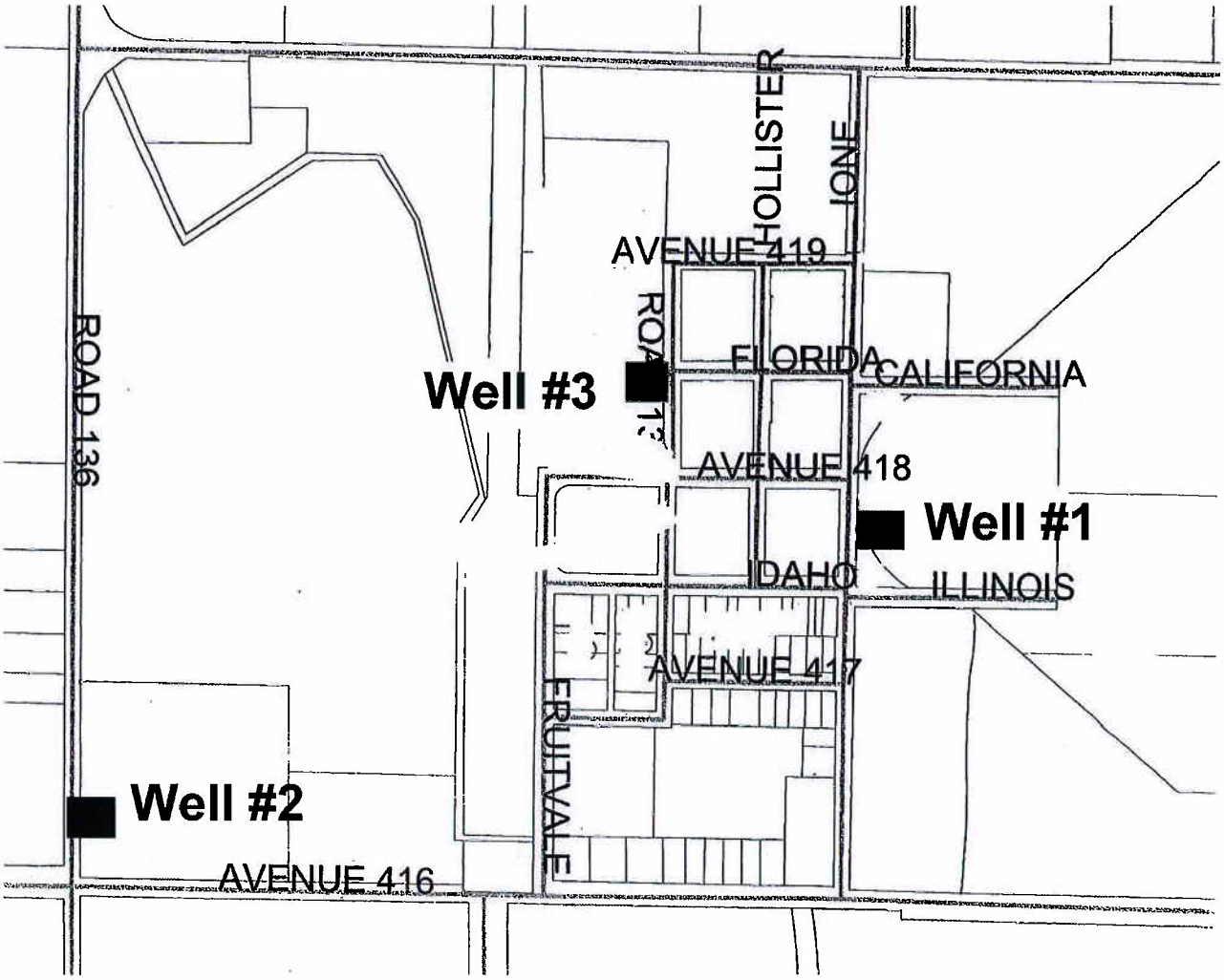
Date	Well #1 (ppm)	Well #2 (ppm)
9/7/1978	36	
12/23/1986	22	29
8/7/1990	41	29
2/28/1994	14	31.1
1/9/1997	43	42
1/11/1999	35	35
1/14/2002		43.4
2/5/2002	33.7	
4/17/2003	50.2	49
6/17/2003	41.2	43.1
10/8/2003	43.7	42.3
8/25/2004	48.6	
11/8/2004	43.4	42.8
1/5/2005	43	38
12/14/2005	61.3	59.9
3/2/2006	44.6	55.8
5/3/2006	42.5	43.5
8/1/2006	48	43
10/24/2006	34.5	45.7
1/15/2007	31.6	38.1
4/5/2007	43.8	44
7/17/2007	47	43.3
10/10/2007	24	54
1/10/2008	39.7	39.9
4/1/2008	39.2	24.2
7/9/2008	43.7	43.1
Times Exceeding MCL	**3**	**4**

The District is seeking grant funding to provide for a solution to their nitrate contamination problem and to bring their water system to consistently meet State Department of Public Health standards.

Existing Facilities and Water Supply

The District has three water wells as a source of supply. One of these wells (Well #3) located at the west end of Florida Street has been taken off line. The two remaining active wells are listed as Well #1 (East) located about a quarter mile south of the District office on Ione Road and Well #2 (West) located about a half mile west of the community on Road 136 just north of Avenue 416. These two existing system water wells were drilled in the 1980's (see Figure 3 below).

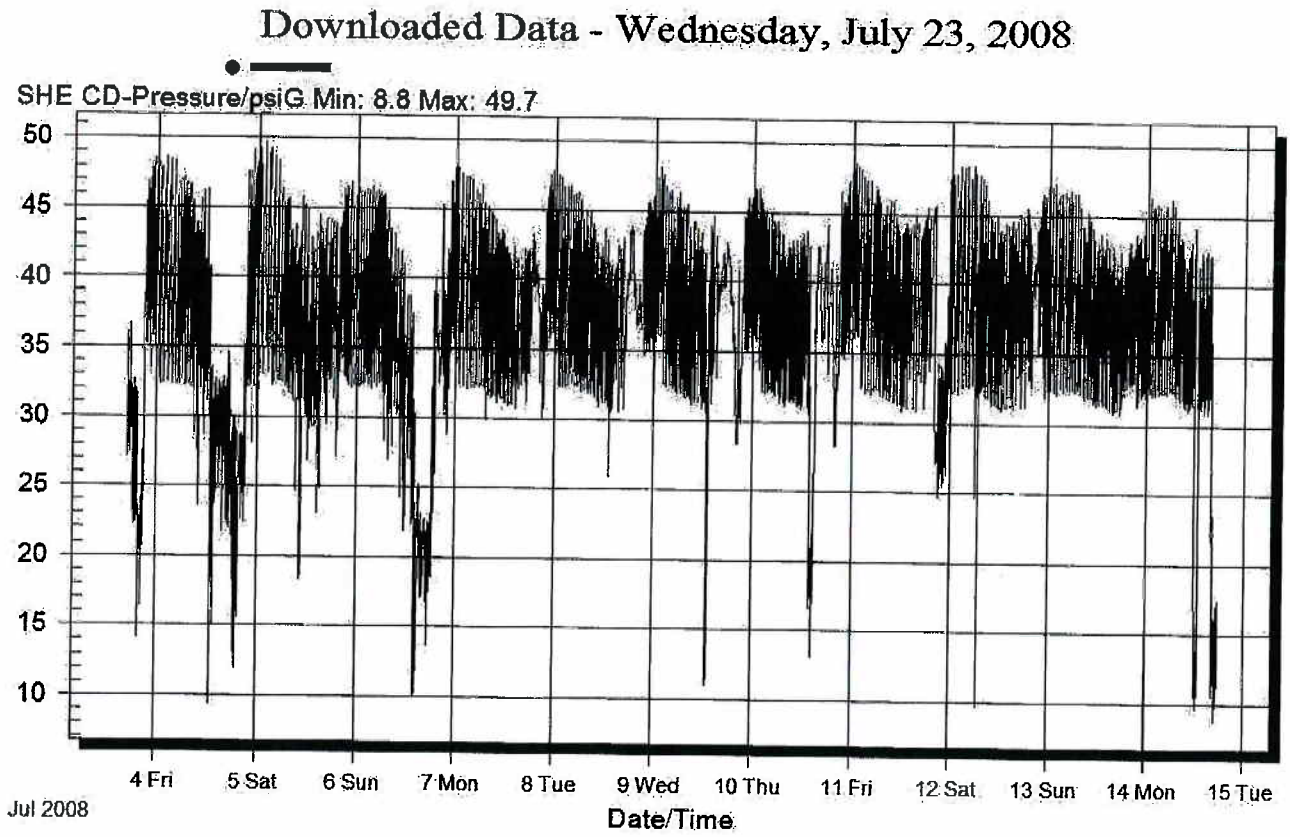
Figure 3
East Orosi CSD Well Sites



Information from the April 2006 Sanitary Survey Report prepared by the Environmental Health Services Division of the Tulare County Health and Human Services Agency (See Appendix B) indicates that Well #1 was drilled to a depth of 350 feet and has a 10" casing. In the well is a 7.5 Hp submersible pump that pumps through a single check valve and flow meter (not operating) into a 7,500 gallon steel hydropneumatic tank. This well is used primarily in the months of October through March. Well #2 was also drilled to a depth of 350 feet. In the well is a 7.5 Hp submersible pump that pumps through a single check valve and flow meter into a 3,500 gallon steel hydropneumatic tank. This well is used primarily in the months of April through September.

The hydro-pneumatic tanks are fitted with pressure switches that maintain system pressures of 30 to 50 psi most of the time. Water system pressure was recorded during the month of July 2008 as shown in Figure 4 indicating that system pressure had dipped on several occasions below 20 psi. Apparently production is not always able to keep up with system demand during the summer months.

Figure 4



The nitrate levels in the wells over the past several years have ranged from 24 to 61 ppm. Figures 5 and 6 below show the nitrate level trends in Wells #1 and #2 indicating there will be a consistent rise over the MCL of 45 ppm.

Figure 5
East Orosi Nitrate Level Trend in Well #1

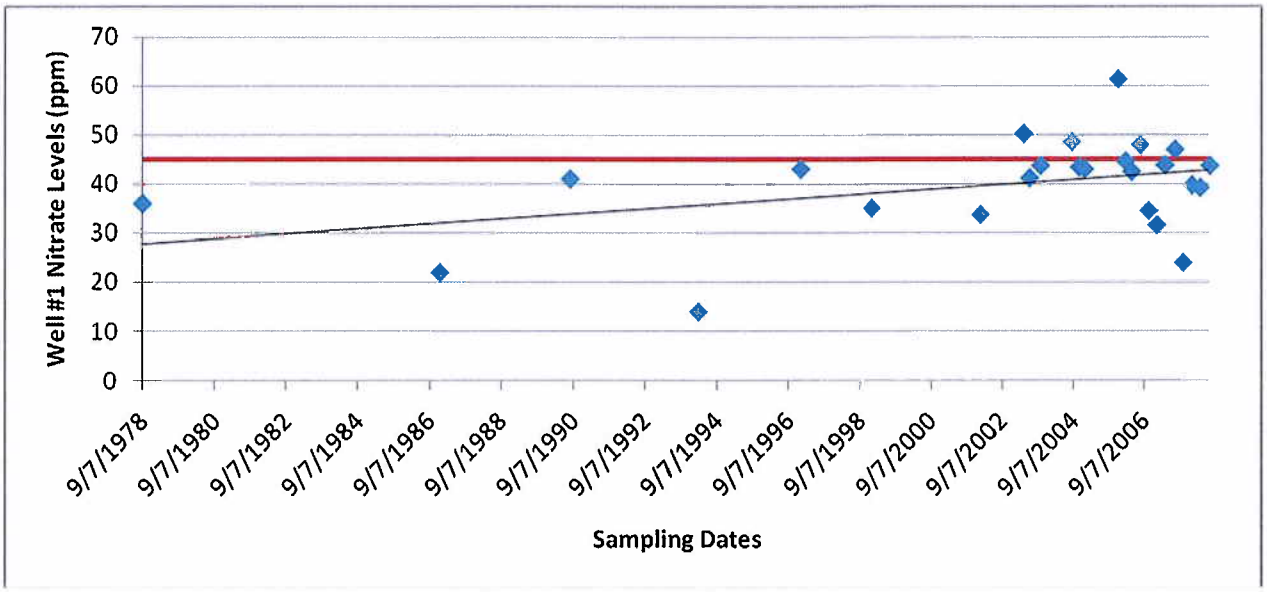
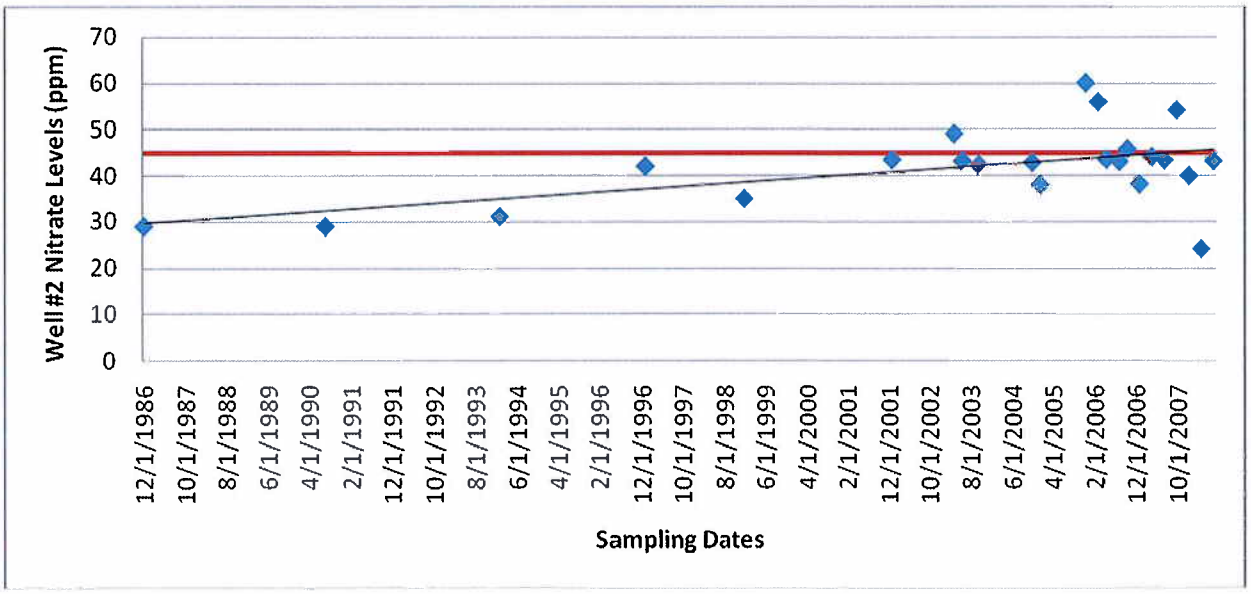


Figure 6
East Orosi Nitrate Level Trend in Well #2



Notices of Violation due to nitrate contamination were issued by Tulare County Health and Human Services Agency on July 14, 2003 and July 15, 2004 (see Appendix C). A comparison of nitrate levels to general groundwater depth in the area for a well located approximately one mile southeast of the

community (16S25E15E) attached as Appendix D.

Analysis of Projected Growth

Based on the last census and history of the community the area is not expected to experience any significant growth. The immediate impact will be to provide water to all current users.

The Year 2000 Census indicated 105 dwellings were in the community. Over the past 8 years this number has basically stayed the same. At this rate it is anticipated that the District will add very few connections over the next 20 years. For planning purposes, it is assumed that another 20 dwellings will be built or moved into the District in the next 20 years and that average daily water consumption will grow from 107,000 gpd to 128,000 gpd.

Alternatives

The objective of the project is to provide a reliable source of good, clean and safe drinking water that is affordable to the residents of the community of East Orosi. This can be accomplished in a phased approach where each well would be rehabilitated and evaluated for water quality and quantity. Following this work it would be determined whether there is still a need for potable water from either (Alternative #2) by drilling 1 or 2 new water wells in the surrounding area or (Alternative #3) consolidation with the Orosi Public Utility District.

Alternative #2 would involve the drilling of 1 or 2 test wells followed by the drilling of 1 or 2 production wells if the test wells are successful. Alternative #3 would be conditioned on a mutually acceptable arrangement between the Districts including the purchase and/or provision of capacity from East Orosi into Orosi's water supply system.

The following are the three potential solutions to solve the nitrate contamination problem and low pressure conditions.

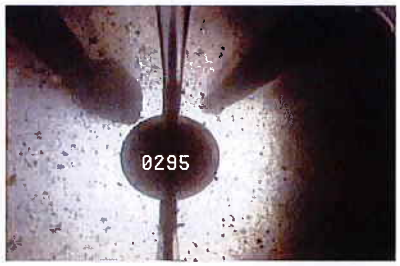
1.) Alternative #1 – Rehabilitate existing water wells and test for quality and quantity.

This alternative involves remediation work on the water system's two active wells in an attempt to unplug well casing perforations that, if successful, would provide a higher percentage of water from the deeper stratas where it is suspected nitrate levels are lower. This work would both provide the possibility of improving water quality as well as increasing water quantity to deal with sporadic low pressure conditions in summer months. The nitrate level in water produced from these wells has been marginally over or under the MCL. There is therefore a chance that opening perforations and pumping water from deeper stratas will be an effective and less costly method of resolving the nitrate issue with each well.

The pump from Well # 1 was pulled and the casing "videoed" on March 10, 2005. At that time it was discovered that a large percentage of perforations were plugged and that the air vent pipe had broken off and was lodged in roughly the bottom 50 feet of the well (see Figure 7). This made it impossible to clean the casing's lower perforations. The upper perforations were cleaned, the pump was replaced and, unfortunately, there was no noticeable difference in nitrate levels from water pumped from this

well.

Figure 7
Broken Pipe in Bottom of Well #1 at Depth of 295 feet



Attached as Appendix E is a cost estimate from a local pump company to do this remediation work on Well #1 which includes removing the fence and pulling pump, videoing well, removing the broken pipe from the bottom of the well, cleaning out the bottom of the well, wire brushing casing, acid washing the casing, removing acid from casing, "revideoing" well, and then installing a new pump and new flow meter. A similar scope of work is also recommended for remediating Well #2. As shown in the cost estimates contained in Cost Table 2, the estimated cost of this alternative for East Orosi is $102,600.

TABLE 1

ALTERNATIVE #1 EAST OROSI WELL REMEDIATION PROJECT

Item	Description	Unit	Quantity	Unit Price	Amount
1	Well #1 Remediation	LS	1	$41,000	$41,000
2	Well #2 Remediation	LS	1	$35,000	$35,000
				Construction subtotal:	**$76,000**
	Legal and Administration (5%)				$3,800
	Engineering (15%)				$11,400
	Contingency (15%)				$11,400

	TOTAL				**$102,600**

2.) <u>Alternative #2 - Drill 1 or 2 new water wells in a new location to provide for a clean water source.</u>

This alternative involves drilling and developing 1 or 2 new water wells in an aquifer that has potentially a much lower concentration of nitrate and is free from other harmful constituents. As shown in the cost estimates contained in Cost Table 3, the estimated cost of drilling each 700 foot deep test well to determine if there exists an aquifer that would yield an acceptably low nitrate supply of water in sufficient quantity for East Orosi is $100,000.

If the results are favorable from the test well phase, the work will include the full development of each well with a new vertical turbine or submersible pump and installation of a piping manifold and new hydropneumatic tank with an estimated 5,000 feet of transmission line to connect to the existing East Orosi water system. As shown in the cost estimate contained in Table 2, the total project cost to provide all of the improvements is $2,314,300.

Table 2

ALTERNATIVE #2 EAST OROSI WELL REPLACEMENT PROJECT

Item	Description	Unit	Quantity	Unit Price	Amount
1	Hydrogeological Investigation	LS	1	$10,000	$10,000
2	Test Well	LS	2	$100,000	$200,000
3	Production well	LS	2	$330,000	$660,000
4	Pump and Equipment	LS	2	$240,000	$480,000
5	Chlorinator	LS	2	$20,000	$40,000
6	Storage (Hydropneumatic Tank)	LS	2	$50,000	$100,000
7	Connection to Distribution System	LS	2	$10,000	$20,000
8	Transmission Line from New Wells	LF	5,000	$40	$200,000
				Construction subtotal:	**$1,710,000**
	Land for Well site(s)	EA	2	$20,000	$40,000
	Legal and Administration (3%)				$51,300
	Engineering (15%)				$256,500
	Contingency (15%)				$256,500

	TOTAL				**$2,314,300**

3.) <u>Alternate #3 -Consolidate with another system in the area that can meet the demands of the East Orosi Community Services District.</u>

The most likely potential area to consolidate with is the water system operated by the Orosi Community Services District. East Orosi has approached the Board of the Orosi Public Utility District in prior years to determine the willingness of Orosi to provide such a connection. The Orosi Board has unofficially stated that if East Orosi covered all of the costs involved including providing additional sources of potable water that such a connection would be seriously considered. Towards this end, the Orosi Public Utility District Board was supportive to East Orosi CSD's action of submitting a Proposition 50 preapplication to CDPH in 2004 to provide such a connection and cover all related costs.

This option would include installing a 12-inch water transmission line roughly 5,000 feet from East Orosi to Orosi and connecting to distribution system lines at both ends. The actual point of connection with the Orosi system would need to be determined at a point acceptable to that District. For the purposes of this report that estimated connection point is on Avenue 416 just east of Sand Creek. The cost includes a buy in to the Orosi system as well as a rough estimate East Orosi's share of costs for treated surface water from a future joint project by both the Orosi and Cutler PUDs in cooperation with the Alta Irrigation District.

In addition, it is proposed that a 200,000 gallon storage tank be built in or near East Orosi to serve as a central point for storage as well as blending of water from the imported water from Orosi and the two existing wells. This would provide the flexibility to utilize surface water for most of the year when it is available and existing wells to the maximum extent possible to provide a sustainable supply at the most affordable rate to the economically disadvantaged community of East Orosi.

As shown in the cost estimate contained in Table 3, the total project cost for this consolidation option is $2,610,350.

Table 3

ALTERNATIVE #3 EAST OROSI CONSOLIDATION PROJECT

Item	Description	Unit	Quantity	Unit Price	Amount
1	Connection to Orosi System	LS	1	$50,000	$50,000
2	12-Inch C900 PVC Water main and fittings	LF	5,000	$80	$400,000
3	Connection to East Orosi System	LS	1	$20,000	$20,000
4	Master meter and RPP backflow valve (6-inch)	LS	1	$25,000	$25,000
5	Water Storage/Blending Tank (200,000 gallon)	LS	1	$200,000	$200,000
6	Booster Pump and Pressurizing Facility	LS	1	$150,000	$150,000
7	Transmission Line from Existing Wells to Blend	LF	2,000	$40	$80,000
				Construction subtotal:	**$925,000**
	EO share of Surface Water Project *				$1,100,000
	Capacity charge per connection	EA	109	$2,400	$261,600
	Legal and Administration (5%)				$46,250
	Engineering (15%)				$138,750
	Contingency (15%)				$138,750
	TOTAL				**$2,610,350**

* Preliminary estimate based on $17.1M cost of regional Plant to treat 2 MGD with Est Demand for East Orosi at 0.12 MGD

Feasibility of Consolidation with Other Systems

Alternative No. 3 is for the consolidation with the Orosi PUD for obtaining water. This proposed solution is probably the best for a long term sustainable water supply to East Orosi and the surrounding area. It is also important to continue with ground water sources as well for those times of the year when there is no surface water available. The consolidation of multiple sources makes water supply for the entire are more dependable. The cost of this alternative is again estimated at $2,610,350 which is higher than the well replacement Alternative #2.

This alternative is dependent on the successful negotiations between the East Orosi Community Services District and the Orosi Public Utility District, negotiations with the Alta Irrigation District that would supply surface water, and potential regulatory and funding agencies.

Analysis of Alternative Solutions

Alternative #1 is the least costly and easiest to implement. There is an element of uncertainty that this alternative will resolve the water quality and pressure issues. It is recommended that this alternative be pursued as Phase 1 of the Project with the intent to pursue a more long term solution as Phase 2.

Alternative 2 appears to be less costly as far as capital costs than Alternative 3 for Phase 2. Alternative 3 also appears more expensive to operate since there is a cost to both purchase surface water and treat that water. The advantage of Alternative 3 over 2 is that the importation of surface water and its treatment appears to be more sustainable than groundwater wells in the area providing low nitrate water on a long term basis.

Based on this information it appears best to move ahead with Alternative 1 initially and then move ahead with Alternative 3 later if sufficient funding is available and if proper approvals from multiple parties is received. This option allows for a more reliable approach of both groundwater and surface water to meet the community's needs for a long term solution.

Table 4
Comparison of Alternative Capital Costs

Description	Alternative 1	Alternative 2	Alternative 3
Construction	$76,000	$1,710,000	$925,000
Land		$40,000	
EO share of Surface Water Project *			$1,100,000
Capacity charge per connection			$261,600
Legal and Administration (5%)	$3,800	$51,300	$46,250
Engineering (15%)	$11,400	$256,500	$138,750
Contingency (15%)	$11,400	$256,500	$138,750
TOTAL	**$102,600**	**$2,314,300**	**$2,610,350**
	(Phase 1)		(Phase 2)

Description of Selected Project Alternative

The recommendation is for a phased approach in resolving East Orosi's nitrate and water supply issues. The most affordable, easiest to implement short term solution is Alternative #1 which may put the District back to the quality obtained in the early 1980's with nitrate levels primarily in the 20s and 30s – still over half the nitrate MCL. Improving the quality and production of water from these wells also has benefits for any long term solutions reached. However, if remediation actions taken on these wells does not significantly improve the water quality and quantity, it is recommended that the next phase be undertaken. There is also good reason to move ahead with this next phase even if the efforts of Phase 1 are successful to provide the most sustainable long term solution to East Orosi's quality and quantity issues. Therefore, if funding agency concurrence is reached it is recommended that both Alternative #1 and Alternative #3 be pursued.

Anticipated Benefits of the Project

The benefits of the project are paramount when considering the health risks associated with continued use of the existing water source as currently contaminated with nitrate. The health effects of the community will be compromised without any action to remedy the current situation.

Conceptual Project Design

The conceptual design will consist of the following elements to provide good, clean drinking water to the East Orosi community:

1.) Phase 1: Remediate Wells #1 and #2. Cycle test each well and evaluate results. After reviewing results, determine if consolidation alternative should be pursued.

2.) Phase 2: Consolidation project with Orosi PUD.

Identification of any Ineligible Costs to be Included in the Project

All project costs as shown are in support of the nitrate removal project and are considered as eligible since they are necessary costs required to provide good, clean drinking water to the community of East Orosi.

Useful Life of Major Project Components

The following are the major components and their useful life given proper care and maintenance.

1.) Distribution system (6-inch waterlines, gate valves and water services) – 20+ years

2.) Water well pump & equipment – 10+ years

3.) Water well (well casing and annular seal) – 30+ years

4.) Hydro-pneumatic tank (including pressure sensors) – 10+ years

5.) Electrical service panel – 10+ years

Operation and Maintenance Costs

The estimated cost of operating the current water system is shown in the attached budget Table 5. If Alternative #3 is implemented, there are only rough costs projected for the operations of the Surface Water Treatment Plant that it is anticipated that the Cutler and Orosi PUDs will operate jointly. These figures are shown in the analyses prepared for the Alta Irrigation District as shown in Appendix E on Table 5-7. This table indicates the total estimated annual cost of operating a surface water treatment plant that treats two million gallons per day is $483,740 or roughly $210 per acre-foot or 64 cents per 1,000 gallons.

Assuming East Orosi's average daily demand will be 107,000, East Orosi's estimated annual expense for covering the operational costs of this surface water treatment plant including the cost of water would be $25,900.

Appendix A – US Census Bureau Fact Sheet on East Orosi Census Designated Place
Appendix B – Sanitary Survey Report
Appendix C – Notices of Violation
Appendix D – Comparison of Nitrate Levels with Groundwater Levels in Area
Appendix E – Cost Estimate from Contractor to Remediate Well #1
Appendix F – Preliminary Cost Estimates for Surface Water Treatment in Cutler-Orosi Area

Residential Meter Implementation Plan

Final Report

January 2008

Prepared by:
HDR Engineering, Inc.

ONE COMPANY | *Many Solutions*℠

January 7, 2008

Mr. Mark Hughson
Project Manager
City of Fresno Department of Public Utilities
Water Division- Technical Services
1910 East University
Fresno, California 93703-2988

Subject: Development of the City's Residential Meter Implementation Plan

Dear Mr. Hughson:

HDR Engineering, Inc. (HDR) was retained by the City of Fresno to develop a residential metering plan. The development of this plan is intended to provide a detailed "roadmap" to keep the City moving forward on this important project. This report provides our key findings, conclusions and recommendations as they relate to the residential metering plan.

Assembly Bill 514 legally mandates that the City install water meters on all water services and charge a metered rate to all customers by 2013. The meter implementation plan developed by HDR has reviewed a number of different areas related to the technology, engineering, operational, financial and public outreach aspects of this overall project. This report reviews each of these key areas, provides our observations and conclusions and finally, provides a clear set of recommendations for the City to consider as it moves forward with the program.

The report was prepared, in part, based upon data and information provided by the City to HDR. In addition, HDR has worked extensively with City management and staff to gain an understanding of their perspectives, issues and concerns associated with the residential metering program. The final plan, presented herein, is a culmination of these efforts. At the conclusion of this study, HDR has provided a summary of "next steps" and detailed time schedule to meet the legislative requirements of AB 514.

HDR appreciates the assistance provided by you, your staff and other City members in the preparation of this report.

Sincerely yours,
HDR ENGINEERING, INC.

Tom Gould
V.P. and Project Manager

Tom Jakubowski
Metering Plan Task Manager

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Executive Summary

Introduction

Existing California law states that all residences built after January 1, 1992, must have a water meter installed on all new connections after that date within systems owned or operated by a water purveyor. The continued absence of water meters and billing based on use has prompted the State to pass another law, Assembly Bill 514 (AB 514) to legally mandate all residences to have a water meter installed and be billed based on water usage if they receive water via the Central Valley Project.

As a result of this legislation, the City of Fresno (City) is legally mandated to install water meters on all of their customers. The most challenging aspect of AB 514 for the City of Fresno is the requirement to have all meters installed by January 1, 2013. This includes approximately 105,000 residential customers that are currently flat rate customers. At the same time, the City also has a contract for the water it receives from the Central Valley Project (CVP) through the US Bureau of Reclamation (Bureau). The Bureau also has a timeline for installation that generally matches AB 514.

The metering effort to meet the legal requirements of AB 514 will require a significant effort and financial investment on the part of the City. To assure that sound and prudent decisions are made in this process, and still meet the time requirements for installation, the City, with assistance from HDR Engineering, Inc. (HDR) has developed a residential metering plan.

Current City Metering Program

The City is mandated to install meters on approximately 105,050 residences currently receiving flat rate bills. There are approximately 24,232 residential homes with meters in place which are not read and an additional 10,223 pits and boxes installed with no meter. The City installed some of the existing meters nearly fifteen years ago, while other meters were inherited when County Islands and other private utility districts were annexed. The annexed meters are up to 30 years old and will need to be replaced. Approximately 81,000 additional meters need to be installed and read by 2013 without anticipated growth.

Table ES-1. Current Metering Program.

Meter Reference and Definition	Number of Meters/Homes Affected
Current Flat Rate Bills Sent Out (2007)	105,050
Less: Residences with Meters Installed	24,232
Residences without Meters (2007)	80,818
Less: Current Residences with Pits and Boxes	10,223
Current Residences without Meter, Pit or Box (Complete meter and box needed)	70,595
Total Number of Meters to be Installed (including Growth by 2013)[1]	113,265

1. Growth was assumed at 1.9% annually

The City has approximately 24,000 commercial, industrial, municipal, irrigation and multi-family meters, read by 12 meter readers which are not included in the 105,050 meters to be installed and read by 2013. The commercial and industrial meters are billed on a bi-monthly basis.

Key Project Timeline (Milestones)

The City receives water from the Central Valley Project (CVP) through the US Bureau of Reclamation (Bureau). The CVP contract also requires the City to meter and bill their customers on a consumption basis. The CVP contract and Assembly Bill 514 have similar milestones which must be met. The CVP contract and AB 514 have the same final deadline for metering and billing on consumption of 2013. The CVP contract additionally requires the City to bill on a metered basis within five years of executing the renewal of the contract or by August of 2010 as the renewal is dated August 2005. The key project timeline (milestones) is shown below

- December 2007 — Write Draft Rate Ordinance
- January 2008 — Submit progress report to Bureau
- January 2008 — Initiate retrofit installation of meters on residences
- December 2008 — 29 percent of meters installed (approximately 30,500 of the total 105,050)
- January 2009 — Submit progress report to Bureau
- December 2009 — 43 percent of meters installed (approximately 47,000)
- January 2010 — Submit progress report to Bureau
- March 2010 — Impose new Rate Ordinance
- December 2010 — 62 percent of meters installed (approximately 69,100)
- January 2011 — Submit progress report to Bureau
- December 2011 — Adopt new Rate Ordinance and 81 percent of meters installed (approximately 91,000)
- January 2012 — Submit compliance report to Bureau
- December 2012 — Meter installation progress: 100 percent of meters installed
- January 2013 — Retrofit completion report; all customers billed on a metered basis

Metering Priorities

In developing this meter implementation plan, HDR interviewed and discussed with key City management and staff members the key objectives or priorities in developing this plan. Given the array of choices for meter reading technology, the number one concern of the City was selecting a technology that is cost justified and will best serve the City over the life of meters and technology chosen. Ideally, the meter reading technology chosen will provide greater benefit than simply the ability to bill customers on a volumetric or consumption basis. Finally, an important priority for this plan was developing an approach or plan for the installation of the

meters that effectively used the limited staff resources of the City, but was still manageable and achievable by the City.

Comparison of the Meter Reading Technologies

The metering of water is not a new technology. What is new is the method used to read the meters. The current methods that may be used to read meters range from the very labor intensive manual read to the use of high technology to read meters remotely, using very little labor. More specifically, there were four meter reading technologies explored within this report. These were as follows:

- **Manual Meter Read** – A very labor intensive method that requires the meter reader to visit each meter location and visually obtain the reading directly from the meter register located on the meter or from a visual reading device which means the meter reader must physically gain access to the meter register or reading device. These readings are typically entered into a handheld "electronic" meter reading device which downloads the data to the billing system. Relative to the meter technology options, manual meter reading has low capital costs, but high labor costs.

- **Touch Read -** Touch read systems enable the meter reader to gather the meter reading through an outside meter reading device (touch pad) connected to the meter register. Unlike the mechanical, visual read remote system, the touch read system allows for direct interrogation of the meter register. As with the manual system, the meter reader must visit every account site to obtain the meter reading from the touch pad device. Readings are collected when contact is made between the handheld reading device and the outside reading device (or pad). Relative to the meter technology options, touch read has slightly higher capital costs when compared to manual read, with similarly high labor costs. A key advantage of the touch read system compared to the manual read system is the greater level of accuracy in meter reads.

- **Mobile Radio (Drive-by) –** A mobile radio (drive-by) uses technology to minimize labor costs. This system enables the meter reader to collect meter readings while walking or driving by a meter equipped with a radio frequency (RF) reading device. The mobile reading system requires the addition of an RF reading device (also called a meter interface unit or MIU) to the encoder meter register. The RF device is powered by a battery. The number of potential reads per day using a drive-by system increases significantly compared to a manual read or touch read system. However, compared to the other technologies, a mobile read system has relatively high capital costs, but relatively low labor costs over time due to the efficiency in reading.

- **Fixed Network Radio -** Fixed network radio systems offer a truly fully automatic meter reading capability. The meter reading is "captured" through a system of collectors which transmits the meter reading back to the utility location. The RF devices are programmed to send the readings to the utility on at least a daily basis. If needed or desired, this system provides the capability for multiple reads within a specified time period. It also has the capability to provide "real-time" information to consumers. Similar to the drive-by reading

option, the fixed network radio system has high capital costs, but very low labor costs over time.

The differing levels of efficiencies of these systems are worth noting. A manual read system may allow a reader to physically read 100 to 500 meters per day, depending upon the location of the meter (e.g. inside sets). This method also has the highest reading error rate of the four alternatives. A touch read system will provide for increases in productivity of 10% to 20%. In contrast to these two labor intensive technologies, a mobile radio (drive-by) system will provide productivity in the range of 5,000 to 10,000 reads per day. Finally, a fixed network has essentially unlimited capability to provide reads. This system can, if needed or desired, provide multiple reads on a daily basis.

The mobile read and fixed network systems offer significant advantages and benefits to the City. However, weighing against these options is the issue of reliability and whether this technology will "work" once it is installed. This report has provided suggestions and ways for the City to mitigate these risks during the bid/procurement selection process. Radio read and fixed network technologies are not so new, that they are unproven or unreliable. It should be noted that given a choice between technologies, municipal water utilities of the size and complexity of the City of Fresno are selecting AMR solutions to minimize labor costs and take advantage of the features that a mobile radio read or a fixed network solution provide.

Other AMR Evaluation Criteria

There are a number of other evaluation parameters that the City should also consider and use in their evaluation process of this technology. Among these evaluation parameters are the method of radio signal transmission, the power of the signal transmission, the use of one-way or two-way communication, battery life and the field serviceability of the battery. All of these items are important, but battery life and the serviceability of the battery will have an impact on the overall cost of operating the system over time. Like most electronic technology, battery life continues to be improved and presently some manufactures have up to 20 year warranties.

Comparisons of the various meter brands were provided within this report. No recommendation on a particular manufacturer or specific brand of meter was provided. However, from this comparison, it was noted that each AMR solution (manufacturer) may use slightly different technology to achieve that solution. There are certain advantages and disadvantages in the specific technology used to achieve the AMR solution. Given that, the City must be aware of, or clearly specify, the technology to be used for the AMR solution (e.g. field replaceable battery).

Technology is constantly changing and improving. Unfortunately, the City, because of the installation requirements of AB 514, can not wait for the next generation or "latest and greatest" technology. However, mobile radio read and fixed network technologies are field proven technologies in use at a number of large municipal utilities. Given that, the City may want to focus on a technology solution and manufacturer that provides compatibility and the potential for future upgrades.

In selecting a preferred technology and AMR solution, it would appear that utilizing a single AMR solution and solution provider will increase the likelihood of receiving the most cost-effective metering solution, while providing the long-term benefit of decreased operation and maintenance costs

Side-by-side comparisons of the technology and operational considerations were developed between the four different technologies. In summary, mobile radio and fixed network AMR solutions provide significantly greater benefits when compared to manual read or touch read technologies. HDR is of the opinion that the City would be able to utilize and take advantage of these key benefits/features. However, the trade-off is that mobile radio and fixed network have the highest initial (capital) cost. From an operational perspective, mobile radio and fixed network AMR solutions provide significant operational benefits when compared to manual read or touch read technologies. The key operational advantage provided by mobile radio and fixed network AMR solutions is the ability for the City to increase the frequency of meter reads with minimal labor costs. Mobile radio and fixed network AMR solutions are very labor-efficient solutions.

The City is also interested in making an AMR investment that is based upon an open architecture design. If the AMR meter and meter register are proprietary, it may limit the City's options. A side-by-side comparison of the compatibility of major manufacturer's products for both mobile read and fixed network solutions has been provided within this report. The City, within the procurement process, should strongly consider those systems that contain open architecture and are non-proprietary. Systems with a high degree of compatibility will best serve the City over the long-term. In addition, utilizing a single solution provider (manufacturer) throughout the City's system will also help minimize the issues of compatibility between multiple manufacturers (vendors).

Ultimately, AMR systems are in place to support the customer service and billing function of the City. The City currently bills customers on a bi-monthly basis. The City has in the past discussed moving to monthly meter reading. The City, for a variety of reasons, may eventually move to a monthly billing cycle. Should that be the case, the mobile read and fixed network AMR solutions provide the greatest opportunity to provide that service with the lowest cost impact to the City's operations.

Finally, compatibility of the AMR system to the City's customer service information and billing system must be considered. The City currently uses an HTE system. The City's HTE customer service information system will support AMR and will, at a minimum, provide for the upload and integration of meter readings from the AMR system. At the very least, this will provide the City with the ability to bill all customers on a consumption-based rate, on a bi-monthly basis. No major risks associated with the integration of an AMR system to the City's HTE system were noted. All risks associated with this transition would be of low risk or manageable risk.

Not surprisingly, the AMR solutions of mobile radio (drive-by) and fixed network appear to provide the greatest potential benefits to the City. However, the key question is whether the

added capital cost (initial investment) for either of these solutions is beneficial and a cost-effective investment for the City over the life of the meters and AMR solution. To help answer that question, a detailed cost analysis was conducted of the four meter reading alternatives.

Cost Analysis of the Alternatives

A detailed cost evaluation was undertaken of the four metering/AMR technology solutions. All four technology solutions were evaluated to assure the City that each was evaluated on an equal basis. The major trade-off in the cost evaluation is the labor costs associated with manual read and touch read compared to the reduced labor costs but higher initial investment for mobile radio and fixed network. In other words, does the higher initial investment for mobile radio or fixed network pay for itself over the life of the AMR system through labor savings, when compared to manual read and touch read.

The detailed cost evaluation conducted for the City considered both the operating and capital costs for each alternative. HDR worked closely with the City to determine a number of key inputs into the cost models. Another important input into the cost analysis was the assumptions concerning the deployment (installation) time line. Under each of the alternatives, the City is assumed to meet the specified deadline for installation contained in AB 514 and the CVP contract. The analysis considered the initial investment and on-going operational costs to establish a total outlay over a twenty (20) year period. This total outlay was then discounted to a net present value (NPV) to provide a uniform comparison between the alternatives.

Within the cost analysis, to meet AB 514 requirements, it has been assumed that all residential meters must be installed by January 1, 2013 (i.e. the deployment period). For the City this means an anticipated 113,265 meter installations, which includes the current 105,050 flat rate bills plus anticipated growth over the deployment period. Although the installation of meters for new growth is included in this project, the costs for the meters as a result of new growth will be charged to the developers according to the City's Master Fee Schedule and not borne by current customers. Included in the total meters to be installed during the deployment period, a conservative estimate for the replacement of meters currently in place was assumed. As some of the meters are nearly 30 years old from the annexed areas and the City began installing meters in 1992, meters are either approaching or have surpassed their useful life. Therefore, for cost analysis purposes, it was assumed all meters in the ground will be replaced as part of the deployment process.

The total capital investment needed varied by option. Provided below is a summary of the assumed total investment required and the average cost per meter.

Table ES-2. Capital Investment Required for Each Alternative

	Total Cost	Cost/Installation
Manual Read	$41.8 Million	$369/Installation
Touch Read	$45.1 Million	$398/Installation
Drive-by	$52.0 Million	$459/Installation
Fixed Network	$53.3 Million	$470/Installation

As can be seen, the needed investment ranges from $41.8 million to $53.3 million. The important question to be answered within the cost analysis was whether the reduced staffing and labor costs associated with the drive-by and fixed network alternative would be cost effective over the twenty year period.

Staffing levels were estimated for each alternative, assuming bi-monthly reading. Provided below are the assumed staffing levels for meter reading at three key points in time.

Table ES-3. Staffing Levels for a 20-Year Bi-Monthly Reading Cycle

	2008	2012	2027
Manual Read	13	32	56
Touch Read	9	25	33
Drive-by	5	7	8
Fixed Network	4	6	8

As expected, the drive-by and fixed network alternatives minimize labor costs. The City's system can grow and expand with minimal incremental labor costs for meter reading.

When total O&M expense, associated debt service payments on the capital infrastructure investments and any other out of pocket expenses are taken together, and a net present value of the cash flows developed, the results are interesting.

Table ES-4. Future and NPV Dollars for 20-Year Bi-Monthly.

Expenses	Total Investment	NPV Dollars
Manual Read	$163.9 Million	$85.9 Million
Touch Read	$143.5 Million	$76.3 Million
Drive-By	$129.8 Million	$70.5 Million
Fixed Network	$131.5 Million	$71.4 Million

In reviewing Table ES-4 and the NPV of each alternative, it appears the manual read is the most costly alternative at $85.9 million, while drive-by is the least costly at $70.5 million. The high cost associated with manual read is simply a function of the high labor costs associated with manual read. In contrast to this, the least cost alternative, drive-by, has significantly lower O&M costs over the 20-year time horizon. The difference between the two least costly alternatives, drive-by and fixed network, is approximately $900,000. In essence, this result indicates that from a financial/cost perspective, there is no significant cost advantage between these two options. Interestingly, this result (no significant cost difference between drive-by and fixed network), are similar to the independent results seen at other utilities.

The cost analysis also reviewed the impact of the City moving to monthly meter reading. To move to monthly meter reading, the staffing levels for both the manual read and touch read increase significantly. Table ES-5 provides a summary of the estimated staffing levels needed to support monthly meter reading and billing.

Table ES-5. Staff Required for 20-Year Monthly Reading Cycle.

	2008	2027
Manual Read	23	106
Touch Read	14	61
Drive-by	5	10
Fixed Network	4	8

As would be expected from this technology, moving to monthly meter reading has little impact upon the staffing levels for the drive-by and fixed network alternatives. A summary of the 20-year costs and net present value for monthly meter reading is provided below in Table ES-6.

Table ES-6. Future and NPV Dollars for 20-Year Monthly.

Expenses	Total Investment	NPV Dollars
Manual Read	$225.6 Million	$116.5 Million
Touch Read	$178.3 Million	$93.5 Million
Drive-By	$132.4 Million	$71.8 Million
Fixed Network	$131.5 Million	$71.4 Million

The only logical conclusion that can be reached from this analysis is that if the City, at some later point, makes a decision to move to monthly meter reading and billing, then the benefits and cost efficiencies associated with radio read and fixed network are even more pronounced when compared to manual read and touch read.

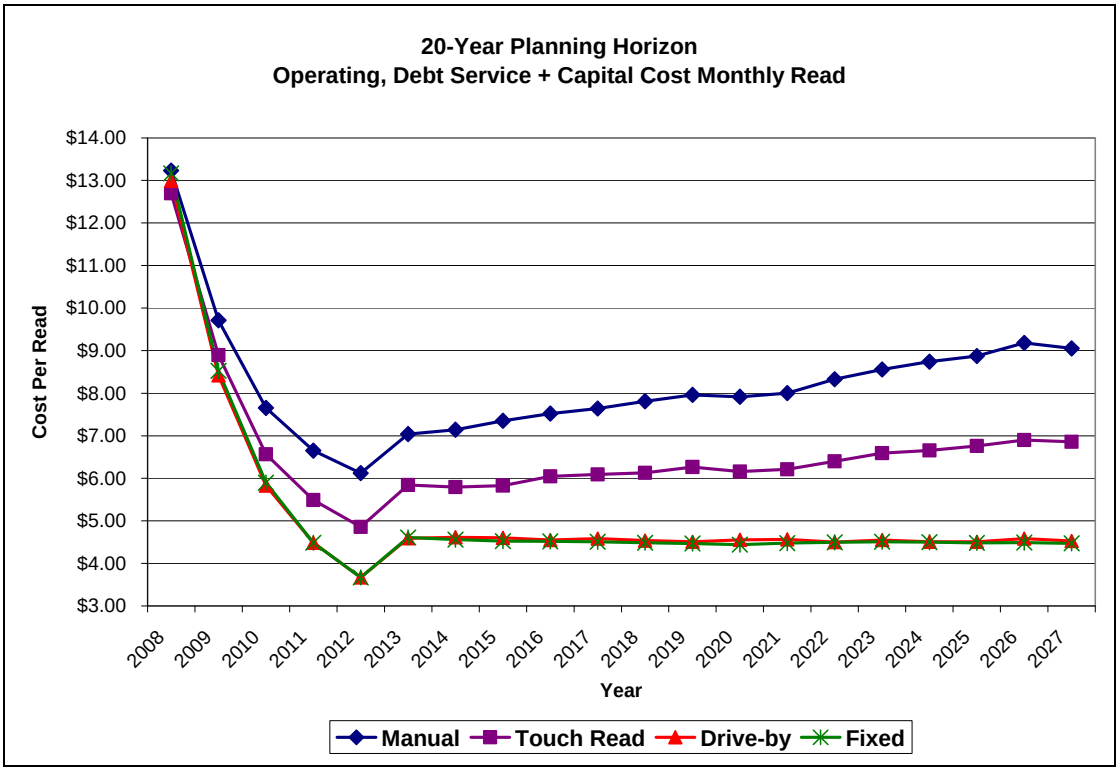


Figure ES-1. Cost Per Read O&M, Debt Service and Capital 20-Year Planning Horizon Monthly Read.

In summary, it appears that from a financial/cost perspective manual read and touch read should be eliminated from further consideration. The two remaining choices – drive-by and

fixed network are almost identical from a financial/cost perspective. Given that, the City will need to make a choice between these two technologies on the basis of factors, other than strictly cost. Therefore, the focus may shift to the soft or non-economic costs associated with these systems.

Additional Residential Meter Plan Considerations

As discussed above, there appears to be no discernable difference in the relative costs between the two lowest cost alternatives, drive-by and fixed network. Given that, the City will need to consider features, benefits or issues other than strictly cost-related to make a final decision on the AMR technology for the City.

- **Key implementation issues and risks:** Implementation issues and risks will be dependent upon the AMR technology solution selected, especially in the area of the City's operations. HDR has recommended that under either the drive-by or fixed network alternative that the City outsource the installation of the meters and at the same time, retain (hire) an outside program management firm to manage the overall installation and inspection program. To minimize risk associated with the technology, HDR has recommended to the City to have vendors, during the procurement phase, provide actual field demonstrations of their product under certain pre-arranged adverse conditions. In addition, during the procurement phase, the City can specify an acceptable level of performance. These two measures should help alleviate any risks or concerns with the drive-by or fixed network technology.
- **Deployment time period for new meters and reading technologies:** The time period involved in implementing a new water meter reading/billing approach can greatly influence the cost of the program.
- **Deployment Strategy:** Geographical, surgical and opportunistic deployment strategies are options available to the City. The City should be able to deploy either the drive-by or fixed network alternative within the time limits of AB 514. The City's final deployment strategy may be primarily driven by the efficiency and time savings required of the contractor to meet the deadline. Given that, the City should request within their procurement process from the installation contractor a preliminary plan for deployment (installation) strategy within the City. Most likely, the plan will be primarily geographic in nature.
- **Reading / billing frequency:** Benefits of migrating from a bi-monthly to a monthly reading and billing frequency will provide additional information to the City depending on the AMR technology solution selected. Both a drive-by and fixed network system will enable the City to read and bill customers on a monthly basis. No significant cost differences would be incurred between these two technologies to move to a monthly billing cycle. More importantly when viewing the two systems, the fixed network system is far more powerful and flexible than a drive-by system in its ability to provide more frequent reads. In addition, the frequent data obtained from the fixed network system can be used to help maximize customer communication and may be an effective tool for conservation purposes. Finally, a fixed network system has the potential to

provide to the City improved data and information for resource planning and rate setting purposes.

- **Meter maintenance and management:** A formal meter maintenance and management program will guide the testing and replacement of water service meters. With the installation of meters City-wide, the City should develop a comprehensive meter maintenance and management program. There would not appear to be any significant differences in the suggested meter maintenance and management program for a drive-by or fixed network system. Battery maintenance may be more frequent on the fixed network system depending upon the desired frequency of reads.
- **Other meter reading alternatives:** Outsourcing meter reading services is an option that the City may consider. However, if a drive-by or fixed network alternative is selected, then outsourcing of meter reading would appear to provide little discernable benefit to the City. The City should be responsible for all meter reading labor and meter reading activities.

HDR also reviewed the issue of migration as a part of this study. Migration from a drive-by system to a fixed network system is likely not feasible from a technology and cost perspective. The technology selected by the City will likely be in place for the life of the product.

In the end, both the drive-by and fixed network alternatives will work well for the City. However, the key differentiator between the two systems is the fixed network is far more powerful in its ability to provide multiple reads and be used as a communication tool with the City's customers. A simple analogy for comparing these two technologies is the drive-by system is limited, but dependable and a fixed network system is faster and more powerful. If the City wants to provide only bi-monthly or monthly billing, then the drive-by system may be perfectly suitable and appropriate. However, the City may want to utilize, now or in the future, the more powerful features and benefits only a fixed network system can provide. These features and benefits have been described in more detail within this report.

Metering Plan Recommendations and Conclusions

A meter implementation plan is not unlike any other utility planning document, such as a master plan or comprehensive plan. That is, it provides a level of detail to allow the overall plan to move forward, but it certainly does not attempt to anticipate, address or resolve every issue that may come up over the next four years. Rather, the meter implementation plan should provide to City management and the City Council a clear approach and plan to help management achieve the City's end objective. Within this report, HDR has attempted to identify the key issues associated with meter implementation and provide recommendations to minimize both risk and costs

Based upon the findings and conclusions of this report, HDR has developed a detailed set of recommendations as a part of the overall meter implementation plan. These recommendations are separated into five main categories: Preferred Technology, Deployment, Bid/Procurement, Implementation/Installation, and Operational. By adopting and following these recommendations, HDR is confident the City will be able to meet the time requirements

established by AB 514 and the CVP contract, while at the same time installing and operate an AMR system which meets the current and future needs and requirements of the system.

Preferred Technology Recommendation

The cost analysis developed noted no significant cost differences between the drive-by and fixed network system. However, it did demonstrate that a drive-by or fixed network system is clearly superior from a cost and operational perspective to a manual read or touch read system.

- **Recommendation 1 - The City eliminate manual read and touch read technologies from further consideration and implement either a radio frequency drive-by or fixed network AMR system.**
- **Recommendation 2 – Do not eliminate either the drive-by technology or fixed network alternative until actual costs (bids) can be received.** No significant cost difference was determined between the drive-by and fixed network alternative. Therefore, it is premature at this point to eliminate either alternative until more formal cost bids and actual costs can be obtained through the bid/procurement process. Either of these technologies will provide the City with the type of benefits which deliver the level of service envisioned by the City's Management Staff.

The above recommendations have been provided since they help the City to minimize labor costs over time, have the potential to increase/improve customer service, and provide the greatest level of accuracy and efficiency in meter reading. Both systems provide the City with the ability to collect data on a more frequent basis which will be useful for planning, customer service and rate development. The cost analysis demonstrated that both systems have the ability for the City to expand and provide meter reading in a cost-effective manner. Finally, the expected performance from both systems should be acceptable to the City.

Deployment Strategy Recommendations

The deployment strategy focuses on the approach or management methods that the City will use to assure meeting the AB 514 requirements of having all the meters installed and read by 2013. Therefore, the City needs to focus on the efforts required to achieve that goal (requirement). The deployment strategy recommended by HDR will greatly influence the "next steps" of the program, which will outline a set of specific tasks to be accomplished and a specific timeline for each.

- **Recommendation 3 - Deploy the selected AMR technology solution within four years or less.** The sooner the system is installed, the sooner the City will receive solution benefits. At the same time, a deployment strategy that provides some flexibility in schedule will be important given the unknown issues that may arise with the physical installation process.
- **Recommendation 4 - Award a single contract to turn-key firm for a fast-track deployment of the system.** The size and magnitude of this project would indicate the need for an award of a single contract to a turnkey firm. This will ensure ease of administration for the City and enable the fast-track deployment schedule to be met.

- **Recommendation 5 - Employ a Program Management Firm to manage the installation contract for the City.** The City appears to currently have limited resources to be able to effectively manage the deployment on a day to day basis. For that reason, HDR recommended that the City employ a Program Management firm to manage the installation contract for the City. There are several well-qualified installation service contractors available on the market.
- **Recommendation 6 - Work with the turn-key firm to establish the most time-efficient and cost effective deployment (installation) of the meters.** The size and magnitude of this project would indicate the need for an award of a single contract to a turnkey firm. This will ensure ease of administration for the City and enable the fast-track deployment schedule to be met. The use of a single contract with subcontractors will also resolve the City's concern regarding staffing up for deployment and then needing to relocate staff once installation is complete.
- **Recommendation 7 - Develop a Public Involvement/Community Outreach Program.** The City will need to develop a public involvement/community outreach program to inform the public of the upcoming project, allow for community involvement in public meetings and announce the progress of the metering project throughout the duration of installation.
- **Recommendation 8 - Gain City Council approval for the meter implementation plan as soon as possible.** Before the City can enter the Bid/Procurement process, the City should have clear support for the meter implementation plan.

Bid/RFP Procurement Recommendations

An important step in the meter implementation plan is the bid/procurement process. HDR has recommended that the City pursue or request bids for both drive-by and fixed network to maximize competition. HDR's specific recommendations for the City's bid/procurement process are as follows:

- **Recommendation 9 - Obtain bids for both a drive-by and fixed network system.** The cost analysis contained within this study set the cost for each of these systems as being roughly equal. Only by receiving actual bids can the City determine the true cost difference. More importantly, by bidding both systems, the City will create competition between the two technologies and between vendors. This will potentially help the City to minimize their costs, or more importantly to receive greater benefits for a lower price per unit.
- **Recommendation 10 - Retain outside expertise/assistance for the preparation of the bid document and bid review process.** The City has limited experience in developing a bid document for this technology. For that reason, HDR has recommended that the City retain outside expertise/assistance to prepare the bid document. The outside expert will be familiar with the procurement process and bid documents associated with metering systems for drive-by and fixed network technologies. This same expert should assist the City in evaluating the bids received.

- **Recommendation 11 - Create a bid document that is City-specific and helps to maximizes competition.** Maximizing competition may include encouraging the vendors to propose on the entire system.
- **Recommendation 12 - Issue bid documents to potential vendors.** The City may pre-qualify certain vendors around certain meter or technology specifications, or simply open up the bid process to all vendors. As has been noted by HDR within this report, the bid and vendor selection process should stress the value of open architecture. The reading system should be able to read multiple makes of meters, while minimizing RF device inventory requirements.
- **Recommendation 13 - Review bids and re-evaluate costs of the systems.** With assistance from the City's outside expert, the City should evaluate all bids. As a part of the evaluation process for each bid, the City should re-validate all major assumptions contained in the financial model to ensure the new operational structure will support the level of activity projected by the selected AMR technology decision. Prior to selecting a vendor, re-run the financial model using the results of the proposals, and other information gathered in the course of the bid process. In the end, the City should select the AMR technology providing the lowest actual whole life cost of ownership and which provides the major features desired by the City. Factors such as useful life, battery life, warranty coverage and terms, failure rates, ease of maintenance, ease of operation may be more important factors than initial purchase price. Soft cost and non-economic factors may also play a key role in the decision making process.
- **Recommendation 14 - Perform On-Site Testing/Demonstration of Preferred Vendor(s) Technologies.** To minimize the risk of unacceptable performance of a product, have the final selected vendor(s) provide on-site demonstration and performance tests. The tests would be conducted under adverse conditions to determine the performance of these products in less than ideal conditions.

Implementation/Installation Recommendations

From the bid/procurement process, the City will select a final technology and vendor. At that point, the City will enter the most important phase of the project, the implementation / installation phase. HDR's specific recommendations for the City's implementation/installation process is as follows:

- **Recommendation 15 - Suspend all investments in manual read meters; move immediately to the selected technology solution.** As soon as an AMR technology solution decision is made, the City should suspend installation of manual read meters and any further investment in the existing meter reading system. Any needed meter replacements should be completed with a product compatible with the selected AMR technology solution.
- **Recommendation 16 -Utilize (Leverage) the technology offered by AMR as quickly as possible.** Once an AMR technology solution decision is made, the City should establish a team to identify and implement strategies to maximize this AMR investment. The City should not wait until the end of the installation cycle to begin to take advantage of the technology solution selected by the City.

- **Recommendation 17 - Provide volumetric consumption information to customers as soon as possible.** Ultimately, metering of customers will lead to the billing of customers on a volumetric basis. One of the challenges for all utilities that convert from a flat rate billing method to a volumetric approach is that customers often do not comprehend how much water they consume on a monthly or annual basis. If the utility waits until it is time to bill the customer on a volumetric basis, the end result will often be exceptionally high bills. The comprehensive rate study will develop an approach to help alleviate a good portion of this issue. However, if the City can provide to the customer their consumption information in advance of when they are finally billed on a volumetric basis, then the customer may have an opportunity to adjust their behavior.
- **Recommendation 18 - Post 2010, avoid converting customers from flat rate to metered rates in high-bill summer periods.** Post 2010, the City will need to bill customers on a metered basis once the meter is place, the meter has been placed into the City's billing system and the meter actually read for the first time. Given that, the City should consider an approach regarding the timing of when these new meters are added into the City's HTE billing system and when the meters are read for the first time. If the City can avoid adding a significant number of meters during the "high bill" summer irrigation period, then the City may be able to minimize the number of high bill complaints from customers billed for the very first time on a metered rate.

Implementation/Installation Recommendations

Testing of the meters should be taking place during the implementation phase to verify accuracy prior to installation and to determine replacement cycle. HDR would recommend the following:

- **Recommendation 19 - Continue to Perform Sampling Testing of the Existing Residential Meter Population** - The City's Meter Department performed sample accuracy tests to the existing system residential meters to determine accuracy and potential meter life. The net result for this type of meter is that the useful life falls within the AWWA recommended replacement interval of 15-20 years. With continued testing for age groups over 15 years results may prove that useful life may be beyond the 20 year point.
- **Recommendation 20 - Establish New Meter Testing Protocol -** It is recommended the City establish a new meter testing protocol. A statistical sample testing of new meter shipments to verify accuracy and to maintain confidence in manufacturer test results is an efficient cost alternative to testing every new meter. For the City of Fresno, approximately one-half to one percent of all new meters should be randomly tested.
- **Recommendation 21 - Establish Future Meter Testing Protocol -** Whether drive-by or fixed network is selected, the future random sampling for residential meters should continue. As proven from the City's past meter test sampling program, meters can perform accurately for many years, and are generally not economical to repair. The best practices approach to residential meter management is monitor the performance of the

meters through a combination of statistical sampling and watching for individual consumption anomalies that could indicate underperforming or stuck meters.

The above concludes the key recommendations of the meter implementation plan. A more detailed discussion of these recommendations and the basis for them can be found in Chapter 5 of this report.

Next Steps

This report has outlined a number of activities and tasks to be undertaken by the City. HDR has reviewed and evaluated these activities and tasks and have organized them into a set of "next steps." Provided below is a brief summary of these "next steps."

- ✓ **AMR Site Visits -** If the City elects to move ahead with full-scale AMR installation, HDR recommends that in lieu of a pilot study, the City's senior staff conduct structured visits at two or three local utilities that have implemented AMR to better understand how these systems function, what is involved in a successful deployment, and how the utilities are coping with integrating the new technology into day-to-day operations.

- ✓ **Public Involvement/Community Outreach –** The installation of meters and billing based on metered consumption will affect every household within the City of Fresno. Therefore, it is imperative to the success of the program to provide a clear and highly informative public involvement and community outreach program prior to and during the implementation of the meter installation program. The detailed discussion suggested major components for this program. The City should work closely with its Public Relations representative to more fully develop a program which will be successful.

- ✓ **AMR System Procurement** – A key task within the meter implementation plan is the preparation of a bid document or request for proposal. This report has provided a discussion of the key elements to be included within the bid document and a sample request for proposal (RFP) has been included within the Technical Appendices.

- ✓ **Prepare Contractor Installation Plan** - Within the procurement process, typically during negotiations, the City will have the opportunity to gain better insight into the deployment plan the selected contractor would recommend. Based upon their experience and observations of the work needed to be completed for the City, the City can work with the selected contractor and Program Manager to finalize a deployment plan. In the end, the City's deployment plan should be the most time-efficient and cost effective, mindful of any City-specific political issues that may arise.

- ✓ **Selection and Contract Negotiation -** Once Bid/RFP's are reviewed, a shortlist of preferred vendors should be scheduled for interviews to meet the key staff involved in the program and present their solutions. At this time, all selection criteria should be weighted carefully in order to select the successful vendor for contract negotiations.

Meter Plan Schedule

As a part of this plan, the final task was to develop a time schedule to meet all of the requirements of AB 514, the CVP contract and the City. A detailed discussion of the time schedule has been included within Chapter 5. The proposed meter implementation plan time schedule is shown below in Table ES-7.

Table ES- 7. Implementation Tasks and Dates.

Task	Date
Task 1.0 - Meter Plan Review and Submittal	July 07 through December 10, 07
Task 1.1 – Council Approval	January 31, 07
Task 2.0 – Public Relations Program	Jan 31, 08 – Mar 1, 2013
Task 2.1 – Announce Metering Program & Progress	Jan 31, 08 – Dec 31, 07
Task 2.2 – Work with Media	Jan 31, 08 – March 31, 08
Task 2.3 – Public Meetings	Jan 31, 08 – Dec 31, 08
Task 2.4 – Citizens' Advisory Committee	Jan 31, 08 – Mar 1, 13
Task 2.5 – Water Meter Installation Hotline	Apr 1, 08- Mar 31, 2013
Task 2.6 – Notification of Installation	July 31, 08 – Dec 15, 12
Task 3.0 – AMR Site Visits	Jan 15 – Feb 13, 08
Task 4.0 – Water Rate Study	Sept 30, 07 – April 30, 08
Task 5.0 - Funding Secured	Jan 1, 08
Task 6.0 – Ongoing Meter Maintenance and Testing	Sept 30, 07 – Mar 1, 13
Task 7.0 – AMR System Procurement	Sept 30, 07 – July 31, 08
Task 7.1 – Prepare Bid/RFP Document	Sept 30 – Oct 31, 07
Task 7.2 – Draft Implementation Plan	Oct 31, 07 – Jan 1, 08
Task 7.3 – Advertise Bid/RFP	Nov 15, 07
Task 7.4 - Pre-Proposal Meeting	Dec 1, 07
Task 7.5 – Bid/RFP Due	Jan 1, 08
Task 7.6 – Evaluate Bid/RFP, Shortlist and Interview	Jan 1, 08 – Feb 8, 08
Task 7.7 – Select and Perform Demonstration by Proposing Firms	Feb 8, 08 - May 31, 08
Task 7.8 – Select and Negotiate Contract	May 31, 08 – June 30, 08
Task 7.9 – Execute Contract & Issue NTP	July 31, 08
Task 8.0 – Program Management Selection	April 15, 08 – May 31, 08
Task 8.1 – Select and Negotiate Contract	April 15,08 – May 15 , 08
Task 8.2 – Execute Contract & Issue NTP	May 31, 08
Task 9.0 – Installation	July 31, 08 – Mar 1, 13
Task 9.1 – Group 1 Installation (29%, 31,600 meters)	July 31, 08 – Dec 31, 08
Task 9.2 – Training for Water Department Staff	Aug 31, 08 – May 31, 09
Task 9.3 – Draft Rate Ordinance	Dec 31, 08
Task 9.4 – Progress Report to Bureau	Jan 1, 09
Task 9.5 – Meter Reading Data Scrub and Testing	Aug 31 – Dec 31, 08
Task 9.6 – Develop Work Flow Process & Procedures Water Dept Staff	Aug 31, 08 – Jun 1, 09
Task 9.7 – Group 2 Installation (43%, 46,900 meters)	Jan 1, 09 – Dec 31, 09
Task 9.8 – Progress Report to Bureau	Jan 1, 10
Task 9.9 – Impose Rate Ordinance	Mar 1, 10
Task 9.10 – Group 3 Installation (62%, 67,600 meters)	Jan 1, 10 – Dec 31, 10
Task 9.11 – Progress Report to Bureau	Jan 1, 11

Task	Date
Task 9.12 – Group 4 Installation (81%, 88,300 meters)	Jan 1 – Dec 31, 11
Task 9.13 – Progress Report to Bureau	Jan 1, 12
Task 9.14 – Group 5 Installation (100%, 105,000 meters)	Jan 1 – Dec 31, 12
Task 9.15 – Compliance Report to Bureau	Jan 1, 12
Task 9.16 – Extended Support Service	Apr 1, 08 – Mar 1, 13
Task 10.0 – Consumption Information with Customers Bills	Jan 1, 09 – Dec 31, 12
Task 10.1 – Group 1 Consumption Information	Jan 1 – Dec 31, 09
Task 10.2 – Group 2 Consumption Information	Jan 1 - Dec 31, 09
Task 10.3 – Group 3 Consumption Information	Jan 1 – Dec 31, 10
Task 10.4 – Group 4 Consumption Information	Jan 1 – Dec 31, 11
Task 10.5 – Group 5 Consumption Information	Jan 1 – Dec 31, 12
Task 11.0 – Commence Metered Billing	Jan 1, 10 – Jan 1, 13
Task 11.1 – Group 1 Metered Billing	Jan 1, 10
Task 11.2 – Group 2 Metered Billing	Jan 1, 10
Task 11.3 – Group 3 Metered Billing	Jan 1, 11
Task 11.4 – Group 4 Metered Billing	Jan 1, 12
Task 11.5 – Group 5 Metered Billing	Jan 1, 13

Summary

The City and HDR Engineering, Inc. have extensively worked together to create this meter implementation plan. It provides the City with a clear path of actions and tasks to be undertaken to achieve compliance with AB 514 and the CVP contracts.

1.0 Introduction and Overview

1.1 Introduction

The State of California (State) is trying to reduce the amount of water taken from the Colorado River in accordance with federal requirements. Because some cities are not monitoring their water use and therefore using an abundance of water, the State has mandated that all cities and municipalities install water meters and bill based on consumption.

Existing California law states that all residences built after January 1, 1992, must have a water meter installed on all new connections after that date within systems owned or operated by a water purveyor. The continued absence of water meters and billing based on use has prompted the State to pass another law, Assembly Bill 514 (AB 514) to legally mandate all residences to have a water meter installed and be billed based on water usage if they receive water via the Central Valley Project.

As a result of this legislation, the City of Fresno (City) is legally mandated to install water meters on all of their customers. This will require a significant effort and financial investment on the part of the City. To assure that sound decisions are made in this process, and still meet the time requirements for installation, the City, with assistance from HDR Engineering, Inc. (HDR) has developed a residential metering plan.

1.2 Summary of this Chapter and Key Recommendations

Assembly Bill 514 legally requires the City to install water meters on all of their customer services. A first step in establishing the metering plan was to review the legal requirements of AB 514. The most challenging aspect of AB 514 for the City of Fresno is the requirement to have all meters installed by January 1, 2013. This includes approximately 105,050 residential customers that are currently flat rate customers. At the same time, the City also has a contract for the water it receives from the Central Valley Project (CVP) through the US Bureau of Reclamation (Bureau). The Bureau also has a timeline for installation that generally matches AB 514. Much of the discussion within this report and around the final recommended metering plan is predicated upon meeting this time schedule, given the current (limited) labor resources of City.

Interviews with City management and staff were held to determine key priorities for this project and the metering plan. Among the important items noted from those interviews for this study to provide guidance and direction on included:

- Cost justification for the selected AMR technology
- Selection of the AMR technology
- Addressing the issues of staffing during and after installation
- Bidding and procurement, and
- Implementation

This report has addressed each of these areas in detail, along with the other issues and concerns raised by City staff.

KEY RECOMMENDATIONS - No key recommendations were made within this chapter of the report.

1.3 Overview of Assembly Bill 514

Assembly Bill (AB) 514 requires "urban water suppliers" who receive water from the federal Central Valley Project (CVP) under a water service contract install water meters on all service connections to "residential and non-agricultural commercial buildings" in their service areas on or before January 1, 2013. Those urban water suppliers who fail to install water meters may lose their federal water supply. AB 514 requires these urban water suppliers, according to the terms of their CVP contract, to charge customers for water based on their actual water usage as measured via a water meter by March 1, 2013. The bill authorizes the urban water suppliers to recover the cost of providing water services related to the "purchase, installation and operation and maintenance" of the water meters through rates, fees or charges.

AB 514 further states that water metering and volumetric pricing are among the most "efficient water conservation tools". Also, that water metering provides the means to identify how much water is being used and therefore facilitates the means to incur a water rate structure which encourages water conservation. The water meters allows homeowners to know and regulate how much water they are using and gives them the ability to control and manage their water use.

AB 514 legally mandates the City of Fresno (City) to install water meters on all water services and charge a metered rate to all customers by March 1, 2013. The City requested HDR to provide technical assistance to update their residential meter program, evaluate their meter system and conduct a comprehensive water rate study. This will be conducted in two phases, the residential metering plan followed by the water rate study. This first phase of the study will discuss the findings, conclusions and recommendations concerning the City's residential meter program.

The objective of this phase is to provide the City with a comprehensive and cohesive plan to move forward with the installation of residential meters. HDR has also provided an assessment of current meter reading practices and an analysis of various meter reading technologies.

1.4 Current City Metering Program

The City is mandated to install meters on approximately 105,050 residences currently receiving flat rate bills. There are approximately 24,000 residential homes with meters in place which are not read and an additional 10,223 pits and boxes installed with no meter. The City installed some of the existing meters nearly fifteen years ago, while other meters were inherited when County Islands and other private utility districts were annexed. The annexed meters are up to 30 years old and will need to be replaced. Approximately 81,000 additional meters need to be installed and read by 2013. More detailed meter installation numbers will be discussed in

Chapter 3.

The City has approximately 24,000 commercial, industrial, municipal, irrigation and multi-family meters, read by 12 meter readers which are not included in the 105,050 meters to be installed and read by 2013. The commercial and industrial meters are billed on a bi-monthly basis.

Key Project Timeline (Milestones)

The City receives water from the Central Valley Project (CVP) through the US Bureau of Reclamation (Bureau). HDR in not providing a legal interpretation of the CVP contract and recommends the City confirm schedule with their legal department. A conservative interpretation of the contract language states the Bureau requires the City to begin reading and billing residences which already have meters by 2010 based on volumetric consumption. The CVP contract and Assembly Bill 514 have similar milestones which must be met. The CVP contract and AB 514 have the same final deadline for metering and billing on consumption of 2013. The key project timeline (milestones) is shown below:

- December 2007 — Write Draft Rate Ordinance
- January 2008 — Submit progress report to Bureau
- January 2008 — Initiate retrofit installation of meters on residences
- December 2008 — 29 percent of meters installed (approximately 30,500 of the total 105,050)
- January 2009 — Submit progress report to Bureau
- December 2009 — 43 percent of meters installed (approximately 47,000)
- January 2010 — Submit progress report to Bureau
- March 2010 — Impose new Rate Ordinance
- December 2010 — 62 percent of meters installed (approximately 69,100)
- January 2011 — Submit progress report to Bureau
- December 2011 — Adopt new Rate Ordinance and 81 percent of meters installed (approximately 91,000)
- January 2012 — Submit compliance report to Bureau
- December 2012 — Meter installation progress: 100 percent of meters installed
- January 2013 — Retrofit completion report; all customers billed on a metered basis

1.5 City Key Personnel Interviews

HDR interviewed six key personnel representing Management, Revenue and Finance, Engineering/Technical Services, Operations, and Meter Maintenance. The interviews were conducted on March 6-7, 2007. Overall, the personnel interviewed all agreed that Automatic Meter Reading (AMR) could be a powerful and useful tool for the City but their concern was the cost may be prohibitive at this point in time.

Once individual interviews were completed, consolidated issues, concerns and requests were discussed in a group forum. Many of the same issues were expressed from different sections. A total of eleven categories were identified from the interviews and prioritized by the City via a vote by all participants. The issues pertain to staffing resources, cost, collaboration, compatibility, installation, political/regulatory issues, technology selection, implementation, and conservation. Each staff member was given a total of ten votes to prioritize the categories. Staff could place all ten votes on one category, one vote on different categories, etc. A summary of the items of greatest concern, at the start of this project, is listed below. The full results of these interviews are presented in Appendix A.

Table 1-1. Summary of Key Personnel Meter Reading Priorities.

Category	Votes
Cost Justification	13
Staffing	9
Technology Selection	9
Bidding of Program	8
Program Implementation	8
Installation	6
Compatibility Field	5
Compatibility Office	4
Political/Regulatory Issues	4
Information Wanted from System	3
Collaboration	1
Conservation	0

The issues and concerns raised by the City's personnel at the start of this study and shown in Table 1-1 are briefly summarized below. The issues and concerns raised in each of these categories will be discussed in more detail throughout the report.

- **Cost Justification:** The cost of the full retrofit (installation of meter box, tapping into water line, and the installation of the meter) is a concern brought up by nearly all participants in the individual interviews. A cost benefit analysis will need to cover how this program may be paid for, what portions of the cost benefit the entire City, what portion benefit only individual residences, and how each residence should be billed. [Addressed in Chapter 3 – Cost Analysis of Alternatives].
- **Bidding of Program:** The bid document for this program must be flexible enough to take into consideration possible uncertainties that may arise in the field including raising or lowering the angle meter stops, tree roots, meter location in concrete driveways, etc. The possibility of adding an opportunity to bid on the retrofit or replacement of older existing meters needs to be addressed. The City is considering pre-qualifying three meter brands prior to bidding. This will standardize the meters in the field for ease of reading and maintenance. Also, the procurement process may need to be examined to allow a proposal type selection instead of a direct bid process. The City is also considering a single "turnkey" installation contract for ease of

administration and to ensure the CVP contract timeline is met. [Addressed in Chapter 5.3 - AMR System Procurement].

- **Staffing:** Staffing issues will concern all sections with the implementation of the meter program. There are concerns about staffing up during the installation process in one section and then the need to integrate this additional staff into another section once installation is complete. Staffing levels in the Water Division are at a minimum at this time and additional internal staffing may be difficult requiring outsourcing. [Addressed in Chapter 3 - Cost Analysis of Alternatives]
- **Collaboration:** In order to reduce costs there are several options to be explored including collaboration with PG&E or the police/fire departments who are all installing infrastructure in the City for their own programs (wi-fi). One issue to consider is who will own the information if the City collaborates with one of them. Another possible cost reduction will be to "piggyback" on the water utility's own SCADA system used to monitor municipal well sites throughout the City. [Addressed in Chapter 4.8 – Outsourcing Meter Reading]
- **Compatibility: This category was divided into two sub-categories**
  - **In the Field:** As mentioned before, some of these meters are more than 30 years old which the City inherited when County and private utility districts were consolidated and the City standards were not followed. There is no uniformity in the curb stop height, type of lid, location on the property, etc. which increases the maintenance department's need for inventory, knowledge and workload. [Addressed in Chapter 2.8.4 – Compatibility of AMR Systems]
  - **In the Office:** The City currently has a 15-year old HTE billing system which is incompatible with most other systems in the City. Verify work orders and requests are currently handled using a paper system. The City would like to eliminate as much manual processing of the billing and work orders as possible to reduce errors and move to an electronic format. The City would like to see compatibility between billing, customer service, meter maintenance, geographic information system (GIS) and a work order system. [Addressed in Chapter 2.9 – Compatibility of the AMR System to the City's Customer Service Information and Billing System]
- **Installation:** There are two installation issues of concern for the City, replacement of the older meters and installation of the approximately 81,000 new meters. Since the City is under a time constraint from Assembly Bill 514, the installation timeframe is a major concern. [Addressed in Chapter 3.5 – Key Assumptions, Cost Effectiveness of Replacement of Existing Residential Meters and Chapter 5.4.5.1 –Bid Document Specifications – Installations and Warranties]
- **Political and Regulatory:** As previously mentioned, there are regulatory requirements for this project that must be met. Rates and meters are topics the public is wary of; therefore a public relations program will be a key component to the implementation of this project and making the transition for the customers smooth. [Primarily Addressed in Chapter 5.2.2 – Deployment Strategy Recommendations]

- **Technology Selection:** Many utilities across the country are incorporating newer technologies into their meter reading programs, while the City is now moving into meters for all customers. While newer AMR technologies would be ideal for a city the size of Fresno, other considerations may need to be taken into account when making the final technology selection including how the meters are going to be read, does the City have the funding for full AMR and is the price of a Fixed Network system compatible with the City Council's overall plans for the City. [Primarily Addressed in Chapter 2, and Chapter 5.2.1 – Preferred Technology Recommendations]
- **Information Wanted from the System:** The City currently does not read the residential meters in the ground as all customers receive a flat rate bill. Therefore little, if any customer information is collected. The City would like to see consumption information, leak detection, reverse flows, and possible other information from the meter reading system. More information is seen as beneficial to the City in monitoring customer use and providing better information when planning for future growth and water use. [Primarily Addressed in Chapter 2.8.2 – Alternatives Considered]
- **Program Implementation:** The City has several concerns regarding the implementation of the program including how to handle the lag time between the installation of the meter and the first metered bill, and how to determine which costs are City-wide benefits and which benefit only the specific residence. In order to make the customer aware of their consumption prior to receiving an actual metered bill, a dual-billing system is being considered which will continue the flat rate but show on the bill the estimated metered bill for the amount of water consumed. [Primarily Addressed in Chapter 4.4 – Key Implementation Issues and Risks]
- **Conservation:** While conservation is considered an ancillary benefit to the metering program, the consumption of water can be monitored with a metered billing system. The City can better plan for future water supply, identify leaks within the system more efficiently and monitor consumption patterns during the year and by customer class. [Primarily Addressed in Chapter 2.4.3. and 2.4.4 – Radio and Fixed Network Descriptions]

The above City concerns, noted at the start of this study, were used to develop the financial model, key recommendations and implementation schedule discussed later in this document.

HDR has attempted to address within this report all of the City's issues and concerns that were raised within the initial discussions with City personnel. In addition, as the study was developed, HDR and the City worked jointly together to review each of the key areas of the study to determine the appropriate level of technical review and recommendations that should be provided by this study.

1.6 Summary

This section of the report has provided a brief introduction to the residential metering plan developed for the City. The City is legally required to install meters by January 1, 2013. This will require an intensive effort to meet this schedule. The development of a residential

metering plan has generated a wide range of issues. The purpose of this report is to explore the various issues and develop a set of recommendations to allow the City to move forward with the metering plan in a cost effective and efficient manner.

2.0 Comparison of Meter Reading Technologies

2.1 Introduction

The technologies associated with the water utility industry are ever-changing. All new technology should be carefully evaluated and reviewed to assure it meets the needs of the utility, but more importantly, provides the cost savings or efficiencies desired. The objective of this section was to provide the City with an assessment of current meter reading practices and an analysis of various meter reading technologies.

2.2 Summary of this Chapter and Key Recommendations

There are four basic meter reading technologies available to the City. These are as follows:

- Manual Read
- Touch Read
- Mobile Radio Read (Drive-By)
- Fixed Network

Each of these meter reading methods (technologies) are viable options for the City. However, each method utilizes a different mix of labor and technology. Manual read is the most labor intensive and very low-tech, while drive-by and fixed network rely on technology to minimize labor costs. At the same time, there are different ancillary benefits that are derived from each technology (e.g. more frequent reads, leak detection, etc.).

The objective of this chapter of the residential metering plan is to familiarize the City with the differences in the various technologies available and some of the key features or issues associated with each. A side-by-side comparison of various major meter manufacturers is provided. Given that the City has not entered the procurement process at this point in time, no recommendation is provided by HDR for a specific meter manufacturer or brand.

As with any technology decision, a key concern is the evolution of the technology whether that should impact or sway near-term decisions. HDR noted that AMR is evolving, particularly as it relates to fixed networks. A comparison was provided of the cost and general capabilities of each alternative. Manual and touch read systems are low-cost, low-technology solutions, with the trade-off of high labor costs. Fixed network systems are the highest capital costs, lowest labor costs, but with significant potential benefits. Mobile read has the benefits of low labor costs, but not the full flexibility and functionality of the fixed network system. In particular, this flexibility and functionality are related to the account service and billing system considerations in which the customer may be provided more frequent consumption (usage) information. This could be a particularly powerful tool for conservation purposes.

Compatibility of the systems between manufacturers was explored. An “open architecture” system is typically preferred to a proprietary system. An open architecture system will provide greater flexibility to the City as the technology changes and evolves over time.

The operational impacts of each technology appear to favor the mobile read and fixed network technology. The benefits of greater information to the customer are also enhanced by better data and information for the City to use within a variety of plans and reports prepared by the City (unaccounted for water, resource planning, compliance with water conservation plans, etc.).

KEY RECOMMENDATIONS - No specific recommendation on an AMR technology is provided within this section of the report. Based upon this side-by-side comparison of the technologies, it would appear that a drive-by system or fixed network system would provide greater benefit to the City over the long-term and meet many of the objectives desired by the City. However, this observation is made absent any cost analysis of the alternative meter reading technologies.

2.3 AMR Historical Overview

One of the first significant advancements towards AMR was the development of the remote meter reading system. This enabled the meter reading on the water register to be recorded via a drive cable or wire to a mechanical totalizer device. This device could be installed in a more accessible location than the water meter itself. For inside set meters, this meant a location on the outside of a building. For pits and vault set locations, this meant a location outside of the pit or vault or underneath the lid. This resolved the significant increase in access issues caused by fewer residential customers being home during normal utility meter reading hours. It also eliminated the problems associated with confined space entry.

The visual outside reading device had several reliability issues that resulted in the inside meter register reading being different than the outside device. Many of these problems stemmed from the lack of maintenance/replacement of the outside device. Water intrusion was also a common problem particularly in pit situations. As a result of these problems there were minimal applications of this technology.

To address the mechanical visual outside reading device problems, a direct outside reading system (touch read) was developed. The development of the encoder register, which allowed the register to be electronically interrogated, laid the platform for AMR. A reading device was plugged into a set of pins or touch pad containing an induction coil that would capture the reading directly from the meter register. These devices also had some problems with bent pins or non-numeric characters when the register was interrogated. However, their reliability and lack of maintenance requirements made them a popular replacement of the mechanical outside reading device. Advances in register sealing systems also enabled these devices to be more reliably deployed in pit and vault situations, improving reading productivity and addressing confined space issues.

After the outside reading device, the next most significant advance in automatic meter reading came with the development of the “electronic” meter reading book. Manual read and early touch read systems required writing the meter reading in route books or on mark sense cards. This manual entering of readings created opportunities for reading errors. The “electronic” meter reading book enabled reading information to be loaded onto these handheld devices and the reading information to be captured with little or no human intervention. Manual entry into

the handhelds resulted in some errors, but significantly less than route books or mark sense cards.

For touch read systems, handheld devices have progressed to the point where readings are captured without any meter reading data entry by the meter reader. These devices significantly improved the read to bill processing time and reduced reading errors. Though the capture of meter reading data was automated, the touch type technology is not considered “automatic meter reading”.

The first commercially viable leap to automatic meter reading came with the development of the phone-based meter reading system. Phone read systems are operated as either dial in-bound or dial outbound systems. The dial in-bound system was based upon the meter’s interface device initiating a call on a pre-programmed basis to the water utility. If the line was in use at the time of the call, it would attempt to call later. Phone company cooperation was not needed for this method of reading, and the utility was not charged by the phone company for the call.

The outbound system approach required the utility to initiate the call to the meter, which was done on a pre-programmed automated basis as well. This approach required phone company cooperation resulting in an additional charge for phone number administration and call usage for each account.

Phone read technology gained early success for large commercial and industrial accounts that needed monthly meter reading, and in utilities looking to significantly reduce meter reading costs. This technology suffered from perceived privacy issues and the lack of third party cooperation from the phone company. Phone read systems deployment was all but eliminated as radio systems and cell phone networks were introduced into the market. In fact many early adopters of the phone read system have converted to or are in the process of converting to radio frequency AMR systems.

The next generation AMR system was Radio Frequency (RF). RF systems are currently offered as mobile or fixed network. The mobile system enables the meter reader to capture the meter reading by driving or walking by the meter. Walk-by systems do not provide significant productivity gains over touch read as meter readers must be in close proximity to the meter interface unit to “capture” a reading. Drive-by units, due to their increased transmitter power and driving speed, offer significant productivity gains on the order of at least ten times or more compared to touch read.

The Fixed Network system provides an additional layer of automation in that meter readings are brought back directly to the utility on a fixed network collection network that is deployed for this specific purpose. Similar to phone read systems, some Fixed Network systems make use of existing networks such as electric power lines, cell phone, and cable.

Radio Frequency systems were initially adopted in the gas and electric utility industry because gas and electricity rates were three to five times greater than water rates which prompted movement to more frequent meter reading and billing. The same drivers that confronted gas

and electric utilities have created the need to move to a higher level of reading automation in the water industry. As a result, the water industry is now experiencing a higher growth rate in AMR than other industries. While RF system meter reading has been available to water utilities for nearly 15 years, it has only recently become the technology of choice for water utilities.

Most water utility early adopters of AMR systems were accounts with inside set meters. However, in the late 1990s and continuing today, AMR has been adopted by accounts with sizable, if not exclusive pit/vault set applications. Mobile RF solutions have been deployed in Houston, TX, Richmond, VA, Charlotte, NC, Montgomery, AL, and Memphis, TN to name a few. Cincinnati, OH is nearing completion of a mobile RF system implementation. The City of Columbia Water and Sewer Authority is wrapping up the largest Fixed Network deployment in the water industry. A Fixed Network solution is currently underway for Corpus Christie, TX for both water and gas meters. Bid specifications have recently been released for Kansas City, MO for its 160,000 inside/outside water accounts. Specifications and request for proposals are pending for San Diego, CA, Henrico County, VA and Atlanta, GA.

2.4 Description of Available Meter Reading Technologies

2.4.1 Manual Meter Reading

Manual meter reading requires the meter reader to visually obtain the reading directly from the meter register located on the meter or from a visual reading device which means the meter reader must physically gain access to the meter register or reading device. These readings are typically entered into a handheld “electronic” meter reading device which downloads the data to the billing system.

Relative to the other meter reading systems on the market, visual read systems have the lowest capital cost. The water meter and standard/generator registers are staples in the industry and their manufacture is highly automated. Operating and maintenance costs, aside from labor costs, of this metering system are also relatively low. The meter body, regardless of the reading technology is the same throughout. The meter itself has a good history of reliability and when failure does occur, it is generally more cost-effective to replace the meter than to repair it. The meter register has also increased in reliability with the advancement of sealing techniques. Moisture under the dial face, which obscures the meter reading, rarely occurs. Operating and maintenance costs do increase with the use of the generator register and visual read remotes.

The low initial capital cost and ongoing operating and maintenance costs of visually read systems are greatly offset by the labor cost needed to collect the reading. Productivity rates are constrained by geography, density, access, weather, and most notably by the physical ability of the meter reader. Depending upon the system used for processing the meter reading, errors lead to additional customer service and field costs. Manual systems typically have the lowest productivity rates and highest reading error rates. For industrial and commercial accounts, reading productivity, depending on the factors noted above could be in the 50 to 100 reads per day range, and in some cases require two meter readers in confined space situations. For residential accounts, inside set meters with visual remotes would see productivity rates in the

150 to 300 reads per day area, whereas pit setting could be in the 250 to 400 range. Any increase in meter reading frequency would require a sizeable increase in labor.

Reliability issues for the manual reading system revolve around the ability of the meter reader to gain access to the meter or reading device, and to accurately record the usage, assuming the reading device was in sync with the meter register. Lack of access normally results in an estimated bill, which can lead to a string of additional services such as billing dispute investigation, meter re-read, and re-billing. An inaccurate reading leads to a demand for the additional services just noted, and in addition a possible meter test as well.

2.4.2 Touch Read

Touch read systems enable the meter reader to gather the meter reading through an outside meter reading device (touch pad) connected to the meter register. Unlike the mechanical, visual read remote system, the touch read system allows for direct interrogation of the meter register. As with the manual system, the meter reader must visit every account site to obtain the meter reading from the touch pad device. Readings are collected when contact is made between the handheld reading device and the outside reading device (or pad).

Additional capital costs associated with this reading system are the encoder register and the outside reading device. The encoder register electronically encodes the meter reading optically (absolute) or digitally and then stores the current meter reading at the time of interrogation. The encoder is considered part of the meter unit itself for all touch, mobile, or fixed networks. This reading system also provides for tamper detection should the wire between the meter's register and the outside reading device be disconnected or cut.

Many of the same labor costs apply to the touch read system as the manual read system. The touch read system, in a pit application will increase reading productivity compared to manual read, but the range is limited. Typically, a touch read system in a pit application might increase productivity in the 10 – 20 percent range. This range might increase if a high percentage of the pits are constantly submerged in water and have to be pumped prior to reading. Further productivity may be gained from route optimization and meter reader incentive systems. However, the productivity ceiling is limited, and as the number of meter readings increases, more readers will be required, increasing labor costs.

Operating costs for the touch read system will increase over the manual read system depending upon the failure rate of the encoder register. While the encoder register has a decent reliability record, there have been reported incidences of manufacturing failures that have resulted in non-numeric readings. The non-numeric reading does cause an estimated bill to be sent or perhaps indicate a re-read. Some utilities have established procedures where a field service call is not

made until two consecutive non-numeric reads have taken place. Similar to the manual read system, anything that results in an estimated bill results in additional customer service cost.

Touch read systems have proven to be a reliable alternative to the visual outside reading device. They have been effective at addressing confined space issues, and the outside reading pad is virtually maintenance free with no moving parts. The encoder register provides a stepping stone to more automated forms of meter reading discussed below.

2.4.3 Mobile Radio

The mobile radio system enables the meter reader to collect meter readings while walking or driving by a meter equipped with an RF reading device. The mobile reading system requires the addition of an RF reading device (also called a meter interface unit or MIU) to the encoder meter register. The RF device is powered by a battery, and can either be an absolute encoder or digital encoder. The type of encoder might impact the RF device that is used.

Obviously, as additional electronic components are added to the metering system, operating and capital costs will rise. Electronics have a failure rate, typically in the area of less than one percent per year. However, the major operations cost driver for an AMR system is the battery life of the RF device. The longer the battery life and life of the RF device, the more cost effective it becomes.

Additional benefits accrue in situations where the meter life is in lockstep with the RF device life so that both the meter and MIU can be replaced at the same time. RF device products are being offered with an estimated battery life of 10 to 20 years. Warranty coverage becomes an important component of owning and operating an AMR system so it is important to clearly define warranty terms ahead of implementation. Additional costs will be involved for coverage beyond the standard warranty.

RF devices operate in two different transmitting modes. Some systems are always transmitting and the reading device just happens to “bump into” the reading signal. These systems have a lower production cost because only signal sending electronics are needed. The battery life for such products is approximately ten to fifteen years, though some companies offer longer battery-life guarantees. The second transmitting mode requires the RF device to be “woken up” to transmit the meter reading data. The battery life for these systems is in the 20 year range. These systems are generally more expensive because they contain sending and receiving electronics, but the additional service life may offset the additional capital cost.

Operation costs might also include software licensing and upgrade fees, maintenance of reading equipment, and Federal Communications Commission (FCC) licensing fees. Reading systems are offered in both licensed and unlicensed frequencies. Unlicensed frequencies operate in the

900 MHz range, and compete for space with other RF operated consumer products which may cause some problems in "capturing" meter readings. Licensed systems provide the utility with its own unique operating frequency eliminating the interference issues associated with unlicensed frequency, thus making the system more reliable. There is an annual fee for these licensed products. Most manufacturers will assist with the licensing process.

The meter reading productivity for a mobile RF system is significantly better than manual (visual) or touch read systems. The actual productivity achieved by a utility is based upon many, ever-changing factors such as meter population density, location of the RF device, weather, temporary obstructions, and average driving speed. Typically, drive-by reading productivity has been in the range of 5,000 to 10,000 reads per day, but current systems are demonstrating even higher reading performance. With flatter terrain and improved signal strength, less travel time is required and reading productivity increases. Some utilities read during late evening hours or off peak traffic hours to improve reading productivity even more. Given the initial capital cost of a mobile collector unit, it is better suited for high volume, repetitive work.

The RF handheld reading devices have a typical reading productivity of 800 to 1,500 reads per day. Typically, these devices become part of an AMR strategy used in special and final readings. It is often more cost effective to use the mobile, drive-by collector for routine meter reading functions and reserve the special and final readings for the handheld collectors. Special and final readings occur at various locations throughout the service territory and may average a few hundred per day, depending upon the size of the utility. It may be more cost-effective from an operations standpoint to have this division of labor and equipment than using a mobile collector.

AMR reading reliability is 98 percent or better. Many specifications have this requirement built into the purchase agreement. The initial reading reliability rate may be less during the early stages of implementation, normally for non-product related issues. For example meter readers getting used to the equipment and reading routes may result in lower reading rates. There may also be some RF device location issues affecting the range of the device. This problem occurs with higher frequency in large meter/vault locations than in residential and small commercial accounts. Temporary obstruction issues such as cars parked on or near the RF device, or the device being under water will also affect transmission range and the reading rate. Such items will need to be addressed and accounted for prior to pursing equipment related issues with the vendor.

Following the manufacturer's installation instructions is an important consideration for reading reliability, especially in a pit set environment. For cast iron lids, maximum reading range is obtained by installing the RF device through the lid. If plastic or polymer concrete lids are used, the RF device may be installed below the lid without significantly affecting reading range. Reading range claims for RF products need to be tempered with how it will actually affect the meter reading process. There may also be some degradation in the reading distance over time. However, unless the signal strength is so great that it enables the utility to

consistently reduce its total drive time or mileage, the extra range may not be operationally beneficial.

2.4.4 Fixed Network Radio

Fixed network radio systems offer a truly fully automatic meter reading capability. The meter reading is "captured" through a system of collectors which transmits the meter reading back to the utility location. The RF devices are programmed to send the readings to the utility on at least a daily basis. These collectors can be located on the towers currently used for the City's SCADA monitoring of the municipal well sites. Figure 2-1 below shows the fixed network schematic from the residential meters through to the utility billing department.

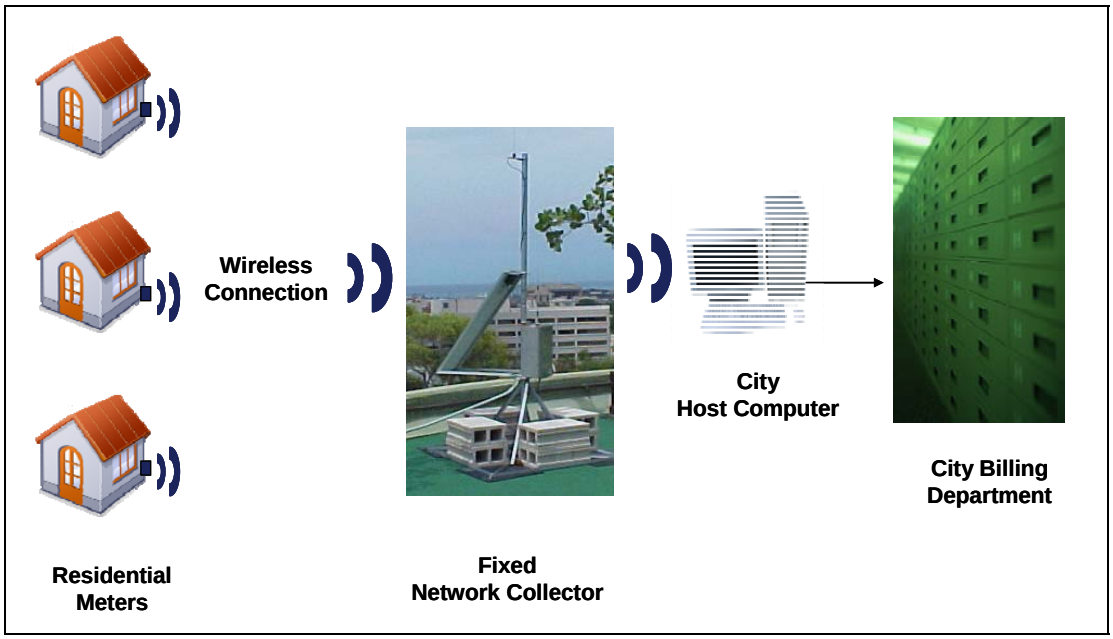


Figure 2-1. Fixed Network Schematic.

Additional capital costs for this reading system include an array of collectors and repeaters positioned throughout the service territory. The number of collection units required is mainly dependent upon the topography of the area. The typical range for a fixed network collector is one collector per square mile, with as little as one collector per four square miles in a flat terrain situation. Generally, collectors are placed upon public buildings, power poles, or water towers. A specialized system server for collecting the reading data and software for its operation is needed as well, adding to the initial cost of this option.

Additional operating costs include FCC licensing fees, cellular fees for the transmission of readings from the data collectors to the utility, hardware and software licensing fees and memory and software upgrades, if not included in the licensing fees. Optional monitoring is an additional service available to utilities for a fee, where the vendor replicates the data received by the utility. Depending upon the location of collection units, owners of buildings and power poles may require some form of compensation for use of those facilities.

The reading productivity of the fixed network system is basically unlimited. As long as there is sufficient memory and software capacity in the collection and utility based components, the utility can collect as much usage data as it wants without sending a meter reader or other personnel into the field.

Regarding reliability, fixed network systems have the same RF device reliability ratings and issues as the mobile systems. During initial project start up, some adjustments may need to be made, including relocation of the RF device to get more reliable, consistent readings. Due to temporary obstructions, meter readings at a property can be missed for several days. Meter reading policies should be established as to when to make an investigative field service call to address these missed readings. For a mobile system, if missed reads continue into the next reading period (monthly) a field service work order should be initiated to determine the cause of the missed read. For a fixed network system and due to the ability to read the meter daily, a missed read investigation may be required within 72 hours of no concurrent reads. A typical lag time policy (72 hours) may be required to address temporary obstructions and possible meteorological conditions.

Utilities throughout the country, especially in dry, arid locations, are encouraging their customers to become more cognizant of water use and conservation. One of the items some utilities are using to communicate water consumption data with residential customers is through the use of a water meter monitor which can affix to a refrigerator via a magnet. The water meter monitor receives data from the customer's water meter on a constant basis to give the customer their regular consumption information. The monitor also acts as a leak detector. For example, an alert will register if the residence does not have one hour of non-water use in a 24-hour period. This will notify the customer to the possibility of a leak prior to their next water bill. The water meter monitor is small and is battery operated. Figure 2-2 shows an example of a water meter monitor refrigerator magnet.

Figure 2-2. Example Refrigerator Magnet Water Meter Monitor.

The above discussion has provided a good background overview of each of the meter reading technologies available to the City. In order for the City to begin to narrow their choices of the technology, the City will need to consider other evaluation parameters. Provided below is a discussion of these other evaluation parameters.

KEY OBSERVATION – Given a choice between technologies, municipal water utilities of the size and complexity of the City of Fresno are selecting AMR solutions to minimize labor costs and take advantage of the features that a mobile radio read or fixed network solution provide.

2.5 Other Evaluation Parameters

To evaluate the different brands of water meters that are available to the City, a set of parameters was developed to compare and contrast the different vendors. These parameters were chosen because they are considered to be important features of the meter that will affect the productivity of the meter reader and the life-cycle cost of the meter.

2.5.1 Radio Signal Transmission

DSSS (Direct Sequence Spread Spectrum) – A technique where the transmitted energy is spread over a wide bandwidth. A conventional narrowband (NB) radio typically occupies 12.5 kHz of bandwidth, while a DSSS radio could occupy a 2 MHz bandwidth (160 times wider). Spreading the energy over a wide bandwidth reduces the energy density and thus interference to other narrowband users.

FH (Frequency Hopping) – Another form of spread spectrum. An FH radio is a narrowband radio that changes its frequency periodically. The FCC requires that the radio hop in at least 50 different channels before it repeats the same sequence. An FH receiver cannot suppress interference like a DSSS receiver, since it is a narrowband radio. FH applications avoid, rather than suppress, interference.

2.5.2 Signal Transmission Power

When transmitting a radio signal, there are limitations set by the FCC as to the strength of the signal that is allowed. Signals with a higher transmission power will have greater reliability and consistency. Therefore, meters with a higher transmission power will allow the signal to travel farther and have less chance of interference. DSSS signal transmission is permitted by the FCC to transmit at power levels up to 1.0 watt. FH signal transmission can be up to 1.0 watt if it is transmitting on at least 50 channels, but only 0.7 watt if operating on less than 50 channels.

2.5.3 Communications

As noted in the prior discussion of the radio read technology, there are two types of communication when dealing with radio read water meters:

1. One way communication means that the water meter transmits information at a fixed time interval regardless of whether anyone is receiving the information. For example, a one-way transmitter will transmit the meter information via radio signal every 14 seconds for 24 hours per day, 7 days per week, 52 weeks per year. Given that the signal will only be read about once every two months during the reading cycle, considerable battery life will be wasted making the other signal transmissions. To conserve battery life, the meter supplier limits the amount of information that is transmitted to just the bare minimum.

2. Two-way communication means that the meter reader sends a signal to the meter, the meter acknowledges that it is being interrogated, and then the meter transmits a radio signal. The only time the battery is being used to transmit a radio signal is when a meter reader has asked for the information. Therefore, the life of the battery is extended and the meter can transmit much more information without draining the battery. Two way communications also includes alert signals to the endpoints which notify the user that a successful transmission has been completed. With this confirmation, misreads are avoided. Other features include password protection, diagnostic capabilities and the ability to adjust features remotely without visiting each site.

2.5.4 Battery Life

The 20 year warranty on the battery involves a 10-year full replacement warranty, and a 10-year pro-rated warranty. In many cases, at the end of the battery life, the utility will choose to upgrade the meter technology rather than replace the battery.

2.5.5 Field Replaceable Battery

Some manufacturers build their meters such that the battery is separable from the meter register and the transmitter. This type of meter allows the battery to be replaced in the field without having to remove the register or the transmitter. In contrast, some manufacturers build their meters so that the battery is integral with the meter register and/or transmitter. This type of meter means that the register and/or transmitter need to be removed in order to replace the battery. There is a significant cost savings in having a field replaceable battery in that the meter readers are able to do this in the field with minimal tools and effort. In addition, the City would only be paying for the cost of the replacement battery, instead of the cost of an entire register. For example, Sensus has a field replaceable battery that costs about $25, whereas Mastermeter has the battery integral with the register and costs about $135 to replace the entire register.

2.6 Meter Suppliers

There are many different meter brands that have proven successful by utilities on the West Coast. Utilities select brands of water meters for different reasons, and many have switched brands because of issues related to capital cost, customer service, availability of technology, or poor O&M history. For the most popular or widely used meter manufacturers, below is a summary of the equipment available from each. Table 2-1 provides a summary of each of these meter brands and the other evaluation parameters previously discussed.

Table 2-1. Meter Brands Commonly Used.

Vendor	Available Technology	Radio Signal Transmission	Signal Transmission Power	Communications	Battery Life	Field Replaceable Battery?
Sensus	Touch Fixed Network Radio Mobile Radio	DSSS	Up to 1 watt	Two-way	20 year Warranty	Yes
Badger (Orion)	Touch Fixed Network Radio Mobile Radio	Narrow Band	Less than 1 watt	One-way	20 year Warranty	No
Neptune	Touch Fixed Network Radio Mobile Radio	FH[1]	Up to 1 watt	One-way	20 year Warranty	Yes
Master Meter	Touch Fixed Network Radio Mobile Radio	DSSS[2]	Up to 1 watt	Two-way	20 year Warranty	No
AMCO	Touch Fixed Network Radio Mobile Radio	DSSS[2]	Up to 1 watt	One-way	20 year Warranty	Yes
Hersey	Touch Fixed Network Radio Mobile Radio	Narrow Band	Up to 1 watt	One-way	20 year Warranty	No

1. Frequency Hopping
2. Direct Sequence Spreading Spectrum

2.6.1 Sensus

Sensus produces two main types of residential water meters for use with their Touch Read and AMR technologies. The antenna for the radio read meters must be mounted to the underside of the meter box. This can cause some problems when dealing with steel lids in traffic areas, and with tampering/vandalism. An added feature of the Sensus system is the two-way transmission capability, which means the Sensus meter transmitter unit transmits only when interrogated by a meter reader. This results in extended battery life as the transmitter can remain in a sleep mode until it receives a “wake-up” signal. Another feature of the Sensus brand of reading equipment is that it is completely compatible with Neptune meters, of which the City has a large amount.

2.6.2 Neptune

Neptune’s water meters are presently based on the Neptune T-10 meter. The majority of the City’s meters are Neptune meters, with a significant amount of those being the T-10 model. The T-10 is a proven reliable meter with the capability to be converted to AMR technology. The Neptune meters have a one-way communication with a transmission every 14 seconds. To conserve battery life, the amount of information transmitted is usually limited. Other features of the Neptune meters include the fact that the E-Coder registers are fully integrated without any exposed wires, and they have leak and reverse flow detection.

2.6.3 Badger

The main residential meter produced by Badger is the Recordall meter. All the Recordall meters are compatible with a Badger AMR system, with the addition of a transmitter or an encoder register. The Badger system is based upon narrow band communication, does not have a field replaceable battery and utilizes one-way communication.

2.6.4 Master Meter

The Master Meter radio read system is fully compatible with most existing products and offers advantages, including a wireless connection for the transmitter, a data logging feature that will hold up to 4,000 individual reads, and leak, tamper, and backflow protection. The Master Meter AMR product is completely self-contained with the RF radio, antenna and water register sealed together under the glass of the register. The Master Meter does not have a field replaceable battery.

2.6.5 AMCO

The Elster AMCO new evolution fixed network AMR is a intelligent two-way system solution for water utilities. The new evolution has just made its debut at the AWWA national conference in Toronto. It has a unique feature that uses an actuated valve to control shut offs and turn-ons. The AMCO system does have a field replaceable battery.

2.6.6 Hersey

Hersey can provide a complete package including enclosed meters, radio transmitters, receivers, handheld or laptop computers, and software. The open architecture design of the system means that the AMR components are highly compatible with other AMR equipment. It is a narrow band system and does not have a field replaceable battery.

As can be seen from this brief review, even when discussing a specific meter reading technology, there are differences in the systems. Even after selecting an overall AMR technology, during the procurement process, the City will need to be aware of the specific features and technology that each meter manufacturer utilizes and which of those features and technologies the City deems to be most desirable.

KEY OBSERVATION – Each AMR solution (manufacturer) may use slightly different technology to achieve that solution. There are certain advantages and disadvantages in the specific technology used to achieve the AMR solution. Given that, the City must be aware of, or clearly specify, the technology to be used for the AMR solution (e.g. field replaceable battery).

2.7 Technology Review

Technology, by its very nature, is ever changing and improving. Given that, a key concern of the City is to avoid a technology that may become obsolete or unsupported in the future. Compatibility of devices between manufacturers provides added security concerning the City's technology choice. At the same time, the City would ideally like to understand where the

technology is headed. Provided below is a brief overview of near-term and long-term considerations for the City.

2.7.1 Near-Term

AMR manufacturers, those that solely manufacture AMR devices, like Itron, Hexagram and Datamatic, have been providing devices that are compatible with various metering products for many years. Meter manufacturers that have manufactured, or marketed their own line of proprietary meter reading products have been branching out to make their RF devices more compatible with other vendors' meters. Meter manufacturers have also been developing their own lines of drive-by and fixed network products in order to add value to their metering product line. Meter manufacturers are building more capabilities into their encoder registers to address the movement towards fixed network systems. Additional capabilities have also been built into some Drive-by systems to provide more than a single day's reading when interrogated. As a result, utilities may be offered more equipment choices, and more competitive prices.

Another promising development is "high powered" fixed network systems. These systems result in significantly less collection device infrastructure. Depending upon the size and topographical conditions of the utility, these fixed network systems may be priced at or close to mobile drive-by systems.

In the near term, the market should still expect some level of proprietary products from AMR and meter vendors. A certain level of compatibility may exist with some equipment manufacturers, but utilities should be cautioned as certain system hardware and software will not have a high degree of interoperability.

2.7.2 Five to Ten Years

Even with the advent of "high powered" fixed network systems, which is still proprietary, there is continued movement to making use of existing public networks. Public networks include phone lines, cable, power lines, cellular phone, and the internet. Efforts have been underway on how to cost-effectively tap these existing networks to offer the utility a more cost-effective AMR alternative. Cost-effective gateways into these networks are being developed. For example, short hop radio will enable the water meter to send its signal to the electric meter for use by power line carrier systems. Satellite reading systems may be perfected in this time frame as well.

It is a difficult choice to decide whether to wait for the "latest and greatest" or make the AMR investment now. The consumer electronics market (personal computers, cell phones, MP3 players, etc.) contributes to this confusion when we observe overnight technology and capability changes. The cost analysis conducted in the following section will provide a financial framework for this crucial investment decision.

KEY OBSERVATION – The City of Fresno, due to the legal requirements of AB 514 can not wait for further development and evolution of AMR technology. However, mobile radio read and fixed network technologies are field proven technologies in use at a number of large municipal utilities. Given that, the City may want to focus on a technology solution and manufacturer that provides compatibility and the potential for future upgrades.

2.8 Issues and Considerations

The following discussion will analyze the four meter reading alternatives over four different scenarios. The relative impacts various meter reading options have upon the City's current meter reading operation will also be addressed. The first part of this review focuses on the bigger picture in which this investment decision will be made.

2.8.1 Transaction Approach vs. Strategic Initiative

Automatic Meter Reading is a significant investment. Complicating this investment decision are other challenges confronting the utility competing for the same capital dollars. Some of these competitive challenges include water quality regulation, infrastructure replacement, security issues, and resource availability. These issues are creating enormous financial, management, staffing, and administrative challenges which must be balanced by the municipal utility. However, regardless of the other pressing financial challenges of the City's water utility, the requirements of AB 514 and the City's contractual requirements from CVP legally require this investment and compliance within a specified period of time.

Compounding the investment decision challenge is the issue of rate increases. A recent AWWA newsletter published the results of water and wastewater rate increases for 75 utilities from 1996 to 2004. It showed that water and wastewater rates rose at an annual rate of 8.36 percent compared to the Consumer Price Index (CPI) rate of 2.31 percent. The message is that consumers will be paying a higher proportion of their incomes for water resource services, therefore water may become an affordability issue for a very limited number of customers. However, even with the increasing cost of providing water service, the price and value of delivered water to the consumer is still very good, particularly in the City of Fresno.

Funding sources for the capital investments and operation improvements needed to meet these challenges is also typically an issue. It is clear that almost all the funds required to support municipal utility capital investments will come from the utility's rate payers. Establishing and maintaining a meaningful, partnering relationship with rate payers and local stakeholders might be the best method for receiving the resource support needed by the City. An important consideration in making an AMR decision, and perhaps a particular AMR investment, is linking the City's Vision, Value, Mission and Goals to the features and benefits AMR has to offer. This may move the AMR investment decision from one that is "transactional" to one that is "strategic". Instead of the customer only feeling that money is being exchanged for the product "water", other investment issues become important or strategic, such as improved customer service, conservation, water quality, consumption data information, etc. As the business case model helps build the hard cost justification for AMR, there are also considerable

soft cost areas that deserve consideration such as minimizing liability risk by providing a safer means to collect meter readings.

All City customers will benefit from a system-wide installation. The less existing product remaining in the system, the more opportunity there will be for the City to receive competitive bids. In other words, by allowing the proposing firms to propose on all residential meters, including replacement of existing meters, the City will increase the likelihood of receiving the most cost-effective meter reading solution. Once the new meters and AMR are in place, having one solution City-wide will decrease maintenance costs and the need for multiple equipment inventories, thereby increasing productivity and benefiting all City customers.

KEY OBSERVATION – Utilizing a single AMR solution and solution provider will increase the likelihood of receiving the most cost-effective metering solution, while providing the long-term benefit of decreased operation and maintenance costs.

2.8.2 Alternatives Considered

Four reading alternatives for the City's needs were compared: Manual Read, Touch Read, Drive-by mobile radio frequency (drive-by), and fixed network radio frequency (fixed network). A comparison matrix of these alternatives is presented below.

Table 2-2. Cost and General Comparison of Meter Reading Alternatives.

Equipment	Manual & Touch Read	Mobile Radio	Fixed Network Radio
Interface Equipment	Touch pad connected via wire to an encoder register (None for manual	Meter interface unit (MIU) connected to an encoder register via wire or integrated to meter register.	Meter interface unit connected to an encoder register via wire or integrated to meter register.
Reading Device	Hand-held interrogator	Hand-held interrogator or Drive-by unit (laptop)	System of collectors and repeaters
Hardware Cost	Touch pad: $10 - $15 Hand-held: $2500 - $3000	MIU: $40 - $100 Hand-held: $3500 - $5000 Drive-by: $25,000 - $40,000	MIU: $80 - $110 Collectors and repeaters cost vary significantly
Installation Labor Effort	Approximately 15 to 20 minutes of labor for pit set meters and 30 to 40 minutes for inside set meters. None for manual	Approximately 15 to 20 minutes of labor for pit set meters and 30 to 40 minutes for inside set meters. Large meters higher.	Approximately 15 to 20 minutes of labor for pit set meters and 30 to 40 minutes for inside set meters. Large meters higher.
Useful Life	20 + years	10 to 20 years depending upon battery life/or replaceable battery. Warranty 5 years, with extensions at higher cost	15 to 20 years depending upon battery life/or replaceable battery. Warranty 5 years, with extensions at higher cost
System Maintenance and Operating Costs	Maintenance service contracts for handheld readers and reading software. Encoder register replacement for touch read.	Maintenance service contracts for collection devices, reading software and programming devices. Licensing fees with some products. Encoder register replacement, RF device and collector maintenance.	Maintenance service contracts for collection devices, reading software and programming devices Licensing fees with some products. Encoder register replacement, RF device and collector maintenance. Fees for location of collection devices possible and for sending readings from collectors to utility.

Equipment	Manual & Touch Read	Mobile Radio	Fixed Network Radio
Pros and Cons			
Advantages	*Lowest capital cost *Visual contact with reading device *Utility presence maintained in service area	*Higher productivity than touch read. *Fewer meter readers required than touch read *Enables movement to more frequent reading & billing with minor capital and operating cost *Utility presence maintained in service area *Reduced site visits for re-reads and customer requested reads	*Lowest labor requirements Highest reading productivity *No meter readers required *Enables movement to more frequent reading and billing at no additional capital or operating cost *Site visit not needed for re-reads or customer requested reads. *Enables proactive leak detection and customer notification. *Enables customized billing cycles and bill consolidation *Provides nearly immediate notification of tampering *Provides data for resource, meter, and rate management functions *Can adapt to system growth with minor capital costs *Reduces meter reading and related operating costs
Disadvantages	*Very labor intensive – highest labor costs More frequent reading and billing requires additional staffing and support. *Reading cost subject to inflation and wage adjustments *System growth requires additional staffing *Re-reads and customer requested reads are labor intensive	*Higher capital cost than touch read, but less than Fixed Network radio. *Reads impacted by radio reception limitations *More expensive to maintain than Touch Read *Migration path to Fixed Network may be more expensive than purchasing Fixed Network initially	*Highest initial cost *Slightly more expensive to maintain than mobile radio

KEY OBSERVATION – Mobile radio and fixed network AMR solutions provide significantly greater benefits when compared to manual read or touch read technologies. The City of Fresno would be able to utilize and take advantage of these key benefits/features. However, the trade-off is that mobile radio and fixed network have the highest initial (capital) cost.

2.8.3 Operation Impacts

Investment in meter reading technology will impact the City's operations for the next 10 to 20 years. This extended service period makes it difficult to predict changes in meter reading technology within that time frame. We can look at the past as an indicator, but that viewpoint may miss or fall short of what future demands may be. Flexibility and growth are two important criteria when considering meter reading technologies, and generate the following questions. Does the system provide flexibility for future requirements, and if not, what will it cost to provide operating flexibility? Can the system keep pace with growth issues, such as the number

of accounts, expansion of territory, and other resources needed to support that growth? The answers to these questions are discussed in detail in Chapter 5.

The following table identifies several operational parameters that are commonly affected by the meter reading system. Some of these parameters have defined, "hard" costs associated with them that will be addressed in the financial/cost model, and other parameters have less well defined "soft" costs that are not as easily quantified (e.g. improved customer service). Costs will be described in detail in Chapter 3 for all alternatives.

Table 2-3. Operational Comparison of Meter Reading Alternatives.

Operational Effort	Manual & Touch Read	Mobile Radio	Fixed Network Radio
Meter reading frequency	Increase in frequency requires additional labor.	Monthly reading possible with 1 meter reader. Depending on configuration of growth, one additional day of reading for every 6% to 9% of growth. Add collector after growth reaches 100,000 to 120,000 accounts	Several readings per day without any meter reading staff
Meter reading effort	150 to 300 reads/person/day for manual. 250 to 600 reads/ person/day for touch.	5,000 to 10,000 reads/ person/day and higher	No meter readers All meters read twice or more per day
Eliminate estimated bills	Dependent upon meter reader capturing a read/visiting the property	Dependent upon meter reader capturing a read/visiting the property	Almost all, unless reading system at meter location is not functioning a few days prior to billing date
Reduce re-reads & customer requested field service calls	15 to 30 per day/man	30 to 100 per day/man	Unlimited
Customer Service transaction times	2 business days	1 to 2 business days	1 business day
Proactive high-bill tracking and notification	Whatever can be done from monthly readings. Too few data points to develop meaningful trend information.	Same as touch pad, unless additional reading done for high-bill tracking purposes. RF device with profiling capability provides daily usage and leak detection	Single to multiple daily reads enable this function
Tamper & theft of service	Sets tamper flag if wire is cut or disconnected from register. Pick up at time of reading or report	Sets tamper flag if wire is cut or disconnected from register. Pick up at time of reading or report	Identifies tamper same day and sends to collector unit. Utility able to identify next business day.
Customize reading/billing dates	Account must stay within designated billing cycle	Account must stay within designated billing cycle	Complete flexibility in establishing billing cycle to meet account needs. Rules and priorities need to be established.
Bill consolidation	Only for accounts within same reading cycle	Only for accounts within same reading cycle	Can be extended to accounts regardless of cycle
Provide consumption profiles for high bill investigations and conservation	Some capability, depending on system	Some capability, depending on system, including on site information	Daily information available. Web access possible.

Operational Effort	Manual & Touch Read	Mobile Radio	Fixed Network Radio
Ability to monitor for leaks in customer's premises	Whatever can be done from monthly readings. Too few data points to develop meaningful trend information.	Same as touch pad, unless additional reading done for high-bill tracking purposes. Encoder with logging capability provides daily usage and leak detection. Some systems set flag for continuous usage	Single to multiple daily reads enable this function
Monitor for compliance with conservation or watering restrictions	No. Must police compliance manually.	No, unless special reading is conducted	Able to monitor compliance remotely
Support unaccounted-for water studies	Limited	More than Touch Read, but less than Fixed Network	Provides daily, detailed data
Support inflow/infiltration studies, hydraulic modeling	Limited	More than Touch Read, but less than Fixed Network	Provides daily, detailed data
Support cost of service rate modeling	Limited	More than Touch Read, but less than Fixed Network	Provides daily, detailed data
Improve resource planning	Limited	More than Touch Read, but less than Fixed Network	Provides daily, detailed data

These operational issues need to be closely scrutinized in order to provide the water utility and the customers the best solution among these meter reading alternatives.

KEY OBSERVATION – Mobile radio and fixed network AMR solutions provide significant operational benefits when compared to manual read or touch read technologies. The key operational advantage provided by mobile radio and fixed network AMR solutions is the ability for the City of Fresno to increase the frequency of meter reads with minimal labor costs. Mobile radio and fixed network AMR solutions are very labor-efficient solutions.

2.8.4 Compatibility of AMR Systems

An important consideration in making an AMR investment is the level of open architecture the City is interested in achieving. As noted earlier, the options for AMR are limited depending upon the open architecture of the RF devices. For example, the meter and meter register are normally produced by the same manufacturer, though several makes of meters may still be deployed throughout the system. The RF device, collection devices and the software are normally produced by the same manufacturer creating "zones" of proprietary product. A complicating factor may arise when the RF device is connected to the meter register. In the past many of the meter manufacturers that produced AMR equipment were very proprietary and typically exclusive with their own meter brand, but recently due to pressures from utilities there has been movement toward greater compatibility. The more open the architecture

regarding compatibility, the more flexibility the utility will have to employ a blend of meter equipment and a broader selection of this equipment for future expansion. Therefore, less compatibility can mean limits to equipment choices for the water utility.

Another important consideration in making an AMR investment is the ability to interface with other utility systems or software applications. While this may have been an issue in the past, these concerns have been mitigated as reading and meter manufacturers are working to standardize software protocol. The benefits of open architecture include the ability to use more than one meter vendor's product with existing utility systems and applications. The City will need to determine what value to place upon open architecture. That final decision may not be made until the AMR procurement evaluation process is completed. HDR recommendations will be discussed in Chapter 5.

The level of open architecture the City is able to achieve is related to the amount of the existing meter base, and its connected encoder register retained versus what will be replaced. The less existing product that remains in the system, the more opportunity there will be for other vendors to offer competitive solutions. In other words, considering meters, in addition to Neptune, should increase the likelihood the City will implement the most cost-effective meter reading solution.

The following two tables present a compatibility comparison between the various major meter brands and AMR systems that are currently on the market. Table 2-4 is for mobile RF systems and Table 2-5 is for fixed network systems.

Table 2-4. Compatibility of Major AMR and Meter Manufacturers for Mobile RF Systems.

AMR	Meter Brand			
Brand	Sensus	Neptune	Badger	AMCO
Sensus – Radio Read	Yes	Yes	No(1)	No(1)
Neptune – R900	Yes	Yes	No	No(1)
Badger – ORION	Yes(2)	Yes(2)	Yes	Yes – digital & Scancoder
AMCO – TRACE	No(3)	No(3)	Yes – RTR No–ADE(3)	Yes – digital encoder
Itron – ERT	Yes	Yes	Yes	Yes

(1) Sensus is developing technology to read Badger register. Sensus and Neptune can read AMCO registers per AMCO.

(2) Badger recently introduced a universal ORION RF device capable of reading selected Sensus/Neptune and AMCO encoders. Different device needed to read Badger's digital encoder.

(3) AMCO is in the process of imbedding Sensus protocol into its encoders.

Table 2-5. Compatibility of Major AMR and Meter Manufacturers for Fixed Network Systems.

AMR	Meter Brand			
Brand	Sensus	Neptune	Badger	AMCO
Sensus – Nexus	Yes	Yes	No	No(3)
Neptune – R900 Micro	Yes	Yes	No	No(3)
Badger – Galaxy	No – not for initial release	No – not for initial release	Yes	No – not for initial release

AMR	Meter Brand			
Brand	Sensus	Neptune	Badger	AMCO
Hexagram – Star(1)	Yes	Yes	Yes	Yes
Itron – Fixed Network 2.5(2)	Yes	Yes	Yes	Yes

(1) Hexagram is marketed directly, through AMCO, and other meter vendors. Different RF device is needed for absolute and digital encoders.

(2) Itron Fixed Network 2.5 uses one RF device for either absolute or digital encoders.

(3) Sensus and Neptune can read AMCO registers per AMCO.

KEY OBSERVATION – The City, within the procurement process, should strongly consider those systems that contain open architecture and are non-proprietary. Systems with a high degree of compatibility will best serve the City over the long-term. In addition, utilizing a single solution provider (manufacturer) throughout the City's system will minimize the issues of compatibility between multiple manufacturers (vendors).

2.8.5 Account Service and Billing Considerations

The account service and billing costs incurred, and the benefits accrued by adopting AMR are not easily quantified. There are benefits to billing, but this report has not attempted to quantify the impact of an AMR system.

In general terms, the cost of account services and billing is not affected by AMR. Account services and billing costs would potentially double if billing frequency is increased to monthly. If the City were to implement AMR, and not change billing frequency, HDR forecasts no significant account service cost savings or increased customer revenue as the number of bills issued per year will not change.

If the City increases bill frequency by moving to monthly billing, account service costs will clearly increase. The most obvious increase in account service costs is bill printing and postage costs which should roughly double. Additional account service staff will need to be added to handle the review of an increased number of meter readings associated with bill preparation. In addition, more account service staff will be needed to handle an increased number of customer requested meter readings. These requests should also roughly double in number, but there may be more requests than received under bi-monthly billing.

While there will be an improvement in productivity related to field service meter readings, HDR does not forecast a decrease in account service costs as the number of customer requested meter readings will not decrease.

HDR has accounted for the increased cost of account service through the increase in meter readings. As the number of meter readings increases, the cost of providing customer service increases at the same rate. Using this proxy, the account service operating cost associated with monthly billing is double that of bi-monthly billing. The City is encouraged to undertake a more complete investigation of account service and billing costs related to increased bill frequency from bi-monthly to monthly.

KEY OBSERVATION – The City, for a variety of reasons, may eventually move to a monthly billing cycle. Should that be the case, the mobile read and fixed network AMR solutions provide the greatest opportunity to provide that service with the lowest cost impact to the City's operations.

2.9 Compatibility of the AMR System to the City's Customer Service Information and Billing System

As a part of this study, the City retained Langham Consulting to review the City's customer service information (CIS) and billing system. The City currently uses a system provided by HTE. As a part of this review, Langham was to determine whether an AMR system would smoothly integrate with the City's HTE system. If that is not the case, then the decision on AMR and specific vendors may need to be narrowed. In summary, Langham was of the opinion that the City's HTE system would integrate and support, at the very least, a minimal integration into the City's system. A minimal integration is defined as providing support for the import of meter readings into HTE for purposes of bi-monthly consumption-based billing for water and wastewater customers.

KEY OBSERVATION – The City's HTE customer service information system will support AMR and will, at a minimum, provide for the upload and integration of meter readings from the AMR system. At a minimum, this will provide the City with the ability to bill all customers on a consumption-based rate, on a bi-monthly basis.

Langham developed a letter report of its key findings, conclusions and recommendations. This letter report is attached within Appendix B of this study. In summary, the key findings of the letter report are as follows:

- The City will not need to make any major modifications to the HTE system. Some minor modifications have been recommended to better manage the data and/or interface the AMR system to the HTE system. The estimated level of effort and cost of these modifications was less than $40,000.

- With AMR and consumption-based billing, the City will also need to consider changes in their business processes. These changes in business process are to recognize that with AMR there will be differing ability to deal with meter reading exceptions. At the same time, the more billing inquiries from customers and the potential need for greater levels of customer service, particularly during the meter installation phase of the project and the initial billings under a consumption-based rate.

- No significant limitations of the HTE system, in relation to system functionality, customer service or best practices, were noted.

- A risk analysis was provided for a number of different areas within the AMR integration process. No significant risks were noted. There are risks, but these risks are either low risks

or, in the opinion of Langham, manageable risks. Mitigation plans for each of the risks identified was provided.

In summary, Langham determined that there were no major impediments or issues associated with the installation of a drive-by or fixed network system, in the context of the City's customer service information and billing system.

2.10 Summary

This chapter has provided an introductory overview of AMR technology and its various features and benefits. Like all technology, it is constantly being refined, improved and changing. Understanding the key differences in the AMR technology will help the City determine how best to utilize the technology to better communicate with the City's customers. The City will need to determine which technology best fits its long-term needs.

At this point and not surprisingly, the AMR solutions of mobile radio (drive-by) and fixed network appear to be the two best solutions for the City of Fresno. This observation is based simply on the needs of the City of Fresno and the benefits that each of these solutions provide. However, the key question is whether the added capital cost (initial investment) is beneficial and a cost-effective investment for the City over the life of the meters and AMR solution. The next section of the report provides a detailed cost analysis comparing the four metering solutions discussed within this report. From that analysis, the City can determine the most cost-effective solutions.

3.0 Cost Analysis of the Alternatives

3.1 Introduction

In the preceding section of the report, a detailed discussion was provided of the four basic technology solutions available to the City. The section provided a detailed discussion of the key features, advantages and disadvantages, and key benefits of each solution. While the discussion clearly demonstrated that mobile radio (drive-by) and fixed network provide significant features and benefits that would be desirable for the City of Fresno, the section did not discuss in detail whether those solutions would be cost-effective for the City. Given that, this section of the report focuses on providing a cost analysis of the four alternatives to determine the most cost-effective solution or solutions. From this analysis, the City should be able to begin to narrow their technology choice based upon the "hard" costs of each alternative.

3.2 Summary of this Chapter and Key Recommendations

A detailed cost evaluation was undertaken of the four metering/AMR technology solutions. All four technology solutions were evaluated to assure the City each was evaluated on an equal basis. The major trade-off in the cost evaluation is the labor costs associated with manual read and touch read compared to the reduced labor costs but higher initial investment for mobile radio and fixed network. In other words, does the higher initial investment for mobile radio or fixed network pay for itself over the life of the AMR system through labor savings, when compared to manual read and touch read?

The detailed cost evaluation conducted for the City considered both the operating and capital costs for each alternative. HDR worked closely with the City to determine a number of key inputs into the cost models. Another important input into the cost analysis was the assumptions concerning the deployment (installation) time line. Under each of the alternatives, the City is assumed to meet the specified deadline for installation contained in AB 514 and the CVP contract. The analysis considered the initial investment and on-going operational costs to establish a total outlay over a twenty-year period. This total outlay was then discounted to a net present value (NPV) to provide a uniform comparison between the alternatives.

In summary, based upon the cost analysis developed herein, it was concluded that mobile radio and fixed network were significantly more cost-effective than manual read and touch read. At the same time, the analysis also indicated that there was no significant cost advantage (i.e. cost difference) between mobile radio and fixed network.

KEY RECOMMENDATIONS – Based upon the cost analysis developed herein, the City should no longer consider manual read or touch read to be cost-effective solutions for the City. At the same time, the cost analysis indicated that both the mobile radio and fixed network solutions were roughly equal from strictly a cost-effectiveness perspective.

3.3 Overview of the General Approach and Methodology

In order to better understand the relative financial/cost merits of each AMR technology solution, an evaluation must be conducted which considers both the operating and capital costs. To gain this understanding, operating and capital costs were projected over a 20-year timeframe to determine the annual and total costs over a 20-year period. However, the simple summation of costs over a 20-year period does not take into account the timing of expenditures and the time value of money. In order to do this, the total cost must be placed in the context of current dollars (i.e., a net present value analysis) to determine the relative cost differences between each of the alternatives. By the end of this financial analysis, a comparison can be shown to demonstrate the relative financial/cost trade-offs between a more manual system with high operating and low capital costs versus a highly automated system with low operating (labor) and higher capital costs.

In conducting a financial/cost analysis of the alternatives, it is important to understand the analysis provides only one perspective – the financial perspective. The use of the financial analysis is only one input into the final selection of the metering technology. In that respect, the metering technology with the lowest net present value does not necessarily imply that it is the "best" technology or the preferred option. This study has identified other criteria that should be considered in the final selection process.

KEY OBSERVATION – The cost analysis developed herein provides only one perspective in making the selection of the final technology. The technology with the lowest cost or net present value does not, imply on its own, the "best" or "preferred" technology for the City.

3.4 Metering Alternatives Reviewed

In conducting this analysis, one of the challenges of evaluating the various alternatives is the nearly infinite number of possible metering/meter reading/billing alternatives due to the number and complexity of the variables (e.g., type of system, costs of each system, system growth, meter reading frequency, billing frequency, etc.). As an initial screening tool to better understand the major or relative relationships, HDR analyzed the cost impacts of four metering/meter reading alternatives using a financial/cost model developed specifically for the City. The four alternatives reviewed included:

- Manual Read
- Touch Read
- Mobile Drive-by radio frequency (drive-by)
- Fixed Network radio frequency (fixed network)

The financial model provides the City with a tool to run additional scenarios, changing variables to further test the "sensitivity" of these results. It should be noted that the model results are extremely sensitive to meter equipment pricing, particularly the cost of the meter interface unit. The price of the meter interface had a large impact on the results. Reducing the price of the meter interface unit changed significantly the net present value (NPV) ranking of

alternatives. The touch pad unit costs in the model were assumed at $15 each while the meter interface units for drive-by were $75 and the fixed network was $85. Installation for all interface units was assumed to be $15 per meter installation. The costs used were average unit costs. Table 3-1 lists the capital items required for each alternative and their assumed costs. The item quantities shown are the numbers of each item in service at the end of the deployment period. These costs were the basis used to create the financial/cost model for the City. An additional capital cost was for program management at $10 per meter. A more detailed discussion of the need to hire a program management firm is included in later chapters.

Table 3-1. Assumed Cost Per Capital Item.

Capital Equipment	Assumed Cost Per Item	Number of Items Needed
Manual		
Vehicle	$17,000	42
Handhelds	2,800	32
Touch Read		
Vehicles	17,000	25
Touch Pad Handheld	2,800	17
Touch Pad Pocket Pro	400	12
Touch Pad	15	113,265
Drive-by		
Vehicles	17,000	7
Mobile Handheld	4,500	2
Installation Programmer	2,500	4
Mobile Collector	30,000	2
System Computer	2,500	2
Software and Training	10,000	2
Drive-by Meter Interface Unit (MIU)	75	113,265
Fixed Network		
Vehicle	17,000	6
Handheld	4,500	1
Collector	2,500	40
Network Control Computer	40,000	1
Software and Training	20,000	1
Fixed MIU	85	113,265
Meters, Pits and Boxes		
Meter	70	113,265
Pit and Box Installation	375	78,810
Program Management	10	113,265

The deployment rate and meter reading productivity also impacted the ranking of results. For this reason, the City is encouraged to investigate the cost of meter reading equipment more thoroughly through a competitive bidding process. Once the City completes a competitive bid, the above prices may change. The tables below will give detailed information for the deployment period and a 20-year planning horizon based on the average unit costs identified

above. For the complete model results for the deployment, 20-year bi-monthly and monthly reading cycles, please see Appendix C.

There are many soft cost and non-economic factors to apply to an AMR technology decision. While soft costs may be an important consideration of the City, it is often difficult to properly or adequately quantify the "soft" or non-economic costs of each option. For that reason, HDR focused on the financial model results first. From that analysis, the relative cost effectiveness of each meter reading technology can be examined. Ultimately, if two technologies appear to be relatively equal, then the soft costs or non-economic factors may help shift the balance to one particular technology.

KEY OBSERVATION – Soft costs and non-economic factors must be considered in the final AMR technology selection. By definition, soft costs are not easily quantifiable and therefore, are not included within this cost analysis. Soft costs can be used to make a choice between two cost-effective alternatives.

To conduct this financial analysis, HDR with assistance from City staff, forecasted the staffing, operation and maintenance, and capital cost for each reading alternative, using both bi-monthly and monthly reading frequency. The net present value (NPV) of costs associated with each alternative was then calculated to form the basis of the cost analysis comparison [(1)].

3.5 Key Assumptions

HDR was required to make certain key assumptions to create this financial/cost model and conduct the analysis. These assumptions were used to determine the net present value of the alternatives, including debt service, escalation factors for growth and customer service costs. These are outlined below.

- **Metering Requirements:** To meet AB 514 requirements, it has been assumed that all residential meters must be installed by January 1, 2013 (i.e. the deployment period). For the City this means an anticipated 113,265 meter installations which include the current 105,050 flat rate bills plus anticipated growth over the deployment period.
- **Meter Replacement:** Included in the total meters to be installed during the deployment period, a conservative estimate for the replacement of meters currently in place was assumed. As some of the meters are nearly 30 years old from the annexed areas and the City began installing meters in 1992, meters are either approaching or have surpassed their useful life.
- **Cost Effectiveness of Replacement of Existing Residential Meters:** Based upon a net present value analysis of replacing the meters now versus waiting until the end of their useful life, it appears to be most cost effective to replace all meters now due to economy of scale for staff time and the age of the existing residential meters. The

[1] In this case, net present value is the future cost of meter reading operations and capital investment presented in current dollars. It takes into account the time value of money where in order to have $1.06 available to pay for operations and capital one year from today, the City would need to invest $1.00 at 6% annual interest. The model extends this concept by calculating the amount of money, invested at an annual rate of 6%, needed today to cover meter reading operations and capital costs over the 20-year planning horizon.

vintage of the existing meters suggests a replacement near the end of the deployment period. Therefore, all meters in the ground will be replaced as part of the deployment process.

- **Deployment Timing**: In every alternative, a five year deployment was assumed. It was further assumed that Year 1 (2008) will be a ramp up year to include bidding, project award and equipment purchasing; therefore meter installation and AMR deployment will actually begin in Year 2 (2009). The 2008 installations will include no pit and box installations and assuming replacement of the full 30,465 meters (24,232 replacements plus 6,233 installations to meet the 29 percent of meters to be installed per the CVP contract). This takes into consideration the backlog of 10,223 pit and boxes installed with no meters. The installations of all meters will be complete in Year 5 (2012).
- **Financing for Capital:** Given the magnitude of the required investment, it is assumed the City will finance the full amount of the capital for the deployment years for all alternatives.[2] During the deployment period meters will be installed for new development, but the cost for materials and installation will be paid by developers according to the Master Fee Schedule. The long-term debt financing for deployment capital was estimated at 5.5 percent over a 20-year period.
- **Customer Growth:** The meters and pits will increase annually starting in 2008 at 1.9 percent to include the estimated City growth over the 105,000 flat rate bills currently sent out. The 1.9 percent growth will be added in each year beginning in 2008 and included in the cost estimates for the capital.
- **Net Present Value Analysis:** The assumed discount rate for the net present value (NPV) analysis was assumed to be six percent.
- **Customer Service Costs:** Customer service costs are the same for all alternatives as the full impact to the customer service operations will not be clarified until the final decision on an AMR alternative is made.
- **Operating Cost Escalation Factors:** The escalation factors varied from 3.5% to 4.0% for most items. Benefits and insurance were escalated at five percent as experience has shown the cost of benefits has risen at a higher rate than other costs.
- **Vehicles:** Vehicles will be required for each meter reader, field technician, lead worker and the Collection System Supervisor. The cost per vehicle in 2008 is assumed to be $17,000 and escalated at 3.5% with a life cycle of seven years.

3.6 Capital Cost

The capital costs included in this section cover the meters, pit and box installation, vehicles and any reading equipment associated with each specific alternative. The reading equipment may include handhelds, touch pads, programmers for the drive-by and fixed network, the drive-by and fixed network units, mobile and fixed interface units, depending on what is needed for the alternative. The capital cost does not include any staffing or other operating costs associated

[2] This may not be the actual or final financing strategy for the City. However, for purposes of the financial/cost analysis, assuming the same financing mechanism for each alternative provides an “apples to apples” comparison.

with the alternatives. These will be discussed in more detail below. Table 3-2 below shows the assumed number of meters, pits and boxes to be installed annually during the deployment period. The total number of installations includes the annual growth rate of 1.9 percent during the deployment period.

Table 3-2. Number of Meters, Pits & Boxes Installed by Year

Installations	Year 1 2008	Year 2 2009	Year 3 2010	Year 4 2011	Year 5 2012	Total
Meters	30,465	16,703	21,994	22,033	22,072	113,265
Pits & Boxes	0	12,713	21,994	22,033	22,072	78,810[1]

1. Total is less than meters installed as City already has 34,455 pits and boxes in the ground. The 34,455 number was calculated based on 10,223 pits and boxes with no meter plus the 24,232 pits and boxes with meters.

Table 3-3 shows the capital components for each AMR alternative. As can be seen, the capital cost associated with meters, pits and boxes is the same for all alternatives as the same number of meters, pits and boxes will need to be installed no matter which technology or alternative is chosen. The difference can be seen once the capital items specific to each AMR technology or alternative are added in. The manual system has the fewest capital items as no interface units are needed for a manual system, only vehicles for each staff member. As mentioned before, no pits and boxes will be installed in Year 1 (2008) as there are already 34,455 pits in the ground. This explains the zero pit and box installation charge for the first year.

Table 3-3. Capital Components for AMR Alternatives – Deployment Period.

Capital Equipment	Year 1 2008	Year 2 2009	Year 3 2010	Year 4 2011	Year 5 2012	Total
Manual						
Meters	$2,132,516	$1,198,439	$1,617,484	$1,660,861	$1,705,396	$8,314,698
Pits & Boxes	0	4,886,552	8,665,095	8,897,472	9,136,052	31,585,172
Vehicle Purchases / (Retirements)	29,143	118,138	176,905	183,077	189,505	696,788
Handhelds	25,200	14,350	14,709	18,902	21,635	93,985
Program Mgmt	304,645	167,030	219,935	220,325	220,715	1,132,650
Total	$2,491,504	$6,384,509	$10,694,129	$10,979,847	$11,273,304	$41,823,293
Ave. Cost/Installation						$369
Touch Read						
Meters	$2,132,516	$1,198,439	$1,617,484	$1,660,861	$1,705,396	$8,314,698
Pits & Boxes	0	4,886,552	8,665,095	8,897,472	9,136,052	31,585,172
Vehicle Purchases / (Retirements)	(9,714)	65,353	122,273	107,704	130,982	416,597
Handhelds	14,000	5,740	8,825	9,046	12,363	49,974
Pocket Pro	1,600	410	1,261	431	1,325	5,026
Touch Pad	913,936	516,122	700,004	722,316	745,355	3,597,733
Program Mgmt	304,645	167,030	219,935	220,325	220,715	1,132,650
Total	$3,356,983	$6,839,646	$11,334,877	$11,618,156	$11,952,188	$45,101,849
Ave. Cost/Installation						$398
Drive-by						
Meters	$2,132,516	$1,198,439	$1,617,484	$1,660,861	$1,705,396	$8,314,698
Pits & Boxes	0	4,886,552	8,665,095	8,897,472	9,136,052	31,585,172

Capital Equipment	Year 1 2008	Year 2 2009	Year 3 2010	Year 4 2011	Year 5 2012	Total
Vehicle Purchases / (Retirements)	(19,429)	30,163	49,429	32,311	52,950	145,425
Handhelds	5,600	0	0	0	0	5,600
Install Programmer	5,000	0	2,627	0	2,760	10,386
Drive-by	85,000	0	0	0	0	85,000
Mobile Interface Unit	2,741,807	1,543,355	2,086,419	2,145,912	2,207,124	10,724,617
Program Mgmt	304,645	167,030	219,935	220,325	220,715	1,132,650
Total	$5,255,140	$7,825,539	$12,640,990	$12,956,882	$13,324,997	$52,003,547
Ave. Cost/Installation						$459
Fixed Network						
Meters	$2,132,516	$1,198,439	$1,617,484	$1,660,861	$1,705,396	$8,314,698
Pits & Boxes	0	4,886,552	8,665,095	8,897,472	9,136,052	31,585,172
Vehicle Purchases / (Retirements)	(21,857)	30,163	49,429	32,311	52,950	142,996
Handhelds	9,000	0	0	0	0	9,000
Install Programmers	5,000	0	2,627	0	2,760	10,386
Fixed Unit	160,000	0	0	0	0	160,000
Fixed Interface Unit	3,046,452	1,714,561	2,317,488	2,383,178	2,450,752	11,912,431
Program Mgmt	304,645	167,030	219,935	220,325	220,715	1,132,650
Total	$5,635,756	$7,996,745	$12,872,059	$13,194,148	$13,568,625	$53,267,333
Ave. Cost/Installation						$470

As Table 3-3 indicates, there is a fairly significant difference in the capital investment required between the alternatives. While the cost difference per installation seems rather small at approximately $100 per meter installation, when that cost is applied to 113,265 installations, the difference in the required total capital investment is fairly significant.

Table 3-3 has stated the capital costs in nominal dollars. The timing of deployment and capital expenditures was explored via a net present value analysis to determine if the cost differences between the alternatives were still significant. Table 3-4 shows the summary of capital costs from Table 3-3 stated in nominal dollars and re-stated as discounted or real dollars (present day costs). These are the amounts HDR assumed will be borrowed to finance the chosen AMR alternative. For the full breakdown of all components included in the capital cost please see Appendix C. As shown, the difference between the lowest cost capital option, manual read, and highest, fixed network, is approximately $9.7 million. The time value of money is not a significant factor in this case due to the short time period over which the costs were analyzed (five years).

Table 3-4. Total Capital Cost for AMR Alternatives During the Deployment Period.

AMR Alternative	Total Investment	Net Present Value
Manual	$41,823,293	$34,132,798
Touch Read	45,101,849	36,905,244
Drive-by	52,003,547	42,756,276
Fixed Network	53,267,333	43,831,721

As will be discussed in more detail below, the net present value as shown in Table 3-4 provides an incomplete view of the financial/cost issues of the technology choices available to the City. The analysis of the investment must ultimately consider the operating costs associated with each technology, and at the same time, view the investment over the assumed useful life of the investment (e.g. 20 years). For that reason, while Table 3-4 is interesting, it should not be utilized for final decision-making purposes regarding the City choice of technology.

KEY OBSERVATION – If the City chooses a radio read or a fixed network AMR solution, both of these technologies will require a significantly greater up-front initial investment by the City.

3.7 Deployment

The review of the capital costs have clearly shown that manual read and touch read has the lowest capital costs (investment). However, the trade-off is that these two alternatives require significant labor costs initially and over the life of the meters. Given that, the next item to be factored into the cost analysis was deployment costs.

Deployment for the purposes discussed herein includes the capital costs discussed above and the operating and maintenance (O&M) costs associated with implementing each of the alternatives. The timeframe used for this section is only the deployment timeframe, or five years, including the first year to ramp up the project. As above, the costs here will be shown in nominal (inflated) dollars as well as real (discounted NPV) dollars.

As noted in the discussion above, there are major trade-offs between the capital investment and the associated annual operating costs of each alternative (technology). While the manual read has the lowest capital investment, it also has the highest labor/operating costs. At the same time, the fixed network system requires the largest capital investment but has the lowest labor/operating costs. Given that relationship, a key question to be answered within this cost analysis is whether the labor and operating cost savings associated with AMR can off-set the larger capital investment and produce overall cost savings to the City over time.

Table 3-5 shows the staff required for bi-monthly readings for each alternative during the deployment period. The numbers for staff are cumulative and not the number to be added each year. The staff includes meter readers, field technicians, lead workers and the Collection Section Supervisor. The meter readers will take the field service reads while the field service technicians become responsible for the radio system including the meter interface units for the drive-by and fixed network systems along with assistance from the lead worker. As shown, it has been assumed that the manual system will require 42 staff members by the end of deployment, while the fixed network system will only require 6 including the lead worker and supervisor.

Table 3-5. Staff Required for Deployment Period – Bi-Monthly Reading.

	2008	2009	2010	2011	2012
Manual	13	18	26	34	42
Touch Read	9	11	16	20	25
Mobile Drive-by[1]	5	5	6	6	7
Fixed Network[1]	4	4	5	5	6

1. Includes one lead worker and one supervisor.

A simple labor ratio of the number of employees per meter indicates that the manual read option requires one employee for every 2,697 meters. In contrast to this, the touch read option requires one employee for every 4,531 meters. The drive-by and fixed network systems are relatively similar at one employee for every 16,181 and 18,878 meters respectively.

KEY OBSERVATION – Mobile radio and fixed network AMR will clearly minimize total labor costs, compared to the manual read and touch read alternatives.

3.7.1 Deployment Operations and Maintenance

Given an understanding of the potential staffing requirements of each technology, operation and maintenance expenses for each alternative could be estimated. Operation and maintenance costs for the deployment timeframe are shown in Table 3-6. The costs are broken down into salaries, miscellaneous and insurance. Miscellaneous costs include education, vehicle (fuel and upkeep), materials and supplies, contract services and facilities rent. These categories and original costs were taken from the City's budget documents. The miscellaneous line item also includes the maintenance cost for the reading equipment, which was estimated based on HDR's experience.

From a purely operation and maintenance perspective, with no capital costs included, the manual system has the highest cost at $7.9 million for 2008 through 2012, while a fixed network system is the least costly at $2.1 million through deployment. The reason for the great difference in cost lies solely with the salaries required for a manual system. As discussed previously, during the deployment period, a manual system will require 42 personnel to conduct the readings. Salaries alone will constitute over $6.3 million for the manual system through the end of deployment.

Table 3-6. Operations and Maintenance Costs for Deployment.

O&M Components	2008	2009	2010	2011	2012	Total
Manual						
Salaries	$580,176	$811,909	$1,216,735	$1,640,463	$2,085,169	$6,334,452
Miscellaneous[1]	188,355	224,434	280,523	341,259	406,859	1,441,430
Insurance	13,000	18,900	28,665	39,359	51,051	150,975
Total	$781,531	$1,055,243	$1,523,923	$2,021,081	$2,543,079	$7,926,858
Avg. Cost/Read	$4.28				$3.74	
Touch Read						
Salaries	$415,232	$519,064	$764,212	$989,226	$1,266,997	$3,954,732

O&M Components	2008	2009	2010	2011	2012	Total
Miscellaneous[1]	166,095	183,849	220,340	253,674	295,918	1,119,876
Insurance	9,000	11,550	17,640	23,153	30,388	91,730
Total	$590,327	$714,463	$1,002,192	$1,266,053	$1,593,303	$5,166,338
Avg. Cost/Read	$3.23				$2.34	
Drive-by						
Salaries	$242,676	$251,169	$310,250	$321,108	$386,218	$1,511,421
Miscellaneous[1]	146,955	152,260	163,767	169,719	182,415	815,116
Insurance	5,000	5,250	6,615	6,946	8,509	32,320
Total	$394,631	$408,679	$480,632	$497,773	$577,142	$2,358,857
Avg. Cost/Read	$2.16				$0.85	
Fixed Network						
Salaries	$203,343	$210,460	$268,115	$277,499	$341,083	$1,300,500
Miscellaneous[1]	148,670	152,899	164,325	170,188	182,789	818,871
Insurance	4,000	4,200	5,513	5,788	7,293	26,794
Total	$356,013	$367,559	$437,952	$453,476	$531,165	$2,146,165
Avg. Cost/Read	$1.95				$0.78	

1. Miscellaneous includes expenses for Education, Vehicle Fuel and Maintenance, Materials and Supplies, Reading Equipment Maintenance, Contract Services, and Facilities Rent from the City's budget and documents HDR's experience (for reading equipment O&M).

Table 3-6 has shown the total out-of-pocket cost, but has also shown the average cost per read in 2012. The time period was selected since this will be the end of the deployment period and each alternative will be fully staffed and reading all 113,265 meters on a bi-monthly basis. As this table shows, there is a significant cost difference on labor O&M associated with each option.

Figure 3-1 shows the cost per read during the deployment horizon for only the operating costs. From an operating perspective, the manual read begins as the highest cost per read at $4.28 per read and remains the highest at $3.74 in year 2012. Fixed network is the lowest cost per read in 2008 at $1.95 and ends just below drive-by in 2012 at $0.78 per read. The final difference between drive-by and fixed network in 2012 is $0.07 per read.

KEY OBSERVATION – Mobile radio and fixed network AMR clearly minimizes O&M costs per read and show substantial savings per read compared to manual read and touch read alternatives.

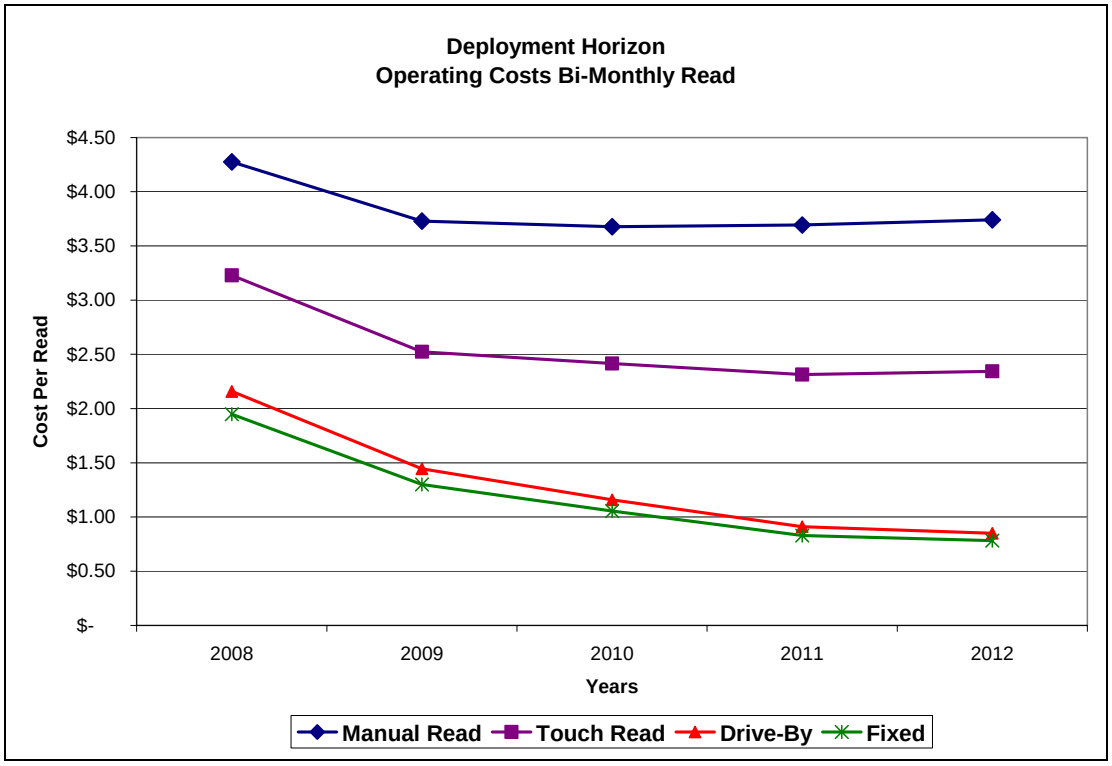


Figure 3-1. O&M Cost per read for Deployment Horizon.

3.7.2 Deployment O&M Plus Capital

Once capital is added to the O&M costs, the full cost of the deployment timeframe can be seen. The debt service for each alternative was determined based on total capital outlay as described in Table 3-3 which includes meters, pits, boxed, vehicles, AMR equipment, and program management. HDR assumed the capital would be borrowed over a 20-year period at 5.5%.

As shown in Table 3-7, the highest cost alternative is manual at approximately $25.5 million and the least costly alternative is touch read at $24.0 million. But this is only a portion of the overall costs of the program. The true cost savings for the alternatives will be seen when viewed long term, which will be discussed later in this chapter.

Table 3-7. Capital (Debt Service Cost) Plus O&M Costs.

O&M Components	2008	2009	2010	2011	2012	Total
Manual						
Debt Service	$3,499,745	$3,499,745	$3,499,745	$,3499,745	$3,499,745	$17,498,725
O&M	781,531	1,055,244	1,525,923	2,021,081	2,543,079	7,926,858
Total	$4,281,276	$4,554,989	$5,025,668	$5,520,826	$6,042,824	$25,425,584
Avg. Cost/Read	$23.42				$8.89	
NPV						$21,201,073

O&M Components	2008	2009	2010	2011	2012	Total
Touch Read						
Debt Service	$3,774,093	$3,774,093	$3,774,093	$3,774,093	$3,774,093	$18,870,465
O&M	590,327	714,463	1,002,192	1,266,053	1,593,303	5,166,338
Total	$4,364,420	$4,488,556	$4,776,285	$5,040,146	$5,367,396	$24,036,803
Avg. Cost/Read	$23.88				$7.90	
NPV						$20,125,534
Drive-by						
Debt Service	$4,351,622	$4,351,622	$4,351,622	$4,351,622	$4,351,622	$21,758,110
O&M	394,631	408,679	480,632	497,773	577,142	2,358,857
Total	$4,746,253	$4,760,301	$4,832,254	$4,849,395	$4,928,764	$24,116,967
Avg. Cost/Read	$25.97				$7.25	
NPV						$20,295,735
Fixed Network						
Debt Service	$4,457,375	$4,457,375	$4,457,375	$4,457,375	$4,457,375	$22,286,875
O&M	356,013	367,559	437,952	453,476	531,165	2,146,165
Total	$4,813,388	$4,824,934	$4,895,327	$4,910,851	$4,988,540	$24,433,040
Avg. Cost/Read	$26.33				$7.34	
NPV						$20,562,897

Figure 3-2 shows the cost per read for the capital and O&M during the deployment timeframe. All the alternatives start out with high costs per read and then drop significantly at the end of the deployment timeframe. At the end of 2012, the drive-by alternative is the lowest at $7.25 per read. It should be noted, that in 2012 the difference between the two lowest alternatives is $0.09 per read.

Table 3-7 also shows the NPV of the debt service payments and the O&M costs. The trade-off between capital investment in an AMR program and labor costs are beginning to show at this early stage, although, the true value can only be seen over the life of the investment. The life of the investment is 20 years and will show the greater differences between the AMR systems (drive-by and fixed network) and the greater labor costs of the manual systems.

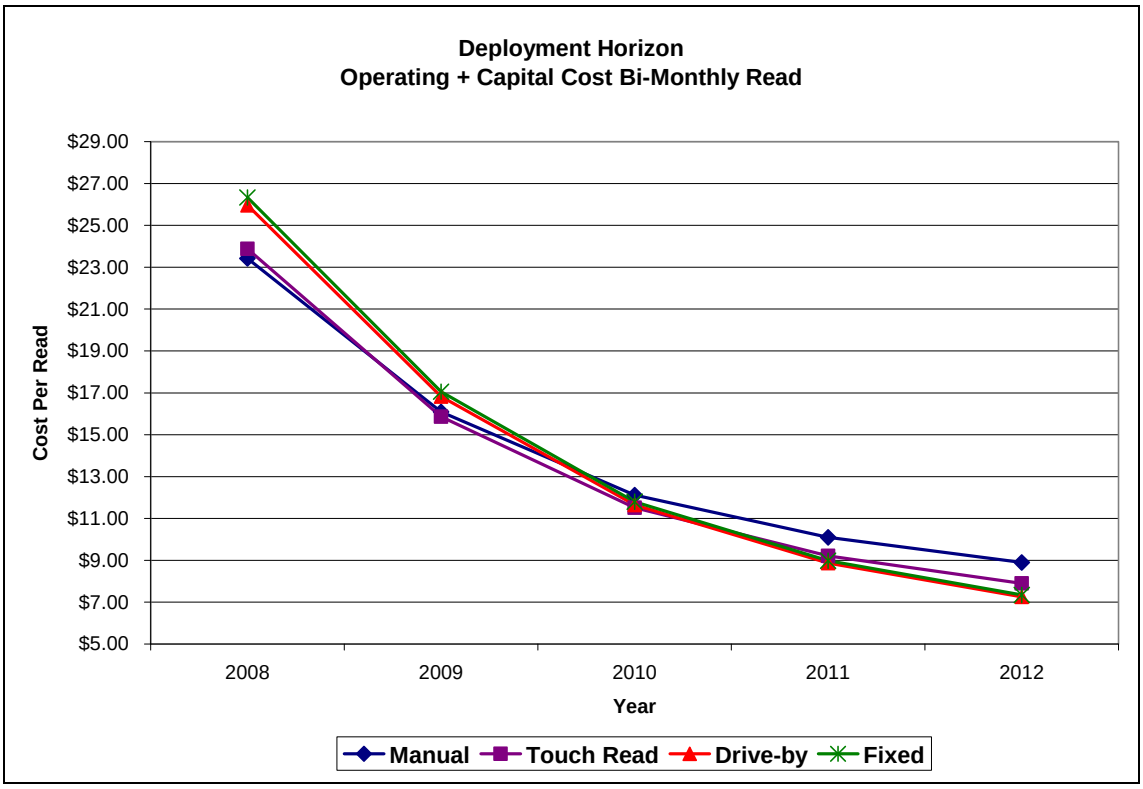


Figure 3-2. Capital (Debt Service Cost) Plus O&M Cost per Read for Deployment Horizon.

KEY OBSERVATION – During the deployment period, the trade-off between up-front capital cost and O&M labor costs makes each alternative roughly equal from a net present value perspective.

3.8 Long-Term Bi-Monthly

As noted above, making a decision based solely on the capital and O&M costs through deployment will not give the City a true cost of the program. After the deployment period, the City will continue to accrue O&M labor savings from the AMR alternatives, which needs to be factored into the final analysis. Therefore, the final portion of the financial/cost analysis has analyzed both O&M and capital costs over a full 20-year bi-monthly reading cycle. As before, the total investment and the NPV of each alternative will be presented.

In the cost tables shown below, deployment capital investment is not shown as the total investment, but rather the annual debt service payment associated with a long-term debt issuance equal to the required capital investment. Furthermore, it has also been assumed that any capital expenses incurred after the deployment timeframe will be paid for "out of pocket" by the City as the capital should be relatively minor compared to the deployment capital required to install meters, pits and AMR technology to be in compliance with the City's CVP contract and AB 514.

Table 3-8 shows the staff required for each alternative in year 2008 and again at the end of the 20-year planning horizon in year 2027. Customer growth and the installation of additional

meters will have an impact upon staffing levels over the 20-year time horizon. As can be seen, the manual read system will require the greatest number of staff members at 13 in 2008 and rising significantly to 56 positions required in 2027. The ramifications of staffing to the overall cost of the project will be discussed in the following tables. As before, the staff numbers include meter readers, field technicians, lead workers and the Collection Section Supervisor.

Table 3-8. Staff Required for 20-Year Bi-Monthly Reading Cycle.

	2008	2027
Manual Read	13	56
Touch Read	9	33
Drive-by[1]	5	8
Fixed Network[1]	4	8

1. Includes one lead worker and one supervisor.

Table 3-9 shows the O&M, debt service and capital out of pocket for each alternative over a 20-year period for a bi-monthly reading cycle. As mentioned in the key assumptions section, HDR has assumed the City will borrow the full amount of the deployment alternative chosen and therefore, there is no capital shown in years 2008 through 2012. The capital for the deployment period is shown in the first five years in the form of debt service payments. Debt service was assumed to be 5.5 percent over a 20-year period for all alternatives.

As was expected, the O&M expenditures for the manual read increased significantly over the other alternatives by the end of the 20-year period due mainly to the increase in staff salaries and benefits. In year 2008 the annual O&M, debt service and out of pocket capital costs for manual read were $4.3 million and jumped to $11.3 million by 2027. Salaries alone constituted $4.6 million of the manual read costs in 2027. The manual system also has the added capital expenditure of vehicle purchases. Each of the 56 staff members in 2027 will require a vehicle to enable them to read all meters and to conduct field service visits. The least costly alternative, drive-by, began at $4.7 million in 2008 and increased slightly to $7.9 million in year 2027.

Table 3-9 provides the 20-year forecast of O&M and capital costs for each of the alternatives in nominal dollars. The final step of the financial/cost analysis was to summarize the 20-year forecast and present the results in present value terms (dollars). To that end, Table 3-10 shows the sum of the 20-year O&M and capital investment for each alternative and the NPV of those total costs.

Table 3-9. Long-Term O&M and Capital Costs for Bi-Monthly Reading (Nominal Dollars).

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Manual																				
O&M Expenses																				
Salaries	$580,176	$811,909	$1,216,735	$1,640,463	$2,085,169	$2,268,066	$2,347,448	$2,489,337	$2,628,257	$2,773,853	$2,870,938	$3,097,384	$3,205,793	$3,379,510	$3,573,784	$3,764,762	$3,896,529	$ 4,103,497	$ 4,506,224	$4,663,942
Miscellaneous	188,355	235,524	286,564	353,847	406,859	436,468	453,874	479,072	505,956	534,270	555,692	595,489	619,435	653,865	689,722	727,883	757,301	799,144	866,268	901,444
Insurance	13,000	18,900	28,665	39,359	51,051	56,156	58,964	63,320	67,963	72,912	76,558	83,807	87,997	94,282	100,977	108,104	113,509	121,477	134,771	141,509
Debt Service	3,499,745	3,499,745	3,499,745	3,499,745	3,499,745	3,499,745	3,499,745	3,499,745	3,499,745	3,499,745	3,499,745	3,499,745	3,499,745	3,499,745	3,499,745	3,499,745	3,499,745	3,499,745	3,499,745	3,499,745
Capital Out of Pocket[1]																				
Meters Installed	0	0	0	0	0	170,435	178,025	185,970	194,201	202,815	211,828	221,257	231,119	241,432	252,117	263,388	275,064	287,266	300,125	313,447
Pits & Boxes Installed	0	0	0	0	0	913,046	953,703	996,267	1,040,364	1,086,511	1,134,795	1,185,306	1,238,138	1,293,388	1,350,626	1,411,004	1,473,557	1,538,927	1,607,813	1,679,182
Vehicle Purchases (Retirements)	0	0	0	0	0	74,994	17,912	58,707	156,700	221,763	205,544	262,377	88,074	49,376	98,278	223,779	277,933	292,019	419,527	112,054
Handhelds	0	0	0	0	0	31,679	16,236	16,642	23,881	27,975	35,842	25,717	18,828	30,879	31,651	44,608	29,096	25,563	43,670	35,810
Pocket Pro	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	$4,281,277	$4,554,989	$5,025,668	$5,520,826	$6,042,825	$7,450,591	$7,525,906	$7,789,059	$8,117,067	$8,419,844	$8,590,943	$8,971,083	$8,989,129	$9,242,478	$9,596,899	$10,043,273	$10,322,736	$10,667,639	$11,378,144	$11,347,134
Touch Read																				
O&M Expenses																				
Salaries	415,232	519,064	764,212	989,226	1,266,997	1,311,342	1,414,947	1,464,470	1,567,520	1,622,384	1,679,167	1,806,477	1,929,138	1,996,658	2,066,541	2,204,766	2,455,608	2,541,554	2,630,508	2,798,193
Miscellaneous	166,095	183,849	220,340	253,674	295,918	307,432	326,198	338,934	359,908	374,003	388,659	412,283	437,611	454,854	472,789	501,766	542,415	563,948	586,351	622,291
Insurance	9,000	11,550	17,640	23,153	30,388	31,907	34,842	36,585	39,891	41,886	43,980	47,890	52,080	54,684	57,418	62,368	69,852	73,345	77,012	83,389
Debt Service	3,774,093	3,774,093	3,774,093	3,774,093	3,774,093	3,774,093	3,774,093	3,774,093	3,774,093	3,774,093	3,774,093	3,774,093	3,774,093	3,774,093	3,774,093	3,774,093	3,774,093	3,774,093	3,774,093	3,774,093
Capital Out of Pocket[1]																				
Meters Installed	0	0	0	0	0	170,435	178,025	185,970	194,201	202,815	211,828	221,257	231,119	241,432	252,117	263,388	275,064	287,266	300,125	313,447
Pits & Boxes Installed	0	0	0	0	0	913,046	953,703	996,267	1,040,364	1,086,511	1,134,795	1,185,306	1,238,138	1,293,388	1,350,626	1,411,004	1,473,557	1,538,927	1,607,813	1,679,182
Vehicle Purchases (Retirements)	0	0	0	0	0	34,613	38,809	0	99,137	139,016	123,327	173,736	69,725	45,578	0	150,542	235,822	156,906	216,530	116,723
Handhelds	0	0	0	0	0	15,840	6,494	9,985	13,646	13,987	17,921	7,348	15,063	15,439	15,825	24,331	8,313	17,042	17,468	26,857
Pocket Pro	0	0	0	0	0	1,810	928	1,426	487	1,499	2,048	1,575	1,614	551	1,696	2,317	2,375	1,826	624	1,918
Touch Pad	0	0	0	0	0	74,860	78,584	82,504	86,590	90,889	95,412	100,168	105,171	110,431	115,916	121,729	127,790	134,161	140,906	147,941
Total	$4,364,420	$4,488,555	$4,776,285	$5,040,145	$5,367,395	$6,635,379	$6,806,623	$6,890,234	$7,175,838	$7,347,081	$7,471,230	$7,730,132	$7,853,751	$7,987,108	$8,107,020	$8,516,304	$8,964,889	$9,089,066	$9,351,430	$9,564,036
Drive-by																				
O&M Expenses																				
Salaries	$242,676	$251,169	$310,250	$321,108	$386,218	$399,736	$413,727	$428,207	$443,194	$458,706	$474,761	$491,377	$508,576	$599,797	$620,790	$642,517	$665,005	$ 688,280	$712,370	$737,303
Miscellaneous	146,955	152,260	163,767	169,719	182,415	189,088	196,008	203,185	210,628	218,349	226,356	234,661	243,275	261,672	271,340	281,371	291,778	302,576	313,780	325,405
Insurance	5,000	5,250	6,615	6,946	8,509	8,934	9,381	9,850	10,342	10,859	11,402	11,972	12,571	15,085	15,839	16,631	17,463	18,336	19,253	20,216
Debt Service	4,351,622	4,351,622	4,351,622	4,351,622	4,351,622	4,351,622	4,351,622	4,351,622	4,351,622	4,351,622	4,351,622	4,351,622	4,351,622	4,351,622	4,351,622	4,351,622	4,351,622	4,351,622	4,351,622	4,351,622
Capital Out of Pocket[1]																				
Meters Installed	0	0	0	0	0	170,435	178,025	185,970	194,201	202,815	211,828	221,257	231,119	241,432	252,117	263,388	275,064	287,266	300,125	313,447
Pits & Boxes Installed	0	0	0	0	0	913,046	953,703	996,267	1,040,364	1,086,511	1,134,795	1,185,306	1,238,138	1,293,388	1,350,626	1,411,004	1,473,557	1,538,927	1,607,813	1,679,182
Vehicle Purchases (Retirements)	0	0	0	0	0	34,613	17,912	0	38,376	59,578	41,109	63,822	44,037	49,376	0	48,824	75,800	52,302	81,199	56,027
Handhelds	0	0	0	0	0	6,336	0	0	0	0	7,168	0	0	0	0	8,110	0	0	0	0
Programmer	0	0	0	0	0	5,657	0	2,972	0	3,122	6,400	0	3,362	3,446	3,532	7,241	0	3,804	3,899	3,997

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Drive-by	0	0	0	0	0	0	98,574	0	0	0	0	0	114,316	0	0	0	0	0	132,571	0
Mobile Interface Unit	0	0	0	0	0	220,948	231,177	241,907	253,048	264,731	276,979	289,817	303,273	317,373	332,016	347,489	363,559	380,389	398,156	416,610
Total	$4,746,253	$4,760,301	$4,832,254	$4,849,395	$4,928,764	$6,300,414	$6,450,127	$6,419,979	$6,541,776	$6,656,293	$6,742,421	$6,849,835	$7,050,289	$7,133,192	$7,197,883	$7,378,199	$7,513,849	$7,623,503	$7,920,788	$7,903,809
Fixed Network																				
O&M Expenses																				
Salaries	$203,343	$210,460	$268,115	$277,499	$341,083	$353,021	$365,377	$378,165	$391,401	$405,100	$419,278	$433,953	$449,141	$538,282	$620,790	$642,517	$665,005	$688,280	$712,370	$737,303
Miscellaneous	148,670	152,899	164,325	170,188	182,789	189,360	196,171	203,231	210,549	218,135	225,999	234,151	242,603	260,826	279,818	290,061	300,685	311,706	323,138	334,997
Insurance	4,000	4,200	5,513	5,788	7,293	7,658	8,041	8,443	8,865	9,308	9,773	10,262	10,775	13,200	15,839	16,631	17,468	18,336	19,253	20,216
Debt Service	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375
Capital Out of Pocket[1]																				
Meters Installed	0	0	0	0	0	170,435	178,025	185,970	194,201	202,815	211,828	221,257	231,119	241,432	252,117	263,388	275,064	287,266	300,125	313,447
Pits & Boxes Installed	0	0	0	0	0	913,046	953,703	996,267	1,040,364	1,086,511	1,134,795	1,185,306	1,238,138	1,293,388	1,350,626	1,411,004	1,473,557	1,538,927	1,607,813	1,679,182
Vehicle Purchases (Retirements)	0	0	0	0	0	34,613	17,912	0	38,376	59,578	41,109	63,822	44,037	49,376	27,518	48,824	75,800	52,302	81,199	56,027
Handhelds	0	0	0	0	0	10,183	0	0	0	0	11,521	0	0	0	0	13,035	0	0	0	0
Programmer	0	0	0	0	0	5,657	0	2,972	0	3,122	6,400	0	3,362	3,446	3,532	7,241	0	3,804	3,899	3,997
Fixed Unit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fixed Interface Unit	0	0	0	0	0	245,296	256,609	268,474	280,791	293,705	307,240	321,425	336,290	351,863	368,033	385,116	402,854	421,427	441,031	461,389
Total	$4,813,388	$4,824,933	$4,895,327	$4,910,850	$4,988,540	$6,386,643	$6,433,211	$6,500,895	$6,621,921	$6,735,648	$6,825,319	$6,927,551	$7,012,840	$7,209,188	$7,375,648	$7,535,193	$7,667,804	$7,779,423	$7,946,203	$8,063,932

1. Capital Out of Pocket does not include deployment capital. HDR has assumed any capital expenses incurred after deployment will be paid by the City without assuming any additional debt.

Table 3-10. Future and NPV Dollars for O&M, Debt Service, and Out of Pocket Capital 20-Year Bi-Monthly.

Expenses	Total Investment	NPV Dollars
Manual		
O&M Expenses	$68,454,372	$34,137,895
Debt Service Payments	69,994,902	40,141,801
Out of Pocket Capital	25,428,234	11,685,802
Total	$163,877,508	$85,965,498
Touch Read		
O&M Expenses	$42,152,182	$21,118,670
Debt Service Payments	75,481,851	43,288,544
Out of Pocket Capital	25,892,891	11,909,599
Total	$143,526,924	$76,316,812
Drive-by		
O&M Expenses	$14,620,809	$7,613,679
Debt Service Payments	87,032,440	49,912,761
Out of Pocket Capital	28,146,075	12,985,290
Total	$129,799,324	$70,511,730
Fixed Network		
O&M Expenses	$13,961,636	$7,176,237
Debt Service Payments	89,147,494	51,125,737
Out of Pocket Capital	23,345,326	13,073,420
Total	$131,454,456	$71,375,394

In reviewing Table 3-10 and the NPV of each alternative, it appears the manual read is the most costly alternative at $85.9 million, while drive-by is the least costly at $70.5 million. The high cost associated with manual read is simply a function of the high labor costs associated with manual read. In contrast to this, the least cost alternative, drive-by, has significantly lower O&M costs over the 20-year time horizon. The difference between the two least costly alternatives, drive-by and fixed network, is approximately $860,000. In essence, this result indicates that from a financial/cost perspective, there is no significant cost advantage between these two options. Interestingly, this result (no significant cost difference between drive-by and fixed network), are similar to the independent results seen at other utilities. The City of Folsom recently conducted a metering analysis and came to a similar conclusion from a financial/cost perspective.

Figure 3-3 includes O&M, capital and debt service expenditures for each alternative to the bi-monthly reading operating cost over a 20-year period. Fixed network and drive-by begin with the highest cost per read at $26.33 and $25.97 respectively, but quickly drop to the lowest cost alternatives at $8.95 and $8.77. Manual begins with the lowest cost per read at $23.42, but ends once again with the highest cost per read at $12.59 in the final year. The jump seen in Year 2013 for all alternatives is the out of pocket capital expenditures beginning. All capital prior to 2013 was rolled into the debt for the deployment.

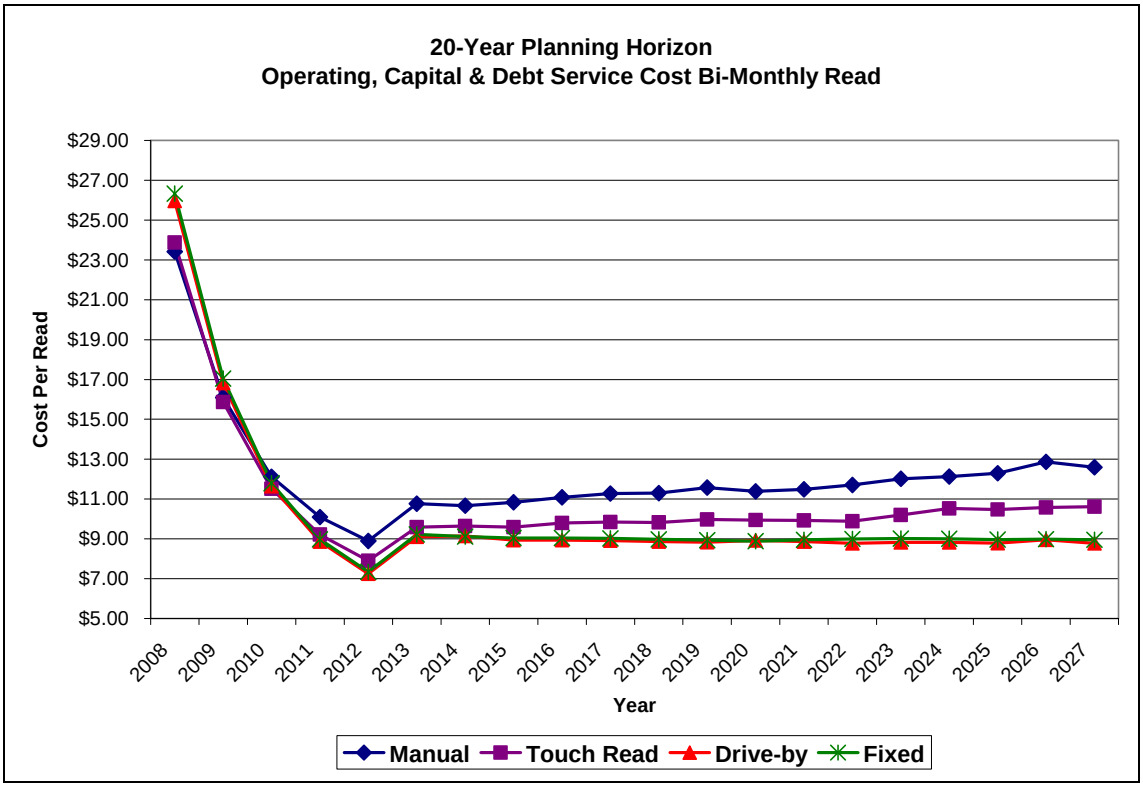


Figure 3-3. Debt Service, O&M, & Capital Cost Per Read 20-Year Bi-Monthly.

KEY OBSERVATION – When long-term capital investment and on-going O&M are taken into consideration, mobile radio read and fixed network AMR are clearly the most cost - effective alternatives for the City over a 20 year period, assuming bi-monthly reads and billing.

3.9 Long-Term Monthly Reading

One of the key benefits of mobile radio read and fixed network AMR system is to increase the number of meter readings with little additional labor costs. To better understand the impacts of more frequent meter readings on the City, HDR analyzed the alternatives over the long-term, assuming monthly meter reading.

Many utilities are moving from a bi-monthly billing cycle to a monthly billing cycle as rates nationally have increased over the past few years along with the industry's focus on communicating usage information more frequently for conservation purposes. The detailed analysis undertaken above for the bi-monthly scenario was also conducted for a monthly read cycle. The costs shown below are for monthly reading cycles.

With a monthly read and bill cycle, the required staffing changes. The staff required for a monthly reading cycle is shown in Table 3-11. Where manual bi-monthly reading required 13 staff in 2008 and 56 in 2027, monthly reading requires 106 staff in 2027. Staffing costs will

have the greatest impact on overall program cost as will be seen in the following discussion. It should be noted that a fixed network system requires the same number of staff for a monthly reading cycle as for a bi-monthly.

Table 3-11. Staff Required for 20-Year Monthly Reading Cycle.

	2008	2027
Manual Read	23	106
Touch Read	14	61
Drive-by	5	10
Fixed Network	4	8

To conduct the analysis, the required staff, as shown in Table 3-11 was used to determine the O&M costs shown below in Table 3-12. As with the bi-monthly reading discussed above, the miscellaneous expenses include education, materials and supplies, vehicle fuel and maintenance, reading equipment maintenance, contract services and facilities rent. The salaries cover meter readers, field technicians, lead workers and the Collections System Supervisor.

The annual costs for manual reads begin at roughly $4.8 million dollars in 2008 and rise significantly to $16.3 million by 2027. As mentioned before, the reason for the dramatic rise is the cost of salaries and vehicles for the 106 staff positions required in 2027. Staff alone in 2027 accounts for $8.7 million of the $16.3 overall annual program cost.

Fixed network, on the other hand begins at $4.8 million annual cost, nearly identical to manual in 2008, but rises only to $8.0 million at the end of the 20-year planning horizon. In fact, the cost for a fixed network system to operate is the same for monthly as it is for bi-monthly readings. The only cost difference would be seen in the customer service billing costs (increased mailing), which have not been included in this cost model.

Table 3-12. Long-Term O&M and Capital Costs for Monthly Reading (Nominal Dollars).

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Manual																				
O&M Expenses																				
Salaries	$1,002,611	$1,572,099	$2,306,626	$3,099,085	$3,996,517	$4,183,111	$4,435,578	$4,640,865	$4,916,908	$5,142,606	$5,444,301	$5,769,967	$6,102,288	$6,377,383	$6,740,250	$7,107,951	$7,506,335	$7,839,646	$8,373,138	$8,741,815
Miscellaneous	243,790	321,986	424,464	534,706	660,447	694,144	736,323	774,101	820,815	862,419	914,133	969,181	1,026,793	1,078,466	1,142,211	1,210,275	1,281,240	1,345,305	1,435,608	1,507,143
Insurance	23,000	36,750	55,125	75,246	98,456	104,655	112,568	119,604	128,539	136,517	146,601	157,351	168,810	179,137	192,053	205,814	220,470	233,786	252,695	267,857
Debt Service	3,566,650	3,566,650	3,566,650	3,566,650	3,566,650	3,566,650	3,566,650	3,566,650	3,566,650	3,566,650	3,566,650	3,566,650	3,566,650	3,566,650	3,566,650	3,566,650	3,566,650	3,566,650	3,566,650	3,566,650
Capital Out of Pocket[1]																				
Meters Installed	0	0	0	0	0	170,435	178,025	185,970	194,201	202,815	211,828	221,257	231,119	241,432	252,117	263,388	275,064	287,266	300,125	313,447
Pits & Boxes Installed	0	0	0	0	0	913,046	953,703	996,267	1,040,364	1,086,511	1,134,795	1,185,306	1,238,138	1,293,388	1,350,626	1,411,004	1,473,557	1,538,927	1,607,813	1,679,182
Vehicle Purchases (Retirements)	0	0	0	0	0	54,803	59,707	244,096	313,401	360,778	397,386	432,568	117,432	94,954	361,663	447,557	513,755	527,378	636,057	172,750
Handhelds	0	0	0	0	0	60,191	32,471	46,596	40,938	48,955	71,685	44,086	56,485	50,178	59,345	93,270	54,036	68,168	65,506	71,620
Pocket Pro	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	$4,836,050	$5,497,484	$6,352,865	$7,275,686	$8,322,070	$9,747,035	$10,075,024	$10,574,149	$11,021,815	$11,407,251	$11,887,379	$12,346,366	$12,507,715	$12,881,588	$13,664,915	$14,305,909	$14,891,107	$15,407,126	$16,237,592	$16,320,464
Touch Read																				
O&M Expenses																				
Salaries	$627,122	$964,162	$1,317,313	$1,796,611	$2,307,846	$2,491,092	$2,578,281	$2,668,520	$2,875,531	$3,029,781	$3,135,823	$3,371,541	$3,489,545	$3,673,194	$3,963,882	$4,168,514	$4,395,815	$4,620,259	$4,855,028	$5,115,207
Miscellaneous	193,640	241,035	292.016	359,236	431,930	462,533	481,055	500,332	535,516	565,097	587,842	629,018	654,403	690,333	737,378	777,86	819,483	863,998	911,276	960,124
Insurance	14,000	22,050	30,870	42,832	55,913	61,262	64,325	67,541	73,873	79,118	83,074	90,648	95,180	101,825	110,876	118,499	126,607	135,229	144,397	154,144
Debt Service	3,807,553	3,807,553	3,807,553	3,807,553	3,807,553	3,807,553	3,807,553	3,807,553	3,807,553	3,807,553	3,807,553	3,807,553	3,807,553	3,807,553	3,807,553	3,807,553	3,807,553	3,807,553	3,807,553	3,807,553
Capital Out of Pocket[1]																				
Meters Installed	0	0	0	0	0	170,435	178,025	185,970	194,201	202,815	211,828	221,257	231,119	241,432	252,117	263,388	275,064	287,266	300,125	313,447
Pits & Boxes Installed	0	0	0	0	0	913,046	953,703	996,267	1,040,364	1,086,511	1,134,795	1,185,306	1,238,138	1,293,388	1,350,626	1,411,004	1,473,557	1,538,927	1,607,813	1,679,182
Vehicle Purchases (Retirements)	0	0	0	0	0	74,994	17,912	55,617	217,462	201,904	226,099	283,651	88,074	49,376	125,796	297,015	282,144	318,170	383,439	144,737
Handhelds	0	0	0	0	0	31,679	16,236	16,642	23,881	27,975	35,842	25,717	18,828	30,879	31,651	44,608	29,096	25,563	43,670	35,810
Pocket Pro	0	0	0	0	0	4,073	928	1,902	2,437	1,499	4,608	1,575	2,152	2,757	2,261	5,214	2,969	2,435	3,119	3,197
Touch Pad	0	0	0	0	0	74,860	78,584	82,504	86,590	90,889	95,412	100,168	105,171	110,431	115,916	121,729	127,790	134,161	140,906	147,941
Total	$4,642,315	$5,034,800	$5,447,752	$6,006,232	$6,603,242	$8,091,528	$8,176,600	$8,382,847	$8,857,407	$9,093,141	$9,322,876	$9,716,433	$9,730,162	$10,001,168	$10,498,056	$11,015,110	$11,340,079	$11,733,561	$12,197,326	$12,361,342
Drive-by																				
O&M Expenses																				
Salaries	$242,676	$251,169	$310,250	$364,717	$431,354	$446,451	$462,077	$528,292	$546,782	$565,919	$585,726	$606,227	$627,445	$722,826	$748,125	$774,309	$801,410	$829,460	$858,491	$888,538
Miscellaneous	146,955	152,260	163,767	176,788	189,767	196,735	203,963	219,735	227,845	236,260	244,991	254,050	263,449	282,663	293,183	304,102	315,434	327,195	339,403	352,074
Insurance	5,000	5,250	6,615	8,103	9,724	10,210	10,721	12,664	13,297	13,962	14,660	15,393	16,163	18,856	19,799	20,789	21,829	22,920	24,066	25,270
Debt Service	4,357,029	4,357,029	4,357,029	4,357,029	4,357,029	4,357,029	4,357,029	4,357,029	4,357,029	4,357,029	4,357,029	4,357,029	4,357,029	4,357,029	4,357,029	4,357,029	4,357,029	4,357,029	4,357,029	4,357,029
Capital Out of Pocket[1]																				
Meters Installed	0	0	0	0	0	170,435	178,025	185,970	194,201	202,815	211,828	221,257	231,119	241,432	252,117	263,388	275,064	287,266	300,125	313,447
Pits & Boxes Installed	0	0	0	0	0	913,046	953,703	996,267	1,040,364	1,086,511	1,134,795	1,185,306	1,238,138	1,293,388	1,350,626	1,411,004	1,473,557	1,538,927	1,607,813	1,679,182
Vehicle Purchases (Retirements)	0	0	0	0	0	34,613	17,912	21,629	38,376	59,578	61,663	63,822	44,037	49,376	23,587	48,824	75,800	78,453	81,199	56,027
Handhelds	0	0	0	0	0	6,336	0	0	0	0	7,168	0	0	0	0	8,110	0	0	0	0
Programmer	0	0	0	0	0	5,657	0	2,972	0	3,122	6,400	0	3,362	3,446	3,532	7,241	0	3,804	3,899	3,997

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Drive-by	0	0	0	0	0	0	98,574	50,519	0	53,077	0	0	114,316	58,587	0	61,553	0	0	132,571	67,943
Mobile Interface Unit	0	0	0	0	0	220,948	231,177	241,907	253,048	264,731	276,979	289,817	303,273	317,373	332,016	347,489	363,559	380,389	398,156	416,610
Total	4,751,660	4,765,708	4,837,661	4,906,638	4,987,874	6,361,460	6,513,179	6,616,983	6,670,942	6,843,004	6,901,241	6,992,901	7,198,330	7,344,978	7,380,015	7,603,840	7,683,683	7,825,443	8,102,752	8,160,117
Fixed Network																				
O&M Expenses																				
Salaries	$203,343	$210,460	$268,115	$277,499	$341,083	$ 353,021	$365,377	$378,165	$391,401	$405,100	$419,278	$433,953	$449,141	$538,282	$620,790	$642,517	$665,005	$688,280	$712,370	$737,303
Miscellaneous	148,670	152,899	164,325	170,188	182,789	189,360	196,171	203,231	210,549	218,135	25,999	234,151	242,603	260,826	279,818	290,061	300,685	311,706	323,38	334,997
Insurance	4,000	4,200	5,513	5,788	7,293	7,658	8,041	8,443	8,865	9,308	9,773	10,262	10,775	13,200	15,839	16,631	17,463	18,336	19,253	20,216
Debt Service	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375
Capital Out of Pocket[1]																				
Meters Installed	0	0	0	0	0	170,435	178,025	185,970	194,201	202,815	211,828	221,257	231,119	241,432	252,117	263,388	275,064	287,266	300,125	313,447
Pits & Boxes Installed	0	0	0	0	0	913,046	953,703	996,267	1,040,364	1,086,511	1,134,795	1,185,306	1,238,138	1,293,388	1,350,626	1,411,004	1,473,557	1,538,927	1,607,813	1,679,182
Vehicle Purchases (Retirements)	0	0	0	0	0	34,613	17,912	0	38,376	59,578	41,109	63,822	44,037	49,376	27,518	48,824	75,800	52,302	81,199	56,027
Handhelds	0	0	0	0	0	10,183	0	0	0	0	11,521	0	0	0	0	13,035	0	0	0	0
Programmer	0	0	0	0	0	5,657	0	2,972	0	3,122	6,400	0	3,362	3,446	3,532	7,241	0	3,804	3,899	3,997
Fixed Unit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fixed Interface Unit	0	0	0	0	0	245,296	256,609	268,474	280,791	293,705	307,240	321,425	336,290	351,863	368,033	385,116	402,854	421,427	441,031	461,389
Total	$4,813,388	$4,824,933	$4,895,327	$4,910,850	$4,988,540	$6,386,643	$6,433,211	$6,500,895	$6,621,921	$6,735,648	$6,825,319	$6,927,551	$7,012,840	$7,209,188	$7,375,648	$7,535,193	$7,667,804	$7,779,423	$7,946,203	$8,063,932

1. Capital Out of Pocket does not include deployment capital. HDR has assumed any capital expenses incurred after deployment will be paid by the City without assuming any additional debt.

Table 3-13 shows the total investment and NPV costs for each alternative for a monthly reading cycle. The costs include the O&M expenses, debt service payments over a 20-year timeframe and any out of pocket capital anticipated. As previously mentioned, the deployment capital is not included in this table, but is accounted for in the debt service payments for each alternative.

Table 3-13. Future and NPV Dollars for O&M, Debt Service, and Out of Pocket Capital 20-Year Monthly.

	Total Investment	NPV Dollars
Manual		
O&M Expenses	$126,197,662	$62,774,372
Debt Service Payments	71,332,992	40,909,190
Out of Pocket Capital	28,028,937	12,863,120
Total	$225,559,591	$116,546,683
Touch Read		
O&M Expenses	$74,811,162	$37,286,293
Debt Service Payments	76,151,052	43,672,328
Out of Pocket Capital	27,289,762	12,539,261
Total	$178,251,975	$93,497,883
Drive-by		
O&M Expenses	$16,778,156	$8,625,388
Debt Service Payments	87,140,580	49,974,780
Out of Pocket Capital	28,529,674	13,161,354
Total	$132,448,10	$71,761,521
Fixed Network		
O&M Expenses	$13,961,636	$7,176,237
Debt Service Payments	89,147,494	51,125,737
Out of Pocket Capital	28,345,326	13,073,420
Total	$131,454,456	$71,375,394

Not surprisingly, the results shown in Table 3-13 mirror the results previously shown for the bi-monthly reading cycle. However, this analysis only further confirms the value of a drive-by or fixed network should the City desire to move to monthly billing. As with the prior analysis, there is virtually no financial/cost difference between the drive-by and fixed network alternative.

KEY OBSERVATION – If the City, at some later point, makes a decision to move to monthly meter reading and billing, then the benefits and cost efficiencies associated with radio read and fixed network are even more pronounced when compared to manual read and touch read.

Figure 3-4 shows the operating, capital and debt service expenditures for each alternative for a monthly reading operating cost over a 20-year period. All alternatives are nearly the same cost per read in 2008, right around $13.00. But, over the 20-year period, the manual read once again is the highest at $9.05 per read, while the drive-by and fixed are the lowest at $4.53 and $4.47 respectively. As mentioned in the bi-monthly cost per read, the jump in 2013 is due to the beginning of the out of pocket capital.

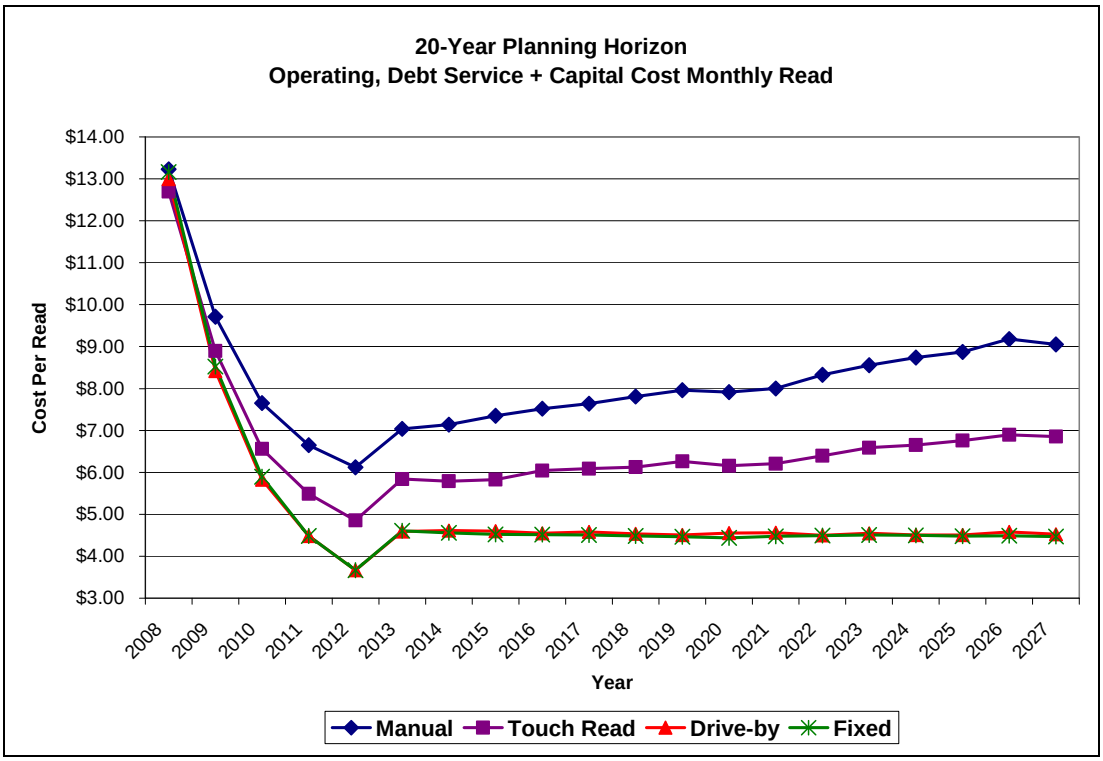


Figure 3-4. Cost Per Read O&M, Debt Service and Capital 20-Year Planning Horizon Monthly Read.

In summary, it appears that from a financial/cost perspective manual read and touch read should be eliminated from further consideration. The two remaining choices – drive-by and fixed network are almost identical from a financial/cost perspective. Given that, the preliminary choice regarding technology will need to be made on a non-financial/cost basis.

3.10 Soft (Non-Economic) Costs

The cost analysis has shown that of the financial/costs associated with drive-by and fixed network technologies appear to be almost identical. Given that, the City will need to make a choice between these two technologies on the basis of factors other than strictly cost.[3] Therefore, the focus may shift to the soft or non-economic costs associated with these systems.

Depending on what results are more important to the City, the soft costs listed below may help to "tip the scales" in the favor of a drive-by or fixed network.

- Meter readers may be deployed onto other projects within the City.
- The City can pro-actively plan meter maintenance.

[3] While the technical analysis shown herein has computed the financial/costs associated with these two systems as nearly identical, it is based upon a number of key assumptions and estimated costs, the City may want to bid both systems to determine the actual cost differences between the two systems.

- The system can flag potential fraud scenarios or theft of water service.
- The City can pro-actively address high water reads and communicate with the customer to identify potential leaks in the system. This will increase the water use efficiency of the City.
- Information will be received on a daily basis. The City can calculate use trends, identify leaks and water theft early.
- The expense of readings, turn-on and –off, off-cycle readings and estimated reads will be lower compared to the manual and touch read systems.
- Should the City adopt any water restriction policies in the future, the system will allow the City to monitor use and identify those not following the policies.

Another issue the City may want to consider, and this can be addressed in the RFP/Bid Document, is the comfort level with the technology. If the City does not feel there are enough AMR systems successfully working nationwide, this may affect the AMR decision.

When making a final decision as to AMR, the City may want to consider if in the long term, the City's customers are best served by investing in labor (manual and touch read) or equipment (drive-by and fixed).

3.11 Key Recommendations From the Cost Analysis

The cost analysis developed herein has demonstrated radio read and fixed network AMR technologies are the most cost effective. As a result of that finding, HDR would recommend the City eliminate manual read and touch read systems from further consideration. Furthermore, the cost analysis found no significant cost differences between radio read (drive by) and the fixed network AMR solution. Given that key finding, the City will not be able to make a choice between a drive-by and fixed network system strictly on the basis of cost effectiveness.

As noted above, the cost analysis developed herein concluded that no significant long-term cost differences were found between drive-by and a fixed network system. However, in coming to that conclusion, HDR needed to make a number of key assumptions. Therefore, HDR would recommend the City consider entering the procurement process in which the City would receive bids for both technologies. Only in that way, can the City accurately understand the actual capital costs associated with these two AMR technology alternatives.

3.12 Summary

This chapter of the report has provided a detailed analysis of the cost effectiveness of the various AMR alternatives. Our findings indicated that a drive-by or fixed network system would appear to be the most cost effective. However, it appears that on a net present value basis, there are no significant differences in the costs associated with either the drive-by or fixed network solutions. Therefore, the City's final decision on AMR technology will likely hinge on the non-economic or soft costs associated with these technologies. The next chapter of the report will discuss these additional considerations.

4.0 Additional Residential Meter Plan Considerations

4.1 Introduction

As concluded in Chapter 3, there appears to be no discernable difference in the relative costs between the two lowest cost alternatives, drive-by and fixed network. Given that, the City will need to consider features, benefits or issues other than strictly cost-related to make a final decision on the AMR technology for the City. This chapter is intended to provide an overview of the additional features, benefits or issues the City may use to reach a final decision on AMR technology. For each issue, a comparison between the two technologies has been provided, along with the key observations of HDR.

4.2 Summary of This Chapter and Key Recommendations

This chapter will discuss additional key considerations when making the final decision between a drive-by and a fixed network AMR system. For each consideration, a comparison between both technologies was provided, including key recommendations and observations.

KEY RECOMMENDATION – The City should hire an outside program management firm for the management and installation of the meter program. Due to the short timeframe for installation and the limited resources available to the City internally, this is the most effective avenue open to the City.

KEY RECOMMENDATION – During the procurement process, require short-listed vendors to install and demonstrate their products, on site and under pre-arranged adverse conditions. This will enable the City to better understand the actual performance of the technologies.

KEY RECOMMENDATION – The City should provide the contractor awarded the final project, the flexibility to determine the most efficient and cost-effective deployment strategy. The most likely deployment strategy will be geographic in nature and the final details will be presented by the contractor and agreed upon by the City.

KEY RECOMMENDATION – The City will need to formalize and establish a meter maintenance and management program.

KEY RECOMMENDATION – Due to significant costs, the City should not consider a migration from a drive-by to a fixed network system. A final decision should be made for one technology or the other.

KEY RECOMMENDATION – HDR sees no advantage for the City to consider a hybrid system and recommends the use of one technology throughout the City.

4.3 Key Considerations

The following discussion will explain the additional key factors or considerations the City should use to further evaluate the AMR options of drive-by or fixed network. The additional elements of a residential meter plan for which decisions or actions are needed include:

- **Key implementation issues and risks:** Implementation issues and risks will be dependent upon the AMR technology solution selected, especially in the area of the City's operations.
- **Deployment time period for new meters and reading technologies:** The time period involved in implementing a new water meter reading/billing approach can greatly influence the cost of the program.
- **Deployment Strategy:** Geographical, surgical and opportunistic deployment strategies are options available to the City.
- **Reading / billing frequency:** Benefits of migrating from a bi-monthly to a monthly reading and billing frequency will provide additional information to the City depending on the AMR technology solution selected.
- **Meter maintenance and management:** A formal meter maintenance and management program will guide the testing and replacement of water service meters.
- **Other meter reading alternatives:** Outsourcing meter reading services is an option to discuss.

Each of these elements is discussed below for both alternatives, with the findings carried forward into the final recommendations presented in Chapter 5.

4.4 Key Implementation Issues and Risks

Implementation issues and risks will be dependent upon the AMR technology solution selected, especially in the area of the City's operations. One component of the decision making process will be the additional effort the City will have to undertake to implement and maximize the AMR technology solution. This section will discuss the implementation issues and risks associated with a drive-by and fixed network AMR technology solution.

4.4.1 Key Implementation Issues and Risks for the Drive-By Alternative

The first consideration is whether the installation services will be performed in-house or out-sourced. The City will need to examine the project management requirements of the drive-by alternative. Even with a turnkey project, there are numerous project management and support tasks that must be performed by the City or an agent retained to represent the City. These decisions will affect the final overall cost of the project.

In order to meet the implementation time constraints for this meter plan with the limited staffing resources the City realizes at this time, outsourcing will be required. The degree of

assistance needs to be carefully determined, whether it is initial program management set-up and assistance or overall program management and field inspection. **For the drive-by alternative, HDR recommends the City hire an outside project management firm to manage the overall installation and inspection of the program.**

Even with outsourcing the implementation, the City will still need to allocate resources to determine how the drive-by system will affect operations and how best to maximize its features. Among the issues the City will need to eventually address from a management perspective with the drive-by alternative are:

- Re-allocation/assignment of meter reading and field service staff members
- Determination of AMR system maintenance material and staffing requirements
- New policies and procedures to support the drive-by system and changes to level of service
- Customer service staffing and service delivery
- Use of AMR data and information to improve management of the City's water resources
- Billing system interface and data management (during system deployment and continued operations)
- Overall process change among departments depending on the AMR technology selected

The selection of a drive-by alternative does not create any unusual issues or risks for the above issues that would not be found in any other metering alternative (e.g. touch read, fixed network, etc.).

The major concern with the drive-by alternative (and also the fixed network system) is whether the technology will work at an acceptable level in the City of Fresno. Drive-by technology is a "tried and true" technology within the water utility industry and HDR has no concerns that if the technology was selected and installed, that it would work (perform) at acceptable levels within the City. As will be discussed later, the method **HDR would recommend to minimize or mitigate this technology risk would be to have vendors, during the procurement phase, provide actual field demonstrations of their product under certain pre-arranged adverse conditions. In addition, during the procurement phase, the City can specify an acceptable level of performance.** These two measures should help alleviate any risks or concerns with the drive-by technology.

4.4.2 Key Implementation Issues and Risks for the Fixed Network Alternative

The implementation issues and risks associated with the fixed network alternative are very similar to the drive-by discussion provided above. In comparing installation of the systems, there is no significant advantage or changes in risk with a fixed network system. HDR is of the

opinion that the City will still need to hire an outside program management firm to provide assistance in managing the installation and inspection of the meters, pits and boxes. **For the fixed network alternative, HDR recommends the City hire an outside project management firm to manage the overall installation and inspection of the program.**

The other key areas identified under the fixed network discussion (e.g. assignment of meter reading personnel, field service, maintenance, etc.) are also very similar to the drive-by solution. In the previous chapter of the report, it was noted that the number of staff members needed to support either drive-by or a fixed network system were very similar. At the same time, the number of meters to maintain is consistent between the two alternatives. One issue that may create differing levels of risk for the City between these two alternatives is battery life. As was noted in the discussion of the technology, more frequent reads will reduce battery life. The fixed network alternative provides the opportunity for frequent reads, if desired by the City. However, as will be discussed later, the issue of battery life can be addressed through the bid/procurement process. At the same time, the City must weigh the benefits of a fixed network system that provides greater flexibility and information from frequent reads, but a potentially shorter battery life. This is one of the reasons why HDR highlighted the feature of a field replaceable battery.

The key risk with the fixed network alternative is the issue of whether the technology will perform at an acceptable level for the City. Fixed network systems are not necessarily new or untried technology. On the contrary, this technology is in use at a number of utilities across the U.S. Fresno is relatively flat and dry, which should reduce or minimize any performance issues or concerns. However, much like the drive-by alternative, if the City is interested in the fixed network alternative, **HDR would recommend that during the procurement process vendors should be required to provide actual field demonstrations of their product under certain pre-arranged adverse conditions. In addition, during the procurement phase, the City can specify an acceptable level of performance.**

KEY OBSERVATION – Under either alternative, the City should hire a program manager and outsource the installation of the meters. There appears to be no significant differences in the risks associated with the installation of either technology.

KEY OBSERVATIONS – The risk of the technology selection can be minimized by actual field demonstrations, along with performance guarantees during the procurement/bid process. Both technologies appear to have good performance records.

KEY OBSERVATIONS – The City's use of the technology and the frequency of reads may be a critical deciding factor. If the City wants to maintain a simple bi-monthly or monthly reading schedule, then a drive-by system would be adequate. A fixed network system provides greater flexibility for frequency of reads, but with the trade-off of shorter battery life. This can be mitigated by field serviceable batteries and battery performance guarantees from the vendor during the procurement bid process.

4.5 Deployment Strategy

The time period involved in implementing a new water meter reading/billing approach can greatly influence the cost of the program. Typically, a utility the size of the City of Fresno could realize full implementation of a new technology (i.e., applied to all service meters) within three to four years if this work is performed by an outside contractor. To conduct the effort in-house with current staff may take on the order of ten or more years. As noted above, due to Assembly Bill 514 the deployment time period must be within the four year period; therefore HDR is recommending the City hire an outside contractor to perform the work. Even with that, the City and their contractor will need to consider a deployment strategy. This section will discuss and compare the deployment strategy under the drive-by and fixed network alternatives.

The City's existing 24,232 residential meter population is varied in age but with a consistent meter type; the majority of the meters are Neptune. Meters are mandated to have been installed on all new residential housing since 1992. Some meters in the system are up to 30 years old from acquired County Islands and private utilities. Of the meters due to have been installed since 1992 there is currently a backlog of 10,223 meters not installed. No residential meters are currently read. There are three different options available to the City when deciding to install or replace all the water meters:

1. **Geographical** – This strategy would involve installing and replacing the meters based on the geographical location. The meters would be installed or replaced without regard to their age or type, but starting on one side of the City and working out from that point until full coverage is achieved. Geographical can be efficient with regard to how much time is spent installing/replacing the meters due to minimized mobilization.
2. **Surgical** – This strategy involves installing or replacing meters based on locations that pose problems due to difficult to access locations. This may include meters located in or on busy streets, meters on difficult slopes, or meters that require service line relocation. This strategy would help to increase the efficiency of the water meter installation by focusing installations on these few difficult locations.
3. **Opportunistic** – This strategy is the opposite of the geographical option where instead of installing or replacing water meters based on location, specific water meters are identified due to age, type, political districts, etc., for installation or replacement regardless of location. This method would take considerably longer because there would be more travel involved, but it would be much more efficient at getting rid of the problematic meter or potential political ramifications.

Deployment strategy decisions become clearer when a utility has an existing meter population with a history of meter-related problems giving guidance to determining the specific deployment strategy. Age, consumption, missed reads, estimated reads, difficult access, etc. are criteria usually employed in this evaluation. Since most of the City's residents have no meters and only a small percentage of residents have meters with limited data, the deployment

strategy becomes less restricted. However, in the case of the City, the deployment strategy appears to be more driven by schedule and amount of meters to be installed.

The City has noted there are some locations where the service lines are located in the backyard and therefore, require meter pit location in the backyards. This would appear to require a surgical strategy. The City will need to work with the Program Manager and contractor to determine the timing and appropriateness of these installations to minimize the time, effort and cost associated with these types of situations.

4.5.1 Deployment Strategy for the Drive-By Alternative

The technology associated with the drive-by alternative will not, on its own, impact the deployment strategy. It would seem that the geographical deployment option will help to decrease installation time and increase efficiency. Along with geographical deployment, some selected surgical deployment may be appropriate. On the surface, it would seem that this combination would be well suited for the City. More importantly, the City should specify and clearly request within their procurement process a specification from the installer as to their proposed deployment (installation) strategy. As noted above, the final deployment strategy may, in the end, be driven by the required time schedule for installation, and the least-cost method for the contractor to install the meters across the City.

One concern of the City is whether there will be concerns on the part of the citizens (customers) with the deployment strategy (e.g. why my section of City first?, etc.). In HDR's experience with other cities, the deployment of the meters has not been an issue[4], rather, it is the implementation strategy used for the metered (volumetric) rates that is more critical. The water rate study will directly address this issue and develop an approach to minimize immediate (high bill) impacts from volumetric rates to allow for a smooth transition of those customers with meters or recently installed meters.

4.5.2 Deployment Strategy for the Fixed Network Alternative

The deployment strategy issues noted above for a drive-by system are similar for the fixed network alternative. No significant differences with deployment appear to occur between the alternatives.

The final decision for the deployment strategy should be made during the procurement period once the contract has been awarded. The City needs to determine how much flexibility it will allow the contractor to decide on the appropriate, most cost-effective, and time sensitive deployment strategy.

[4] Recent discussions with the City of Reedley, California have indicated little or no citizen (customer) issues on meter installation. The types of issues that have come up are either why meters are being installed, or a contractor-related installation issue (e.g. landscaping issue, etc.). The City of Folsom had a similar experience.

KEY OBSERVATION – The City should be able to deploy either the drive-by or fixed network alternative within the time limits of AB 514.

KEY OBSERVATION – The City's final deployment strategy may be primarily driven by the efficiency and time savings required of the contractor to meet the deadline. Given that, the City should request within their procurement process from the installation contractor a preliminary plan for deployment (installation) strategy within the City. Most likely, the plan will be primarily geographic in nature.

4.6 Reading / Billing Frequency

The City is currently on a bi-monthly flat rate billing frequency. As discussed in Chapter 3, both the drive-by and fixed network alternatives provide the opportunity for the City to transition to a monthly billing cycle. As noted in that discussion, transitioning to a monthly frequency increases operational costs related to meter reading, customer service, and billing. The additional meter reading costs under each alternative are relatively comparable. However, the flexibility of the two systems is fairly significant and should be carefully considered by the City. That discussion is provided below.

The City has discussed the potential of moving to a monthly billing cycle. Both of these technologies will easily support this requirement. HDR would not recommend the City move to monthly billing at this time. The City needs to focus on installing the meters and getting metered (volumetric) rates in place. This should be the higher priority for the City. That does not imply that HDR does not suggest monthly billing at some future point in time, but not for now.

4.6.1 Reading / Billing Frequency for the Drive-By Alternative

The drive-by alternative, when compared to manual read and touch read, appears to be a highly efficient system. It actually is highly efficient, but in terms of reaching its limitations, when a utility moves to a monthly billing cycle with this technology, it has for the most part, reached its maximum potential for usefulness. That is not to say the City couldn't perform more frequent reads, but not without greater labor effort. With that understanding, if the City is only interested in providing monthly billings to their customers, and not going to the next (future) level of customer service and data gathering, then the drive-by alternative would certainly suffice.

4.6.2 Reading / Billing Frequency for the Fixed Network Alternative

Simply stated, the fixed network alternative can take the City to the next level of customer billing, service and data gathering. The fixed network alternative will easily provide the ability for the City to move to monthly billing. However, it is the features beyond that basic task that

separates the fixed network from the drive-by system. As was discussed in the technology overview, a fixed network system can provide, if needed or necessary, multiple readings within a day. This type of information can be useful in a number of different ways. Special reads can be made without having to send a reader out into the field to collect the information. HDR currently has a client that provides to their larger customers, over the internet, instantaneous and total consumption information. This allows the customer to understand their usage (demands) at that very moment and over the billing period. Another potential use is for conservation purposes. The refrigerator magnet showing consumption and total bill to date will continue to be refined and will be an important tool for utilities to instantaneously communicate to their customers. Finally, a fixed network will allow the City to collect more detailed consumption and demand information for resource planning and rate purposes. Obviously, obtaining consumption data on twice a day reading basis is far superior to a single reading at the end of the month provided by a drive-by system. As fixed networks mature and become the standard of the industry, it is likely that other methods/applications will be developed to better take advantage of the power provided by a fixed network system.

A simple analogy for comparing these two technologies is the drive-by system is limited, but dependable and a fixed network system is faster and more powerful. If the City wants to provide only bi-monthly or monthly billing, then the drive-by system may be perfectly suitable and appropriate. However, the City may want to utilize, now or in the future, the more powerful features and benefits only a fixed network system can provide.

KEY OBSERVATION – Both a drive-by and fixed network system will enable the City to read and bill customers on a monthly basis. No significant cost differences would be incurred between these two technologies to move to a monthly billing cycle.

KEY OBSERVATION – The City will have the capability to move to monthly billing, regardless of the system selected. For a variety of reasons, HDR would not recommend the City attempt to move to monthly billing at this time.

KEY OBSERVATION – The fixed network system is far more powerful and flexible than a drive-by system in its ability to provide more frequent reads. In addition, the frequent data obtained from the fixed network system can be used to help maximize customer communication and may be an effective tool for conservation purposes. Finally, a fixed network system has the potential to provide to the City improved data and information for resource planning and rate setting purposes.

4.7 Meter Maintenance and Management

Historically, the City has not implemented a formal maintenance program or schedule to guide testing and replacement of water service meters. The current practice is to install a water meter only for new construction. The only meter testing that occurs has been random bench testing of existing meters which have been installed but not read.

By contrast, a formal meter maintenance program involves routine testing of older meters to maintain a database of information related to meter age, location, and level of accuracy. By compiling such data, informed decisions as to replacement schedules can be made. Typically, water meters remain in systems for 15-20 years before inaccuracies require their replacement. This is consistent with the battery warranties of most AMR manufacturers. However, AWWA Manual M6 cites water quality as having the potential to have a detrimental effect on the performance (i.e. accuracy) of a meter. Examples of water quality issues are build-up of chemicals from the water or abrasive materials carried by water. Zones within a municipality's distribution system supplied by different sources could create zones with different water quality and, therefore, zones with different potentials for water quality induced meter accuracy issues that can lead to shortened meter life spans.

The City of Fresno recently completed a random testing of meters based on age and location. Since meter type, size and manufacturer are consistent throughout the residential meter population, age was used as the key parameter in the meter accuracy testing program. All meters were Neptune T-10 1-inch residential meters and ages were selected for testing over 5, 10, and 15 year periods. The results are as follows:

- 5 year accuracy tests -99.64% (.36 % under-registration) overall accuracy for all meters tested.
- 10 year accuracy tests-99.56% (.44% under-registration) overall accuracy for all meters tested.
- 15 year accuracy tests-100.08% (.08% over-registration) overall accuracy for all meters tested.

These results show that through 15 years of use within the Fresno' distribution system the residential meters have held within the limits of accuracy for the Neptune T-10 1-inch meters. **Due to testing equipment and human error, residential meter accuracy tests are considered accurate if test results fall in the range of 98% - 102%.** The net result for this type of meter is that the useful life falls within the AWWA recommended replacement interval of 15-20 years. With further testing for age groups over 20 years, the results may prove that useful life maybe beyond the 20 year expected life.

KEY OBSERVATION – Meters installed in the Fresno water system have a useful life at or above AWWA recommended replacement interval. Therefore, meter system life can be safely predicted out to 20 years as provided in the cost model.

4.7.1 New Meter Testing Protocol

It is recommended that the City establish a new meter testing protocol. During the procurement process, specify as a requirement that the manufacturer provide certified meter test results. Certified test results may be easily transferred to a database thus establishing the complete history of a meter. The database can be referenced for inspection or maintenance work, or to

address customer concerns. A statistical sample testing of new meter shipments to verify accuracy and to maintain confidence in manufacturer test results is an efficient cost alternative to testing every new meter. For the City of Fresno approximately one-half to one percent of all new meters randomly should be tested, based on 81,000 new meters, 405-810 meter would require testing over the four year installation.

4.7.2 Future Meter Testing Protocol

Whether drive-by or fixed network is selected, the future random sampling for residential meters should continue. As proven from the City's past meter test sampling program, meters can perform accurately for many years, and are generally not economical to repair. The best practices approach to residential meter management is monitor the performance of the meters through a combination of statistical sampling and watching for individual consumption anomalies that could indicate underperforming or stuck meters.

The principal is that all the meters in a given size/age/make class should be homogenous, and expected to behave and age similarly. Conversely, one manufacturer's meters could perform and age slightly differently than another's.

Meters decline in accuracy slowly with age. They are guaranteed to be accurate for the first five years, so there is no reason to test them during this time period, except for those that are seriously under-registering which may be stuck.

Starting at age five years, small meters should be monitored for accuracy through statistical sampling, using the following protocol. Each year, a statistically significant random sample of meters from each size/age/make class should be scheduled for removal and test. The sample size will be 50-100 for each class, depending on the class size and level of confidence required. These meters should be tested under controlled conditions (that is, they shouldn't be excessively jostled or banged around during transport, the ends should be capped upon removal from service to prevent the meter from drying out, and the meter should be tested right away (within a few days of removal). The meters should be tested at three flow rates (1/4 gallons per minute, 2 gallons per minute, and 15 gallons per minute), low flow first, following AWWA procedures.

The small meters removed during random sampling should be replaced by meters from new stock or from inventory. These meters should be assigned the appropriate size/age/make class.

In accord with statistical theory, if the class of meters is homogenous, and if the random sample from that class is determined to be accurate, then the City can be confident the entire size/age/make class is accurate. If the sample fails the accuracy criteria, then the entire class can be presumed to fail the accuracy criteria, and every meter in the class should be scheduled for replacement. In fact, if the sample is showing signs of nearing the accuracy limits, the City can plan for a future change-out of that class.

Following this procedure, when should a size/age/make class be replaced? The time to replace a small meter is when the revenue lost from the decline in accuracy by leaving the meter in for another year exceeds the costs (both of the meter and the labor to replace it) deferred by postponing the change out another year. This optimal point in time is dependent on the price of water (and wastewater), the rate at which the accuracy of the meter declines, the cost of a new meter and the cost of the labor to replace the old meter.

During implementation and once meters are installed throughout the City, some meter maintenance and testing of the residential meters will be required. Although, it is generally considered advisable to provide for more frequent testing of large meters, mainly commercial and industrial, as an error in their registration affects revenue to a much greater extent.

For a City the size of Fresno, some additional staff such as one lead worker to determine the residential testing, maintenance protocol, record keeping, as well as the testing schedule, and one maintenance staff member to complete the actual sample testing, maintenance and replacement as needed. Many times field service technicians are assigned to provide these meter testing functions and fall short due to other activities. It is HDR's experience that a designated testing staff of two be employed by the City, with any additional testing and maintenance assistance needed, be provided by the field service techs discussed previously.

4.7.3 Meter Maintenance and Management for the Drive-By Alternative

The meter maintenance and management activities for the drive-by alternative (meters) should follow the approach and recommendations noted above.

4.7.4 Meter Maintenance and Management for the Fixed Network Alternative

The meter maintenance and management activities for the fixed network alternative (meters) should follow the approach and recommendations noted above. There should be no significant differences in the meter maintenance and management of the fixed network system and the drive-by systems at the meter endpoint. As noted previously, the fixed network system and drive-by system may have a shorter battery life depending upon the frequency of meter reads.

KEY OBSERVATION – With the installation of meters City-wide, the City should develop a comprehensive meter maintenance and management program.

KEY OBSERVATION – There would not appear to be any significant differences in the suggested meter maintenance and management program for a drive-by or fixed network system. Battery maintenance may be more frequent on the fixed network system than the drive-by system depending upon the frequency of reads.

4.8 Outsourcing of Meter Reading

One alternative some utilities consider is the outsourcing of meter reading. In essence, the City would own the meters, but outsource the actual labor for meter reading. The outsourcing of meter reading is primarily applicable to the drive-by alternative. There are several national firms, including local gas and electric utilities (PG&E) that may offer this service. Contract periods are typically three to five years long and provide a fixed network unit cost for most reading activities. Price per read for this service runs from $1.00 to 2.00.

HDR's concern with outsourcing the actual meter reading is the potential loss of control of this important data and information. In addition, the drive-by and fixed network solutions require very limited labor. As such, outsourcing may have very limited benefits. For that reason, **HDR would recommend the City not consider outsourcing of meter reading, particularly if a drive-by or fixed network solution is selected.**

KEY OBSERVATION – Outsourcing of meter reading will provide little discernable benefit to the City. The City should be responsible for all meter reading labor and meter reading activities.

4.9 Migration from Drive-by to Fixed Network

One strategy that has been raised is the potential to install a drive-by system, but at some later point, migrate to a fixed network system. The thought is this strategy could be used if the City is uncomfortable with the current technology or performance of fixed network systems. The City would simply wait until the technology improves and then, at that point, invest in the new technology. While on the surface, this strategy seems very logical; in reality it may not be prudent. First, based upon HDR's knowledge of the vendors and their products, there are few drive-by systems that provide for easy upgrade (migration) to a fixed network. It should be remembered that the drive-by technology is different from a fixed network system. More important is the potential cost of a migration. Assuming an estimated cost of $100 per meter installation for a meter interface, and 113,265 meters; it would equate to a cost of $11,326,500 to simply convert the meter interface units to a fixed network. That cost estimate does not include the cost labor to install the new interface units. It also has not included the cost of the other required hardware (e.g. collectors, etc.) to make the fixed network system function. In very rough terms, it would appear that the total cost may be in the range of $15 - $20 million to achieve such a migration. It is doubtful the utility management or City Council would be supportive of such a migration unless it was proposed at or near the end of the life cycle for drive-by technology (i.e. 15-20 years down the road). For that reason, HDR is of the opinion that whichever technology the City selects, that technology will need to be in place for the life of the product.

KEY OBSERVATION – Migration from a drive-by system to a fixed network system is likely not feasible from a technology and cost perspective. The technology selected by the City will likely be in place for the life of the product.

4.10 Hybrid System

A hybrid system is another alternative the City may consider. A hybrid system is simply a system that uses more than one technology. As an example, certain portions of the City may be drive-by and another portion a fixed network. In other cases, a utility may use touch read in certain portions of their system where the other technology may not be effective or work . Hybrid systems are many times used when AMR installation programs are transitioning from one technology to another.

Since this plan is only looking at residential metering, HDR is not aware of any situation or reason that might suggest that a hybrid system would be beneficial for the City; from either a cost or operational perspective. Presently where hybrid systems provide an advantage is when high water consumers, such as industry or commercial customers, require a fixed network for data management. This blend of a fixed network can then work well with a mobile network designated for the residential use.

KEY OBSERVATION – HDR is not aware of any situation or reason that would justify the City to consider a hybrid system.

4.11 Lessons Learned from Other Utilities

Technology by its very nature is complex and subject to "technical problems." A major concern of the City, and rightfully so, is to have a good understanding of the current technology and the experiences of other utilities with these technologies. Installations and operations of drive-by and fixed network technologies are not without their problems. The following discussion describes the problems faced by a few utilities and how they were resolved with the vendors.

LAS VEGAS VALLEY WATER DISTRICT - The Las Vegas Valley Water District (LVVWD), due to unprecedented population growth, has recently moved to AMR technology. LVVWD, over the last eight years has added approximately 2,000 water meters per month, largely located in outside meter boxes. In order to keep up with accurate reading, LVVWD selected the Datamatic Firefly Mobile AMR. The full case study is provided in Appendix D.

LVVWD experienced some initial "growing pains when some Firefly electrical connections were not properly waterproofed. Scratched and dirty lenses also contributed to problems tuning the optical sensors to address variable conditions of existing meter registers. However, these problems were easily remedied through collaboration between the LVVWD and Datamatic.

In addition, a sub-contractor was chosen to install Firefly units, which led to some preliminary programming issues that were not addressed in a timely manner. The sub-contractor also

experienced some difficulty in properly programming the units in the field with the meter reading of the meter. Datamatic, however, quickly overcame the issues by modifying the contract to offer clear incentives to correct the problem. See Appendix D for full explanation of resolution.

KEY OBSERVATION – The lessons learned by LVVWD and Datamatic was to work closely with each key player to build and install the AMR system.

CITY OF REEDLEY - The City of Reedley is in the process of installing a drive-by system with the capability of migrating to a fixed network at some point in the future. The installation is contracted out to Johnson Controls, Inc. In a recent discussion with the City they noted that there have been few problems with the installations or the system. In those few instances where issues were found, they were quickly and easily resolved.

CITY OF FOLSOM - The City of Folsom recently installed meters in the Ashland area using a touch read system. The City selected Hersey meters with Sensus handhelds. City crews installed the meters. The City has been using this system for almost two years and has not experienced any major problems or issues. There have been some minor problems with data transfers. The City is currently in the process of developing their meter implementation plan for the rest of the City. Interestingly, the City will be installing drive-by meters, but pilot testing a fixed network system. If after the short-term pilot test, the City is satisfied with the fixed network system, the City will then migrate the few drive-by meters installed to a fixed network over the remainder of the system.

CITY OF SAN LUIS OBISPO - The City of San Luis Obispo installed Metron Farnier single jet technology on all large meters in the system. These meters incorporated a mobile reading system that helped eliminate the meter readers' entry into confined space vaults. After many months of reading issues the system finally achieved successful reads. Although the City's patience grew thin due to the time it took to resolve the reading issues, the AMR vendor is in the business to make the system work and their persistence paid off.

KEY OBSERVATION – Reputable AMR vendors are willing to resolve issues to the utility's satisfaction. Not only is resolving the issues important, but the need to do so in a timely manner.

4.11.1 National Benchmark Comparison

The Ascent Group, Inc. developed a national survey and benchmark study on meter reading best performance strategies in 2004. The full white paper is included as Appendix E. The survey was based on the responses of 47 utilities ranging in size from 3,750 meters to 4.5 million. The survey was sent to a mix of water/wastewater, gas and electric utilities.

The content of the survey includes information on what was called "Best Performing Companies", the role of meter reading in today's utilities and a discussion on automation. HDR is drawing no conclusions from the white paper but believes it provides valuable information for the City.

4.11.2 National Survey

Informal telephone surveys were conducted with several large water utilities nationally to gather a comparison with different meter reading technologies and metering programs. The purpose of this information is to provide the City with an understanding of the choices other utilities have made with their metering programs. Table 4-1 summarizes the findings:

Table 4-1. Summary of National Utility Meter Reading Survey.

		Vendors			
Utility	Meter Number	Meter Brand	AMR Technology	System Type	Comments
Aiken, SC	20,000	Badger	Badger	Mobile	Completed
Akron, OH	84,000	Badger	Itron	Mobile	Completed
Albany, NY	25,000	Badger	Badger	Mobile	Completed
Ann Arbor, MI	27,000	AMCO	Hexagram	Fixed	Completed
Aqua Pennsylvania	80,000	Mixed	Itron	Mobile	In progress
Atlanta, GA	150,000	Neptune	Neptune	Mobile	In progress
Boston, MA (Boston Water & Sewer Commission)	90,000	AMCO	Hexagram	Fixed	Completed
Chester, PA (Chester MUA)	41,000	Sensus	Sensus	Mobile	Completed
Chicago	162,000	Badger	Badger	Mobile	80,000 retrofits; balance new plastic meters
Cincinnati, OH (Greater Cincinnati Waterworks)	240,000	Neptune	Neptune	Mobile	In progress
Conway, SC (Grand Strand Water & Sewer Authority)	56,000	AMCO	Itron	Mobile	Completed
Corpus Christi, TX	90,000	Neptune	Hexagram	Fixed	In progress - 150,000 water and gas meters
Denver	204,000	Mixed	Itron	Mobile	Completed
Des Moinces, IA, (Des Moines Waterworks)	70,000	Neptune	Hexagram	Fixed	In progress as of 2/06
Detroit	275,000	AMCO	Itron	Fixed	In progress
Ft Wayne, IN	75,000	AMCO	Itron	Mobile	Completed
Houston, TX	100,000	Badger	Itron	Mobile	Completed
Kansas City, MO	160,000	Neptune	Hexagram	Fixed	In progress
Montgomery, AL	80,000	Neptune	Neptune	Mobile	Completed
Portland, ME	54,000	AMCO	Itron	Mobile	In progress

		Vendors			
Utility	Meter Number	Meter Brand	AMR Technology	System Type	Comments
(Portland Water District)					
Providence, RI (Providence Water Supply Board)	50,000	AMCO	Itron	Mobile	Completed
United Water NJ	180,000	Neptune	Neptune	Mobile	In progress
United Water NY	60,000	Neptune	Neptune	Mobile	In progress
Washington DC (DCWASA)	125,000	AMCO	Hexagram	Fixed	Completed
Wilmington, DE	36,000	AMCO	Itron	Mobile	Completed

Some of the utilities in Table 4-1 are still in the process of installation and various stages of completion. This is presented to provide a list of recent meter programs and is not a complete list in the US AMR market.

KEY OBSERVATION – AMR technology has been embraced and implemented successfully by numerous water utilities nationally.

4.12 Key Recommendations From the Additional Considerations

As Chapter 3 noted, the cost differences between the drive-by and fixed network systems is relatively even. Given that, this section of the report has attempted to highlight those other considerations the City may want to consider in making a final technology choice.

A number of key observations were provided in this chapter, however, two observations may be the most relevant. First, a key difference between these two technologies is the greater flexibility to achieve multiple reads provided by a fixed network system. If the City is interested in obtaining this benefit, then a fixed network system is the best suited to provide this benefit. The second key observation noted was that migration from drive-by to a fixed network system is most likely not feasible because of the cost impacts. Therefore, whichever technology the City selects will be the technology for the next 15 to 20 years or until the end of the life cycle of the product selected.

A number of recommendations were provided in this section of the report. The most important recommendation provided in this section is that the City hire an outside program manager for the management and installation of the meters. AB 514 has too short of a timeline to allow the City to manage and install these meters in-house. Next, HDR also recommended that during the procurement process the City require the vendors to install and demonstrate their products on site, under pre-arranged adverse conditions. This will help the City better understand the actual performance of these technologies under less than ideal conditions.

A recommendation from HDR concerning deployment strategy is to provide to the contractor the flexibility to determine the most efficient and cost-effective deployment strategy. The City should request within their procurement process that the vendor/contractor clearly delineate their deployment strategy. In that way the City can arrange a final deployment strategy. Most likely, the deployment strategy will be geographic in nature.

The other recommendations of this section of the report are important, but relatively minor, particularly in making a final technology choice. The first recommendation was that the City not change to monthly billing until the metering system is in place and volumetric metering and billing is completed. The City needs to focus on the meter implementation plan, and moving to monthly billing at this point is simply adding one more complicated issue to deal with. The second recommendation was that the City will need to formalize and establish a meter maintenance and management program. The next recommendation was that the City not consider outsourcing of meter reading. No clear cost or operational advantage of outsourcing was noted and the City should internally control this function and the critical billing data that it produces. The next two recommendations were similar in scope. That is, the City should not consider a migration strategy from a drive-by system to a fixed network system. It appeared to be, on the surface, not cost effective and worthy of further consideration. Finally, related to that was the issue of a hybrid system. HDR could see no reason or advantage for a hybrid system and recommended the use of one technology for the City.

4.13 Summary

This concludes our discussion on the additional residential meter plan considerations for drive-by and fixed networks. As can be seen, during the deployment phase there are not many differences between the drive-by and fixed network alternative. A key differentiator is how these systems may be used over the long-term and what data and information the City wants to derive from them.

The final chapter of this report provides HDR's summary recommendations, conclusions and an implementation plan for the City to use during the deployment phase.

5.0 Metering Plan Recommendations and Conclusions

5.1 Introduction

The previous chapters of the report have provided a complete review of AMR technology and the many issues and considerations that may be used to make a final selection concerning technology. The objective of the this report, and of the meter implementation plan developed herein for the City, is to provide a clear road map to keep the City moving forward with the process of meeting the AB 514 requirements.

A meter implementation plan is not unlike any other utility planning document, such as a master plan or comprehensive plan. That is, it provides a level of detail to allow the overall plan to move forward, but it certainly does not attempt to anticipate, address or resolve every issue that may come up over the next four years. Rather, the meter implementation plan should provide to City management and the City Council a clear approach and plan to help management achieve the City's end objective. Within this report, HDR has attempted to identify the key issues associated with meter implementation and provide recommendations to minimize both risk and costs.

This chapter of the report provides the summary recommendations for the City and a set of next steps (tasks) to carry out the meter plan, and a comprehensive schedule to ensure key milestones can be accomplished.

5.2 Meter Plan Recommendations

Based upon the findings and conclusions of this report, HDR has developed a detailed set of recommendations as a part of the overall meter implementation plan. These recommendations are separated into five main categories: Preferred Technology, Deployment, Bid/Procurement, Implementation/Installation, and Operational. By adopting and following these recommendations, HDR is confident the City will be able to meet the time requirements established by AB 514 and the CVP contract, while at the same time installing and operating an AMR system which meets the future needs and requirements of the system.

5.2.1 Preferred Technology Recommendations

The cost analysis developed in Chapter 3 noted no significant cost differences between the drive-by and fixed network system. However, it did demonstrate that a drive-by or fixed network system is clearly superior from a cost and operational perspective to a manual read or touch read system. For that reason, **HDR recommends the City implement either a radio frequency drive-by or fixed network AMR system**. As noted above, from a cost/economic perspective, these two technologies were determined to be roughly equal. Given that the costs of these two systems appeared to be roughly equal on a net present value basis, **HDR is of the**

opinion that it is premature at this point to eliminate either alternative until more formal cost bids and actual costs can be obtained through the bid/procurement process. This aspect of our formal recommendations is discussed in more detail under the bid/procurement subsections.

Either of these technologies will provide the City with the type of benefits which deliver the level of service envisioned by the City's Management Staff. This includes efficient use of labor, the potential to move to monthly billing, and an overall cost effective solution.

Drive-by or fixed network AMR systems provide the flexibility to address future challenges and uncertainties the current manual read system cannot hope to address. Our recommendation for the preferred technology is based upon the following issues/considerations:

- **Minimize Labor Costs –** Both alternatives provide the City with an immediate strategy to eliminate and cap certain labor costs, while positioning itself for low-cost service territory expansion. Both systems require nearly the same level of staffing over the long-term to operate and maintain the system, even as the system is expanded. **Although with the fixed network all meter reading labor and the associated vehicle cost for the mobile system is eliminated.** Therefore, the fixed network would better cap certain labor costs even though the estimated cost per reading after full implementation showed no discernable differences between the two technologies. Additionally, with fixed network on-site visits, estimated reads, and final reads would be reduced.
- **Increase/Improve Customer Service –** Both alternatives will allow the City to easily move, if they should so choose, to a monthly billing cycle. The fixed network system is the more powerful system that would allow the City to further elevate meter reading and billing from a transaction to a relationship with the customer, which is a trend within the utility industry. As was noted in the earlier discussion, the fixed network system allows customer service to provide almost instantaneous remote reads, which is a significant benefit compared to a drive-by system. In addition, the fixed network technology can also increase customer communication via up-to-date internet information and in-home information (e.g. refrigerator magnets). The technology will continue to evolve and HDR is of the opinion that advances in customer service will be hinged on a foundation of a fixed network system. Real-time data improvements in customer services include theft and leak detection, data profiling, and time-of-use billing.
- **Accuracy and Efficiency –** Both alternatives are proven to be more accurate and efficient than manual read. Touch read has comparable accuracy, but as was shown in the cost analysis, the labor costs associated with touch read make it far less efficient than either the drive-by or fixed read systems.
- **Data Collection and Management –** Both systems provide the ability for the City to collect data on a more frequent basis. This additional data and information can be used

for a variety of purposes (planning, customer service, conservation, rate development, etc.). **The drive-by system has certain limited capabilities in this area, whereas the fixed network system provides the potential for unparalleled amounts of data which can be crafted into proactive customer service and utility management information.** Customer service enhancements include providing customers with consumption history/analysis, identifying leaks before they escalate out of control, and reducing response time to customer inquiries. Utility management information includes consumption data which can assist with hydraulic modeling, evidence of meter trends which can help in the right sizing of meters, revenue losses based on meter inaccuracies, meter replacement scheduling, and overall increased data for water accountability. A fixed network system can easily be set up to provide the desired level of information to the customer in real time should the City decide to move to that level of information sharing.

- **Flexibility For Expansion –** Both systems are flexible in their ability to expand with growth or acquisition, but do so in a cost effective manner. **Given the number of reads per day for both drive-by and fixed network, growth or expansion on the system has little impact on labor costs for data collection.** This was demonstrated and clearly shown in the cost analysis over the 20-year time horizon. In contrast to this, both manual read and touch read are very labor intensive and growth or expansion of the system requires proportional increases in staffing of labor. Both alternatives provide the City with the flexibility to easily incorporate additional customer accounts into the system to keep up with future City growth. Cost for expansion will be minimal as no additional staff will be needed and little capital will be required as the infrastructure will already be in place. Both drive-by and fixed network will have all customer information uploaded into one database which will easily enable additional accounts to be added.

- **Expected Performance –** Both systems should perform to acceptable levels of performance. Upon the acceptance of the meter installation, 100% accuracy is required. Once all meters are installed and fully operable the vendor should meet a certain level of overall system accuracy (98%-99% full system accuracy). Also, as part of the request for proposal, the vendor should indicate the expected and maximum failure rates of the AMR system components per thousand units installed. This is a typical request from AMR vendors and all should be able to provide the City with this information. One advantage to the City is that its terrain is relatively flat, with minimal elevation changes. **This type of terrain typically provides for high levels of performance and accuracy on both the drive-by and fixed network AMR systems**. With a relatively flat terrain, RF signals can typically carry a greater distance. For a drive-by system, this can translate into less distance traveled or larger mobile reading routes. For a fixed network, a flat terrain may require fewer collectors due to improved RF signal strength.

In summary, for a variety of reasons, it would appear the City should pursue both a drive-by and fixed network system within the bid/procurement process. Based on the preferred technology recommendations the City may see added benefits to the fixed network solution, but at what cost? By opening the procurement process to both technologies the real cost comparison can be determined. Many times pricing both technologies seems to introduce competitiveness and the price gap is reduced. Manual read and touch read systems should be eliminated from further consideration unless there are serious and major concerns on the City's part with the drive-by and/or fixed network technology.

5.2.2 Deployment Strategy Recommendations

The deployment strategy focuses on the approach or management methods the City will use to ensure meeting the AB 514 requirements of all meters installed and read by 2013. Therefore, the City needs to focus on the efforts required to achieve that goal (requirement). The deployment strategy recommended by HDR will greatly influence the next steps of the program, which will outline a set of specific tasks to be accomplished and a specific timeline for each. **For a deployment strategy, HDR recommends the following:**

1. **Deploy the selected AMR technology solution within four years or less.**
2. **Award a single contract to turn-key firm requiring responsibility for all services with one firm. This should ease program management and help fast-track deployment of the system.**
3. **Employ a Program Management Firm to manage the installation contract for the City.**
4. **Work with the selected Contractor and Program Management Firm to establish the most time-efficient and cost effective deployment (installation) plan.**
5. **Develop a Public Involvement/Community Outreach Program.**
6. **Gain City Council Approval for the Meter Implementation Plan As Soon As Possible.**

Provided below is a more detailed discussion of each of these recommendations and HDR's support for these recommendations.

- **Deploy In Four Years or Less –** The sooner the system is installed, the sooner the City will receive solution benefits. At the same time, a deployment strategy that provides some flexibility in schedule will be important given the unknown issues that may arise with the physical installation process. To avoid the perception of some customers having the benefits first, a fast-track deployment mindful of any local political issues should be considered. HDR believes the political issues associated with deployment should be minimal. However, one issue that may arise is the question of why meters are being installed in one area of the City before another. Ultimately, the deployment strategy should <u>not</u> be based upon politics, but rather on the strategy that will be most time efficient and cost effective for the City. As was noted in Chapter 4, the political issues associated with metering are not typically around the installation of

the meters, but rather the implementation of the metered rates. The comprehensive rate study will determine the strategy to minimize this issue for the City.

- It would seem that a fast-track deployment strategy, along with the geographic and some surgical deployment, will be the least costly approach. This will assist in responding to concerns over the first groups billed on consumption three years before the final group. The City should work closely with its Public Relations Department to inform its customers that by choosing these options, money will be saved over the duration of the project and will assist to gain public acceptance of the program. Jumping around and installing meters using an opportunistic approach to avoid certain areas until last, will likely cost the City more money.

- **Award of a Turnkey Contract –** The size and magnitude of this project would indicate the need for an award of a single contract to a turnkey firm. This will ensure ease of administration for the City and enable the fast-track deployment schedule to be met. The use of a single contract with subcontractors will also resolve the City's concern regarding staffing up for deployment and then needing to relocate staff once installation is complete. This type of contracting is common throughout the U.S .and has been successfully implemented for projects similar in size and schedule demands required by the City.

- **Hire a Program Management Firm –** The City appears to currently have limited resources to be able to effectively manage the deployment on a day to day basis. For that reason, HDR recommends the City employ a Program Management firm to manage the implementation contract for the City. There are several well-qualified service consultants available on the market. Typical responsibilities for program management firms include development of a detailed scope of work with the selected vendor, processing invoices, promptly responding to field issues, and providing an adequate level of inspection during installation, which may include 100% inspection at the beginning and tapering off to 5-10% as the program nears completion. A typical number of staff needed for a project of this size is approximately three. This would be made up of one full-time project manager and two inspectors at the beginning of the project, which would be reduced once inspection tapers off. A qualified firm would require on-site staff, with program management, construction and inspection experience.

  - Even with the hiring of an outside Program Management Firm, the City will still have an extensive project management responsibility and role to interact with the firm, City Council and City customers. The interaction with City customers will be vital to assure acceptance and support of the program. No matter how experienced the installation contractor, or how comprehensive its scope of work, the City will still need an internal project management team to oversee the project. This team would consist of office staff and field inspectors, including vehicles, public relations, purchasing, and legal and consulting expenses.

- HDR has seen program management costs for projects of this size ranging between $800,000 and $1 million or approximately $10.00 additional cost per meter. These costs have been included in the cost models discussed in Chapter 3.

- **Establish a Time-Efficient and Cost-Effective Deployment (Installation) Plan –** Within the procurement process, typically during negotiations, the City will have the opportunity to gain better insight into the deployment plan the selected contractor would recommend. Based upon their experience and observations of the work needed to be completed for the City, the City can work with the Program Manager and the selected contractor to finalize a deployment plan. In the end, the City's deployment plan should be the most time-efficient and cost effective, mindful of any City-specific political issues that may arise.

- **Develop a Public Involvement/Community Outreach Program** – The City will need to develop a public involvement/community outreach program to inform the public of the upcoming project, allow for community involvement in public meetings and announce the progress of the metering project throughout the duration of installation. The City has experts in the area of public outreach and public relations well-suited to develop appropriate communication strategies for the metering project.

- **Gain City Council Approval For the Plan –** Before the City can enter the Bid/Procurement process, the City should have clear support for the meter implementation plan. The City should present this Residential Metering Plan to the City Council with a follow-up workshop to assist with gaining approval. The sooner the City's staff, Council, and water customers get involved, the more informed and supportive they will become.

5.2.3 Bid/RFP Procurement Recommendations

An important step in the meter implementation plan is the bid/procurement process. HDR has recommended the City pursue (request bids/RFP) for both drive-by and fixed network to maximize competition. HDR's specific recommendations for the City's bid/procurement process are as follows:

1. **Obtain bids for both a drive-by and fixed network system.**
2. **Retain outside expertise/assistance for the preparation of the bid/RFP specification documents and bid/RFP review process.**
3. **Create a bid document that is City-specific and helps to maximizes competition.**
4. **Issue bid specification documents to potential vendors.**
5. **Review bids/RFPs and re-evaluate costs of the systems.**
6. **Perform On-Site Testing/Demonstration of Preferred Vendor(s) Technologies.**

A clear and concise Bid/RFP document will be crucial in order for the City to receive suitable proposals to address the City's needs. HDR's rationale and support for the above recommendations are as follows:

- **Obtain Bids For Both Systems –** HDR has noted that both systems, from a cost perspective appear to be relatively equal on a cost basis. However, the cost analysis contained within this report is based upon estimates of the marketplace. Solicited bids/RFPs from a vendor will provide the actual costs and the City will then have a far better understanding of the potential cost differences between these systems. Furthermore, by bidding both a drive-by and fixed network system the City will create competition between the two technologies and between vendors. This will potentially help the City to minimize their costs, or more importantly, to receive greater benefits for a lower price per unit.

- **Retain Outside Expertise/Assistance in the Preparation of the Bid/RFP Specification Documents and Bid Review Process** – Assuming the City will pursue bids from both a drive-by and fixed network system, the City will need to develop a bid document to support those requests. The City has limited experience in developing a bid document for this technology. For that reason, HDR has recommended the City retain outside expertise/assistance to prepare the bid document. The outside expert will be familiar with the procurement process and bid documents associated with metering systems for drive-by and fixed network technologies. This same expert should assist the City in evaluating the bids received.

- **Create City-Specific Bid/RFP Document to Maximize Competition** – The bid document, as developed by the City should be structured to maximize competition. Maximizing competition may include encouraging the vendors to propose on the entire system. This may require the City to abandon an existing metering product before the end of its useful life. Many vendors will want to install their product throughout the system so any meters in place from another vendor will be removed even if they have not reached the end of their useful life. This will ensure consistency in the field, decreasing the maintenance department's need for a variety of inventory and training.

  An example of creating a City specific bid/RFP document is to have bidders investigate the existing pumping stations for accommodating power and support for a fixed network collector system. This may prove to be a cost effective solution if a fixed network system is selected. The City should provide this type of City-specific information as part of the Bid Documents to help vendors prepare proposals.

  HDR has included an example or sample bid document in Appendix F as a part of this report. This is not intended to be the City specific bid document for the City's use, but it provides an excellent overview of the typical components and issues included within this type of bid document. In addition, HDR has included a more detailed discussion of this particular task at Section 5.4.

- **Issue Bid/RFP Documents to Vendors –** Once the bid document is prepared and approved by the City, it should be issued to vendors. The City may pre-qualify certain vendors around certain meter or technology specifications, or simply open up the bid process to all vendors. As has been noted by HDR within this report, the bid and

vendor selection process should stress the value of open architecture. The reading system should be able to read multiple makes of meters, while minimizing RF device inventory requirements.

- **Review Bids and Re-Evaluate Costs –** With assistance from the City's outside expert, the City should evaluate all bids. As a part of the evaluation process for each bid, the City should re-validate all major assumptions contained in the financial model to ensure the new operational structure will support the level of activity projected by the selected AMR technology decision. Prior to selecting a vendor, re-run the financial model using the results of the proposals, and other information gathered in the course of the bid process. In the end, the City should select the AMR technology providing the lowest actual whole life cost of ownership and which provides the major features desired by the City. Factors such as useful life, battery life, warranty coverage and terms, failure rates, ease of maintenance, ease of operation may be more important factors than initial purchase price. Soft cost and non-economic factors may play a key role in the decision making process. These non-economic factors were identified at the end of Chapter 3.
- **Perform On-Site Testing/Demonstration of Preferred Vendor Technologies –** One of the strategies that HDR discussed in this report to minimize the risk of unacceptable performance of a specific technology was to have the final selected vendor(s) provide on-site demonstrations and performance tests. The tests would be conducted under adverse conditions to determine the performance of these products in less than ideal conditions. (See Section 4.4.1)

5.2.4 Implementation/Installation Recommendations

From the bid/procurement process, the City will select a final technology and vendor. At that point, the City will enter the most important phase of the project, the implementation/installation phase. HDR's specific recommendations for the City's implementation/installation process are as follows:

1. **Suspend all investments in manual read meters; move immediately to the selected technology solution.**
2. **Utilize (leverage) the technology offered by AMR as quickly as possible.**
3. **Provide volumetric consumption information to customers as soon as possible.**
4. **Post 2010, avoid converting customers to metered rates in high-bill summer periods.**

A more detailed discussion of each of these recommendations is provided below.

- **Suspend Investments in Manual Read Meters –** As soon as an AMR technology solution decision is made, the City should suspend installation of manual read meters and any further investment in the existing meter reading system. Any needed meter replacements should be completed with a product compatible with the selected AMR technology solution.

- **Utilize (Leverage) the Technology Immediately -** Once an AMR technology solution decision is made, the City should establish a team to identify and implement strategies to maximize this AMR investment. Many opportunities such as leak detection, tamper detection, demand profiling, etc. will present themselves and the City needs to have a mechanism for customer service/billing, meter maintenance, and engineering in place to take advantage of them. The City should not wait until the end of the installation cycle to begin to take advantage of the technology solution selected by the City.
- **Provide Consumption Information to Customers –** Ultimately, metering of customers will lead to the billing of customers on a volumetric basis. One of the challenges for all utilities that convert from a flat rate billing method to a volumetric approach is that customers often do not comprehend how much water they consume on a monthly or annual basis. If the utility waits until it is time to bill the customer on a volumetric basis, the end result will often be exceptionally high bills. The comprehensive rate study will develop an approach to help alleviate a good portion of this issue. However, if the City can provide to the customer their consumption information in advance of when they are finally billed on a volumetric basis, then the customer may have an opportunity to adjust their behavior. Due to the time schedule associated with AB 514 metered billing requirements and installation requirements, it is understood the City will not have enough time to provide this service (information) to all customers. However, those customers whose meters are installed prior to 2010 could certainly benefit from this information. The City has correctly noted it will be impossible to provide this consumption history to all customers prior to being billed on a volumetric basis. All customers who have meters installed after 2010 will have to be billed on a volumetric basis once their meter is in place. HDR is of the opinion and would still recommend that the City give their customers as much information as possible, even if that means that all customers may not have the same opportunity. If the City can provide this information to more than half of their customers prior to being billed on a metered volumetric basis, that is better than not providing any information at all.
- **Timing of Billing Conversions** – Post 2010, the City will need to bill customers on a metered basis once the meter is installed, the meter has been placed into the City's billing system and the meter actually read for the first time. Given that, the City should consider an approach regarding the timing of when these new meters are added into the City's HTE billing system and when the meters are read for the first time. If the City can avoid adding a significant number of meters during the "high bill" summer irrigation period, then the City may be able to minimize the number of high bill complaints for customers billed for the first time on a metered rate. This strategy is certainly not an attempt on the City's part to circumvent the requirements of AB 514, but rather an attempt to work with the City's customers in a positive manner to allow for a smoother transition to a metered rate and bill.

5.2.5 Operation

Testing of the meters is a ongoing maintenance program for most utilities and HDR would recommend the following for the City:

1. **Continue to Perform Sampling Testing of the Existing Residential Meter Population.**
2. **Establish New Meter Testing Protocol.**
3. **Establish Future Meter Testing Protocol.**

- **Continue to Perform Sampling Testing of the Existing Residential Meter Population -** The City's Meter Department performed sample accuracy tests to the existing system residential meters to determine accuracy and potential meter life.. The random testing of meters was based on age and meter location. Since meter type, size and manufacturer are consistent throughout the residential meter population, age was used as the key parameter in the meter accuracy testing program. All meters were Neptune T-10 1-inch residential meters and ages selected for testing were 5, 10, and 15 year periods. Five year accuracy tests-99.64% overall accuracy for all meters tested.

  The net result for this type of meter is that the useful life falls within the AWWA recommended replacement interval of 15-20 years. With continued testing for age groups over 15 years results may prove that useful life may be beyond the 20 year point.

- **Establish New Meter Testing Protocol -** It is recommended the City establish a new meter testing protocol. A statistical sample testing of new meter shipments to verify accuracy and to maintain confidence in manufacturer test results is an efficient cost alternative to testing every new meter. For the City of Fresno approximately one-half to one percent of all new meters should be randomly tested. Based on 81,000 new meters, 405-810 meter would require testing over the four-year installation.

- **Establish Future Meter Testing Protocol -** Whether drive-by or fixed network is selected, the future random sampling/testing for residential meters should continue. As proven from the City's past meter test sampling program, meters can perform accurately for many years, and are generally not economical to repair. The best practices approach to residential meter management is monitor the performance of the meters through a combination of statistical sampling and watching for individual consumption anomalies that could indicate underperforming or stuck meters.

The above recommendations provide HDR's summary of the conclusions and recommendations from the metering plan. This set of recommendations should serve the City well in moving the metering plan forward. To assist in moving the plan forward, HDR has determined and established a list of next steps for the City.

5.3 Next Steps

There are a number of activities and tasks to be undertaken by the City. HDR has reviewed and evaluated these activities and tasks and have organized them into a set of next steps. Provided below is a detailed discussion of the next steps for the City's metering study.

5.3.1 AMR Site Visits

If the City elects to move ahead with full-scale AMR installation, HDR recommends that in lieu of a pilot study, the City's senior staff conduct structured visits at two or three local utilities that have implemented AMR to better understand how these systems function, what is involved in a successful deployment, and how the utilities are coping with integrating the new technology into day-to-day operations. HDR recommends visiting Sacramento Suburban Water because of a recent study they performed on AMR technology. Also Turlock is in the process of procuring meter installation and AMR technology and may have some good insight or lessons learned and product demonstration.

A discussion of lessons learned from the issues other utilities have encountered and the mitigation is outlined at the end of Chapter 4.

5.3.2 Public Involvement/Community Outreach

The installation of meters and billing based on metered consumption will affect every household within the City of Fresno. Therefore, it is imperative to the success of the program to provide a clear and highly informative public involvement and community outreach program prior to and during the implementation of the meter installation program. The following discusses the major components of a successful public involvement/community outreach program. The meter implementation plan is not intended or designed to develop a comprehensive public involvement/community outreach plan. Rather, the meter implementation plan should simply highlight the importance of this task and any key issues that may be foreseen at this time. The City should work closely with its Public Relations representative to more fully develop a program which will be successful.

Items which should, at a minimum, be included in a public involvement/community outreach program are:

- **Announcement of the Metering Program:** This activity should occur in the form of mailers, website, door hangers, newsletter, or flyers included with their bi-monthly water bill. These announcements should communicate the commencement and progress of the meter installation program and keep the public informed of upcoming changes to their water bills. The City should clearly communicate that the metering program is designed to meet certain legal/regulatory requirements, and that the metering program will also provide other significant benefits to the community (enhanced conservation, more equitable rates based upon volumetric use, etc.). This will be especially important as some customers will be billed on a metered basis earlier than others.

- **Working with the Media:** Newspaper and television should be an important component of communicating to the public the City's plan to meet the metering requirements. This is also an excellent method to communicate to the public the process that will be used to install meters over the extended time horizon. As work and installations progress, the City should clearly communicate the progress being made and the near-term plans for future areas of meter installations.
- **City's Website:** The City's website should be used to communicate key information about the metering program, schedule and other important information.
- **Public Meetings:** Public meetings are to be led by City staff and/or an outside facilitator and should include an overview of the metering program, the project timeline and the anticipated order of installations throughout the City. A minimum of two meetings should be held to ensure maximum opportunity for public attendance.
- **Citizens' Advisory Committee:** The Citizens' Advisory Committee will work closely with the City Council to advise or assist in informing the public of the program and to relay comments and information to the Council from the public.
- **Water Meter Installation Hot-Line:** Provide a phone number for customers to call if they have questions or concerns about installations within their neighborhood. The City should designate an individual lead for this task to work with customers in a positive manner and resolve issues within a reasonable timeframe.
- **Notification of Installation:** The City should provide to customers notification of an approximate time when their meter will be installed (e.g., the week of August 23rd – 27th). This notification should occur approximately two weeks before the actual installation. The notification can be provided via a door hanger or a letter to the customer.
- **Consumption Information:** Prior to being billed on a volumetric basis, the customer should have some understanding of the amount of water they are currently consuming. If possible, the customer would ideally be provided, on a bi-monthly billing basis, with their consumption during that time period and how that compared to the average customer. This will enable the consumer to better understand their current consumption levels and manage their water use and be more efficient when metered billing is finally introduced. It is understood only the first groups, pre-2010, will benefit from this service. The City will need to decide if it is beneficial to provide this information for only a portion of its customers. The City should also attempt to flag, within their billing system, any exceptionally high use accounts. This could be a result of a leaking service line, which if repaired prior to being billed on a volumetric basis, could save the customer substantial dollars.

The importance of the City's public involvement/community outreach process cannot be over-stated. Given the importance of this overall effort, the City should consider retaining an outside public relations firm to assist the City in developing the outreach materials and in communicating this program to the public.

5.4 AMR System Procurement

A key task within the meter implementation plan is the preparation of a bid document or request for proposal. This subsection of the report provides a more detailed discussion of the preparation of this important document. As noted previously, a key recommendation of HDR related to this task was the hiring of an outside expert to assist the City with the development of this bid document.

5.4.1.1 Prepare BID/Request for Proposals

In addition to the technical requirements, the Bid/RFP must cover installation scheduling and support, project management, training, acceptance testing, bonding, warranties, vendor support and numerous other provisions.

Sample or model Bid/RFPs for advanced metering systems abound, so the City's Bid/RFP need not be constructed from scratch. However, it is important to note that these Bid/RFPs often reflect a vendor bias or the particular needs of another utility. Therefore, the City should be careful in using the bid documents from other utilities. The City's bid document should reflect the City's specific needs and overall objectives. Provided below is a discussion of typical components of a bid document.

5.4.2 Typical Bid/RFP Document Specifications

To move forward with the meter plan and the installation of meters, the City will need to obtain City Council approval of the drive-by and fixed networks and develop the specific bid documents to proceed. When creating a bid document, the City can clearly state the requirements each vendor must meet (bid on) when responding to the bid. The City should create a document that is detailed and specific to the City's needs and requirements. This section of the report outlines the information typically included in an AMR Bid Document and information included for each bid item. For a detailed example of a Bid Document/Request for Proposal used by similar utilities, please see Appendix F.

The items shown below are typical for an AMR Bid Document, but should not be considered a comprehensive or all inclusive discussion. The City will want to work closely with their Procurement Department to streamline the bidding process. HDR can also work with the City to create a detailed Bid Document that will provide the City with a contract which will enable the City to meet the installation schedule and requirements. In HDR's experience the timeframe from advertising the Bid to the selection of the successful vendor is usually 12 weeks or more.

5.4.3 Bid Document Specifications – Equipment

There are a number of equipment components for the bid document. These include meters, the AMR system, the meter interface unit, the collector system or handhelds, and computers/software. Provided below is a discussion of each of these equipment components.

5.4.3.1 Meters

As discussed previously, the City may want to pre-qualify certain meter manufacturers prior to the actual bidding process. This will enable the City to narrow down the proposals early in the process. The purpose of pre-qualification is to standardize meters in the field for ease of reading and maintenance.

In this section of the bid document, the City can specify the type of meter they wish to receive bids on including, for example, turbine, displacement, piston, etc. The City can also include specifications regarding system compatibility and meeting AWWA standards. Other items that can be listed in the meters section include:

- Encoder-Type Remote Registration System, if the City chooses to use this;
- Design, which can include register interchangeability, tamper resistance, hermetically sealed, leak indicator, or condensation prevention; or
- Low lead meter to meet NSF 61 requirements.

5.4.3.2 AMR System

This section of the bid document can be used to outline the specific requirements for the AMR system. These can include discussion on the number and accuracy of meter readings for all customers, a specific AMR technology (i.e., drive-by and/or fixed network), or the possibility of a hybrid system. Since this plan is only looking at residential metering, HDR is not aware of any situation or reason that might suggest that a hybrid system would be beneficial for the City, from either a cost or operational perspective. Within this section, the City can specify the proposing firms must use well-established AMR vendors (see section 5.4.6) who have for example at least a specified minimum (e.g. three systems) of successful systems piloted or in place nationwide with a minimum of failure rates per 1,000 meters (i.e., 2% failure rate).

The City should address detailed components and the interaction of all components in this section of the Bid Document. The Bid Document should require the proposing firms to describe:

- **Mode of Operation**: Identify the normal mode of operation for obtaining periodic readings.
- **Frequency of Readings**: Describe how often the readings will be obtained and any options for alternative frequencies.
- **System Capacity**: Describe the capacity of each system component, how many readings can be stored and transmitted or received.
- **Read on Demand**: Identify how the system will obtain “off-cycle” readings.
- **Demand Profiling**: Identify how short-interval readings can be obtained to monitor water consumptions patterns.

- **Data Transmission Accuracy and Security**: Describe how the system will ensure data transmission accuracy and security from outside interference.
- **Stored Data System Integrity and Security**: Describe how the system will ensure data integrity and security and protect against data loss.
- **Tamper Detection**: Describe how the system handles tamper detection and notification of potential tampering.
- **Leak Detection**: Identify monitoring of water consumption and indicate any abnormal increases in water consumption.
- **FCC Licenses**: Delineate any licenses required and ensure they are FCC approved.
- **Component Firmware**: Include firmware for all components as part of the overall cost of the project.

The list above is not all inclusive, but has been provided to identify potential items to be included in the Bid Document and the level of detail to be included.

5.4.3.3 Meter Interface Units

The meter interface units (MIUs) are designed to capture meter readings, accumulated consumption, or other information from the meters and transmit to the data collectors. The City can use this section to describe in detail the physical characteristics of the MIU, information provided by the MIU, and programmability. Other items the City can include for bid in this section are:

- **Multiple Meters**: Describe how the MIU will handle multiple meters in close proximity.
- **Batteries**: Type and expected life of the battery. Ease of replacement is also a consideration to be included.
- **Programmability**: Describe the programmability options, features and procedures.
- **Installation**: Describe installation procedures and how the MIU should be mounted in the pit.
- **Interoperability**: State how the City wants the MIU to operate e.g., must be able to read at least two different types of meter registers.

5.4.3.4 Mobile Data Collector and Handhelds (Drive-By Alternative)

If the City selects a mobile drive-by system, the mobile data collector is meant to be mounted in a City vehicle as part of the drive-by system. This section of the Bid Document would describe how the item would be designed to operate from within a City vehicle and how it would communicate with the driver to identify the next meter to be read.

The handhelds are mainly used in a manual or touch read system. But they can also be used in a drive-by or fixed network if there are weak spots in the system where the AMR signal cannot

be received or for final, requested reads or other situations where an individual reading is required. This section of the Bid Document would outline the system functions of the handheld (cradle/data transfer unit, control computer, software), time stamp, out of range warnings, data to be displayed on the handheld, data entry by meter reader, or any comments entered by the meter reader. Other items the City can include for the handhelds are physical durability and characteristics, e.g., size, weight, batteries, keypad, etc.

The City can also request descriptions of route selection and sequencing of the device, data validation and reports the control computer can run. The City can request specific information on the handhelds both for information transmitted and received as well as the functionality and ease of use for the meter reader.

5.4.3.5 Fixed Network Data Collector (Fixed Network Alternative)

If the City decides upon a fixed network system, fixed network data collectors will be required. A fixed network data collector can be mounted on roofs, utility poles, towers, etc. at sufficient density to enable the City to collect readings from all meters in the surrounding area designated for each collector. The City already has a SCADA network set up to monitor the wells throughout the City. This may be a built-in location to mount the fixed network data collectors.

In this section of the Bid Document, the City can require the firms proposing to list the normal mode of operation of the data collector, communication with the control computer, power supply, programming required, etc.

5.4.3.6 AMR Control Computer

The AMR system should have a dedicated control computer. The City can specify within the Bid Document whether this computer should be a PC or a server. The control computer could also receive information from the handheld devices. The City can give specifications for the computer including make and model, memory, configuration and any necessary hardware to be included.

5.4.3.7 AMR System Software

The City can specify the software compatibility with the current City HTE billing system. The software should include interfaces so customer information, meter readings, synchronization of databases, customer service requests, etc. can be transferred. The City should require that all software must be provided with all licenses and maintained by the AMR system vendor over the life of the system. HDR recommends the City work with their IT staff to work out any specifics needed for the interface. The example RFP included in Appendix F includes additional software information the City can include in their Bid Document and how to construct the language for compatibility with their HTE system.

5.4.4 Bid Document Specifications - Training and Support

An important element of the implementation of any AMR system is the ability of staff to effectively and efficiently use the system. To achieve that objective, the City can require the

firms proposing to provide adequate training to enable City staff to effectively operate and maintain the system. This can include workbooks, manuals, experienced instructors, and hands-on training for the staff. The training should be on the actual equipment installed at the City's offices or in the field.

Training can include all aspects of the AMR system's operation including obtaining reads and consumption data, transferring data, changing or adding meters to the system, database management, and installation for future equipment, field diagnostics, and maintenance. The selected firm should also include within their proposal how many hours of training will be provided and for how many City staff.

Support should be in the form of on-site and telephone support as needed by the City over the life of the system. There should be an initial support period of perhaps four years from Notice to Proceed at no additional cost, and an extended support period for up to ten years. In HDR's experience, these are fairly standard support types and time periods.

5.4.5 Bid Document Specifications - Installation and Warranties

A critical element to minimize the City's risk is the terms and conditions associated with the installation and warranties of the meters and AMR system. The Bid Document will specify these two important areas.

5.4.5.1 Installation

Installation involves many different moving parts and therefore should be spelled out clearly in the Bid/RFP Document. The City has a short timeframe to complete all the installations. The ideal scenario for this would be a "turnkey" operation where one firm is selected and responsible for all sub-contractors on the team to complete the installation.

In this section of the Bid Document the City should lay out the timeframe for the project duration. For example, the City may specify the requirement of a complete working installation of all meters and the AMR system within four years from Notice to Proceed, and with a complete working system accuracy of 98+%. The installation sequence should be spelled out clearly so the proposing firms know how many meters need to be installed annually to meet the City's CVP contract milestones. The City should also include a reporting schedule required between the project manager of the selected firm and the City. For example, the City should specify whether meetings take place weekly, bi-weekly, over the phone or face to face. The City should also request and determine, in general terms, the deployment strategy of the firm.

Other items to be considered for the Bid/RFP Document include:

- Installation Acceptance Procedures by the City for each meter and meter box – Standard specification that are required by the City along with any acceptable modification due to AMR technology.
- Payments

- Automated Project Control System to manage the installation information management
- Selected Firm's Subcontractor Staff Requirements
- Items to be Supplied by Subcontractors
- Subcontractors' Vehicles
- Field Communication
- Account Data and Installation Scheduling
- Customer Notification
- Installation Procedures
- Work Order Processing
- Meter Geopositioning – Longitude/Latitude Coordinates. Geopositioning will enable the City to have locations on all meters in their GIS system. By using geopositioning during installation the City will help reporting and inspection efforts along with invoicing. After installation is complete with either a drive-by or a fixed network, the readers will not be visiting the meters on a regular basis and it would be easy to lose a meter on a property. Geopositioning will eliminate this issue and improve on future work order locates. The cost to add the longitude/latitude coordinates into a GIS system is pennies per meter and will clearly label the meters on a map for future maintenance work. It is more cost effective to map the meter during installation versus a later date as there will be labor costs incurred to have a staff member go back out after installation is complete to add the meters to the system.
- Cost for Installation variances including tree roots, concrete driveways, etc.
- Plumbing Irregularities
- Service Line Damage
- Quality Control
- Response to Complaints
- Improper Installations
- Difficult Installs
- Inspections

These items are not a complete list of all items the City needs to consider when creating the Bid/RFP Document. The above list is included in more detail in Appendix F.

5.4.5.2 Warranties

In the Bid/RFP Document, warranties for all components, both meter and AMR, should be spelled out clearly. The proposing firms should be able to meet and guarantee all warranty items in order to be considered for the project.

Warranties should cover the meter registers, all AMR components, and installation work. For each warranty there should be a specific timeframe included. For example, meter registers are normally warranted for at least five years; AMR components other than the MIU, typically have a one year from date of installation warranty including parts and labor, and batteries have a typical warranty of 10 to 20 years. Installation work, including materials, should be guaranteed for one year or until acceptance of the entire project. Industry standard for a project of this size is to warranty until the acceptance of the entire project. Maintenance of the installed system is generally contracted out as part of the warranty. Internal labor for maintenance and operation is typically software and hardware upgrades, along with changing batteries for some AMR system. With the recent advancements in battery life, most AMR vendors will warranty the battery life up to as much as 20 years.

5.4.6 Selection Criteria

Along with the bid documents, it is necessary to develop well defined selection criteria. The selection of a successful vendor will be based upon the submission of a proposal/bid that meets the following criteria. The City, as a part of the development of their Bid Document preparation process will need to develop the specific selection criteria. However, at a minimum the selection criteria should include:

- **Price:** Total present value of initial and on-going costs to acquire, install, operate and maintain the system over 10 years, including any battery and capital replacements.
- **Conformance to Requirements:** Degree to which the proposal meets the technical and business specifications and degree to which the proposal clearly and concisely follows the City's Bid/Request for Proposal. Exceptions will detract from overall rating.
- **Project Management:** Proposed procedures and control systems.
- **Meter Inter-Operability:** The degree to which the proposed AMR system can read different makes and models of water meters.
- **Strength of Vendor:** Financial stability (solvency, revenue growth, projections, and profitability); staffing and facilities installed base (total number of units) for this type of system, ability to acquire bonding and insurance. Includes subcontractors. Typically the vendor receiving the largest percent of the project takes the roll of the prime. In the City's case most of the work will be provided by the installer and then the AMR vendor.
- **References:** Recommendations of purchasers of proposed products and services, particularly similar installed systems.
- **Warranty:** Period and extent of coverage on meters, meter reading system components, MIUs, batteries, etc. Systems and components performance guarantees. Protection in the event of excessive failure.
- **Support:** How the vendor proposes to deliver maintenance support and training. Response modes and times.

- **Ease of Use:** Degree of difficulty for AMR component installation, maintenance, use of software, reporting capabilities, maintenance, and field interrogators.

The above list is not provided in any order of importance. In addition, there may be trade-offs between the various items on this list (e.g., price vs. meter inter-operability, etc.). The City will need to determine the relative priority of each of these items in the Bid Document preparation process and/or evaluation of the bids.

5.5 Contractor Deployment (Installation) Plan

It should be required by the selected Contractor during the negotiation stage, that the preparation of a deployment plan be developed. This plan will be critical to the overall success of the installation phase of the meter implementation plan. The contractor deployment plan helps to define the detailed scope of work to be followed during installation. The deployment plan should cover key areas such as project control and integration with City's other information systems, installation scheduling management, customer and employee communications, project management, process and policy modifications to capture the benefits of the system is recommended. Attention should also be given to align this plan with the City's corporate and customer service strategy.

5.5.1 Selection and Contract Negotiation

As part of the selection process, a vendor pre-bid meeting and site visit should be scheduled and performed. This takes place within a few weeks of advertising and provides answers to any questions that may arise.

Once Bid/RFPs are reviewed, a shortlist of preferred vendors should be scheduled for interviews to meet the key staff involved in the program and present their solutions. At this time, all selection criteria should be weighted carefully in order to select the successful vendor for contract negotiations.

An additional scenario the City is considering is a demonstration from each proposing vendor. This demonstration would require each contractor to install a limited number of meters (20-30) in the system in various types of situations common to the City and demonstrate their accuracy and ease of reads. Situations may include meters installed in backyards, under vehicles, under water, or with sand in the pit. This demonstration will be part of the Bid/RFP Procurement process and will assist the City to make its final decision. Up to 16 weeks may be allotted for the demonstrations.

Contracts for advanced metering systems are typically straight-forward. Most of the performance requirements have been defined in the Bid/RFP and the vendor's response. Contract negotiations usually focus on installation protocols and performance requirements. In addition to the contract itself, which covers legal terms, conditions, obligations, indemnifications, etc., the contractor should create a deployment plan that both parties agree

upon. This plan will be attached to the contract and serve as the "manual of practice" for the parties during the project implementation.

The final step in the contract negotiations will be Council approval. Once the contract is finalized and approved a Notice to Proceed is issued and the installation process begins. This concludes the procurement process.

5.6 Residential Meter Plan Schedule

Figure 5-1 shows the proposed meter plan schedule. There were several assumptions used when creating this schedule:

- The procurement process may take ten to twelve months to complete. This schedule assumes the City will bid one contract for a single, turnkey project. The City will need to work closely with the Procurement Department to ensure the meter installation progress timeframe is met.
- Installation will be done on a fast-track schedule, being completed in four years or less. Having a single contract for the installation will help ensure the four year schedule is met.
- One year of consumption information for the first phases of installations (prior to 2010) would be beneficial for gaining and keeping support in the community for the project. As mentioned before, consumption information will only be available to the first (earliest installation) groups and the City will need to determine if it will be beneficial to provide this information to only a portion of the City. HDR is of the opinion it would be.
- The Council will need to give approval at two different times, once for the approval of the chosen AMR technology (drive-by or fixed network) and again at the award of the installation contract. Keeping the Council informed of City decisions as they happen will assist in obtaining Council approval. The City should also provide periodic reports to the City Council concerning the status of the project and progress to date once installation begins.
- A Project Management firm needs to be brought on shortly before the contract has been awarded. The Project Management firm can assist the City by managing the contract and all subcontractors involved. This will resolve the City's concern regarding a lack of staff to manage the project along with other regular duties.
- The Citizens' Advisory Committee should be brought on prior to the first installations. This Advisory Committee should work closely with the City's Public Relations section to again help with gaining support from the community throughout the project.

Insert Figure/Schedule

Figure 5-1. Implementation Schedule.

5.6.1 Fresno Meter Plan Tasks

If any of the early scheduled items slip, then the project will be pushed close to the final deadline set by the CVP contract and AB 514. There is little leeway in the schedule so the City must work closely with their various sections involved and the City Council to make decisions in a timely manner and keep the project on schedule.

Table 5-1. Implementation Tasks and Dates.

Task	Date
Task 1.0 - Meter Plan Review and Submittal	July 07 through December 10, 07
Task 1.1 – Council Approval	January 31, 07
Task 2.0 – Public Relations Program	Jan 31, 08 – Mar 1, 2013
Task 2.1 – Announce Metering Program & Progress	Jan 31, 08 – Dec 31, 07
Task 2.2 – Work with Media	Jan 31, 08 – March 31, 08
Task 2.3 – Public Meetings	Jan 31, 08 – Dec 31, 08
Task 2.4 – Citizens' Advisory Committee	Jan 31, 08 – Mar 1, 13
Task 2.5 – Water Meter Installation Hotline	Apr 1, 08- Mar 31, 2013
Task 2.6 – Notification of Installation	July 31, 08 – Dec 15, 12
Task 3.0 – AMR Site Visits	Jan 15 – Feb 13, 08
Task 4.0 – Water Rate Study	Sept 30, 07 – April 30, 08
Task 5.0 - Funding Secured	Jan 1, 08
Task 6.0 – Ongoing Meter Maintenance and Testing	Sept 30, 07 – Mar 1, 13
Task 7.0 – AMR System Procurement	Sept 30, 07 – July 31, 08
Task 7.1 – Prepare Bid/RFP Document	Sept 30 – Oct 31, 07
Task 7.2 – Draft Implementation Plan	Oct 31, 07 – Jan 1, 08
Task 7.3 – Advertise Bid/RFP	Nov 15, 07
Task 7.4 - Pre-Proposal Meeting	Dec 1, 07
Task 7.5 – Bid/RFP Due	Jan 1, 08
Task 7.6 – Evaluate Bid/RFP, Shortlist and Interview	Jan 1, 08 – Feb 8, 08
Task 7.7 – Select and Perform Demonstration by Proposing Firms	Feb 8, 08 - May 31, 08
Task 7.8 – Select and Negotiate Contract	May 31, 08 – June 30, 08
Task 7.9 – Execute Contract & Issue NTP	July 31, 08
Task 8.0 – Program Management Selection	April 15, 08 – May 31, 08
Task 8.1 – Select and Negotiate Contract	April 15,08 – May 15 , 08
Task 8.2 – Execute Contract & Issue NTP	May 31, 08
Task 9.0 – Installation	July 31, 08 – Mar 1, 13
Task 9.1 – Group 1 Installation (29%, 31,600 meters)	July 31, 08 – Dec 31, 08
Task 9.2 – Training for Water Department Staff	Aug 31, 08 – May 31, 09
Task 9.3 – Draft Rate Ordinance	Dec 31, 08
Task 9.4 – Progress Report to Bureau	Jan 1, 09
Task 9.5 – Meter Reading Data Scrub and Testing	Aug 31 – Dec 31, 08
Task 9.6 – Develop Work Flow Process & Procedures Water Dept Staff	Aug 31, 08 – Jun 1, 09
Task 9.7 – Group 2 Installation (43%, 46,900 meters)	Jan 1, 09 – Dec 31, 09
Task 9.8 – Progress Report to Bureau	Jan 1, 10
Task 9.9 – Impose Rate Ordinance	Mar 1, 10

Task	Date
Task 9.10 – Group 3 Installation (62%, 67,600 meters)	Jan 1, 10 – Dec 31, 10
Task 9.11 – Progress Report to Bureau	Jan 1, 11
Task 9.12 – Group 4 Installation (81%, 88,300 meters)	Jan 1 – Dec 31, 11
Task 9.13 – Progress Report to Bureau	Jan 1, 12
Task 9.14 – Group 5 Installation (100%, 105,000 meters)	Jan 1 – Dec 31, 12
Task 9.15 – Compliance Report to Bureau	Jan 1, 12
Task 9.16 – Extended Support Service	Apr 1, 08 – Mar 1, 13
Task 10.0 – Consumption Information with Customers Bills	Jan 1, 09 – Dec 31, 12
Task 10.1 – Group 1 Consumption Information	Jan 1 – Dec 31, 09
Task 10.2 – Group 2 Consumption Information	Jan 1 - Dec 31, 09
Task 10.3 – Group 3 Consumption Information	Jan 1 – Dec 31, 10
Task 10.4 – Group 4 Consumption Information	Jan 1 – Dec 31, 11
Task 10.5 – Group 5 Consumption Information	Jan 1 – Dec 31, 12
Task 11.0 – Commence Metered Billing	Jan 1, 10 – Jan 1, 13
Task 11.1 – Group 1 Metered Billing	Jan 1, 10
Task 11.2 – Group 2 Metered Billing	Jan 1, 10
Task 11.3 – Group 3 Metered Billing	Jan 1, 11
Task 11.4 – Group 4 Metered Billing	Jan 1, 12
Task 11.5 – Group 5 Metered Billing	Jan 1, 13

5.7 Summary

This meter implementation plan has provide a set of observations and recommendations to the City of Fresno to select and install an automated meter reading technology, while meeting the requirements of AB 514 and the CVP contract. This meter implementation plan should be used to manage the variety of steps and tasks that will be undertaken over the next five years.

Appendix A

City of Fresno Staff Interviews

Appendix A.

Issues, Concerns and Requests from Key City Interviews
March 6-7, 2007

Cost Justification:

- Cost analysis/cost benefits of the project will determine what level of program is adopted.
  - Cost AMR system vs. manual vs. mobile
  - What is the payback of each alternative?
- Cost is a large issue to selling the program to the mayor and council.
- Cost benefit analysis needed for each alternative to go out to bid based on the decision. Which makes more sense for the City long-term?
- Justification is needed for why this is a City-wide improvement and everyone needs to contribute.
  - Is the meter a system wide benefit? What components are system-wide vs. what are individual?
- How is the City going to pay for the program, rate increase or separate meter installation charge?
- Repayment strategy: system-wide benefit vs. individual cost and payment plan.

Bidding of Program:

- Create a bid spec that is flexible enough to take into consideration all the uncertainties that arise in the field (i.e., tree roots, meters falling in concrete driveways, etc.).
- Possibly add to the contract/bid retrofit or replacement of existing meters.
- Open up bidding vs. sole source to be more competitive.
- Possibly bid the whole project, including replacement of 20,000 meters currently in the ground. Once the contract is won, rewrite the City standard so this meter will be the only type used.
- Possibly pre-qualify a meter brand prior to bidding. Build a performance spec around pre-qualified meter brand.
- Consider the possibility of open architecture bidding.
- Custom-build the contract to guarantee the first portion of the contract and if satisfied with the performance, award the second phase.

Staffing:

- Staffing issues for all departments need to be addressed (metering, customer service, billing, IT).
- Concerns about losing staff or integration into other departments once implementation complete.

Collaboration:

- Possible collaboration with PG&E. (HDR possibly attend with City to approach PG&E). Issues to consider: Who has control of the data, who sets the price?
- Some reduction in infrastructure may be possible as the City owns all the property at their wells and has telemetry set up under a licensed radio SCADA with four towers through town. The City can build a wi-fi backbone.
- Police and fire are going to a wi-fi system, perhaps piggyback onto their system.

Compatibility:

Field

- Standardize the size of meters and fees (change the master fee schedule). No more new ¾" meters in the ground, replace all with 1" meters.
- System/equipment uniformity: curb height, type of lid, location, other private utility districts annexed into the City, etc.

Office

- Eliminate as much manual processing as possible for error reduction on billing. Currently, the City has a 15 year old HTE billing system.
- Plan ahead to make the best decision that is going to be the most viable into the future, not just the cheapest now. Include AMR in the study to show what the City may be cutting out. The flow of information would help them to make the read faster.
- Would like to see compatibility between billing, customer service, meter maintenance, GIS and work order system (CIS).
- Information sharing and information format (paper vs. electronic) needs to be addressed.
- Can the current HTE system be upgraded to be compatible with new technology?

Installation:

- Retrofit vs. replacement of older meters (old County Island system that was annexed in). Newer meters being installed have the capability to add on AMR later.
- Possibly breaking the overall project into manageable parts, to get a firm handle on the logistics. Program management of the project: if can be set up as one project, plan for that.
  - Possibly 3-4 separate contracts for the project (procurement, installation, etc.) vs. one turnkey program. Look at the justification for both sides, especially if financing needs to be adjusted. Currently, financing is set up for 3-4 contracts under 2 bonds (2008 and 2012).
  - Progress will determine how the project is bid.
- Installation timeline is an issue. Drive the value of bidding the whole project at once (economy of scale) vs. several projects over time. When to begin the metered billing?
- Program Manager hired for this project must be experienced in this level of project scope and schedule.
- Fast track 18 months to 2 year program installation.
- Installation needs to be handled in an even-handed manner, start in various areas not from one end of the City to the other.
- Interface with the customers during installation process.

Political/Regulatory Issues:

- Pilot programs currently in place.
- Process and public relations are key issues for the communication of the project internally and externally.
- Federal vs. State requirements
- Who are decision makers for this program? The decision makers need to buy-in on the program.

Technology Selection:

- Would like to see the City to on the cutting edge and no longer left behind with newer technologies. Other utilities are moving into AMR and Fresno is just moving into meters for all.
- AMR makes the most sense for a City this size. If the City has to go to a mobile system, it should be able to retrofit to a fixed system.
- They are hoping to end up with a fixed system. Does the City have the money and is a fixed system sellable? The City should at least go to a mobile system.
- How are the meters going to be read? Fixed system would be the way to go, but unsure if the City can afford to go that route.

Information Wanted from System:

- A lot of information from the meter program (readings) should be collected. A higher flow of information would be used.
- Data wanted from the system: leak detection, reverse flows, consumption data.
- Extra information/fixed system will be beneficial to the City.

Program Implementation:

- The City would like to be more pro-active with the meter program. Older meters from previous water systems and poorly installed meters need to be replaced.
- How to spread the costs for the program? If people have meters, they feel they shouldn't be paying for the new meter program. Installation of meters is to the benefit of everyone in the system, improved flows, increased reliability of delivery, pressure is stabilized. In the future the existing meters will be replaced to match the current system. The program continues beyond installation.
- How to handle lag time between installation of meter and actually billing the customer flat rate vs. meter billed?
- The City needs to proactively engage the dual billing system. See what the current rate vs. the metered rate would be. Implement as soon as possible.
    - Possibly one year of showing consumption and billing flat rate, then go to meter billing.

Conservation: - This in an ancillary benefit that may come out of the program

- Future water supply issues.
- Leak detection capabilities.
- Consumption patterns.

Appendix B

Langham Consulting Report

LANGHAM CONSULTING SERVICES, INC.
2240 Monroe St., Mandeville , LA 70488

September 13, 2007

Mr. Mark Hughson
Project Manager
City of Fresno
Department of Public Utilities
Water Division- Technical Services
1910 East University
Fresno, California 93703-2988

Dear Mr. Hughson:

Langham Consulting Services, Inc. (Langham) was retained by the City of Fresno (City) to provide a review of the perceived impacts, risks and limitations of the implementation of an AMR system to the City's current Customer Information System (CIS) HTE. This report has been prepared as a result of a broader effort on the City's part to develop a meter implementation plan.

Langham based the content of this report on a series of discovery meetings conducted on-site at Fresno City Hall on August 21, 2007. Drawing on our industry expertise in AMR and CIS implementations, we examined the impacts to both the HTE application and existing business operations of an AMR implementation. We considered these impacts from the perspective of both a fixed and mobile AMR solution.

In brief, we conclude that the proposed "minimal integration" of AMR with HTE is actually the typical method of integrating these two systems, and therefore the limitations of such integration are minimal. The reason for this is straight forward: the key function of CIS systems does not include the storage of interval data and therefore only the information required to charge and bill the customer is required. Should the utility or customer require access to that data, the AMR system itself is considered the system of record. Where the storage of interval data is a requirement (for example in the power markets where real-time-pricing is often offered to the customer), complex billing systems are available that are tightly integrated with the CIS.

We also concluded that the most significant impacts and risks to the City of the AMR implementation were related to changes in customer behavior and business process, rather than in the technical integration of the two systems. For example, the risk of having a call center that will encounter an increased number of calls which they may not be equipped to answer (and the obvious effects that may have on customer relations, call abandonment rates and data quality) in our opinion, far outweighs that of implementing an interface with a new meter reading system.
In addition to identifying risks, we recommend mitigation plans. Some mitigation plans include further changes to the HTE system such as the automation of loading new inventory and switching a customer's account from flat rate billing to new consumption based rates. We weighed these recommendations against the alternatives and the risks they imply: performing these tasks manually in our opinion carries far greater risk from both the perspective of overburdening existing staff and possible human error than the automation of the process.

I'd like to take this opportunity to thank you for your business and commend you on the decision to proceed with this project with eyes wide open. We recommend that this subject matter is

continually reviewed and refined as more is known about the technology that will be selected, the logistics of the deployment and the rate structure that will be recommended by HDR Engineering, Inc.

Please don't hesitate to contact me if you require further explanation or clarification.

Sincerely,

Tim Almond, Vice President
Langham Consulting,
1943 Davina Street,
Henderson, NV 89074
(702) 278-4302
Web: www.LanghamConsulting.NET
eMail: TAlmond@LanghamConsulting.NET

AMR Implementation Impact Analysis on the City of Fresno's Business and Application Processes

1.0 Introduction

The City of Fresno (City) is in the process of planning for the installation of residential meters. The City has an array of meter reading technology choices which may be implemented. A concern of the City is the ability of the City to integrate these meter reading technologies into the City's customer service information (CIS) system. The City currently has an HTE system. To better understand the potential issues associated with this integration, Langham Consulting Services, Inc. (Langham) was retained by the City of Fresno to explore this issue.

Currently, the City's 105,000 residential customers are billed for water and wastewater using a flat rate (unmeasured billing). 24,000 commercial and industrial accounts are billed for water and wastewater using consumption based rates where a meter is installed and read for those accounts. It is the City's intent to install a meter at each property. At this time, it appears that those meters will be read using either a fixed network or drive-by AMR system and the readings gathered will be used to bill customers. This report examines the impacts of such a change in terms of both the technical integration required between the AMR system and the City's Customer Information System (HTE CIS) and business process changes required.

Langham, experts in both CIS and AMR systems, conducted this impact analysis, based on a series of meetings with subject matter experts from the City's IT and business departments and with the City's AMR selection committee, on-site at Fresno City Hall on August 21, 2007.

2.0 Overview of the Objectives of the Study

Langham's review of the City's CIS system was intended to determine the extent that the City's system would integrate and support the AMR solutions that the City is considering. To that end, the City specifically requested that Langham provide the following services:

- ✓ A summary of risks and suggested mitigation plans in performing such an integration;
- ✓ A list, with descriptions of technical modifications and changes in business processes required in order to support a *minimal* integration of AMR with HTE. That is, to support the import of meter readings into HTE for the purposes of bi-monthly consumption based billing for water and waste water;
- ✓ A descriptive list of limitations in terms of system functionality, customer service or best practice, etc that may occur as a result of either a simplistic integration or as a result of limitations within the HTE CIS itself;
- ✓ A summary of costs that could be used for budgetary purposes related to any technical modifications required.

To help the City better understand their overall CIS system, a background discussion has been also provided which lists or describes the following:

- ✓ The systems utilized by the City that are pertinent to this study;

- ✓ A high level description of the Utility Billing and Collections (UB&C) departmental structure;
- ✓ The current revenue cycle business process;
- ✓ The typical operation of HTE with AMR (given a minimal integration).

This report has been organized to address the specific objectives identified above.

3.0 Background Discussion of the City's CIS System

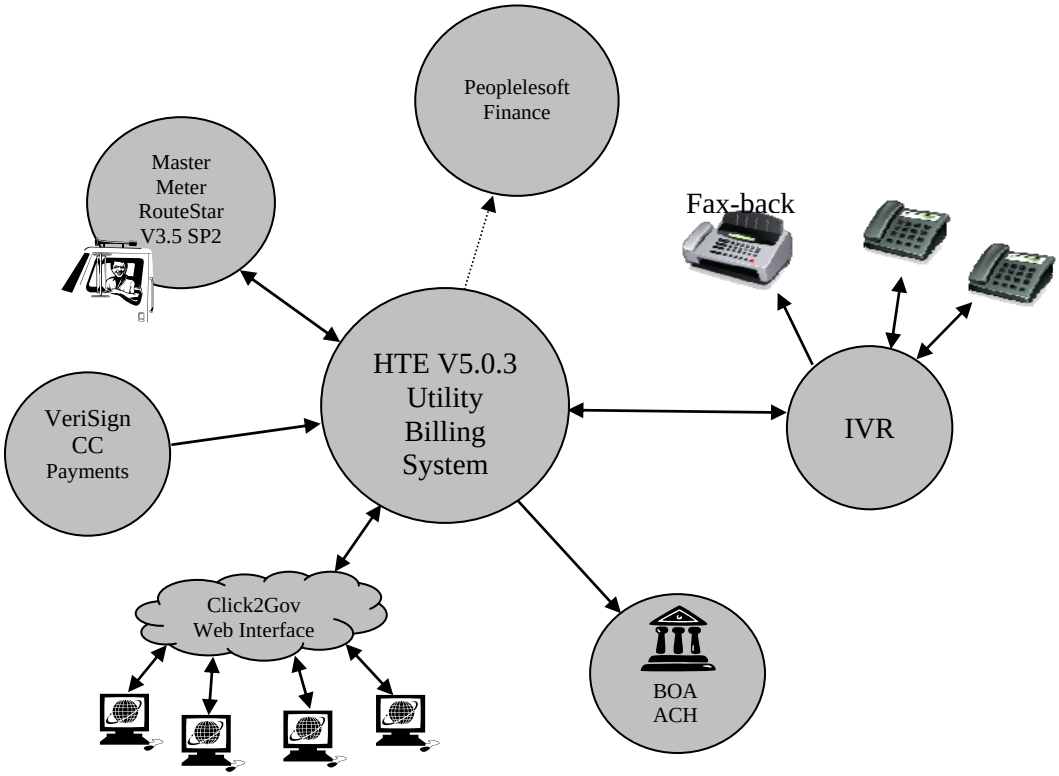
To better understand the City's current CIS system, a brief discussion and description of that system has been provided. This overview and description is not intended to be an in-depth description or analysis of the City's current or future operation.

3.1 Systems Utilized

The City's current systems being utilized are as follows:

Customer Information System:	HTE V 5.0.3
Meter Reading System:	RouteStar V 3.5 SP2 (from MasterMeter)
Service Order:	HTE's standard service order functionality
Cashiering:	HTE's CR cash receipting system
ACH:	Bank of America (BoA)
Asset Management:	Hansen (no active interface)
Finance:	Peoplesoft (manual JV's are posted)

The following context diagram shows the relationships and data flows (a solid line denotes an electronic interface, a dashed line denotes a manual interface) between these systems:



3.2 Utility Billing and Customer Service Departmental Structure

The primary users of the HTE system and the Departments primarily affected by the proposed AMR implementation project are:

- ✓ Meter Reading Staff : 12
- ✓ Field Service Staff : 11 (5 certified for backflow work)
- ✓ Customer Service Staff: responsible for call taking and front desk work (accepting payments, start/stops, inquiries, etc.): 20 CSRs at City Hall, 4 CSRs at the Manchester Center.

3.3 Current Business Process

The following is Langham's understanding, at a high level, of the City's revenue cycle.

- 105,000 residential customers are billed bi-monthly using a flat rate for water and wastewater.
- 24,000 residential customers already have meters installed but these are not currently read and may be replaced as part of the AMR implementation (to be determined in the bid/procurement process);
- 24,000 C&I customers are also billed bi-monthly using actual reads from meters installed at the customer's property;
- A small number of C&I customers have flow meters. These meters are manually read and effluent is calculated and billed manually outside of the HTE system;
- All accounts fall into one of four cycles.
- For C&I accounts:
  - ✓ All meters in a cycle are downloaded every other week to the RouteStar meter reading system;
  - ✓ Meter readers schedule the reading of routes within the cycle using the RouteStar software;
  - ✓ Meters are read over the following week with individual (or partial) routes being uploaded through RouteStar to HTE on a daily basis;
  - ✓ Customer Service processes meter reading exceptions such as missed reads, high-low exceptions on a daily basis using HTE to issue service orders for additional work (such as re-reads) to be performed in the field;
- The bill currently shows single line items for sewer and water although these charges have a number of components that are not printed on the bill such as fluoridation, property square footage and air conditioning;
- Bills are typically produced every other Friday (thus the four billing cycles in a bi-monthly period);
- The Call Center typically deals with 450 calls per day although this peaks on Mondays at between 650 and 750 calls;
- Seasonal variances are small – a rise of perhaps 100 calls per day during summer months, caused mainly as a result of increased move-ins / move-outs;
- Payments are made through various methods and tender types: web, phone, drop-box, ACH, over-the counter payments are all available to customers;

- Payment plans, payment arrangements or monthly budget payments are not currently available;
- Collections processing:
  - ✓ First notice 25 days after the bill date;
  - ✓ Intent to disconnect notice 7 days after first notice;
  - ✓ Shut off 48 hours+ after intent to disconnect;
  - ✓ Lien processing may follow.

Other significant items noted were as follows:

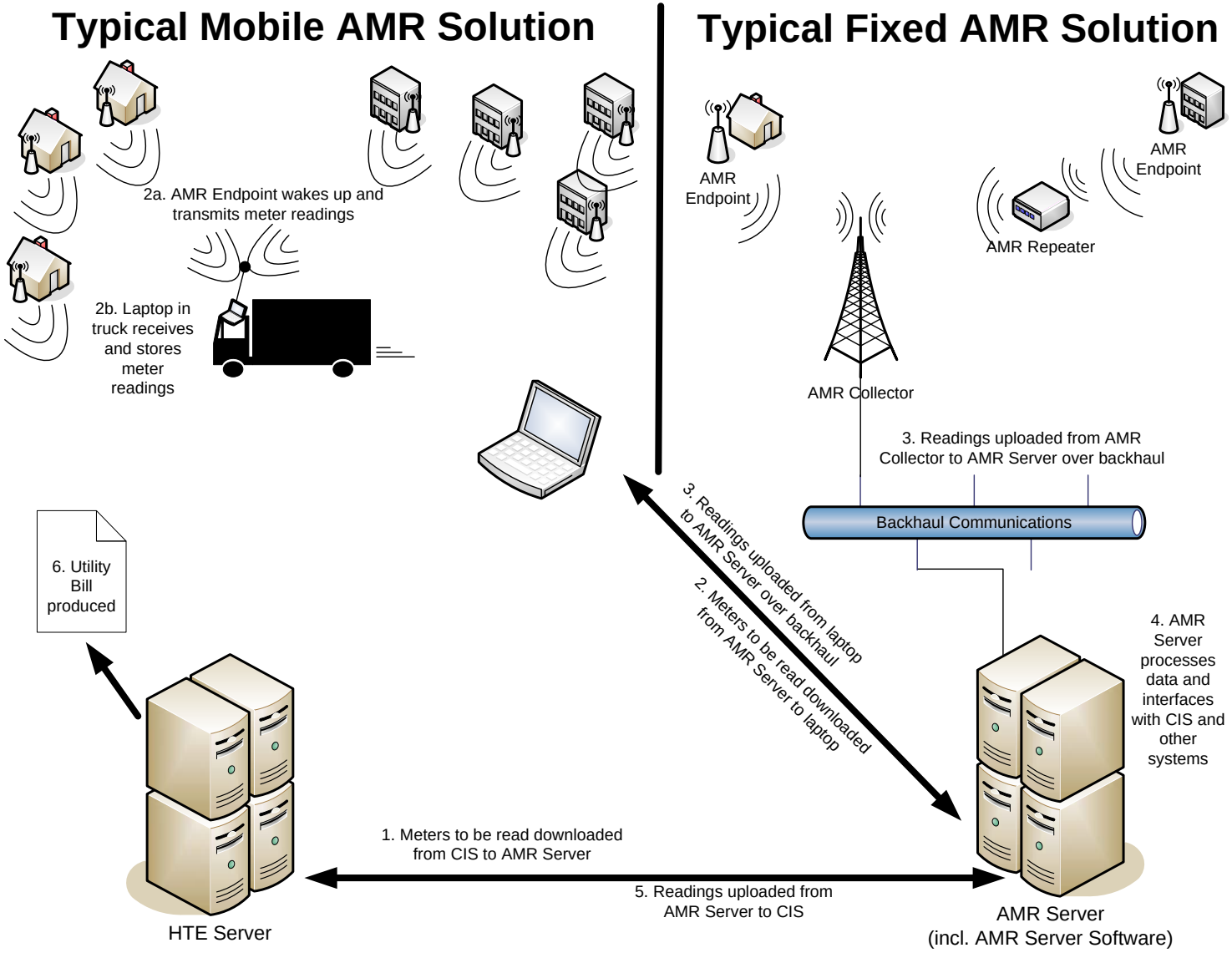
- Financial transactions (billings, payments, etc) are posted to Peoplesoft Finance via a manual journal entry on a monthly basis.
- Deposits are taken for all accounts unless the customer has a previous good payment history with the City or can provide a recent good credit report (letters of credit may also be accepted according to the municipal code, although this is not common practice);
- The City utilizes both Web (known as Click2Gov) and IVR self service features to assist customers with account information inquiries such as account balance and payment and consumption history information (which may be delivered via fax-back) and to make payments via credit card;
- CRA checks and referrals will probably be adopted in the near future;
- Special programs give seniors a discount on water and sewer rates;
- Low flow toilet rebates are offered (although not billed through HTE).

4.0 Typical Operating Processes (HTE with AMR)

This section describes the typical operation of HTE with an AMR system and assumes a minimal integration between HTE and AMR.[1] Where the operation differs, dependent on the AMR technology chosen (Fixed Network or Mobile Drive-By), this is highlighted.

Provided on the next page is a diagram overview of these two AMR systems and their integration into the CIS:

[1] Minimal, as used herein, refers to the ability to support the import of meter readings into HTE for the purposes of bi-monthly consumption based billing for water and waste water


Typical Mobile AMR Solution
Typical Fixed AMR Solution
2a. AMR Endpoint wakes up and transmits meter readings
2b. Laptop in truck receives and stores meter readings
AMR Endpoint
AMR Repeater
AMR Endpoint
AMR Collector
3. Readings uploaded from AMR Collector to AMR Server over backhaul
Backhaul Communications
3. Readings uploaded from laptop to AMR Server over backhaul
2. Meters to be read downloaded from AMR Server to laptop
6. Utility Bill produced
4. AMR Server processes data and interfaces with CIS and other systems
1. Meters to be read downloaded from CIS to AMR Server
5. Readings uploaded from AMR Server to CIS
HTE Server
AMR Server
(incl. AMR Server Software)

In order to use consumption based information to bill customers, HTE may accept meter readings via two different methods. First, meter readings may be manually entered directly into the meter reading screen of the HTE application. Second, meter readings may be imported using an interface that accepts a formatted flat file which is then processed by an upload program in HTE. The use of multiple interfaces, where source data comes from different meter reading systems, is possible.

HTE produces (via a batch process) a download file of meters that should be read according to a reading schedule stored within the rules established in HTE. The reading schedule is typically synchronized to the billing schedule. For example, if the system expects to bill a given customer on Monday, August 20, 2007, the download file produced by HTE on August 15 will contain an instruction to read that meter.

Regardless of the technology used to read the meter, this "download" (UTDWNLOAD) is required; it not only informs the meter reading system that a read is expected but flags the meter in HTE as having a read pending.

As the date of the bill approaches, meter readings are uploaded to HTE using batch processing (UTUPLOAD) which imports a flat file containing meter readings (upload file). This typically occurs on a daily basis as billing typically occurs on a daily basis. Although some utilities, such as the City, still produce bills on a weekly schedule. Utilities may also bill on a bi-weekly or monthly basis and schedule other events such as meter reading, cut-offs and delinquency processes around the billing schedule.

- For both manually read (probe read AMR) and drive-by/walk-by (mobile AMR) systems:

  Having received the download file, the meter reading system processes the information and creates a schedule for each meter reader, in the sequence the meters should be read (route by route, meter by meter).

  Meter readers use either a laptop (mounted in the cab of a truck) or a handheld device (which is basically a modified PDA) to read the meter. At the start of each work day, a meter reader will interface their reading device with the meter reading system server. The system will load onto that device the list of meters to be read. Mobile AMR systems typically have sophisticated mapping software that uses GPS to show the meter reader in real-time where on the route he/she is and whether or not the meter was successfully read as the route is driven or walked. At the end of the work day, the device is again interfaced with the meter reading system server. The meter readings captured and additional information such as comments entered by the meter reader or alerts raised by the meter/AMR endpoint are then uploaded to the meter reading system.

  A process in the meter reading system is run that extracts meter readings (and additional information) obtained that day, preparing an "upload" file that feeds HTE's upload process.

  HTE processes the upload file and may raise exceptions based on additional information or high-low tolerances configured in HTE. The result may be that the meter must be manually read or serviced in order to obtain a good read for billing (a service order will be issued through HTE to accommodate this).

- For fixed network technologies:

  Fixed networks obtain meter readings without having to visit the meter. The AMR endpoint can be configured to transmit meter readings as frequently as 5 minute intervals (for water systems). As the AMR endpoint is battery powered, many utilities tend to take readings between 1-4 times a day to conserve battery life, unless the customer is a key account such as large manufacturing plant that might require interval read data in order to manage their consumption. Meter readings are delivered via a backhaul network to the meter reading system server. Other data may accompany the reading such as alerts to the utility indicating tampering, low battery life or backflow.

  The volume of data collected by a fixed network is typically 20 to 80 times that of a mobile system, based on one to four readings per day. However, from the perspective of the CIS, only the most recent read is required to provide accurate billing. Therefore the process run to prepare the flat file to be fed to HTE is based on the latest good read for all meters in a given download file.

  Given a typical frequency of one reading per day versus a billing cycle of one bill every two months, it is unlikely (unless the utility is ignoring missed reads or AMR alerts) that there is not a good meter read to use for billing. Therefore, the upload file can be produced the same day as the download file and the period between this upload and the billing process can also be shortened to a matter of hours.

HTE's billing process essentially consists of two basic steps. First, the charges that will appear on the bill are calculated. Consumption is calculated by subtracting the last billed read from the current read (allowing for any roll-over of the meter's register). Rate structures stored in HTE determine the way in which these charges are calculated for both water and wastewater. If HTE detects a problem in the calculation, a billing exception will be generated by the system that must be resolved before that customer's account can bill. For example, if a read is missing, an estimate may be generated by the system, entered by a user or a service order may be issued in order to get a reading from the field. The second step is the formatting and printing of the bill itself which can be achieved either by the HTE application itself (producing a standard bill which is very basic in appearance) or through 3rd party formatting software (where a more sophisticated appearance is available).

5.0 Technical Modifications & Business Process Reengineering

One of the initial objectives or task of this review was to provide a list, with descriptions of technical modifications and changes in business processes required in order to support a minimal integration of AMR with HTE. That is, what changes are needed to support the import of meter readings into HTE for the purposes of bi-monthly consumption based billing for water and wastewater. This section of the report provides a detailed list of the modifications identified by Langham.

5.1 Modifications Needed

Langham has reviewed the City's current system and contemplated AMR system. Based upon that review, the following recommendations are made concerning any needed modifications in hardware/software or business processes.

Modification #1; HTE Configuration Data Changes

Requirement

This requirement deals with the data configuration changes that must occur in HTE to accommodate billing an account on a consumption-based rate, when the rate is currently billed as a flat rate customer.

1. **Definition of new cycles and routes.**

   For a mobile drive-by AMR system, the route plays a role in not just the billing but in the logistics and scheduling of meter readers that drive the routes. For a fixed system, the route will drive which meters HTE requires a meter reading for and is therefore organized by the billing schedule.

2. **Configuration of new rate structures;**

   The system must be configured and updated as the new rate structure is adopted and implemented.

Effort

There are several methods to accomplish this:

- ✓ Write a program to automatically populate the route and sequence # based on the billing cycle. *Recommended option.*
- ✓ Use specialist software (not currently owned by the City) to plan and assign routed automatically. *Should not be considered unless a mobile AMR solution is chosen.*
- ✓ Manually enter routes for all customers' meters. *Not recommended: Very labor intensive.*
- ✓ The effort to configure new rate structures is minimal. The association of these rates is covered in Modification #2.

Modification #2; HTE Operational Data Changes

Requirement

This requirement deals with the operational data changes that must occur in HTE to accommodate billing an account that is currently billed using a flat rate, but will be billed using a consumption-based rate as a result of the AMR implementation:

1. **Installation of new inventory and association of new inventory with an account**;

   This requirement is specified in an HTE SCR that addresses CASE #345664. Langham recommends considering the following modifications to CASE #345664

   - ✓ Consider capturing GPS coordinates of equipment at the time of installation. This can be particularly useful to find meters if a fixed AMR system is utilized.
   - ✓ Make the addition of meter manufacturer mandatory. Since manufacturers offer different warranties, this may be useful in the future to determine which meters to

replace as part of a replacement program [Note: This observation should not be construed as a recommendation by Langham for the purchase or installation of meters or systems from multiple manufacturers.]

- ✓ Ensure that the AMR device (if a separate device is chosen as the solution) is captured and stored as an associated device.

2. **Association of new rates with accounts;**

   Having reviewed CASE #345664, it appears that through the creation of the location/service record, the new rate will be associated with the account.

   - ✓ Langham recommends that the City verify that this requirement is covered in CASE #345664.

Effort

According to the SCR response from HTE: $18,000.

Modification #3; New HTE AMR Interface

Requirement

All mainstream AMR companies have existing interfaces with HTE and have experience of working with CIS vendors in the integration of the two products.

In a metered system, the billing of a customers account must have up-to-date consumption information from the meter(s) associated with the account. The majority of CIS systems (including HTE) use a simple two way interface between the CIS and the meter reading system (a download file is produced and an upload file is accepted). The download file is produced by a batch job that takes a series of meter route numbers as parameters. Each route number has a number of meters associated with it in HTE's inventory and it is those meters that appear in the download file, and when processed by the meter reading system, will be marked as read.

This process holds true whether using manual readings, fixed or mobile drive-by AMR readings. HTE does not care what the source of the meter reading is.

It should be noted that this same process is currently employed in order to obtain meter readings for the City's commercial and industrial (C&I) accounts through MasterMeter's RouteStar system.

This modification is to provide a *new* interface, similar to the one currently working with RouteStar. This new interface and the RouteStar interface must be able to operate concurrently (during the AMR implementation, meter readings will be accepted from both systems). HTE does support this configuration, providing the same meter does not appear in more than one download or upload file (refer to risks section).

In Langham's opinion, this constitutes the minimum requirement in order to support the current and proposed utility business operations of the City.

Effort

HTE has a great deal of experience interfacing with different meter reading systems. HTE has a library of standard interfaces and interfaces they have customized for other

customers. It is therefore highly likely that they will not have to write from scratch an interface for the City (providing the City selects a mainstream AMR vendor). Rather, the City will be able to use an existing customized or standard interface as a starting point. The effort involved in customizing such an interface is typically in the region of 150 hours.

Modification #4; AMR Customer Web Interface

Requirement

For Fixed AMR systems, interval data (at a frequency to be determined by the City) can be made available to utility customers through the City's web portal.

This may reduce the number of incoming calls regarding high bill complaints and consumption inquiries, but is also good practice in an environment where water conservation is encouraged. It will also prove to be a helpful tool to a customer service representative trying to deal with a high bill complaint. In addition, it may also be a useful tool for larger commercial and industrial customers that need to monitor their consumption closely.

Effort

All AMR systems are delivered with a number of canned reports that can be published easily via the intranet or internet. At this point, an estimate of effort is not possible other than to say that if a canned report *is* available, providing ITS have the requisite web skills, the effort in publishing such a report should be less than 8 hours.

Business Process Change #1; Change in Policy/Approach for Reading Exceptions

Currently, the City downloads an entire bill cycle to the meter reading system. The meter readers themselves schedule the order in which they read the routes, sometimes only completing partial routes. As meter readers upload their reads on a daily basis, this makes managing the workload of the Customer Service function that deals with billing and meter reading exceptions very unpredictable.

For consumption billing with a fixed network, this policy will obviously become redundant in the long-term as there will be no human involvement in taking readings. For drive-by systems, where tens of thousands of meter readings need to be synchronized with billing (regardless of whether billing remains bi-weekly or if the City moves to daily billings) the scheduling of when routes are driven must be controlled by the billing system to avoid missed readings and to create a predictable environment for the staff that has to deal with meter reading and billing exceptions.

Business Process Change #2

Refer to the discussion of "Risk" items 2, 6 & 7. Review / Establish process, procedures and policies (3 P's) for the following areas and train staff accordingly:

Customer Service: The number and nature of calls and transactions handled by the call center will change as more customers are switched to a consumption-based rate. To maintain current customer service levels, benchmarks are required now in order to recognize and therefore forecast changes in resources and/or structure that need to occur in the future. Establish service levels within Customer Service that measure at a minimum: Average Wait Time and Abandonment Rate. This will measure the effect of increases in call volumes. In addition, consider measuring response time for web requests (start and stop service) and Average call Handling Time (AHT). This will measure the effects of potentially more complex transactions / effectiveness of CSR in dealing with this.

Consider establishing a specialist group within the call center that deal with complex billing issues. The largest increase of transactions handled by the call center will be in bill inquiries. As staff turnover is high and the average system and business knowledge is correspondingly low, many CSR's may struggle to explain complex billing issues to customers. The routing of calls to this group could be accomplished by either introducing a new "bill inquiry" option in the IVR or can be achieved through call escalation from a CSR to this group.

Finance & Accounting: Langham recommends reviewing the current C&C policies and procedures. Thresholds for assessing collection actions and the calculation of penalties should be revisited based on a risk that the incidence of delinquent accounts will increase with consumption-based billing. Also, the practice of allowing payment plans/ payment arrangements and budgeted payments should be reviewed in order to ease the transition for customers experiencing genuine hardship.

In addition, Langham recommend that procedures and policies should be considered for the following issues that will arise:

- ✓ **Accruals**. Many utilities measure sales against revenue, making a journal adjustment at the end of each month for "unbilled revenue." This is because water flowing into the system is an expense, yet water flowing out of the system (consumed by the customer) is typically not billed and accounted for as revenue until the next accounting period. This is particularly apparent where there is a stark transition between summer and winter consumption.
- ✓ **Gap in Revenue**. An account moving from flat to consumption-based rates may experience a one month gap in revenue simply because the flat rate is billed in advance yet the consumption rate is billed in arrears. A policy should be set as to how to deal with this anomaly.
- ✓ **Unaccounted For Water (UFW).** A fact of water distribution is that water loss occurs across the system. This is through theft, leakage, flushing and non-metered consumption such as fire department usage. Procedures should be established to measure and track this on a monthly basis.

5.2 Technical Modifications: Cost Summary

From the modifications discussed above, Langham has attempted to quantify the cost associated with these modifications. These are simply estimates at this point, but should be useful for budgetary purposes related to any technical modifications required.

Description of Change/Modification	Estimated Labor Hours	Assumed Vendor Blended Hourly Rate	Total Est. Cost
Modification #2: HTE Operational Data Changes	100	$150	$22,500
Modification #3: New HTE AMR Interface	150	$150	$15,000
Total Estimated Cost			$37,500

As can be seen from the above table, the estimated impact of moving to AMR will have little impact on the HTE system from the perspective of needed changes or modifications to meet the City's minimal requirements.

6.0 Limitations

Langham was requested to provide a list of limitations in terms of system functionality, customer service or best practice, etc that may occur as a result of either a simplistic integration or as a result of limitations within the HTE CIS itself. This section provides a detailed discussion of the perceived limitations noted by Langham during the on-site review and based upon our experience with AMR systems and the HTE CIS.

The following sections summarize the recognized benefits of an AMR deployment and discuss any limitations that the City will encounter as a result of a minimal integration. A minimal integration was defined in "Modification #3: New HTE AMR Interface".

Many of these benefits depend on the type of AMR technology chosen and the majority relies directly on the AMR software, rather than the Utility Billing software, to deliver the benefit. It will be shown that there are no limitations other than HTE is incapable (or it is impractical) of storing and or utilizing interval data from a fixed AMR system. However, this is a limitation of most CIS packages.

➢ Dispute Resolution (Fixed Network AMR)

Having profile data can be used to resolve customer disputes by providing daily data to customers and customer service representatives.

Limitations: No perceived limitations. The profile data can be obtained directly from the AMR system.

➢ Reading Accuracy (Fixed Network and Mobile Drive-By AMR)

Increased accuracy of an AMR system ensures that readings are done correctly the first time. This will improve customer satisfaction and revenue forecasting, reducing the cost of billing and the cost of call center activity accordingly.

Limitations: No perceived limitations. The accuracy of meter reading in HTE will be that of the AMR system.

➢ Eliminate Estimated Bills (Fixed Network and Mobile Drive-By AMR)

Bills are estimated primarily as a result of a missing valid read within the billing cycle. AMR (particularly Fixed Network AMR) improves the probability that a good read will be available for billing.

Limitations: No perceived limitations. The accuracy of this statement depends on the diligence with which field service personnel maintain AMR devices, proactively working data output from the AMR system that will highlight devices that are not transmitting reads.

➢ Make Final Bills Quick and Easy to Obtain (Fixed Network AMR)

A final bill cannot be estimated. It can only be issued after a final read is obtained. The timeliness of a final read with AMR implies fewer disputes from the departing customer. Where the service is transferred to a new owner or reverts back to a landlord, a timely reading means that the departing customer is not paying for consumption used by the landlord or new owner. Where the customer is moving outside of the City's jurisdiction, the incidence of delinquent absconding customers will reduce.

Limitations: No perceived limitations. HTE allows out of cycle billing to bill final reads. HTE can request a final read from the AMR system at the appropriate time.

➢ Field Activities and Meter Reading (Fixed Network and Mobile Drive-By AMR)

As the number of visits to the meter will be eliminated or reduced, the occupational hazards of being a field service technician or meter reader are correspondingly reduced.

Limitations: No perceived limitations. There is no dependency here on HTE.

➢ Meter Accuracy and Warranty Disputes (Fixed Network AMR)

AMR can verify that meters are not exceeding their rated register capacity. Data collected by the AMR system allows a detailed review of usage patterns and peak flows through the meter. As well as correctly sizing meters and assessing that the correct type of meter is installed, this data can be used during warranty disputes with meter manufacturers.

Limitations: No perceived limitations. Profile data can be obtained directly from the AMR system.

➢ Leak Detection (Fixed Network AMR)

Profile data has the potential to indicate a leak within the system. Tools available within the AMR software allow the identification of anomalies within profile data for customer water usage. Reports and queries can identify data that indicates potential leaks – these reports can then be used as a pick-list for proactive customer contacts or site inspections.

Meter consumption for a specific area can also be summed and compared to the flow of water measured through a pump station. If the delta (change) is outside a specific tolerance, this may indicate a potential leak between the pump station and the consumer.

***Limitation*:** No perceived limitations. Profile data can be obtained directly from the AMR system.

➢ Negative Consumption/Back Flow (Fixed Network AMR)

AMR can alert the utility to meters with negative consumption. This can be an indication of tampering (accidental or intentional), where the meter has been removed and its direction reversed. It can also indicate water flowing back into the distribution system. For example, this can be caused where a backflow device has failed or a well has more pressure than the incoming feed (but there is no backflow device).

Limitations: No perceived limitations. This kind of alert would typically be trapped in the AMR system anyway.

➢ Detects Stopped Meters / Zero Consumption (Fixed Network and Mobile Drive-By AMR)

Zero consumption at a meter can be an indicator of a number of issues. This may indicate a faulty meter needing maintenance, or a customer on vacation. However, tampering is an issue at every utility. Whatever the cause, a service order may be issued for Customer Service / Field Service personnel to proactively investigate the issue and take appropriate action.

Limitations: No perceived limitations. This issue is most prudently trapped within the AMR system itself although with mobile AMR, HTE could also report this situation.

➢ Conservation Monitoring (Fixed Network AMR)

Measures such as odd/even watering days are easily monitored using daily profile data. Irrigation can be the major consumption factor for many customers. Many utilities enforce the concept of irrigation days by area and impose escalating penalties for those customers that abuse this.

Limitations: No perceived limitations. This benefit is typically delivered by the AMR system itself rather than the billing system.

➢ Decrease in Working Capital (Fixed Network and Mobile Drive-By AMR)

AMR deployments also reduce working capital requirements in two ways: First, by reducing the meter read-to-bill window, and second, by reducing accounts receivable. At many utilities, it takes two to five days, or more, from the time a meter is read to the time the read is processed and billed. In addition, high-bill complaints, estimated reads, and other metering-related inquiries can cause 10 to 45 days of delay in receiving payment.

Limitations: No perceived limitations. Providing changes in business practice occur to capitalize on faster turn around of readings and more accurate reading, this benefit will be realized regardless of the method of integration.

➢ Distribution Network (Fixed Network and Mobile Drive-By AMR)

AMR can achieve significant improvement in a utility's distribution operations. AMR can give utility planners access to consumption and load profile data down to the individual and

neighborhood level. This enables utility planners to improve capital infrastructure planning and forecasting.

Limitations: No perceived limitations. The realization of this benefit is dependent on the sophistication of the reporting within the AMR system itself and the possible integration or export of the relevant data to planning department software.

➢ Additional Services and Business Opportunities (Fixed Network AMR)

Among the additional services and business opportunities that a fixed network AMR can provide is are the following:

- ✓ **Tailored Rates -** AMR can interpret customer usage patterns in much greater detail than manual meter reading as readings may be taken more frequently. The City could develop service offerings and create tariffs that are tailored to meet the needs of individual or segmented customer groups. For example, high usage commercial and industrial customers could be incentivized by lower rates to consume water out of peak demand periods on the distribution network.

  Limitations: As HTE will not contain (or is able to process) interval data, demand based rates cannot be supported. However, this functionality is typically delivered via specialist complex billing software such as ORACLE's LoadStar product or ITRON's MV-PBS system.

- ✓ **Monitoring for Leakage or Theft -** Detailed reporting of consumption for large users could be offered. This can be used to detect consumption anomalies that may indicate leakage or theft on their premises.

  Limitations: No perceived limitations. Profile data can be obtained directly from the AMR system.

- ✓ **Emergency Detection and Reporting -** Many AMR devices support emergency detection and reporting. AMR devices fitted on fire-lines for example can detect flow that corresponds to sprinkler systems being activated. This can trigger an emergency call to 911 services.

  Limitations: No perceived limitations. Profile data can be obtained directly from the AMR system.

- ✓ **Monitoring of Elderly or Infirmed -** As AMR can monitor usage several times a day, elderly or infirm customers could be offered a monitoring service whereby if consumption does not occur for a period of time, a responsible party could be alerted to check that everything is ok with the customer.

  Limitations: No perceived limitations. Profile data can be obtained directly from the AMR system.

7.0 Risk Analysis

The final item Langham was asked to provide within their review for the City a risk analysis and any suggested mitigation plans in performing such an integration. The following discussion lists

the risks that have been identified as a result of discovery meetings held with the City at Fresno City Hall on August 21, 2007.

In developing this discussion, each section assesses the risk in terms of "Risk Assessment" (the likelihood of the risk being realized) and the "Impact if Realized" (the risk's likely impact to the organization, if realized). For each risk listed, the "Description" describes the risk and its potential impacts. No attempt is made at assessing material impacts such as costs or schedule delays. In addition, possible mitigation measures are also listed. These are neither exhaustive nor prescriptive, but as with any high level plan they require verification, cost analysis and detailed planning.

Risk 1: Integration of the AMR system with HTE.

Risk assessment: Low
Impact if realized: High, due to potential loss of revenue

The introduction of AMR implies the download and upload of meters to and from the AMR system to HTE via an interface. The probability HTE won't be able to provide a robust interface is very low, although the impact of not having a robust interface is very high (no meter reading, means potential loss of revenue).

The existing interface whereby HTE accepts meter readings through RouteStar for existing commercial and industrial accounts also sets a good precedent. In addition, HTE has a great deal of experience interfacing with different meter reading systems and therefore are likely to have an off-the-shelf interface that they can customize for the City. The City will also have a certain amount of lead time before billing on a consumption basis is legally required. This should provide ample opportunity to resolve any interface issues.

The format of the upload and download files is typically dictated by the meter reading vendor. It is therefore unlikely and impractical to use the existing RouteStar interface: a new interface is required and therefore, for the duration of the AMR Implementation, HTE must accept meter readings through both the new AMR interface and the existing RouteStar interface. HTE supports this configuration providing meters read *do not* appear in more than one interface. There is a small risk that this could occur given that a download to RouteStar may request a C&I meter to be read. If that meter is replaced (as part of the AMR installation) before a corresponding upload of that meter reading takes place, a manual meter reading may be uploaded to HTE on the same day as an AMR reading (like letters crossing in the mail).

- **Mitigation Plan**:
  - ✓ Obtain a list of AMR/Meter manufacturers from HTE that have active interfaces with the HTE product. Have them to specify product versions and customer references where that information is available;
  - ✓ As soon as an AMR system is selected, prepare an SCR with HTE for the interface and have them perform the work ASAP;
  - ✓ Test the interface ASAP (well before the first meter and AMR device go in the ground);

- ✓ Ensure that test scenarios include the concurrent reading of existing C&I meters and are end to end tests (that is, they include the download of routes to be read and the eventual billing of the customer);
- ✓ If an AMR pilot is underway, for the manufacturer selected, real data could be used to test, otherwise, ITS should be able to provide a mock-up upload file.
- ✓ Ensure the installation of AMR equipment is synchronized with the reading of C&I meters so that meter readings cannot appear in both AMR and RouteStar interfaces.

Risk 2: Interaction of the customer with the City will increase significantly as a result of consumption based billing and the AMR project itself.

Risk assessment: High
Impact if realized: High

The probability of this risk becoming an issue will be greatest during the AMR implementation itself as a result of:

- "Sticker shock" for those customers that are high consumers and whose consumption-based bills are much more than under the flat rate system;
- Inquiries and complaints as a result of installation contractors performing work on or near a customer's property;
- The change in billed charge will be highlighted with the customer (firstly, the charge will be a different amount each month; second, the City will inform the customer of these changes through outreach programs);
- Teething problems with the system (a few meters / AMR devices will undoubtedly be configured incorrectly during installation, causing bad bills to be issued).

The complexity of calls taken by the City's customer service representatives is also likely to increase with the nature of calls potentially becoming more confrontational. In addition, it is our understanding that the City has difficulty in retaining staff in this area, and as a result, a corresponding low level of knowledge on average across the customer service represenative's.

The implications are:

- Increased call volumes;
- Increased average call handling times (AHT);
- Increase of call escalations to supervisors/managers.

With no action, call abandonment rates will increase dramatically and the quality of information and service given to customers will fall. This exposes the City to poor public relations and increases the City's liability.

➢ **Mitigation Plan**:

- ✓ The AMR implementation project will have an outreach component of which the Call Center should be an integral part. HTE can be used to generate letters to customers that are scheduled to have a meter or AMR device installed;

- ✓ Establish service levels within Customer Service now that measure at least Average Wait Time and Abandonment Rate – this sets a benchmark against which performance after the start of the project can be measured;
- ✓ Billing Exceptions should be defined in HTE's File Maintenance function that can flag errors which trap or warn of bad bills;
- ✓ Consider establishing a specialist group within the Call Center that deal with complex billing issues. Water utilities that issue consumption based bills typically experience bill inquiries and complaints at over 30% of their incoming calls (although this is closer to 20% with fixed networks);
- ✓ Consider extending Call Center hours of operation for at least the duration of the AMR implementation;
- ✓ Consider hiring over-strength or temporary agency staff in order to cater for the temporary increase in call volume and AHT;
- ✓ For Fixed AMR systems: Consider offering additional self-service options on the web where the customer can view their interval data;
- ✓ Attempt to address the issue of customer service representative retention and improve long-term retention rates for these important and key positions.
- ✓ Business processes must be written with associated policies and procedures for customer service representatives. Corresponding training programs should be written and rolled out to existing and newly recruited personnel on an ongoing basis.

Risk 3: The current practice of bi-weekly billing for approximately 25% of the accounts may become impractical.

Risk assessment: Medium
Impact if realized: Medium

The City typically experiences peaks of customer interaction based on the date the customer receives a bill. Thus, there are peaks of customer complaints and bill inquiries, payments being made, delinquent actions taken, meter reading activity and back office work to process meter reads.

Therefore, some staff need to be multi-skilled in order to move from one peak to the next. For example, customer service representatives take payments as well as answering the phone. This situation is ideal in a small operation where department size does not permit demarcation of responsibility. In general, staff has a better high level view of the operation as a whole, but lack an in-depth understanding of any one area. The exceptions being where one or two staff have worked in that area for many years.

There is a risk that retaining a bi-weekly cycle while changing from a flat rate to an AMR consumption based billing may cause such an increase in peaks that there is insufficient staff to cope with the peaks while keeping the day-to-day operation running. There is always the risk with such a cyclical approach that events such as staff sickness and system issues have much more impact than if the work is evenly spread throughout the period.

➢ **Mitigation Plan**:

- ✓ Consider moving to a daily billing cycle (even if the billing period of 2 months is retained). This can be accomplished in HTE using Exception Billing, which is mainly used by large companies that need to bill every night;
- ✓ Recommend retaining the bi-monthly billing period (from the context of this risk) as this, together with daily billing, will help to spread the workload during the transition;
- ✓ Recommend specialization of roles. Consider specializing for complex billing inquiries and resolution in the Call Center, establishing a payments only counter, a billing function that deals with meter reading and billing (including exceptions) and a credit and collections function.

- ***Risk 4: In order to support consumption-based billing on accounts that are currently billed using a flat rate, HTE rate changes will be required.***

Risk assessment: Medium
Impact if realized: Medium

As each meter and AMR device goes into the ground, the City will be required to start using that consumption to bill the customer according to the requirements of AB 514. In order to accomplish this, the new consumption-based rate must be adopted and established in HTE and the account with the new meter must be "pointing" at that rate.

The addition of the new rate (to be recommended as part of the HDR comprehensive rate study) should not be an issue. HTE will support fairly complex consumption-based rates that support conservation measures without modifying the system. However, the rate is associated to a grouping of accounts: typically this is inside/outside the City, jurisdiction, the meter size and service. Each rate also has an effective date. The implication is that if you change a rate, you change it for the entire rate grouping. This aspect of the system does not appear to be an issue or problem.

The risk is that given the likely installation pattern, it is unlikely that all meters within a given grouping will be installed within a single billing cycle.

- **Mitigation Plan**:
  - ✓ Utilize HTE's feature to over-ride the rate at the account level whereby specific accounts within a grouping can point to a different rate. Alternatively, and probably the better long-term solution for the City, would be to utilize a different service code for the metered service and associate the new rates with the new service.
  - ✓ Given the extent of this project (as many as 500 installations per week), recommend obtaining a quote from HTE to automate this process. It may be that employing an intern to perform this task may be more cost effective than a modification. However, a modification would guarantee a level of quality and consistency a human cannot.

- ***Risk 5: The storage of new meter and AMR inventory in HTE and the association of that inventory with a premises and customer's***

account is a significant manual effort and carries risk of human error.

Risk assessment: Low
Impact if realized: High

The process of installing equipment in the ground through to having that inventory associated with accounts and premises in HTE is prone to error, particularly the more manual the effort is.

For approximately 24,000 residential and 24,000 commercial and industrial customers, an existing meter will potentially (and likely) be replaced. As the commercial and industrial meters are already read, they exist as inventory in HTE and can therefore be regarded as a meter exchange. Some proportion of the 24,000 residential meters may exist as inventory in HTE, the rest may not. For the remaining residential accounts, a meter will be installed for the first time.

The process starts as equipment is pulled from the truck in preparation for installation. The installation contractor must know which meter and AMR device has to be installed where and which meter is to be replaced (if any). Upon installation, the contractor must record all information required in HTE. At the end of each day, the contractor must pass this information back to the City where it is entered into HTE's inventory. The information may also be used as a basis of payment from the City to the contractor and as a basis for further quality control methods, such as spot checks.

Contractors use a variety of methods and controls to ensure that the correct information reaches the utility. Some methods are paper based, some use manual entry into spreadsheets, some scan equipment as it goes in the ground using specialist software to interface with the billing system. Typically, the more equipment installed and the shorter the installation project, the more sophisticated the solution is employed. Large, intense installations that employ manual controls are therefore prone to a high rate of error

- **Mitigation Plan**:
  - For meters already in HTE's inventory, recommend driving the installation of equipment by providing the contractor with download files from RouteStar. As meter readers already have these routes mapped out, the replacement of meters and installation of AMR route by route makes logical sense from a billing perspective. Additionally, installing these as the first part of the project would also front load the benefit of releasing meter readers to be re-deployed elsewhere.
  - Recommend that the bid/procurement RFP reflects a preference to select installation contractors that utilize automated, rather than manual, methods of capturing and passing information.
  - Consider capturing GPS coordinates of equipment at the time of installation. This can be particularly useful to locate meters at a later date, particularly if a fixed AMR system is utilized (e.g. landscape growth, etc.).
  - An SCR (system change request) has been raised with HTE to accomplish the import of both new meter and AMR installations via an interface. This should be reviewed in the light of the recommendations above.

- ***Risk 6: The incidence of delinquent customers is likely to increase at least initially following the implementation of consumption-based rates.***

Risk assessment: Medium
Impact if realized: Low

Depending on new rate structures, it is likely that a significant portion of the City's customer base will experience, at least at some point in time, an increase in their bill amount. Particularly vulnerable are large households of lower income. The incidence of delinquencies is therefore likely to rise with a corresponding rise in disconnections, slip in cash flow and increase of Days Sales Outstanding (DSO). It should be noted that Langham had previously identified this risk to the City and noted that their Credit and Collections policies are not up-to-date.

- **Mitigation Plan**:
  - ✓ Langham recommend reviewing the current Credit and Collections policies and procedures. Thresholds for assessing collection actions and the calculation of penalties should be revisited. Consider using the Penalty Exception function in HTE to waive penalties for specific customers.
  - ✓ Consider "turning off" penalties altogether for the period of the implementation and stabilization period.

- ***Risk 7: New meter equipment in the field will imply a significant increase to field service personnel workloads and Customer Service Representative / back-office work-order processing.***

Risk assessment: Medium
Impact if realized: Low

The incidence of problems reported that require field service attention will clearly change. Initially, there will probably be a number of issues with the new system to resolve. Typical problems that come with aging meters (for those currently installed and read) will be reduced as new equipment replaces old. However, as the project progresses, more issues will arise simply because there will be more installed equipment that can go wrong.

In addition to the existing sources of these Service Orders (Customer Service and Meter Readers (if a mobile system is deployed)) the AMR system itself may raise trouble codes that can be configured in HTE to automatically trigger a service order to be issued. For example, a missed read or a low battery alert from the AMR system can be associated with a service order type that will dispatch a field engineer to investigate the issue.

Due to the fact that neither a fixed or mobile AMR system requires the meter reader to enter the customer's property or lift a meter lid, there will also be a fall in the number of trouble codes reported for the commercial and industrial meters currently read manually. This will translate directly to a reduction in the number of estimates required.

- **Mitigation Plan**:

- ✓ The addition of field personnel should be determined by the City and included within the up-coming comprehensive rate study to be conducted by HDR.
- ✓ Additional business processes, policies and procedures may be required to cater for additional or increased volumes of transactions in the field;
- ✓ Configuration may be required in HTE to make additional service order types or trouble codes available for use.

Risk 8: Changes in calculations may imply changes in accounting.

Risk assessment: Low
Impact if realized: Low

Currently, revenue from accounts with a fixed rate is very predictable. Moving to a consumption-based rate over a four year period may make revenues unstable and less predictable for this period.

The amount of water consumed is currently not accurately measured, although it can be estimated. The volume of water entering the system is known and the highest consumers (commercial and industrial customers) are measured. However, the volume of Unaccounted for Water (UFW) is currently unknown and therefore the residential consumption can only be estimated. In addition, the structure of new rates will affect the amount of revenue generated and its predictability (for example, if a tiered rate is employed, one cannot predict how much consumption will fall into each tier and therefore what revenue will be generated.

In addition, flat rate water is billed in advance, but a consumption-based rate will be billed current. This will imply a reduction of revenue for the length of the project although the numbers will wash by the end of the project.

- **Mitigation Plan**:
  - ✓ New GL account codes will need to be established in Peoplesoft Finance;
  - ✓ Revenue projections should be conservative, or the rate study should determine a good method to transition in consumption-based rates.

8.0 Summary

Langham Consulting Services, Inc. has provided a review of the City of Fresno's HTE Customer Service Information and billing system. The intent was to determine if there were any major impediments or issues associated with the installation of an AMR system. This review determined that there are no major impediments or issues associated with the installation of a mobile drive-by or fixed network system. That is not to imply that there are no risks or issues that will arise during the installation and implementation. Rather, Langham is of the opinion that the issues can be managed and that the HTE system will support AMR with little or no need for major modifications.

Appendix C

Cost Models

City of Fresno

Meter Reading Feasibility 10-Year Planning Horizon Model Bi-Monthly
4-Year Deployment
Summary of Results
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Operating Budget (Does Not Include Customer Service)										
Manual Read	$ 781,531	$ 1,055,244	$ 1,525,923	$ 2,021,081	$ 2,543,079	$ 2,760,690	$ 2,860,286	$ 3,031,728	$ 3,202,176	$ 3,381,035
Touch Read	$ 590,327	$ 714,463	$ 1,002,192	$ 1,266,053	$ 1,593,303	$ 1,650,681	$ 1,775,988	$ 1,839,989	$ 1,967,320	$ 2,038,272
Mobile Drive-by	$ 394,631	$ 408,679	$ 480,632	$ 497,773	$ 577,142	$ 597,757	$ 619,115	$ 641,242	$ 664,165	$ 687,914
Fixed Radio	$ 356,013	$ 367,559	$ 437,952	$ 453,476	$ 531,165	$ 550,038	$ 569,588	$ 589,838	$ 610,814	$ 632,543
Capital Outlay to be Borrowed (Does Not Include Customer Service or Debt Service)										
Manual Read	$ 2,491,504	$ 6,384,509	$ 10,694,129	$ 10,979,847	$ 11,273,304	$ -	$ -	$ -	$ -	$ -
Touch Read	$ 3,356,983	$ 6,839,646	$ 11,334,877	$ 11,618,156	$ 11,952,188	$ -	$ -	$ -	$ -	$ -
Mobile Drive-by	$ 5,255,140	$ 7,825,539	$ 12,640,990	$ 12,956,882	$ 13,324,997	$ -	$ -	$ -	$ -	$ -
Fixed Radio	$ 5,635,756	$ 7,996,745	$ 12,872,059	$ 13,194,148	$ 13,568,625	$ -	$ -	$ -	$ -	$ -
Capital Cost out of Pocket (Does Not Include Customer Service or Debt Service)										
Manual Read	$ -	$ -	$ -	$ -	$ -	$ 1,190,155	$ 1,165,875	$ 1,257,585	$ 1,415,146	$ 1,539,064
Touch Read	$ -	$ -	$ -	$ -	$ -	$ 1,210,605	$ 1,256,543	$ 1,276,152	$ 1,434,426	$ 1,534,717
Mobile Drive-by	$ -	$ -	$ -	$ -	$ -	$ 1,351,035	$ 1,479,390	$ 1,427,115	$ 1,525,989	$ 1,616,757
Fixed Radio	$ -	$ -	$ -	$ -	$ -	$ 1,379,230	$ 1,406,248	$ 1,453,683	$ 1,553,732	$ 1,645,731
Debt Service Payments										
Manual Read	$ 3,499,745	$ 3,499,745	$ 3,499,745	$ 3,499,745	$ 3,499,745	$ 3,499,745	$ 3,499,745	$ 3,499,745	$ 3,499,745	$ 3,499,745
Touch Read	$ 3,774,093	$ 3,774,093	$ 3,774,093	$ 3,774,093	$ 3,774,093	$ 3,774,093	$ 3,774,093	$ 3,774,093	$ 3,774,093	$ 3,774,093
Mobile Drive-by	$ 4,351,622	$ 4,351,622	$ 4,351,622	$ 4,351,622	$ 4,351,622	$ 4,351,622	$ 4,351,622	$ 4,351,622	$ 4,351,622	$ 4,351,622
Fixed Radio	$ 4,457,375	$ 4,457,375	$ 4,457,375	$ 4,457,375	$ 4,457,375	$ 4,457,375	$ 4,457,375	$ 4,457,375	$ 4,457,375	$ 4,457,375
Long-Term Budget (Does Not Include Customer Service)										
Manual Read	$ 4,281,277	$ 4,554,989	$ 5,025,668	$ 5,520,826	$ 6,042,825	$ 7,450,591	$ 7,525,906	$ 7,789,059	$ 8,117,067	$ 8,419,844
Touch Read	$ 4,364,420	$ 4,488,555	$ 4,776,285	$ 5,040,145	$ 5,367,395	$ 6,635,379	$ 6,806,623	$ 6,890,234	$ 7,175,838	$ 7,347,081
Mobile Drive-by	$ 4,746,253	$ 4,760,301	$ 4,832,254	$ 4,849,395	$ 4,928,764	$ 6,300,414	$ 6,450,127	$ 6,419,979	$ 6,541,776	$ 6,656,293
Fixed Radio	$ 4,813,388	$ 4,824,933	$ 4,895,327	$ 4,910,850	$ 4,988,540	$ 6,386,643	$ 6,433,211	$ 6,500,895	$ 6,621,921	$ 6,735,648

Results and Inputs	**NPV Capital**	**Rank Capital**	**NPV Deployment**	**Rank Deployment**	**NPV Long-Term**	**Rank Long-Term**	Yrs to Impl.	Reads/Day	Visits/Day	$/Pad. MIU	Startup-Infra.	Read Eq. Life
Manual Read	**$ 34,132,798**	1	**$ 46,934,105**	1	**$45,851,631**	4	4	160	25	$ -		5
Touch Read	**$ 36,905,244**	2	**$ 47,422,819**	2	**$42,002,965**	3	4	320	35	$ 15.00		5
Mobile Drive-by	**$ 42,756,276**	3	**$ 51,285,286**	3	**$40,643,863**	1	4	7,000	300	$ 75.00	$ 42,500	6
Fixed Radio	**$ 43,831,721**	4	**$ 52,276,884**	4	**$41,103,078**	2	4			$ 85.00	$ 160,000	20

Cost per Read	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Meter Readings										
Meter Readers	182,787	283,005	414,966	547,161	679,590	692,502	705,660	719,070	732,732	746,652
Field Service	22,848	35,376	51,871	68,395	84,949	86,563	88,208	89,884	91,592	93,332
Operating Cost/Read (Meter Readers + Field Service + Customer Service)										
Manual Read	$ 4.28	$ 3.73	$ 3.68	$ 3.69	$ 3.74	$ 3.99	$ 4.05	$ 4.22	$ 4.37	$ 4.53
Touch Read	$ 3.23	$ 2.52	$ 2.42	$ 2.31	$ 2.34	$ 2.38	$ 2.52	$ 2.56	$ 2.68	$ 2.73
Mobile Drive-by	$ 2.16	$ 1.44	$ 1.16	$ 0.91	$ 0.85	$ 0.86	$ 0.88	$ 0.89	$ 0.91	$ 0.92
Fixed Radio	$ 1.95	$ 1.30	$ 1.06	$ 0.83	$ 0.78	$ 0.79	$ 0.81	$ 0.82	$ 0.83	$ 0.85
Op.+Cap. Cost/Read										
Manual Read	$ 23.42	$ 16.10	$ 12.11	$ 10.09	$ 8.89	$ 10.76	$ 10.67	$ 10.83	$ 11.08	$ 11.28
Touch Read	$ 23.88	$ 15.86	$ 11.51	$ 9.21	$ 7.90	$ 9.58	$ 9.65	$ 9.58	$ 9.79	$ 9.84
Mobile Drive-by	$ 25.97	$ 16.82	$ 11.64	$ 8.86	$ 7.25	$ 9.10	$ 9.14	$ 8.93	$ 8.93	$ 8.91
Fixed Radio	$ 26.33	$ 17.05	$ 11.80	$ 8.98	$ 7.34	$ 9.22	$ 9.12	$ 9.04	$ 9.04	$ 9.02

End of Deployment

City of Fresno

Meter Reading Feasibility 10-Year Planning Horizon Model Bi-Monthly
4-Year Deployment
Fixed Radio Frequency
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Meter Reading										
Meters										
Total Meters	30,465	47,168	69,161	91,194	113,265	115,417	117,610	119,845	122,122	124,442
Meters to be Installed	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320
Pits & Boxes to be Installed*	(0)	12,713	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320
*Year 2008 total is 31,732 minus 24,232 pits already in the ground										
Installations include annual growth of 1.3%										
Read Frequency										
Quarterly %	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Bi-monthly %	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Monthly %	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Annual Reads										
Quarterly	-	-	-	-	-	-	-	-	-	-
Bi-monthly	182,787	283,005	414,966	547,161	679,590	692,502	705,660	719,070	732,732	746,652
Monthly	-	-	-	-	-	-	-	-	-	-
Total	182,787	283,005	414,966	547,161	679,590	692,502	705,660	719,070	732,732	746,652
Reading Days/Year										
Reading Days/Man Week	5	5	5	5	5	5	5	5	5	5
Holidays/Year	11	11	11	11	11	11	11	11	11	11
Vacation Days/Year	15	15	15	15	15	15	15	15	15	15
Sick Days/Year	12	12	12	12	12	12	12	12	12	12
Total Reading Days/Year	222	222	222	222	222	222	222	222	222	222
Meters/FTE	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
Field Service (Meter Reading Related)										
Field Service Reads per Year										
Cust. Serv. Request % of Reads	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%
Final Reads % of Meters	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%
Annual Customer Service Req.	18,279	28,301	41,497	54,716	67,959	69,250	70,566	71,907	73,273	74,665
Annual Final Reads	4,570	7,075	10,374	13,679	16,990	17,313	17,642	17,977	18,318	18,666
Total Annual Field Service Reads	22,848	35,376	51,871	68,395	84,949	86,563	88,208	89,884	91,592	93,332
Field Service Days/Year										
Service Days/Man Week	5	5	5	5	5	5	5	5	5	5
Holidays/Year	11	11	11	11	11	11	11	11	11	11
Vacation Days/Year	15	15	15	15	15	15	15	15	15	15
Sick Days/Year	12	12	12	12	12	12	12	12	12	12
Total Reading Days/Year	222	222	222	222	222	222	222	222	222	222
Meters/FTE	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000
Personnel Required										
Calculated Meter Readers	1.0	1.0	1.0	1.0	1.1	1.2	1.2	1.2	1.2	1.2
Calculated Field Service Techs	1.0	1.2	1.7	2.3	2.8	2.9	2.9	3.0	3.1	3.1
Meter Readers (FTE)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Field Techs (FTE)	1.0	1.0	2.0	2.0	3.0	3.0	3.0	3.0	3.0	3.0
Calculated Lead Worker(s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Actual Lead Workers	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Supervisor Collections Section	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

* Meter readers take field service reads. Field Service Techs become responsible for the radio system including the meter interface units.

City of Fresno
Meter Reading Feasibility 10-Year Planning Horizon Model Bi-Monthly
4-Year Deployment
Fixed Radio Frequency
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Operating Expenses										
Meter Related										
Salary										
Readers	$ 39,333	$ 40,709	$ 42,134	$ 43,609	$ 45,135	$ 46,715	$ 48,350	$ 50,042	$ 51,794	$ 53,607
Field Service Techs	46,946	48,589	100,579	104,099	161,613	167,270	173,124	179,184	185,455	191,946
Lead Worker	53,213	55,076	57,004	58,999	61,064	63,201	65,413	67,702	70,072	72,525
Supervisor Collections	63,851	66,086	68,399	70,793	73,270	75,835	78,489	81,236	84,080	87,022
Total Salary	$ 203,343	$ 210,460	$ 268,115	$ 277,499	$ 341,083	$ 353,021	$ 365,377	$ 378,165	$ 391,401	$ 405,100
Education										
Readers	$ 185	$ 192	$ 200	$ 208	$ 216	$ 225	$ 234	$ 243	$ 253	$ 263
Field Service Techs	185	192	400	416	649	675	702	730	760	790
Lead Worker + Supervisor	500	520	541	562	585	608	633	658	684	712
Total Education	$ 870	$ 905	$ 1,141	$ 1,187	$ 1,451	$ 1,509	$ 1,569	$ 1,632	$ 1,697	$ 1,765
M & S										
Readers	$ 1,000	$ 1,035	$ 1,071	$ 1,109	$ 1,148	$ 1,188	$ 1,229	$ 1,272	$ 1,317	$ 1,363
Field Service Techs	1,000	1,035	2,142	2,217	3,443	3,563	3,688	3,817	3,950	4,089
Lead Worker + Supervisor	2,000	2,070	2,142	2,217	2,295	2,375	2,459	2,545	2,634	2,726
Total M&S	$ 4,000	$ 4,140	$ 5,356	$ 5,544	$ 6,885	$ 7,126	$ 7,376	$ 7,634	$ 7,901	$ 8,177
Contract Services										
Readers	$ 100	$ 104	$ 107	$ 111	$ 115	$ 119	$ 123	$ 127	$ 132	$ 136
Field Service Techs	100	104	214	222	344	356	369	382	395	409
Lead Worker + Supervisor	200	207	214	222	230	238	246	254	263	273
Total Contract Services	$ 400	$ 414	$ 536	$ 554	$ 689	$ 713	$ 738	$ 763	$ 790	$ 818
Vehicles (Fuel + Maintenance)										
Readers	$ 4,000	$ 4,180	$ 4,368	$ 4,565	$ 4,770	$ 4,985	$ 5,209	$ 5,443	$ 5,688	$ 5,944
Field Service Techs	4,000	4,180	8,736	9,129	14,310	14,954	15,627	16,330	17,065	17,833
Lead Worker + Supervisor	8,000	8,360	8,736	9,129	9,540	9,969	10,418	10,887	11,377	11,889
Total Fuel	$ 16,000	$ 16,720	$ 21,841	$ 22,823	$ 28,620	$ 29,908	$ 31,254	$ 32,661	$ 34,130	$ 35,666
Insurance										
Readers	$ 1,000	$ 1,050	$ 1,103	$ 1,158	$ 1,216	$ 1,276	$ 1,340	$ 1,407	$ 1,477	$ 1,551
Field Service Techs	1,000	1,050	2,205	2,315	3,647	3,829	4,020	4,221	4,432	4,654
Lead Worker + Supervisor	2,000	2,100	2,205	2,315	2,431	2,553	2,680	2,814	2,955	3,103
Total Insurance	$ 4,000	$ 4,200	$ 5,513	$ 5,788	$ 7,293	$ 7,658	$ 8,041	$ 8,443	$ 8,865	$ 9,308
Misc.										
Readers	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Field Service Techs	-	-	-	-	-	-	-	-	-	-
Lead Worker + Supervisor	-	-	-	-	-	-	-	-	-	-
Total Miscellaneous	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Meter Reading Equipment Maintenance										
Hand-held	$ 900	$ 923	$ 946	$ 969	$ 993	$ 1,018	$ 1,044	$ 1,070	$ 1,097	$ 1,124
Collectors	$ 8,000	$ 8,200	$ 8,405	$ 8,615	$ 8,831	$ 9,051	$ 9,278	$ 9,509	$ 9,747	$ 9,991
Software	2,000	1,025	1,051	1,077	1,104	1,131	1,160	1,189	1,218	1,249
Installation Programmer	500	513	788	808	1,104	1,131	1,160	1,189	1,218	1,249
Total Annual Meter Reading Budget										
Readers	$ 45,618	$ 47,270	$ 48,983	$ 50,759	$ 52,600	$ 54,508	$ 56,485	$ 58,536	$ 60,661	$ 62,865
Field Service Techs	53,231	55,150	114,277	118,399	184,006	190,648	197,531	204,664	212,058	219,721
Lead Worker + Supervisor	129,764	134,419	139,241	144,238	149,415	154,779	160,337	166,097	172,065	178,248
Facilities Rent	116,000	120,060	124,262	128,611	133,113	137,772	142,594	147,584	152,750	158,096
Reading Equipment Maintenance	11,400	10,660	11,189	11,469	12,032	12,332	12,641	12,957	13,281	13,613
Meter Reading Operating Budget	$ 356,013	$ 367,559	$ 437,952	$ 453,476	$ 531,165	$ 550,038	$ 569,588	$ 589,838	$ 610,814	$ 632,543
Customer Service Related										
Total Customer Service	$ 925,359	$ 1,482,858	$ 2,250,392	$ 3,071,151	$ 3,947,966	$ 4,163,780	$ 4,391,396	$ 4,631,468	$ 4,884,645	$ 5,151,651
Total Meter Reading Related	$ 1,281,372	$ 1,850,416	$ 2,688,345	$ 3,524,627	$ 4,479,131	$ 4,713,819	$ 4,960,984	$ 5,221,306	$ 5,495,459	$ 5,784,193

City of Fresno
Meter Reading Feasibility 10-Year Planning Horizon Model Bi-Monthly
4-Year Deployment
Fixed Radio Frequency
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Operating Cost per Read										
Regular Meter Read	$0.25	$0.17	$0.12	$0.09	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08
Field Service Read	$2.33	$1.56	$2.20	$1.73	$2.17	$2.20	$2.24	$2.28	$2.32	$2.35
Regular + Field Service	$1.73	$1.15	$0.94	$0.74	$0.69	$0.71	$0.72	$0.73	$0.74	$0.75
Reg + Field Serv. + Cust. Serv.	$6.23	$5.81	$5.76	$5.73	$5.86	$6.05	$6.25	$6.45	$6.67	$6.89
Capital Items										
Meters and Pits										
Meters to be Installed	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320
Pits to be Installed	(0)	12,713	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320
Vehicles										
Vehicles Req'd	4	4	5	5	6	6	6	6	6	6
Vehicles in Service	13	4	4	5	5	6	6	6	6	6
New Vehicles (Retirements)	(9)	-	1	-	1	-	-	-	-	-
Potential In-Service Replacement	2	2	2	2	2	2	1	-	-	-
Potential Vehicle Replacements					-	-	-	-	2	3
New Vehicle Purchases	-	2	3	2	3	2	1	-	2	3
Vehicle Retirements	9	2	2	2	2	2	1	-	2	3
Reading Equipment										
# of Handhelds	1	1	1	1	1	1	1	1	1	1
# of Spare Handhelds	1	1	1	1	1	1	1	1	1	1
Purchases (Retirements)	2	-	-	-	-	-	-	-	-	-
Potential Replacements					-	2	-	-	-	-
Purchases + Replacements	2	-	-	-	-	2	-	-	-	-
Installation Programmers Req'd	2	2	3	3	4	4	4	4	4	4
Programmers Purchased (Retired)	2	-	1	-	1	-	-	-	-	-
Calculated Prog. Replacements					-	2	-	1	-	1
Purchases + Replacements	2	-	1	-	1	2	-	1	-	1
Calculated Fixed Units Req'd	1	1	1	1	1	1	1	1	1	1
Fixed Units Required	1	1	1	1	1	1	1	1	1	1
Fixed Units Purchased (Retired)	1	-	-	-	-	-	-	-	-	-
Calculated Replacements						-	-	-	-	-
Purchases + Replacements	1	-	-	-	-	-	-	-	-	-
Mobile Interface Unit										
Years to Install MIU	4									
MIU's Replaced/Year	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320
Cummulative Replaced	30,465	47,168	69,161	91,194	113,265	115,417	117,610	119,845	122,122	124,442
New Services Installed	-	1,996	2,034	2,073	2,112	2,152	2,193	2,235	2,277	2,320
MIU's Installed & Replaced	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320
Cummulative Replaced & Installed	30,465	47,168	69,161	91,194	113,265	115,417	117,610	119,845	122,122	124,442
MIU Cost	$85.00	$87.13	$89.30	$91.54	$93.82	$96.17	$98.57	$101.04	$103.56	$106.15
Installation Cost	$ 15.00	$ 15.53	$ 16.07	$ 16.63	$ 17.21	$ 17.82	$ 18.44	$ 19.08	$ 19.75	$ 20.44

City of Fresno
Meter Reading Feasibility 10-Year Planning Horizon Model Bi-Monthly
4-Year Deployment
Fixed Radio Frequency
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Capital Budget (to be Borrowed)										
Meters Installed	$ 2,132,516	$ 1,198,439	$ 1,617,484	$ 1,660,861	$ 1,705,396	$ -	$ -	$ -	$ -	$ -
Pits & Boxes Installed	$ -	$ 4,886,552	$ 8,665,095	$ 8,897,472	$ 9,136,052	$ -	$ -	$ -	$ -	$ -
Program Management	$ 304,645	$ 167,030	$ 219,935	$ 220,325	$ 220,715					
Vehicle Purchases (Retirements)	$ (21,857)	$ 30,163	$ 49,429	$ 32,311	$ 52,950	$ -	$ -	$ -	$ -	$ -
Reading Equipment Purchases (Ret.)										
Handhelds	$ 9,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Installation Programmers	$ 5,000	$ -	$ 2,627	$ -	$ 2,760	$ -	$ -	$ -	$ -	$ -
Fixed Unit	$ 160,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Fixed Interface Unit	$ 3,046,452	$ 1,714,561	$ 2,317,488	$ 2,383,178	$ 2,450,752	$ -	$ -	$ -	$ -	$ -
Total Capital Budget	$ 5,635,756	$ 7,996,745	$ 12,872,059	$ 13,194,148	$ 13,568,625	$ -	$ -	$ -	$ -	$ -
Debt Service Payments	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375
Capital Budget (Out of Pocket)										
Meters Installed	$ -	$ -	$ -	$ -	$ -	$ 170,435	$ 178,025	$ 185,970	$ 194,201	$ 202,815
Pits & Boxes Installed	$ -	$ -	$ -	$ -	$ -	$ 913,046	$ 953,703	$ 996,267	$ 1,040,364	$ 1,086,511
Vehicle Purchases (Retirements)	$ -	$ -	$ -	$ -	$ -	$ 34,613	$ 17,912	$ -	$ 38,376	$ 59,578
Reading Equipment Purchases (Ret.)										
Handhelds	$ -	$ -	$ -	$ -	$ -	$ 10,183	$ -	$ -	$ -	$ -
Installation Programmers	$ -	$ -	$ -	$ -	$ -	$ 5,657	$ -	$ 2,972	$ -	$ 3,122
Fixed Unit	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Fixed Interface Unit	$ -	$ -	$ -	$ -	$ -	$ 245,296	$ 256,609	$ 268,474	$ 280,791	$ 293,705
Total Capital Budget	$ -	$ -	$ -	$ -	$ -	$ 1,379,230	$ 1,406,248	$ 1,453,683	$ 1,553,732	$ 1,645,731
Total Budget (Operating + Capital)	$ 5,991,769	$ 8,364,303	$ 13,310,011	$ 13,647,623	$ 14,099,790	$ 1,929,268	$ 1,975,836	$ 2,043,520	$ 2,164,546	$ 2,278,273
Does Not Include Customer Service or Debt Service										
Long-Term Budget	$ 4,813,388	$ 4,824,933	$ 4,895,327	$ 4,910,850	$ 4,988,540	$ 6,386,643	$ 6,433,211	$ 6,500,895	$ 6,621,921	$ 6,735,648
Includes Debt Service, Capital Out of Pocket and Operating Costs)										
NPV Annually	$ 4,540,932	$ 4,294,174	$ 4,110,211	$ 3,889,853	$ 3,727,727	$ 4,502,331	$ 4,278,453	$ 4,078,742	$ 3,919,505	$ 3,761,151
Total Capital	$ 53,267,333									
Total Operating Budget (thru deployment)	$ 2,146,164									
Total Capital	$ 53,267,333									
Total Deployment	$ 55,413,497									
Total Debt Service (10 years)	$ 44,573,747									
Long-Term Cost										
Total Debt Service	$ 44,573,747									
Total Operating Budget (10 years)	$ 5,098,985									
Total Out of Pocket Capital	$ 7,438,624									
Total Long-Term Cost	$ 57,111,356									
Net Present Value										
Discount Rate	6.0%									
NPV Capital	$43,831,721									
NPV Deployment	$52,276,884									
NPV Long-Term Cost	$ 41,103,078									
Total Cost per Read	$ 23.41	$ 15.15	$ 10.49	$ 7.98	$ 6.52	$ 8.20	$ 8.10	$ 8.04	$ 8.03	$ 8.02

City of Fresno

Meter Reading Feasibility 10-Year Planning Horizon Model Bi-Monthly
4-Year Deployment
Drive-By Radio Frequency
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Meter Reading										
Meters										
Total Meters	30,465	47,168	69,161	91,194	113,265	115,417	117,610	119,845	122,122	124,442
Meters to be Installed	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320
Pits & Boxes to be Installed*	(0)	12,713	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320
*Year 2008 total is 31,732 minus 24,232 pits already in the ground										
Installations include annual growth of 1.3%										
Read Frequency										
Quarterly %	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Bi-monthly %	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Monthly %	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Annual Reads										
Quarterly	-	-	-	-	-	-	-	-	-	-
Bi-monthly	182,787	283,005	414,966	547,161	679,590	692,502	705,660	719,070	732,732	746,652
Monthly	-	-	-	-	-	-	-	-	-	-
Total	182,787	283,005	414,966	547,161	679,590	692,502	705,660	719,070	732,732	746,652
Reading Days/Year										
Reading Days/Man Week	5	5	5	5	5	5	5	5	5	5
Holidays/Year	11	11	11	11	11	11	11	11	11	11
Vacation Days/Year	15	15	15	15	15	15	15	15	15	15
Sick Days/Year	12	12	12	12	12	12	12	12	12	12
Total Reading Days/Year	222	222	222	222	222	222	222	222	222	222
Reads/Man Day	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000
Field Service (Meter Reading Related)										
Field Service Reads per Year										
Cust. Serv. Request % of Reads	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%
Final Reads % of Meters	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%
Annual Customer Service Req.	18,279	28,301	41,497	54,716	67,959	69,250	70,566	71,907	73,273	74,665
Annual Final Reads	4,570	7,075	10,374	13,679	16,990	17,313	17,642	17,977	18,318	18,666
Total Annual Field Service Reads	22,848	35,376	51,871	68,395	84,949	86,563	88,208	89,884	91,592	93,332
Field Service Days/Year										
Service Days/Man Week	5	5	5	5	5	5	5	5	5	5
Holidays/Year	11	11	11	11	11	11	11	11	11	11
Vacation Days/Year	15	15	15	15	15	15	15	15	15	15
Sick Days/Year	12	12	12	12	12	12	12	12	12	12
Total Reading Days/Year	222	222	222	222	222	222	222	222	222	222
Visits/Man Day	300	300	300	300	300	300	300	300	300	300
Meters/FTE	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000
Personnel Required										
Calculated Meter Readers*	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Calculated Field Service Techs	1.0	1.2	1.7	2.3	2.8	2.9	2.9	3.0	3.1	3.1
Meter Readers (FTE)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Field Techs (FTE)	1.0	1.0	2.0	2.0	3.0	3.0	3.0	3.0	3.0	3.0
Calculated Lead Worker(s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Actual Lead Workers	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Supervisor Collections Section	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

* Meter readers take field service reads. Field Service Techs become responsible for the radio system including the meter interface units.

City of Fresno
Meter Reading Feasibility 10-Year Planning Horizon Model Bi-Monthly
4-Year Deployment
Drive-By Radio Frequency
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Operating Expenses										
Meter Related										
Salary										
Readers	$ 78,666	$ 81,419	$ 84,269	$ 87,218	$ 90,271	$ 93,430	$ 96,700	$ 100,085	$ 103,588	$ 107,213
Field Service Techs	46,946	48,589	100,579	104,099	161,613	167,270	173,124	179,184	185,455	191,946
Lead Worker	53,213	55,076	57,004	58,999	61,064	63,201	65,413	67,702	70,072	72,525
Supervisor Collections	63,851	66,086	68,399	70,793	73,270	75,835	78,489	81,236	84,080	87,022
Total Salary	$ 242,676	$ 251,169	$ 310,250	$ 321,108	$ 386,218	$ 399,736	$ 413,727	$ 428,207	$ 443,194	$ 458,706
Education										
Readers	$ 370	$ 385	$ 400	$ 416	$ 433	$ 450	$ 468	$ 487	$ 506	$ 527
Field Service Techs	185	192	400	416	649	675	702	730	760	790
Lead Worker + Supervisor	500	520	541	562	585	608	633	658	684	712
Total Education	$ 1,055	$ 1,097	$ 1,341	$ 1,395	$ 1,667	$ 1,734	$ 1,803	$ 1,875	$ 1,950	$ 2,028
M & S										
Readers	$ 2,000	$ 2,070	$ 2,142	$ 2,217	$ 2,295	$ 2,375	$ 2,459	$ 2,545	$ 2,634	$ 2,726
Field Service Techs	1,000	1,035	2,142	2,217	3,443	3,563	3,688	3,817	3,950	4,089
Lead Worker + Supervisor	2,000	2,070	2,142	2,217	2,295	2,375	2,459	2,545	2,634	2,726
Total M&S	$ 5,000	$ 5,175	$ 6,427	$ 6,652	$ 8,033	$ 8,314	$ 8,605	$ 8,906	$ 9,218	$ 9,540
Contract Services										
Readers	$ 200	$ 207	$ 214	$ 222	$ 230	$ 238	$ 246	$ 254	$ 263	$ 273
Field Service Techs	100	104	214	222	344	356	369	382	395	409
Lead Worker + Supervisor	200	207	214	222	230	238	246	254	263	273
Total Contract Services	$ 500	$ 518	$ 643	$ 665	$ 803	$ 831	$ 860	$ 891	$ 922	$ 954
Vehicles (Fuel + Maintenance)										
Readers	$ 8,000	$ 8,360	$ 8,736	$ 9,129	$ 9,540	$ 9,969	$ 10,418	$ 10,887	$ 11,377	$ 11,889
Field Service Techs	4,000	4,180	8,736	9,129	14,310	14,954	15,627	16,330	17,065	17,833
Lead Worker + Supervisor	8,000	8,360	8,736	9,129	9,540	9,969	10,418	10,887	11,377	11,889
Total Fuel	$ 20,000	$ 20,900	$ 26,209	$ 27,388	$ 33,391	$ 34,893	$ 36,463	$ 38,104	$ 39,819	$ 41,611
Insurance										
Readers	$ 2,000	$ 2,100	$ 2,205	$ 2,315	$ 2,431	$ 2,553	$ 2,680	$ 2,814	$ 2,955	$ 3,103
Field Service Techs	1,000	1,050	2,205	2,315	3,647	3,829	4,020	4,221	4,432	4,654
Lead Worker + Supervisor	2,000	2,100	2,205	2,315	2,431	2,553	2,680	2,814	2,955	3,103
Total Insurance	$ 5,000	$ 5,250	$ 6,615	$ 6,946	$ 8,509	$ 8,934	$ 9,381	$ 9,850	$ 10,342	$ 10,859
Misc.										
Readers	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Field Service Techs	-	-	-	-	-	-	-	-	-	-
Lead Worker + Supervisor	-	-	-	-	-	-	-	-	-	-
Total Miscellaneous	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Meter Reading Equipment Maintenance										
Hand-held	$ 900	$ 923	$ 946	$ 969	$ 993	$ 1,018	$ 1,044	$ 1,070	$ 1,097	$ 1,124
Drive-by	2,000	2,050	2,101	2,154	2,208	2,263	2,319	2,377	2,437	2,498
Software	1,000	1,025	1,051	1,077	1,104	1,131	1,160	1,189	1,218	1,249
Installation Programmer	500	513	788	808	1,104	1,131	1,160	1,189	1,218	1,249
Total Annual Meter Reading Budget										
Readers	$ 91,236	$ 94,541	$ 97,967	$ 101,518	$ 105,199	$ 109,015	$ 112,971	$ 117,072	$ 121,323	$ 125,730
Field Service Techs	53,231	55,150	114,277	118,399	184,006	190,648	197,531	204,664	212,058	219,721
Lead Worker + Supervisor	129,764	134,419	139,241	144,238	149,415	154,779	160,337	166,097	172,065	178,248
Facilities Rent	116,000	120,060	124,262	128,611	133,113	137,772	142,594	147,584	152,750	158,096
Reading Equipment Maintenance	4,400	4,510	4,885	5,008	5,409	5,544	5,682	5,825	5,970	6,119
Meter Reading Operating Budget	$ 394,631	$ 408,679	$ 480,632	$ 497,773	$ 577,142	$ 597,757	$ 619,115	$ 641,242	$ 664,165	$ 687,914
Customer Service Related										
Total Customer Service	$ 925,359	$ 1,482,858	$ 2,250,392	$ 3,071,151	$ 3,947,966	$ 4,163,780	$ 4,391,396	$ 4,631,468	$ 4,884,645	$ 5,151,651
Total Meter Reading Related	$ 1,319,990	$ 1,891,537	$ 2,731,024	$ 3,568,925	$ 4,525,108	$ 4,761,538	$ 5,010,511	$ 5,272,709	$ 5,548,810	$ 5,839,565

City of Fresno
Meter Reading Feasibility 10-Year Planning Horizon Model Bi-Monthly
4-Year Deployment
Drive-By Radio Frequency
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Operating Cost per Read										
Regular Meter Read	$0.50	$0.33	$0.24	$0.19	$0.15	$0.16	$0.16	$0.16	$0.17	$0.17
Field Service Read	$2.33	$1.56	$2.20	$1.73	$2.17	$2.20	$2.24	$2.28	$2.32	$2.35
Regular + Field Service	$1.92	$1.28	$1.03	$0.81	$0.75	$0.77	$0.78	$0.79	$0.81	$0.82
Reg + Field Serv. + Cust. Serv.	$6.42	$5.94	$5.85	$5.80	$5.92	$6.11	$6.31	$6.52	$6.73	$6.95
Capital Items										
Meters and Pits										
Meters to be Installed	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320
Pits to be Installed	(0)	12,713	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320
Vehicles										
Vehicles Req'd	5	5	6	6	7	7	7	7	7	7
Vehicles in Service	13	5	5	6	6	7	7	7	7	7
New Vehicles (Retirements)	(8)	-	1	-	1	-	-	-	-	-
Potential In-Service Replacement	2	2	2	2	2	2	1	-	-	-
Potential Vehicle Replacements					-	-	-	-	2	3
New Vehicle Purchases	-	2	3	2	3	2	1	-	2	3
Vehicle Retirements	8	2	2	2	2	2	1	-	2	3
Reading Equipment										
# of Handhelds (1/Meter Read)	1	1	1	1	1	1	1	1	1	1
# of Spare Handhelds	1	1	1	1	1	1	1	1	1	1
Purchases (Retirements)	2	-	-	-	-	-	-	-	-	-
Potential Replacements					-	2	-	-	-	-
Purchases + Replacements	2	-	-	-	-	2	-	-	-	-
Installation Programmers Req'd	2	2	3	3	4	4	4	4	4	4
Programmers Purchased (Retired)	2	-	1	-	1	-	-	-	-	-
Potential Replacements					-	2	-	1	-	1
Purchases + Replacements	2	-	1	-	1	2	-	1	-	1
Drive-by Units Required	2	2	2	2	2	2	2	2	2	2
Drive-by Units Purchased	2	-	-	-	-	-	-	-	-	-
Drive-by Units Replaced					-	-	2	-	-	-
Purchases + Replacements	2	-	-	-	-	-	2	-	-	-
Mobile Interface Unit										
Years to Install MIU	4									
MIU's Replaced/Year	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320
Cummulative Replaced	30,465	47,168	69,161	91,194	113,265	115,417	117,610	119,845	122,122	124,442
New Services Installed	-	1,996	2,034	2,073	2,112	2,152	2,193	2,235	2,277	2,320
MIU's Installed & Replaced	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320
Cummulative Replaced & Installed	30,465	47,168	69,161	91,194	113,265	115,417	117,610	119,845	122,122	124,442
MIU Cost	$ 75.00	$ 76.88	$ 78.80	$ 80.77	$ 82.79	$ 84.86	$ 86.98	$ 89.15	$ 91.38	$ 93.66
Installation Cost	$ 15.00	$ 15.53	$ 16.07	$ 16.63	$ 17.21	$ 17.82	$ 18.44	$ 19.08	$ 19.75	$ 20.44

City of Fresno
Meter Reading Feasibility 10-Year Planning Horizon Model Bi-Monthly
4-Year Deployment
Drive-By Radio Frequency
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Capital Budget (to be Borrowed)										
Meters Installed	$ 2,132,516	$ 1,198,439	$ 1,617,484	$ 1,660,861	$ 1,705,396	$ -	$ -	$ -	$ -	$ -
Pits & Boxes Installed	$ -	$ 4,886,552	$ 8,665,095	$ 8,897,472	$ 9,136,052	$ -	$ -	$ -	$ -	$ -
Program Management	$ 304,645	$ 167,030	$ 219,935	$ 220,325	$ 220,715					
Vehicle Purchases (Retirements)	$ (19,429)	$ 30,163	$ 49,429	$ 32,311	$ 52,950	$ -	$ -	$ -	$ -	$ -
Reading Equipment Purchases (Ret.)										
Handhelds	$ 5,600	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Installation Programmer	$ 5,000	$ -	$ 2,627	$ -	$ 2,760	$ -	$ -	$ -	$ -	$ -
Drivey-by	$ 85,000	$ -	$ -	$ -	$ -					
Mobile Interfact Unit	2,741,807	1,543,355	2,086,419	2,145,912	2,207,124	-	-	-	-	-
Total Capital Budget	$ 5,255,140	$ 7,825,539	$ 12,640,990	$ 12,956,882	$ 13,324,997	$ -	$ -	$ -	$ -	$ -
Debt Service Payments	4,351,622	4,351,622	4,351,622	4,351,622	4,351,622	4,351,622	4,351,622	4,351,622	4,351,622	4,351,622
Capital Budget (Out of Pocket)										
Meters Installed	$ -	$ -	$ -	$ -	$ -	$ 170,435	$ 178,025	$ 185,970	$ 194,201	$ 202,815
Pits & Boxes Installed	$ -	$ -	$ -	$ -	$ -	$ 913,046	$ 953,703	$ 996,267	$ 1,040,364	$ 1,086,511
Vehicle Purchases (Retirements)	$ -	$ -	$ -	$ -	$ -	$ 34,613	$ 17,912	$ -	$ 38,376	$ 59,578
Reading Equipment Purchases (Ret.)										
Handhelds	$ -	$ -	$ -	$ -	$ -	$ 6,336	$ -	$ -	$ -	$ -
Installation Programmer	$ -	$ -	$ -	$ -	$ -	$ 5,657	$ -	$ 2,972	$ -	$ 3,122
Drivey-by	$ -	$ -	$ -	$ -	$ -	$ -	$ 98,574	$ -	$ -	$ -
Mobile Interfact Unit	-	-	-	-	-	220,948	231,177	241,907	253,048	264,731
Total Capital Budget	$ -	$ -	$ -	$ -	$ -	$ 1,351,035	$ 1,479,390	$ 1,427,115	$ 1,525,989	$ 1,616,757
Total Budget (Operating + Capital)	$ 5,649,770	$ 8,234,218	$ 13,121,622	$ 13,454,655	$ 13,902,139	$ 1,948,792	$ 2,098,505	$ 2,068,357	$ 2,190,154	$ 2,304,671
Does Not Include Customer Service or Debt Service										
Long-Term Budget	$ 4,746,253	$ 4,760,301	$ 4,832,254	$ 4,849,395	$ 4,928,764	$ 6,300,414	$ 6,450,127	$ 6,419,979	$ 6,541,776	$ 6,656,293
Includes Debt Service, Capital Out of Pocket and Operating Costs)										
NPV Annually	$ 4,477,597	$ 4,236,651	$ 4,057,254	$ 3,841,175	$ 3,683,059	$ 4,441,544	$ 4,289,703	$ 4,027,974	$ 3,872,067	$ 3,716,840
Total Capital	$ 52,003,547									
Total Operating Budget (thru deployment)	$ 2,358,856									
Total Capital	$ 52,003,547									
Total Deployment	$ 54,362,404									
Total Debt Service (10 years)	$ 43,516,220									
Long-Term Cost										
Total Debt Service	$ 43,516,220									
Total Operating Budget (10 years)	$ 5,569,049									
Total Out of Pocket Capital	$ 7,400,287									
Total Long-Term Cost	$ 56,485,557									
Net Present Value										
Discount Rate	200800.0%									
NPV Capital	$42,756,276									
NPV Deployment	$51,285,286									
NPV Long-Term Cost	$ 40,643,863									
Total Cost per Read	$ 23.08	$ 14.95	$ 10.35	$ 7.88	$ 6.45	$ 8.09	$ 8.12	$ 7.94	$ 7.94	$ 7.92

City of Fresno
Meter Reading Feasibility 10-Year Planning Horizon Model Bi-Monthly
4-Year Deployment
Touch Read
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Meter Reading										
Meters										
Total Meters	30,465	47,168	69,161	91,194	113,265	115,417	117,610	119,845	122,122	124,442
Meters to be Installed	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320
Pits & Boxes to be Installed*	(0)	12,713	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320
*Year 2008 total is 31,732 minus 24,232 pits already in the ground										
Installations include annual growth of 1.3%										
Read Frequency										
Quarterly %	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Bi-monthly %	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Monthly %	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Annual Reads										
Quarterly	-	-	-	-	-	-	-	-	-	-
Bi-monthly	182,787	283,005	414,966	547,161	679,590	692,502	705,660	719,070	732,732	746,652
Monthly	-	-	-	-	-	-	-	-	-	-
Total	182,787	283,005	414,966	547,161	679,590	692,502	705,660	719,070	732,732	746,652
Reading Days/Year										
Reading Days/Man Week	4	4	4	4	4	4	4	4	4	4
Holidays/Year	11	11	11	11	11	11	11	11	11	11
Vacation Days/Year	15	15	15	15	15	15	15	15	15	15
Sick Days/Year	12	12	12	12	12	12	12	12	12	12
Total Reading Days/Year	170	170	170	170	170	170	170	170	170	170
Reads/Man Day	320	320	320	320	320	320	320	320	320	320
Field Service (Meter Reading Related)										
Field Service Reads per Year										
Cust. Serv. Request % of Reads	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%
Final Reads % of Meters	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%
Annual Customer Service Req.	18,279	28,301	41,497	54,716	67,959	69,250	70,566	71,907	73,273	74,665
Annual Final Reads	4,570	7,075	10,374	13,679	16,990	17,313	17,642	17,977	18,318	18,666
Total Annual Field Service Reads	22,848	35,376	51,871	68,395	84,949	86,563	88,208	89,884	91,592	93,332
Field Service Days/Year										
Service Days/Man Week	5	5	5	5	5	5	5	5	5	5
Holidays/Year	11	11	11	11	11	11	11	11	11	11
Vacation Days/Year	15	15	15	15	15	15	15	15	15	15
Sick Days/Year	12	12	12	12	12	12	12	12	12	12
Total Reading Days/Year	222	222	222	222	222	222	222	222	222	222
Visits/Man Day	35	35	35	35	35	35	35	35	35	35
Personnel Required										
Calculated Meter Readers	3.4	5.2	7.6	10.1	12.5	12.7	13.0	13.2	13.5	13.7
Calculated Field Service Techs *	2.5	3.8	5.6	7.3	9.1	9.3	9.5	9.6	9.8	10.0
Meter Readers (FTE)	4.0	5.0	8.0	10.0	13.0	13.0	13.0	13.0	14.0	14.0
Field Techs (FTE)	3.0	4.0	6.0	7.0	9.0	9.0	10.0	10.0	10.0	10.0
Calculated Lead Worker(s)	1.0	1.0	1.3	1.5	2.0	2.0	2.1	2.1	2.2	2.2
Actual Lead Workers	1.0	1.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Supervisor Collections Section	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

* Field Service Techs are supported by meter readers on any off-reading days.

City of Fresno
Meter Reading Feasibility 10-Year Planning Horizon Model Bi-Monthly
4-Year Deployment
Touch Read
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Operating Expenses										
Meter Related										
Salary										
Readers	$ 157,331	$ 203,547	$ 337,074	$ 436,090	$ 586,759	$ 607,295	$ 628,551	$ 650,550	$ 725,113	$ 750,492
Field Service Techs	140,837	194,355	301,736	364,346	484,840	501,810	577,081	597,279	618,184	639,820
Lead Worker	53,213	55,076	57,004	117,997	122,127	126,402	130,826	135,405	140,144	145,049
Supervisor Collections	63,851	66,086	68,399	70,793	73,270	75,835	78,489	81,236	84,080	87,022
Total Salary	$ 415,232	$ 519,064	$ 764,212	$ 989,226	$ 1,266,997	$ 1,311,342	$ 1,414,947	$ 1,464,470	$ 1,567,520	$ 1,622,384
Education										
Readers	$ 740	$ 962	$ 1,601	$ 2,081	$ 2,814	$ 2,926	$ 3,043	$ 3,165	$ 3,545	$ 3,686
Field Service Techs	555	770	1,201	1,457	1,948	2,026	2,341	2,434	2,532	2,633
Lead Worker + Supervisor	500	520	541	844	877	912	949	987	1,026	1,067
Total Education	$ 1,795	$ 2,252	$ 3,342	$ 4,381	$ 5,639	$ 5,864	$ 6,333	$ 6,586	$ 7,103	$ 7,387
M & S										
Readers	$ 4,000	$ 5,175	$ 8,570	$ 11,087	$ 14,918	$ 15,440	$ 15,980	$ 16,540	$ 18,435	$ 19,081
Field Service Techs	3,000	4,140	6,427	7,761	10,328	10,689	12,293	12,723	13,168	13,629
Lead Worker + Supervisor	2,000	2,070	2,142	3,326	3,443	3,563	3,688	3,817	3,950	4,089
Total M&S	$ 9,000	$ 11,385	$ 17,140	$ 22,174	$ 28,688	$ 29,692	$ 31,961	$ 33,079	$ 35,554	$ 36,798
Contract Services										
Readers	$ 400	$ 518	$ 857	$ 1,109	$ 1,492	$ 1,544	$ 1,598	$ 1,654	$ 1,844	$ 1,908
Field Service Techs	300	414	643	776	1,033	1,069	1,229	1,272	1,317	1,363
Lead Worker + Supervisor	200	207	214	333	344	356	369	382	395	409
Total Contract Services	$ 900	$ 1,139	$ 1,714	$ 2,217	$ 2,869	$ 2,969	$ 3,196	$ 3,308	$ 3,555	$ 3,680
Vehicles (Fuel + Maintenance)										
Readers	$ 16,000	$ 20,900	$ 34,945	$ 45,647	$ 62,011	$ 64,801	$ 67,718	$ 70,765	$ 79,638	$ 83,221
Field Service Techs	12,000	16,720	26,209	31,953	42,931	44,863	52,090	54,434	56,884	59,444
Lead Worker + Supervisor	8,000	8,360	8,736	13,694	14,310	14,954	15,627	16,330	17,065	17,833
Total Fuel	$ 36,000	$ 45,980	$ 69,890	$ 91,293	$ 119,252	$ 124,618	$ 135,435	$ 141,530	$ 153,587	$ 160,498
Insurance										
Readers	$ 4,000	$ 5,250	$ 8,820	$ 11,576	$ 15,802	$ 16,592	$ 17,421	$ 18,292	$ 20,684	$ 21,719
Field Service Techs	3,000	4,200	6,615	8,103	10,940	11,487	13,401	14,071	14,775	15,513
Lead Worker + Supervisor	2,000	2,100	2,205	3,473	3,647	3,829	4,020	4,221	4,432	4,654
Total Insurance	$ 9,000	$ 11,550	$ 17,640	$ 23,153	$ 30,388	$ 31,907	$ 34,842	$ 36,585	$ 39,891	$ 41,886
Misc.										
Readers	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Field Service Techs	-	-	-	-	-	-	-	-	-	-
Lead Worker + Supervisor	-	-	-	-	-	-	-	-	-	-
Total Miscellaneous	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Meter Reading Equipment Maintenance										
Hand-held	$ 1,400	$ 2,009	$ 2,942	$ 3,920	$ 5,254	$ 5,386	$ 5,520	$ 5,658	$ 6,141	$ 6,294
Software	1,000	1,025	1,051	1,077	1,104	1,131	1,160	1,189	1,218	1,249
Total Annual Meter Reading Budget										
Readers	$ 182,471	$ 236,352	$ 391,867	$ 507,590	$ 683,794	$ 708,598	$ 734,311	$ 760,966	$ 849,258	$ 880,107
Field Service Techs	159,692	220,598	342,830	414,396	552,019	571,943	658,435	682,214	706,859	732,402
Lead Worker + Supervisor	129,764	134,419	139,241	210,459	218,019	225,852	233,968	242,378	251,093	260,124
Facilities Rent	116,000	120,060	124,262	128,611	133,113	137,772	142,594	147,584	152,750	158,096
Reading Equipment Maintenance	2,400	3,034	3,992	4,997	6,358	6,517	6,680	6,847	7,359	7,543
Meter Reading Operating Budget	$ 590,327	$ 714,463	$ 1,002,192	$ 1,266,053	$ 1,593,303	$ 1,650,681	$ 1,775,988	$ 1,839,989	$ 1,967,320	$ 2,038,272
Customer Service Related										
Total Customer Service	$ 925,359	$ 1,482,858	$ 2,250,392	$ 3,071,151	$ 3,947,966	$ 4,163,780	$ 4,391,396	$ 4,631,468	$ 4,884,645	$ 5,151,651
Total Reading + Techs + Cust. Serv.	$ 1,515,687	$ 2,197,321	$ 3,252,585	$ 4,337,204	$ 5,541,269	$ 5,814,462	$ 6,167,384	$ 6,471,457	$ 6,851,965	$ 7,189,923

City of Fresno
Meter Reading Feasibility 10-Year Planning Horizon Model Bi-Monthly
4-Year Deployment
Touch Read
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Operating Cost per Read										
Regular Meter Read	$1.00	$0.84	$0.94	$0.93	$1.01	$1.02	$1.04	$1.06	$1.16	$1.18
Field Service Read	$6.99	$6.24	$6.61	$6.06	$6.50	$6.61	$7.46	$7.59	$7.72	$7.85
Regular + Field Service	$2.87	$2.24	$2.15	$2.06	$2.08	$2.12	$2.24	$2.27	$2.39	$2.43
Reg + Field Serv. + Cust. Serv.	$7.37	$6.90	$6.97	$7.05	$7.25	$7.46	$7.77	$8.00	$8.31	$8.56
Capital Items										
Meters and Pits										
Meters to be Installed	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320
Pits to be Installed	(0)	12,713	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320
Vehicles										
Vehicles Req'd	9	11	16	20	25	25	26	26	27	27
Vehicles in Service	13	9	11	16	20	25	25	26	26	27
New Vehicles (Retirements)	(4)	2	5	4	5	-	1	-	1	-
Potential In-Service Replacement	2	2	2	2	2	2	1	-	-	-
Potential Vehicle Replacements					-	-	-	-	4	7
New Vehicle Purchases	-	4	7	6	7	2	2	-	5	7
Vehicle Retirements	4	2	2	2	2	2	1	-	4	7
Reading Equipment										
# of Handhelds (1/Meter Read)	4	5	8	10	13	13	13	13	14	14
# of Spare Handhelds	1	2	2	3	4	4	4	4	4	4
Purchases (Retirements)	5	2	3	3	4	-	-	-	1	-
Potential Replacements					-	5	2	3	3	4
Purchases + Replacements	5	2	3	3	4	5	2	3	4	4
# of Pocket Pro (1/Field Service)	3	4	6	7	9	9	10	10	10	10
# of Spare Pocket Pro	1	1	2	2	3	3	3	3	3	3
Purchases (Retirements)	4	1	3	1	3	-	1	-	-	-
Potential Replacements					-	4	1	3	1	3
Purchases + Replacements	4	1	3	1	3	4	2	3	1	3
Touch Pad										
Years to Install Pads	4									
Pads Replaced/Year	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320
Cummulative Replaced	30,465	47,168	69,161	91,194	113,265	115,417	117,610	119,845	122,122	124,442
New Services Installed	-	1,996	2,034	2,073	2,112	2,152	2,193	2,235	2,277	2,320
Total Pads Installed & Replaced	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320
Cummulative Replaced & Installed	30,465	47,168	69,161	91,194	113,265	115,417	117,610	119,845	122,122	124,442
Touch Pad Cost	$15.00	$15.38	$15.76	$16.15	$16.56	$16.97	$17.40	$17.83	$18.28	$18.73
Installation Cost	$15.00	$15.53	$16.07	$16.63	$17.21	$17.82	$18.44	$19.08	$19.75	$20.44

City of Fresno
Meter Reading Feasibility 10-Year Planning Horizon Model Bi-Monthly
4-Year Deployment
Touch Read
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Capital Budget (to be Borrowed)										
Meters Installed	$ 2,132,516	$ 1,198,439	$ 1,617,484	$ 1,660,861	$ 1,705,396	$ -	$ -	$ -	$ -	$ -
Pits & Boxes Installed	$ -	$ 4,886,552	$ 8,665,095	$ 8,897,472	$ 9,136,052	$ -	$ -	$ -	$ -	$ -
Program Management	$ 304,645	$ 167,030	$ 219,935	$ 220,325	$ 220,715					
Vehicle Purchases (Retirements)	$ (9,714)	$ 65,353	$ 122,273	$ 107,704	$ 130,982	$ -	$ -	$ -	$ -	$ -
Reading Equipment Purchases (Ret.)										
Handhelds	$ 14,000	$ 5,740	$ 8,825	$ 9,046	$ 12,363	$ -	$ -	$ -	$ -	$ -
Pocket Pro	$ 1,600	$ 410	$ 1,261	$ 431	$ 1,325	$ -	$ -	$ -	$ -	$ -
Touch Pad	$ 913,936	$ 516,122	$ 700,004	$ 722,316	$ 745,355	$ -	$ -	$ -	$ -	$ -
Total Capital Budget	$ 3,356,983	$ 6,839,646	$ 11,334,877	$ 11,618,156	$ 11,952,188	$ -	$ -	$ -	$ -	$ -
Debt Service Payments	3,774,093	3,774,093	3,774,093	3,774,093	3,774,093	3,774,093	3,774,093	3,774,093	3,774,093	3,774,093
Capital Budget (Out of Pocket)										
Meters Installed	$ -	$ -	$ -	$ -	$ -	$ 170,435	$ 178,025	$ 185,970	$ 194,201	$ 202,815
Pits & Boxes Installed	$ -	$ -	$ -	$ -	$ -	$ 913,046	$ 953,703	$ 996,267	$ 1,040,364	$ 1,086,511
Vehicle Purchases (Retirements)	$ -	$ -	$ -	$ -	$ -	$ 34,613	$ 38,809	$ -	$ 99,137	$ 139,016
Reading Equipment Purchases (Ret.)										
Handhelds	$ -	$ -	$ -	$ -	$ -	$ 15,840	$ 6,494	$ 9,985	$ 13,646	$ 13,987
Pocket Pro	$ -	$ -	$ -	$ -	$ -	$ 1,810	$ 928	$ 1,426	$ 487	$ 1,499
Touch Pad	-	-	-	-	-	$ 74,860	$ 78,584	$ 82,504	$ 86,590	$ 90,889
Total Capital Budget	$ -	$ -	$ -	$ -	$ -	$ 1,210,605	$ 1,256,543	$ 1,276,152	$ 1,434,426	$ 1,534,717
Total Budget (Operating + Capital)	$ 3,947,310	$ 7,554,109	$ 12,337,069	$ 12,884,209	$ 13,545,491	$ 2,861,286	$ 3,032,531	$ 3,116,141	$ 3,401,745	$ 3,572,989
Does Not Include Customer Service or Debt Service										
Long-Term Budget	$ 4,364,420	$ 4,488,555	$ 4,776,285	$ 5,040,145	$ 5,367,395	$ 6,635,379	$ 6,806,623	$ 6,890,234	$ 7,175,838	$ 7,347,081
Includes Debt Service, Capital Out of Pocket and Operating Costs)										
NPV Annually	$ 4,117,377	$ 3,994,798	$ 4,010,261	$ 3,992,267	$ 4,010,830	$ 4,677,680	$ 4,526,793	$ 4,323,018	$ 4,247,367	$ 4,102,572
Total Capital	$ 45,101,849									
Total Operating Budget (thru deployment)	$ 5,166,338									
Total Capital	$ 45,101,849									
Total Deployment	$ 50,268,188									
Total Debt Service (10 years)	$ 37,740,925									
Long-Term Cost										
Total Debt Service	$ 37,740,925									
Total Operating Budget (10 years)	$ 14,438,588									
Total Out of Pocket Capital	$ 6,712,443									
Total Long-Term Cost	$ 58,891,956									
Net Present Value										
Discount Rate	6.0%									
NPV Capital	$36,905,244									
NPV Deployment	$47,422,819									
NPV Long-Term Cost	$ 42,002,965									
Total Cost per Read	$ 21.22	$ 14.10	$ 10.23	$ 8.19	$ 7.02	$ 8.52	$ 8.57	$ 8.52	$ 8.71	$ 8.75

City of Fresno
Meter Reading Feasibility 10-Year Planning Horizon Model Bi-Monthly
4-Year Deployment
Manual Read
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Meter Reading										
Meters										
Total Meters	30,465	47,168	69,161	91,194	113,265	115,417	117,610	119,845	122,122	124,442
Meters to be Installed	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320
Pits & Boxes to be Installed*	(0)	12,713	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320
*Year 2008-2009 total is 31,732 minus 34,455 (24,232+10,223) pits already in the ground										
Installations include annual growth of 1.3%										
Read Frequency										
Quarterly %	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Bi-monthly %	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Monthly %	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Annual Reads										
Quarterly	-	-	-	-	-	-	-	-	-	-
Bi-monthly	182,787	283,005	414,966	547,161	679,590	692,502	705,660	719,070	732,732	746,652
Monthly	-	-	-	-	-	-	-	-	-	-
Total	182,787	283,005	414,966	547,161	679,590	692,502	705,660	719,070	732,732	746,652
Reading Days/Year										
Reading Days/Man Week	4	4	4	4	4	4	4	4	4	4
Holidays/Year	11	11	11	11	11	11	11	11	11	11
Vacation Days/Year	15	15	15	15	15	15	15	15	15	15
Sick Days/Year	12	12	12	12	12	12	12	12	12	12
Total Reading Days/Year	170	170	170	170	170	170	170	170	170	170
Reads/Man Day	160	160	160	160	160	160	160	160	160	160
Field Service (Meter Reading Related)										
Field Service Reads per Year										
Cust. Serv. Request % of Reads	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%
Final Reads % of Meters	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%
Annual Customer Service Req.	18,279	28,301	41,497	54,716	67,959	69,250	70,566	71,907	73,273	74,665
Annual Final Reads	4,570	7,075	10,374	13,679	16,990	17,313	17,642	17,977	18,318	18,666
Total Annual Field Service Reads	22,848	35,376	51,871	68,395	84,949	86,563	88,208	89,884	91,592	93,332
Field Service Days/Year										
Service Days/Man Week	5	5	5	5	5	5	5	5	5	5
Holidays/Year	11	11	11	11	11	11	11	11	11	11
Vacation Days/Year	15	15	15	15	15	15	15	15	15	15
Sick Days/Year	12	12	12	12	12	12	12	12	12	12
Total Reading Days/Year	222	222	222	222	222	222	222	222	222	222
Visits/Man Day	25	25	25	25	25	25	25	25	25	25
Personnel Required										
Calculated Meter Readers	6.7	10.4	15.3	20.1	25.0	25.5	25.9	26.4	26.9	27.5
Calculated Field Service Techs *	3.4	5.3	7.8	10.3	12.8	13.0	13.2	13.5	13.8	14.0
Meter Readers (FTE)	7.0	11.0	15.0	20.0	25.0	26.0	26.0	26.0	27.0	28.0
Field Techs (FTE)	4.0	5.0	8.0	10.0	13.0	13.0	13.0	14.0	14.0	14.0
Calculated Lead Worker(s)	1.0	1.5	2.1	2.7	3.5	3.5	3.5	3.6	3.7	3.8
Actual Lead Workers	1.0	1.0	2.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0
Supervisor Collections Section	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

* Field Service Techs are supported by meter readers on any off-reading days.

City of Fresno
Meter Reading Feasibility 10-Year Planning Horizon Model Bi-Monthly
4-Year Deployment
Manual Read
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Operating Expenses										
Meter Related										
Salary										
Readers	$ 275,330	$ 447,804	$ 632,014	$ 872,180	$ 1,128,382	$ 1,214,591	$ 1,257,101	$ 1,301,100	$ 1,398,432	$ 1,500,984
Field Service Techs	187,782	242,943	402,314	520,494	700,325	724,836	750,206	836,191	865,457	895,748
Lead Worker	53,213	55,076	114,007	176,996	183,191	252,804	261,652	270,810	280,288	290,098
Supervisor Collections	63,851	66,086	68,399	70,793	73,270	75,835	78,489	81,236	84,080	87,022
Total Salary	$ 580,176	$ 811,909	$ 1,216,735	$ 1,640,463	$ 2,085,169	$ 2,268,066	$ 2,347,448	$ 2,489,337	$ 2,628,257	$ 2,773,853
Education										
Readers	$ 1,295	$ 2,116	$ 3,001	$ 4,162	$ 5,411	$ 5,852	$ 6,086	$ 6,330	$ 6,836	$ 7,373
Field Service Techs	740	962	1,601	2,081	2,814	2,926	3,043	3,408	3,545	3,686
Lead Worker + Supervisor	500	520	811	1,125	1,170	1,521	1,582	1,645	1,711	1,779
Total Education	$ 2,535	$ 3,598	$ 5,413	$ 7,368	$ 9,394	$ 10,299	$ 10,711	$ 11,383	$ 12,091	$ 12,838
M & S										
Readers	$ 7,000	$ 11,385	$ 16,068	$ 22,174	$ 28,688	$ 30,880	$ 31,961	$ 33,079	$ 35,554	$ 38,161
Field Service Techs	4,000	5,175	8,570	11,087	14,918	15,440	15,980	17,812	18,435	19,081
Lead Worker + Supervisor	2,000	2,070	3,214	4,435	4,590	5,938	6,146	6,361	6,584	6,814
Total M&S	$ 13,000	$ 18,630	$ 27,852	$ 37,696	$ 48,196	$ 52,258	$ 54,087	$ 57,253	$ 60,573	$ 64,056
Contract Services										
Readers	$ 700	$ 1,139	$ 1,607	$ 2,217	$ 2,869	$ 3,088	$ 3,196	$ 3,308	$ 3,555	$ 3,816
Field Service Techs	400	518	857	1,109	1,492	1,544	1,598	1,781	1,844	1,908
Lead Worker + Supervisor	200	207	321	443	459	594	615	636	658	681
Total Contract Services	$ 1,300	$ 1,863	$ 2,785	$ 3,770	$ 4,820	$ 5,226	$ 5,409	$ 5,725	$ 6,057	$ 6,406
Vehicles (Fuel + Maintenance)										
Readers	$ 28,000	$ 45,980	$ 65,522	$ 91,293	$ 119,252	$ 129,603	$ 135,435	$ 141,530	$ 153,587	$ 166,443
Field Service Techs	16,000	20,900	34,945	45,647	62,011	64,801	67,718	76,208	79,638	83,221
Lead Worker + Supervisor	8,000	8,360	13,104	18,259	19,080	24,924	26,045	27,217	28,442	29,722
Total Fuel	$ 52,000	$ 75,240	$ 113,571	$ 155,199	$ 200,343	$ 219,328	$ 229,198	$ 244,955	$ 261,667	$ 279,386
Insurance										
Readers	$ 7,000	$ 11,550	$ 16,538	$ 23,153	$ 30,388	$ 33,183	$ 34,842	$ 36,585	$ 39,891	$ 43,437
Field Service Techs	4,000	5,250	8,820	11,576	15,802	16,592	17,421	19,699	20,684	21,719
Lead Worker + Supervisor	2,000	2,100	3,308	4,631	4,862	6,381	6,700	7,036	7,387	7,757
Total Insurance	$ 13,000	$ 18,900	$ 28,665	$ 39,359	$ 51,051	$ 56,156	$ 58,964	$ 63,320	$ 67,963	$ 72,912
Misc.										
Readers	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Field Service Techs	-	-	-	-	-	-	-	-	-	-
Lead Worker + Supervisor	-	-	-	-	-	-	-	-	-	-
Total Miscellaneous	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Meter Reading Equipment Maintenance										
Hand-held	$ 2,520	$ 4,018	$ 5,589	$ 7,538	$ 9,890	$ 10,454	$ 10,716	$ 10,983	$ 11,599	$ 12,239
Software	1,000	1,025	1,051	1,077	1,104	1,131	1,160	1,189	1,218	1,249
Total Annual Meter Reading Budget										
Readers	$ 319,325	$ 519,974	$ 734,750	$ 1,015,179	$ 1,314,989	$ 1,417,197	$ 1,468,622	$ 1,521,931	$ 1,637,856	$ 1,760,214
Field Service Techs	212,922	275,748	457,107	591,994	797,361	826,139	855,966	955,100	989,603	1,025,363
Lead Worker + Supervisor	129,764	134,419	203,164	276,681	286,623	367,997	381,229	394,941	409,150	423,874
Facilities Rent	116,000	120,060	124,262	128,611	133,113	137,772	142,594	147,584	152,750	158,096
Reading Equipment Maintenance	3,520	5,043	6,640	8,615	10,994	11,586	11,875	12,172	12,818	13,488
Meter Reading Operating Budget	$ 781,531	$ 1,055,244	$ 1,525,923	$ 2,021,081	$ 2,543,079	$ 2,760,690	$ 2,860,286	$ 3,031,728	$ 3,202,176	$ 3,381,035
Customer Service Related										
Total Customer Service	$ 925,359	$ 1,482,858	$ 2,250,392	$ 3,071,151	$ 3,947,966	$ 4,163,780	$ 4,391,396	$ 4,631,468	$ 4,884,645	$ 5,151,651
Total Reading + Techs + Cust. Serv.	$ 1,706,891	$ 2,538,101	$ 3,776,315	$ 5,092,232	$ 6,491,046	$ 6,924,471	$ 7,251,682	$ 7,663,196	$ 8,086,821	$ 8,532,686

City of Fresno
Meter Reading Feasibility 10-Year Planning Horizon Model Bi-Monthly
4-Year Deployment
Manual Read
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Operating Cost per Read										
Regular Meter Read	$1.75	$1.84	$1.77	$1.86	$1.93	$2.05	$2.08	$2.12	$2.24	$2.36
Field Service Read	$9.32	$7.79	$8.81	$8.66	$9.39	$9.54	$9.70	$10.63	$10.80	$10.99
Regular + Field Service	$3.80	$3.31	$3.27	$3.28	$3.33	$3.54	$3.60	$3.75	$3.88	$4.03
Reg + Field Serv. + Cust. Serv.	$8.30	$7.97	$8.09	$8.27	$8.49	$8.89	$9.13	$9.47	$9.81	$10.16
Capital Items										
Meters and Pits										
Meters to be Installed	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320
Pits to be Installed	(0)	12,713	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320
Vehicles										
Vehicles Req'd	13	18	26	34	42	44	44	45	46	47
Vehicles in Service	13	13	18	26	34	42	44	44	45	46
New Vehicles (Retirements)	-	5	8	8	8	2	-	1	1	1
Potential In-Service Replacement	2	2	2	2	2	2	1	-	-	-
Potential Vehicle Replacements					-	-	-	2	7	10
New Vehicle Purchases	2	7	10	10	10	4	1	3	8	11
Vehicle Retirements	2	2	2	2	2	2	1	2	7	10
Reading Equipment										
# of Handhelds (1/Meter Read)	7	11	15	20	25	26	26	26	27	28
# of Spare Handhelds	2	3	4	5	7	7	7	7	7	7
Purchases (Retirements)	9	5	5	6	7	1	-	-	1	1
Potential Replacements					-	9	5	5	6	7
Purchases + Replacements	9	5	5	6	7	10	5	5	7	8
# of Pocket Pro (1/Field Service)	-	-	-	-	-	-	-	-	-	-
# of Spare Pocket Pro	-	-	-	-	-	-	-	-	-	-
Purchases (Retirements)	-	-	-	-	-	-	-	-	-	-
Calculated Replacements					-	-	-	-	-	-
Purchases + Replacements					-	-	-	-	-	-
Lenses (Not used in this model)										
Years to Replace Existing Lenses	4									
Lenses Replaced/Year	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320
Cummulative Replaced	30,465	47,168	69,161	91,194	113,265	115,417	117,610	119,845	122,122	124,442
New Services Installed	-	1,996	2,034	2,073	2,112	2,152	2,193	2,235	2,277	2,320
Total Lenses Installed & Replaced	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320
Cummulative Replaced & Installed	30,465	47,168	69,161	91,194	113,265	115,417	117,610	119,845	122,122	124,442
Lens Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Installation Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

City of Fresno
Meter Reading Feasibility 10-Year Planning Horizon Model Bi-Monthly
4-Year Deployment
Manual Read
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Capital Budget (to be Borrowed)										
Meters Installed	$ 2,132,516	$ 1,198,439	$ 1,617,484	$ 1,660,861	$ 1,705,396	$ -	$ -	$ -	$ -	$ -
Pits & Boxes Installed	$ -	$ 4,886,552	$ 8,665,095	$ 8,897,472	$ 9,136,052	$ -	$ -	$ -	$ -	$ -
Program Management	$ 304,645	$ 167,030	$ 219,935	$ 220,325	$ 220,715					
Vehicle Purchases (Retirements)	$ 29,143	$ 118,138	$ 176,905	$ 183,097	$ 189,505	$ -	$ -	$ -	$ -	$ -
Reading Equipment Purchases (Ret.)										
Handhelds	$ 25,200	$ 14,350	$ 14,709	$ 18,092	$ 21,635	$ -	$ -	$ -	$ -	$ -
Pocket Pro	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Lens	-	-	-	-	-	$ -	$ -	$ -	$ -	$ -
Total Capital Budget	$ 2,491,504	$ 6,384,509	$ 10,694,129	$ 10,979,847	$ 11,273,304	$ -	$ -	$ -	$ -	$ -
Debt Service Payments	$3,499,745	$3,499,745	$3,499,745	$3,499,745	$3,499,745	$3,499,745	$3,499,745	$3,499,745	$3,499,745	$3,499,745
Capital Budget (out of Pocket)										
Meters Installed	$ -	$ -	$ -	$ -	$ -	$ 170,435	$ 178,025	$ 185,970	$ 194,201	$ 202,815
Pits & Boxes Installed	$ -	$ -	$ -	$ -	$ -	$ 913,046	$ 953,703	$ 996,267	$ 1,040,364	$ 1,086,511
Vehicle Purchases (Retirements)	$ -	$ -	$ -	$ -	$ -	$ 74,994	$ 17,912	$ 58,707	$ 156,700	$ 221,763
Reading Equipment Purchases (Ret.)										
Handhelds	$ -	$ -	$ -	$ -	$ -	$ 31,679	$ 16,236	$ 16,642	$ 23,881	$ 27,975
Pocket Pro	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Lens	$ -	$ -	$ -	$ -	$ -	-	-	-	-	-
Total Capital Budget	$ -	$ -	$ -	$ -	$ -	$ 1,190,155	$ 1,165,875	$ 1,257,585	$ 1,415,146	$ 1,539,064
Total Budget (Operating + Capital)	$ 3,273,036	$ 7,439,752	$ 12,220,051	$ 13,000,928	$ 13,816,383	$ 3,950,845	$ 4,026,161	$ 4,289,314	$ 4,617,322	$ 4,920,098
Does Not Include Customer Service or Debt Service										
Long-Term Budget	$ 4,281,277	$ 4,554,989	$ 5,025,668	$ 5,520,826	$ 6,042,825	$ 7,450,591	$ 7,525,906	$ 7,789,059	$ 8,117,067	$ 8,419,844
Includes Debt Service, Capital Out of Pocket and Operating Costs)										
NPV Annually	$ 4,038,940	$ 4,053,924	$ 4,219,648	$ 4,373,011	$ 4,515,550	$ 5,252,372	$ 5,005,157	$ 4,886,952	$ 4,804,480	$ 4,701,597
Total Capital	$ 41,823,293									
Total Operating Budget (thru deployment)	$ 7,926,858									
Total Capital	$ 41,823,293									
Total Deployment	$ 49,750,151									
Total Debt Service (10 years)	$ 34,997,451									
Long-Term Cost										
Total Debt Service	$ 34,997,451									
Total Operating Budget (10 years)	$ 23,162,774									
Total Out of Pocket Capital	$ 6,567,825									
Total Long-Term Cost	$ 64,728,050									
Net Present Value										
Discount Rate	6.0%									
NPV Capital	$34,132,798									
NPV Deployment	$46,934,105									
NPV Long-Term Cost	$ 45,851,631									
Total Cost per Read	$ 20.82	$ 14.31	$ 10.77	$ 8.97	$ 7.90	$ 9.56	$ 9.48	$ 9.63	$ 9.85	$ 10.02

City of Fresno

Meter Reading Feasibility 10-Year Planning Horizon Model Bi-Monthly

4-Year Deployment

Model Inputs

(Updated: September 17, 2007)

	2008 Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Meters										
Growth Factor		1.9%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%
Total Meter Accounts	105,050	107,046	109,080	111,153	113,265	115,417	117,610	119,845	122,122	124,442
Meters Installed at Year End	30,465	47,168	69,161	91,194	113,265	115,417	117,610	119,845	122,122	124,442
Pits & Boxes Installed Annually	(0)	12,713	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320
Meters Installed Annually	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320
Read Frequency (Monthly % of Meters)										
Manual	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Touch Read	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Mobile Drive-by	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Fixed Radio	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Read Frequency (Bi-monthly % of Meters)										
Manual	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Touch Read	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Mobile Drive-by	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Fixed Radio	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Field Service Visits										
Customer Service/Billing (% of Reads)	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%
Final Reads (% of Meters)	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%
Reading and Field Visit Productivity										
Meter Reading										
Manual Read Days per Week	4	4	4	4	4	4	4	4	4	4
Touch Read Days per Week	4	4	4	4	4	4	4	4	4	4
Mobile Drive-by Days per Week	5	5	5	5	5	5	5	5	5	5
Fixed Radio Days per Week	5	5	5	5	5	5	5	5	5	5
Manual Reads per Day	160	160	160	160	160	160	160	160	160	160
Touch Reads per Day	320	320	320	320	320	320	320	320	320	320
Mobile Drive-by Reads per Day	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000
Mobile Drive-by Rounding Factor	0.25	Any mobile drive-by unit calculation greater than				0.25	will round up to the next integer			
Meters per Meter Reader (Fixed)	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
Field Visits										
Manual Read Days per Week	5	5	5	5	5	5	5	5	5	5
Touch Read Days per Week	5	5	5	5	5	5	5	5	5	5
Mobile Drive-by Days per Week	5	5	5	5	5	5	5	5	5	5
Fixed Radio Days per Week	5	5	5	5	5	5	5	5	5	5
Manual Read Visits per Day	25	25	25	25	25	25	25	25	25	25
Touch Read Visits per Day	35	35	35	35	35	35	35	35	35	35
Mobile Drive-by Visits per Day	300	300	300	300	300	300	300	300	300	300
Meters/Field Service (Drive + Fixed)	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000
Reading and Field Visit Paid Time Off										
Meter Reading + Field Service										
Holidays/Year	11	11	11	11	11	11	11	11	11	11
Vacation Days/Year (avg.)	15	15	15	15	15	15	15	15	15	15
Sick Days/Year (avg.)	12	12	12	12	12	12	12	12	12	12
Lead Worker										
Holidays/Year	11	11	11	11	11	11	11	11	11	11
Vacation Days/Year	20	20	20	20	20	20	20	20	20	20
Sick Days/Year	12	12	12	12	12	12	12	12	12	12
Readers Rounding factor	0.40	Any personnel calculation greater than or equal to				0.40	will round up to the next integer			
Field Service Tech Rounding factor	0.40	Any personnel calculation greater than or equal to				0.40	will round up to the next integer			
Lead Worker Rounding factor	0.50	Any personnel calculation greater than or equal to				0.50	will round up to the next integer			

City of Fresno
Meter Reading Feasibility 10-Year Planning Horizon Model Bi-Monthly
4-Year Deployment
Model Inputs
(Updated: September 17, 2007)

	2008 Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Operating Expenses										
Meter Related										
Salary										
Growth Factor (Inflation)		3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Paid Hours per Year	2,080	2,080	2,080	2,080	2,080	2,080	2,080	2,080	2,080	2,080
Meter Readers Hourly Rate (avg.)	$15.50	$16.04	$16.60	$17.19	$17.79	$18.41	$19.05	$19.72	$20.41	$21.12
Field Service Tech Hourly Rate (avg.)	$18.50	$19.15	$19.82	$20.51	$21.23	$21.97	$22.74	$23.54	$24.36	$25.21
Read & FS Benefits Multiplier	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22
Loaded Meter Reading Rate	$18.91	$19.57	$20.26	$20.97	$21.70	$22.46	$23.25	$24.06	$24.90	$25.77
Loaded Field Service Tech Rate	$22.57	$23.36	$24.18	$25.02	$25.90	$26.81	$27.74	$28.72	$29.72	$30.76
Lead Worker Hourly Rate	$20.97	$21.70	$22.46	$23.25	$24.06	$24.91	$25.78	$26.68	$27.61	$28.58
Lead Worker Benefits Multiplier	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22
Lead Worker Loaded Hourly Rate	$25.58	$26.48	$27.41	$28.36	$29.36	$30.39	$31.45	$32.55	$33.69	$34.87
Supervisor Collections Section	$63,851.00	$66,085.79	$68,398.79	$70,792.75	$73,270.49	$75,834.96	$78,489.18	$81,236.30	$84,079.57	$87,022.36
FTE/Lead Worker	11									
Supervisor Collections	1									
Education										
Growth Factor (Inflation)		4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
Meter Readers $/FTE	$185.00	$192.40	$200.10	$208.10	$216.42	$225.08	$234.08	$243.45	$253.19	$263.31
Field Service Techs $/FTE	$185.00	$192.40	$200.10	$208.10	$216.42	$225.08	$234.08	$243.45	$253.19	$263.31
Lead Worker + Super. $/FTE	$250.00	$260.00	$270.40	$281.22	$292.46	$304.16	$316.33	$328.98	$342.14	$355.83
Material & Supplies										
Growth Factor (Inflation)		3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Meter Readers $/FTE	$1,000.00	$1,035.00	$1,071.23	$1,108.72	$1,147.52	$1,187.69	$1,229.26	$1,272.28	$1,316.81	$1,362.90
Field Service Techs $/FTE	$1,000.00	$1,035.00	$1,071.23	$1,108.72	$1,147.52	$1,187.69	$1,229.26	$1,272.28	$1,316.81	$1,362.90
Lead Worker + Super. $/FTE	$1,000.00	$1,035.00	$1,071.23	$1,108.72	$1,147.52	$1,187.69	$1,229.26	$1,272.28	$1,316.81	$1,362.90
Contract Services										
Growth Factor (Inflation)		3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Meter Readers $/FTE	$100.00	$103.50	$107.12	$110.87	$114.75	$118.77	$122.93	$127.23	$131.68	$136.29
Field Service Techs $/FTE	$100.00	$103.50	$107.12	$110.87	$114.75	$118.77	$122.93	$127.23	$131.68	$136.29
Lead Worker + Super. $/FTE	$100.00	$103.50	$107.12	$110.87	$114.75	$118.77	$122.93	$127.23	$131.68	$136.29
Vehicle Fuel + Maint.										
Growth Factor (Inflation)		4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%
Meter Readers $/FTE	$4,000.00	$4,180.00	$4,368.10	$4,564.66	$4,770.07	$4,984.73	$5,209.04	$5,443.45	$5,688.40	$5,944.38
Field Service Techs $/FTE	$4,000.00	$4,180.00	$4,368.10	$4,564.66	$4,770.07	$4,984.73	$5,209.04	$5,443.45	$5,688.40	$5,944.38
Lead Worker + Super. $/FTE	$4,000.00	$4,180.00	$4,368.10	$4,564.66	$4,770.07	$4,984.73	$5,209.04	$5,443.45	$5,688.40	$5,944.38
Insurance										
Growth Factor (Inflation)		5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
Meter Readers $/FTE	$1,000.00	$1,050.00	$1,102.50	$1,157.63	$1,215.51	$1,276.28	$1,340.10	$1,407.10	$1,477.46	$1,551.33
Field Service Techs $/FTE	$1,000.00	$1,050.00	$1,102.50	$1,157.63	$1,215.51	$1,276.28	$1,340.10	$1,407.10	$1,477.46	$1,551.33
Lead Worker + Super. $/FTE	$1,000.00	$1,050.00	$1,102.50	$1,157.63	$1,215.51	$1,276.28	$1,340.10	$1,407.10	$1,477.46	$1,551.33
Misc.										
Growth Factor (Inflation)		3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Meter Readers $/FTE	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Field Service Techs $/FTE	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Lead Worker + Super. $/FTE	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00

City of Fresno
Meter Reading Feasibility 10-Year Planning Horizon Model Bi-Monthly
4-Year Deployment
Model Inputs
(Updated: September 17, 2007)

	2008 Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Facilities Rent	$116,000.00	$120,060.00	$124,262.10	$128,611.27	$133,112.67	$137,771.61	$142,593.62	$147,584.39	$152,749.85	$158,096.09
Meter Reading Equipment Maintenance										
Growth Factor (Inflation)		2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
Touch Read Hand-held	$280.00	$287.00	$294.18	$301.53	$309.07	$316.79	$324.71	$332.83	$341.15	$349.68
Mobile Hand-held	$450.00	$461.25	$472.78	$484.60	$496.72	$509.13	$521.86	$534.91	$548.28	$561.99
Drive-by	$1,000.00	$1,025.00	$1,050.63	$1,076.89	$1,103.81	$1,131.41	$1,159.69	$1,188.69	$1,218.40	$1,248.86
Collectors	$200.00	$205.00	$210.13	$215.38	$220.76	$226.28	$231.94	$237.74	$243.68	$249.77
Touch and Mobile Software	$1,000.00	$1,025.00	$1,050.63	$1,076.89	$1,103.81	$1,131.41	$1,159.69	$1,188.69	$1,218.40	$1,248.86
Fixed Software	$2,000.00	$2,050.00	$2,101.25	$2,153.78	$2,207.63	$2,262.82	$2,319.39	$2,377.37	$2,436.81	$2,497.73
Installation Programmers	$250.00	$256.25	$262.66	$269.22	$275.95	$282.85	$289.92	$297.17	$304.60	$312.22
Customer Service Related										
Growth Factor		3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Cost per Read	$ 4.50	$ 4.66	$ 4.82	$ 4.99	$ 5.16	$ 5.34	$ 5.53	$ 5.73	$ 5.93	$ 6.13
Capital Related										
Vehicles										
Current Vehicles in Service	13									
Currnet Vehicle Replacement Factor	2.00	vehicles per year								
Cost Growth Factor		3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Vehicle Cost	$17,000	$17,595	$18,211	$18,848	$19,508	$20,191	$20,897	$21,629	$22,386	$23,169
Vehicle Life in Years	7	**Inputs restricted to values of 4 to 10 years**								
Reading Equipment										
Cost Growth Factor		2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
Touch Pad Handheld Cost	$2,800	$2,870	$2,942	$3,015	$3,091	$3,168	$3,247	$3,328	$3,412	$3,497
Touch Pad Handheld Life	5	**Inputs restricted to values of 4 to 10 years**								
Touch Pad Pocket Pro Cost	$400	$410	$420	$431	$442	$453	$464	$475	$487	$500
Touch Pad Pocket Pro Life	5	**Inputs restricted to values of 4 to 10 years**								
Mobile Handheld Cost	$4,500	$4,613	$4,728	$4,846	$4,967	$5,091	$5,219	$5,349	$5,483	$5,620
Mobile Handheld Life	5	**Inputs restricted to values of 4 to 10 years**								
Handheld Spares % of FTE	25%									
Touch Spare for Mobile and Fixed	1									
Installation Programmer Cost	$2,500	$2,563	$2,627	$2,692	$2,760	$2,829	$2,899	$2,972	$3,046	$3,122
Installation Programmer Life	5	**Inputs restricted to values of 4 to 10 years**								
Mobile Walk										
System Computer	$2,500									
Software and Training	$10,000									
Total Mobile Walk Startup Cost	$12,500	$12,813	$13,133	$13,461	$13,798	$14,143	$14,496	$14,859	$15,230	$15,611
	6	**Inputs restricted to values of 4 to 10 years**								
Drive-by										
Mobile Collector	$ 30,000									
System Computer	$ 2,500									
Software and Training	$ 10,000									
Total Drive-by Mobile Unit Cost	$ 42,500	$ 43,563	$ 44,652	$ 45,768	$ 46,912	$ 48,085	$ 49,287	$ 50,519	$ 51,782	$ 53,077
Drive-by Unit Life in Years	6	**Inputs restricted to values of 4 to 10 years**								

City of Fresno

Meter Reading Feasibility 10-Year Planning Horizon Model Bi-Monthly

4-Year Deployment

Model Inputs

(Updated: September 17, 2007)

	2008 Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Fixed Radio										
Collector Units	40									
Cost per Collector	$2,500									
Network Control Computer	$40,000									
Sotware and Training	$20,000									
Fixed Unit Infrastructure Cost	$160,000	$164,000	$168,100	$172,303	$176,610	$181,025	$185,551	$190,190	$194,944	$199,818
Fixed Unit Infrastructure Life	20	**Inputs restricted to values of 5, 10, 15 & 20 years**								
Touch Pad and MIU										
Initial Replacement Time in Years	4	**year deployment**								
Manual Read	4									
Touch Read	4									
Mobile Drive-by	4									
Fixed Radio	4									
Pad and MIU Cost										
Manual Read Cost Growth Factor		2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
Lens Cost	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Touch Read Cost Growth Factor		2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
Touch Pad Cost	$15.00	$15.38	$15.76	$16.15	$16.56	$16.97	$17.40	$17.83	$18.28	$18.73
Mobile Drive-by Growth Factor		2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
Mobile Drive-by MIU Cost	$75.00	$76.88	$78.80	$80.77	$82.79	$84.86	$86.98	$89.15	$91.38	$93.66
Fixed Radio Growth Factor		2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
Fixed MIU Cost	$85.00	$87.13	$89.30	$91.54	$93.82	$96.17	$98.57	$101.04	$103.56	$106.15
Pad and MIU Installation Cost										
Manual Read Cost Growth Factor		3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Lens Installation Cost	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Touch Read Cost Growth Factor		3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Touch Pad Installation Cost	$15.00	$15.53	$16.07	$16.63	$17.21	$17.82	$18.44	$19.08	$19.75	$20.44
Mobile Drive-by Growth Factor		3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Mobile Drive-by MIU Installation Cost	$15.00	$15.53	$16.07	$16.63	$17.21	$17.82	$18.44	$19.08	$19.75	$20.44
Fixed Radio Growth Factor		3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Fixed MIU Installation Cost	$15.00	$15.53	$16.07	$16.63	$17.21	$17.82	$18.44	$19.08	$19.75	$20.44
Meter and Pit Installation Cost										
Meter Cost Growth Factor		2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
Meter Cost	$70.00	$71.75	$73.54	$75.38	$77.27	$79.20	$81.18	$83.21	$85.29	$87.42
Pit & Box Installation Growth Factor		2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
Pit & Box Installation Cost	$375.00	$384.38	$393.98	$403.83	$413.93	$424.28	$434.89	$445.76	$456.90	$468.32
Program Management	$10.00									
Discount Rate	6.0%									

City of Fresno

Meter Reading Feasibility 20-Year Planning Horizon Model Bi-Monthly
4-Year Deployment
Summary of Results
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Operating Budget (Does Not Include Customer Service)																				
Manual Read	$ 781,531	$ 1,055,244	$ 1,525,923	$ 2,021,081	$ 2,543,079	$ 2,760,690	$ 2,860,286	$ 3,031,728	$ 3,202,176	$ 3,381,035	$ 3,503,188	$ 3,776,680	$ 3,913,225	$ 4,127,657	$ 4,364,482	$ 4,600,750	$ 4,767,340	$ 5,024,118	$ 5,507,263	$ 5,706,896
Touch Read	$ 590,327	$ 714,463	$ 1,002,192	$ 1,266,053	$ 1,593,303	$ 1,650,681	$ 1,775,988	$ 1,839,989	$ 1,967,320	$ 2,038,272	$ 2,111,806	$ 2,266,649	$ 2,418,829	$ 2,506,196	$ 2,596,748	$ 2,768,900	$ 3,067,874	$ 3,178,846	$ 3,293,871	$ 3,503,874
Mobile Drive-by	$ 394,631	$ 408,679	$ 480,632	$ 497,773	$ 577,142	$ 597,757	$ 619,115	$ 641,242	$ 664,165	$ 687,914	$ 712,519	$ 738,011	$ 764,422	$ 876,554	$ 907,969	$ 940,519	$ 974,246	$ 1,009,193	$ 1,045,403	$ 1,082,924
Fixed Radio	$ 356,013	$ 367,559	$ 437,952	$ 453,476	$ 531,165	$ 550,038	$ 569,588	$ 589,838	$ 610,814	$ 632,543	$ 655,050	$ 678,366	$ 702,519	$ 812,307	$ 916,447	$ 949,209	$ 983,153	$ 1,018,322	$ 1,054,761	$ 1,092,516
Capital Outlay to be Borrowed (Does Not Include Customer Service or Debt Service)																				
Manual Read	$ 2,491,504	$ 6,384,509	$ 10,694,129	$ 10,979,847	$ 11,273,304	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Touch Read	$ 3,356,983	$ 6,839,646	$ 11,334,877	$ 11,618,156	$ 11,952,188	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Mobile Drive-by	$ 5,255,140	$ 7,825,539	$ 12,640,990	$ 12,956,882	$ 13,324,997	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Fixed Radio	$ 5,635,756	$ 7,996,745	$ 12,872,059	$ 13,194,148	$ 13,568,625	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Capital Cost out of Pocket (Does Not Include Customer Service or Debt Service)																				
Manual Read	$ -	$ -	$ -	$ -	$ -	$ 1,190,155	$ 1,165,875	$ 1,257,585	$ 1,415,146	$ 1,539,064	$ 1,588,010	$ 1,694,658	$ 1,576,160	$ 1,615,075	$ 1,732,672	$ 1,942,778	$ 2,055,651	$ 2,143,776	$ 2,371,136	$ 2,140,494
Touch Read	$ -	$ -	$ -	$ -	$ -	$ 1,210,605	$ 1,256,543	$ 1,276,152	$ 1,434,426	$ 1,534,717	$ 1,585,331	$ 1,689,390	$ 1,660,830	$ 1,706,820	$ 1,736,180	$ 1,973,311	$ 2,122,922	$ 2,136,128	$ 2,283,467	$ 2,286,070
Mobile Drive-by	$ -	$ -	$ -	$ -	$ -	$ 1,351,035	$ 1,479,390	$ 1,427,115	$ 1,525,989	$ 1,616,757	$ 1,678,280	$ 1,760,202	$ 1,934,245	$ 1,905,016	$ 1,938,292	$ 2,086,058	$ 2,187,981	$ 2,262,688	$ 2,523,763	$ 2,469,264
Fixed Radio	$ -	$ -	$ -	$ -	$ -	$ 1,379,230	$ 1,406,248	$ 1,453,683	$ 1,553,732	$ 1,645,731	$ 1,712,893	$ 1,791,810	$ 1,852,946	$ 1,939,506	$ 2,001,826	$ 2,128,609	$ 2,227,276	$ 2,303,726	$ 2,434,067	$ 2,514,042
Debt Service Payments																				
Manual Read	$ 3,499,745	$ 3,499,745	$ 3,499,745	$ 3,499,745	$ 3,499,745	$ 3,499,745	$ 3,499,745	$ 3,499,745	$ 3,499,745	$ 3,499,745	$ 3,499,745	$ 3,499,745	$ 3,499,745	$ 3,499,745	$ 3,499,745	$ 3,499,745	$ 3,499,745	$ 3,499,745	$ 3,499,745	$ 3,499,745
Touch Read	$ 3,774,093	$ 3,774,093	$ 3,774,093	$ 3,774,093	$ 3,774,093	$ 3,774,093	$ 3,774,093	$ 3,774,093	$ 3,774,093	$ 3,774,093	$ 3,774,093	$ 3,774,093	$ 3,774,093	$ 3,774,093	$ 3,774,093	$ 3,774,093	$ 3,774,093	$ 3,774,093	$ 3,774,093	$ 3,774,093
Mobile Drive-by	$ 4,351,622	$ 4,351,622	$ 4,351,622	$ 4,351,622	$ 4,351,622	$ 4,351,622	$ 4,351,622	$ 4,351,622	$ 4,351,622	$ 4,351,622	$ 4,351,622	$ 4,351,622	$ 4,351,622	$ 4,351,622	$ 4,351,622	$ 4,351,622	$ 4,351,622	$ 4,351,622	$ 4,351,622	$ 4,351,622
Fixed Radio	$ 4,457,375	$ 4,457,375	$ 4,457,375	$ 4,457,375	$ 4,457,375	$ 4,457,375	$ 4,457,375	$ 4,457,375	$ 4,457,375	$ 4,457,375	$ 4,457,375	$ 4,457,375	$ 4,457,375	$ 4,457,375	$ 4,457,375	$ 4,457,375	$ 4,457,375	$ 4,457,375	$ 4,457,375	$ 4,457,375
Long-Term Budget (Does Not Include Customer Service)																				
Manual Read	$ 4,281,277	$ 4,554,989	$ 5,025,668	$ 5,520,826	$ 6,042,825	$ 7,450,591	$ 7,525,906	$ 7,789,059	$ 8,117,067	$ 8,419,844	$ 8,590,943	$ 8,971,083	$ 8,989,129	$ 9,242,478	$ 9,596,899	$ 10,043,273	$ 10,322,736	$ 10,667,639	$ 11,378,144	$ 11,347,134
Touch Read	$ 4,364,420	$ 4,488,555	$ 4,776,285	$ 5,040,145	$ 5,367,395	$ 6,635,379	$ 6,806,623	$ 6,890,234	$ 7,175,838	$ 7,347,081	$ 7,471,230	$ 7,730,132	$ 7,853,751	$ 7,987,108	$ 8,107,020	$ 8,516,304	$ 8,964,889	$ 9,089,066	$ 9,351,430	$ 9,564,036
Mobile Drive-by	$ 4,746,253	$ 4,760,301	$ 4,832,254	$ 4,849,395	$ 4,928,764	$ 6,300,414	$ 6,450,127	$ 6,419,979	$ 6,541,776	$ 6,656,293	$ 6,742,421	$ 6,849,835	$ 7,050,289	$ 7,133,192	$ 7,197,883	$ 7,378,199	$ 7,513,849	$ 7,623,503	$ 7,920,788	$ 7,903,809
Fixed Radio	$ 4,813,388	$ 4,824,933	$ 4,895,327	$ 4,910,850	$ 4,988,540	$ 6,386,643	$ 6,433,211	$ 6,500,895	$ 6,621,921	$ 6,735,648	$ 6,825,319	$ 6,927,551	$ 7,012,840	$ 7,209,188	$ 7,375,648	$ 7,535,193	$ 7,667,804	$ 7,779,423	$ 7,946,203	$ 8,063,932

Results and Inputs	**NPV Capital**	**Rank Capital**	**NPV Deployment**	**Rank Deployment**	**NPV Long-Term**	**Rank Long-Term**	Yrs to Impl.	Reads/Day	Visits/Day	$/Pad, MIU	Startup-Infra.	Read Eq. Life
Manual Read	**$ 34,132,798**	1	**$ 46,934,105**	1	**$85,965,498**	4	4	160	25	$ -		5
Touch Read	**$ 36,905,244**	2	**$ 47,422,819**	2	**$76,316,812**	3	4	320	35	$ 15.00		5
Mobile Drive-by	**$ 42,756,276**	3	**$ 51,285,286**	3	**$70,511,730**	1	4	7,000	300	$ 75.00	$ 42,500	6
Fixed Radio	**$ 43,831,721**	4	**$ 52,276,884**	4	**$71,375,394**	2	4			$ 85.00	$ 160,000	20

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Cost per Read																				
Meter Readings																				
Meter Readers	182,787	283,005	414,966	547,161	679,590	692,502	705,660	719,070	732,732	746,652	760,836	775,290	790,020	805,032	820,326	835,914	851,796	867,978	884,472	901,278
Field Service	22,848	35,376	51,871	68,395	84,949	86,563	88,208	89,884	91,592	93,332	95,105	96,911	98,753	100,629	102,541	104,489	106,475	108,497	110,559	112,660
Operating Cost/Read (Meter Readers + Field Service + Customer Service)																				
Manual Read	$ 4.28	$ 3.73	$ 3.68	$ 3.69	$ 3.74	$ 3.99	$ 4.05	$ 4.22	$ 4.37	$ 4.53	$ 4.60	$ 4.87	$ 4.95	$ 5.13	$ 5.32	$ 5.50	$ 5.60	$ 5.79	$ 6.23	$ 6.33
Touch Read	$ 3.23	$ 2.52	$ 2.42	$ 2.31	$ 2.34	$ 2.38	$ 2.52	$ 2.56	$ 2.68	$ 2.73	$ 2.78	$ 2.92	$ 3.06	$ 3.11	$ 3.17	$ 3.31	$ 3.60	$ 3.66	$ 3.72	$ 3.89
Mobile Drive-by	$ 2.16	$ 1.44	$ 1.16	$ 0.91	$ 0.85	$ 0.86	$ 0.88	$ 0.89	$ 0.91	$ 0.92	$ 0.94	$ 0.95	$ 0.97	$ 1.09	$ 1.11	$ 1.13	$ 1.14	$ 1.16	$ 1.18	$ 1.20
Fixed Radio	$ 1.95	$ 1.30	$ 1.06	$ 0.83	$ 0.78	$ 0.79	$ 0.81	$ 0.82	$ 0.83	$ 0.85	$ 0.86	$ 0.87	$ 0.89	$ 1.01	$ 1.12	$ 1.14	$ 1.15	$ 1.17	$ 1.19	$ 1.21
Op.+Cap. Cost/Read																				
Manual Read	$ 23.42	$ 16.10	$ 12.11	$ 10.09	$ 8.89	$ 10.76	$ 10.67	$ 10.83	$ 11.08	$ 11.28	$ 11.29	$ 11.57	$ 11.38	$ 11.48	$ 11.70	$ 12.01	$ 12.12	$ 12.29	$ 12.86	$ 12.59
Touch Read	$ 23.88	$ 15.86	$ 11.51	$ 9.21	$ 7.90	$ 9.58	$ 9.65	$ 9.58	$ 9.79	$ 9.84	$ 9.82	$ 9.97	$ 9.94	$ 9.92	$ 9.88	$ 10.19	$ 10.52	$ 10.47	$ 10.57	$ 10.61
Mobile Drive-by	$ 25.97	$ 16.82	$ 11.64	$ 8.86	$ 7.25	$ 9.10	$ 9.14	$ 8.93	$ 8.93	$ 8.91	$ 8.86	$ 8.84	$ 8.92	$ 8.86	$ 8.77	$ 8.83	$ 8.82	$ 8.78	$ 8.96	$ 8.77
Fixed Radio	$ 26.33	$ 17.05	$ 11.80	$ 8.98	$ 7.34	$ 9.22	$ 9.12	$ 9.04	$ 9.04	$ 9.02	$ 8.97	$ 8.94	$ 8.88	$ 8.96	$ 8.99	$ 9.01	$ 9.00	$ 8.96	$ 8.98	$ 8.95

City of Fresno
Meter Reading Feasibility 20-Year Planning Horizon Model Bi-Monthly
4-Year Deployment
Fixed Radio Frequency
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Meter Reading																				
Meters																				
Total Meters	30,465	47,168	69,161	91,194	113,265	115,417	117,610	119,845	122,122	124,442	126,806	129,215	131,670	134,172	136,721	139,319	141,966	144,663	147,412	150,213
Meters to be Installed	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Pits & Boxes to be Installed*	(0)	12,713	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
*Year 2008 total is 31,732 minus 24,232 pits already in the ground																				
Installations include annual growth of 1.3%																				
Read Frequency																				
Quarterly %	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%	0.0%	0.0%	0.0%
Bi-monthly %	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%	100.0%	100.0%
Monthly %	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%	0.0%	0.0%	0.0%
Total	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%	100.0%	100.0%
Annual Reads																				
Quarterly	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bi-monthly	182,787	283,005	414,966	547,161	679,590	692,502	705,660	719,070	732,732	746,652	760,836	775,290	790,020	805,032	820,326	835,914	851,796	867,978	884,472	901,278
Monthly	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	182,787	283,005	414,966	547,161	679,590	692,502	705,660	719,070	732,732	746,652	760,836	775,290	790,020	805,032	820,326	835,914	851,796	867,978	884,472	901,278
Reading Days/Year																				
Reading Days/Man Week	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Holidays/Year	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Vacation Days/Year	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Sick Days/Year	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Total Reading Days/Year	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222
Meters/FTE	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
Field Service (Meter Reading Related)																				
Field Service Reads per Year																				
Cust. Serv. Request % of Reads	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%
Final Reads % of Meters	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%
Annual Customer Service Req.	18,279	28,301	41,497	54,716	67,959	69,250	70,566	71,907	73,273	74,665	76,084	77,529	79,002	80,503	82,033	83,591	85,180	86,798	88,447	90,128
Annual Final Reads	4,570	7,075	10,374	13,679	16,990	17,313	17,642	17,977	18,318	18,666	19,021	19,382	19,751	20,126	20,508	20,898	21,295	21,699	22,112	22,532
Total Annual Field Service Reads	22,848	35,376	51,871	68,395	84,949	86,563	88,208	89,884	91,592	93,332	95,105	96,911	98,753	100,629	102,541	104,489	106,475	108,497	110,559	112,660
Field Service Days/Year																				
Service Days/Man Week	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Holidays/Year	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Vacation Days/Year	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Sick Days/Year	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Total Reading Days/Year	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222
Meters/FTE	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000
Personnel Required																				
Calculated Meter Readers	1.0	1.0	1.0	1.0	1.1	1.2	1.2	1.2	1.2	1.2	1.3	1.3	1.3	1.3	1.4	1.4	1.4	1.4	1.5	1.5
Calculated Field Service Techs	1.0	1.2	1.7	2.3	2.8	2.9	2.9	3.0	3.1	3.1	3.2	3.2	3.3	3.4	3.4	3.5	3.5	3.6	3.7	3.8
Meter Readers (FTE)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0
Field Techs (FTE)	1.0	1.0	2.0	2.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Calculated Lead Worker(s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Actual Lead Workers	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Supervisor Collections Section	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

* Meter readers take field service reads. Field Service Techs become responsible for the radio system including the meter interface units.

City of Fresno
Meter Reading Feasibility 20-Year Planning Horizon Model Bi-Monthly
4-Year Deployment
Fixed Radio Frequency
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Operating Expenses																				
Meter Related																				
Salary																				
Readers	$ 39,333	$ 40,709	$ 42,134	$ 43,609	$ 45,135	$ 46,715	$ 48,350	$ 50,042	$ 51,794	$ 53,607	$ 55,483	$ 57,425	$ 59,435	$ 61,515	$ 127,336	$ 131,792	$ 136,405	$ 141,179	$ 146,121	$ 151,235
Field Service Techs	46,946	48,589	100,579	104,099	161,613	167,270	173,124	179,184	185,455	191,946	198,664	205,617	212,814	293,683	303,962	314,601	325,612	337,008	348,804	361,012
Lead Worker	53,213	55,076	57,004	58,999	61,064	63,201	65,413	67,702	70,072	72,525	75,063	77,690	80,409	83,224	86,136	89,151	92,271	95,501	98,843	102,303
Supervisor Collections	63,851	66,086	68,399	70,793	73,270	75,835	78,489	81,236	84,080	87,022	90,068	93,221	96,483	99,860	103,355	106,973	110,717	114,592	118,603	122,754
Total Salary	$ 203,343	$ 210,460	$ 268,115	$ 277,499	$ 341,083	$ 353,021	$ 365,377	$ 378,165	$ 391,401	$ 405,100	$ 419,278	$ 433,953	$ 449,141	$ 538,282	$ 620,790	$ 642,517	$ 665,005	$ 688,280	$ 712,370	$ 737,303
Education																				
Readers	$ 185	$ 192	$ 200	$ 208	$ 216	$ 225	$ 234	$ 243	$ 253	$ 263	$ 274	$ 285	$ 296	$ 308	$ 641	$ 666	$ 693	$ 721	$ 750	$ 780
Field Service Techs	185	192	400	416	649	675	702	730	760	790	822	854	889	1,232	1,281	1,333	1,386	1,441	1,499	1,559
Lead Worker + Supervisor	500	520	541	562	585	608	633	658	684	712	740	770	801	833	866	900	936	974	1,013	1,053
Total Education	$ 870	$ 905	$ 1,141	$ 1,187	$ 1,451	$ 1,509	$ 1,569	$ 1,632	$ 1,697	$ 1,765	$ 1,836	$ 1,909	$ 1,985	$ 2,373	$ 2,788	$ 2,900	$ 3,015	$ 3,136	$ 3,262	$ 3,392
M & S																				
Readers	$ 1,000	$ 1,035	$ 1,071	$ 1,109	$ 1,148	$ 1,188	$ 1,229	$ 1,272	$ 1,317	$ 1,363	$ 1,411	$ 1,460	$ 1,511	$ 1,564	$ 3,237	$ 3,351	$ 3,468	$ 3,589	$ 3,715	$ 3,845
Field Service Techs	1,000	1,035	2,142	2,217	3,443	3,563	3,688	3,817	3,950	4,089	4,232	4,380	4,533	6,256	6,475	6,701	6,936	7,179	7,430	7,690
Lead Worker + Supervisor	2,000	2,070	2,142	2,217	2,295	2,375	2,459	2,545	2,634	2,726	2,821	2,920	3,022	3,128	3,237	3,351	3,468	3,589	3,715	3,845
Total M&S	$ 4,000	$ 4,140	$ 5,356	$ 5,544	$ 6,885	$ 7,126	$ 7,376	$ 7,634	$ 7,901	$ 8,177	$ 8,464	$ 8,760	$ 9,066	$ 10,948	$ 12,950	$ 13,403	$ 13,872	$ 14,357	$ 14,860	$ 15,380
Contract Services																				
Readers	$ 100	$ 104	$ 107	$ 111	$ 115	$ 119	$ 123	$ 127	$ 132	$ 136	$ 141	$ 146	$ 151	$ 156	$ 324	$ 335	$ 347	$ 359	$ 371	$ 385
Field Service Techs	100	104	214	222	344	356	369	382	395	409	423	438	453	626	647	670	694	718	743	769
Lead Worker + Supervisor	200	207	214	222	230	238	246	254	263	273	282	292	302	313	324	335	347	359	371	385
Total Contract Services	$ 400	$ 414	$ 536	$ 554	$ 689	$ 713	$ 738	$ 763	$ 790	$ 818	$ 846	$ 876	$ 907	$ 1,095	$ 1,295	$ 1,340	$ 1,387	$ 1,436	$ 1,486	$ 1,538
Vehicles (Fuel + Maintenance)																				
Readers	$ 4,000	$ 4,180	$ 4,368	$ 4,565	$ 4,770	$ 4,985	$ 5,209	$ 5,443	$ 5,688	$ 5,944	$ 6,212	$ 6,491	$ 6,784	$ 7,089	$ 14,816	$ 15,482	$ 16,179	$ 16,907	$ 17,668	$ 18,463
Field Service Techs	4,000	4,180	8,736	9,129	14,310	14,954	15,627	16,330	17,065	17,833	18,636	19,474	20,351	28,355	29,631	30,965	32,358	33,814	35,336	36,926
Lead Worker + Supervisor	8,000	8,360	8,736	9,129	9,540	9,969	10,418	10,887	11,377	11,889	12,424	12,983	13,567	14,178	14,816	15,482	16,179	16,907	17,668	18,463
Total Fuel	$ 16,000	$ 16,720	$ 21,841	$ 22,823	$ 28,620	$ 29,908	$ 31,254	$ 32,661	$ 34,130	$ 35,666	$ 37,271	$ 38,948	$ 40,701	$ 49,621	$ 59,262	$ 61,929	$ 64,716	$ 67,628	$ 70,671	$ 73,852
Insurance																				
Readers	$ 1,000	$ 1,050	$ 1,103	$ 1,158	$ 1,216	$ 1,276	$ 1,340	$ 1,407	$ 1,477	$ 1,551	$ 1,629	$ 1,710	$ 1,796	$ 1,886	$ 3,960	$ 4,158	$ 4,366	$ 4,584	$ 4,813	$ 5,054
Field Service Techs	1,000	1,050	2,205	2,315	3,647	3,829	4,020	4,221	4,432	4,654	4,887	5,131	5,388	7,543	7,920	8,316	8,731	9,168	9,626	10,108
Lead Worker + Supervisor	2,000	2,100	2,205	2,315	2,431	2,553	2,680	2,814	2,955	3,103	3,258	3,421	3,592	3,771	3,960	4,158	4,366	4,584	4,813	5,054
Total Insurance	$ 4,000	$ 4,200	$ 5,513	$ 5,788	$ 7,293	$ 7,658	$ 8,041	$ 8,443	$ 8,865	$ 9,308	$ 9,773	$ 10,262	$ 10,775	$ 13,200	$ 15,839	$ 16,631	$ 17,463	$ 18,336	$ 19,253	$ 20,216
Misc.																				
Readers	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Field Service Techs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead Worker + Supervisor	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Miscellaneous	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Meter Reading Equipment Maintenance																				
Hand-held	$ 900	$ 923	$ 946	$ 969	$ 993	$ 1,018	$ 1,044	$ 1,070	$ 1,097	$ 1,124	$ 1,152	$ 1,181	$ 1,210	$ 1,241	$ 1,272	$ 1,303	$ 1,336	$ 1,369	$ 1,404	$ 1,439
Collectors	$ 8,000	$ 8,200	$ 8,405	$ 8,615	$ 8,831	$ 9,051	$ 9,278	$ 9,509	$ 9,747	$ 9,991	$ 10,241	$ 10,497	$ 10,759	$ 11,028	$ 11,304	$ 11,586	$ 11,876	$ 12,173	$ 12,477	$ 12,789
Software	2,000	1,025	1,051	1,077	1,104	1,131	1,160	1,189	1,218	1,249	1,280	1,312	1,345	1,379	1,413	1,448	1,485	1,522	1,560	1,599
Installation Programmer	500	513	788	808	1,104	1,131	1,160	1,189	1,218	1,249	1,280	1,312	1,345	1,723	1,766	1,810	1,856	1,902	1,950	1,998
Total Annual Meter Reading Budget																				
Readers	$ 45,618	$ 47,270	$ 48,983	$ 50,759	$ 52,600	$ 54,508	$ 56,485	$ 58,536	$ 60,661	$ 62,865	$ 65,149	$ 67,517	$ 69,972	$ 72,518	$ 150,313	$ 155,785	$ 161,458	$ 167,339	$ 173,438	$ 179,761
Field Service Techs	53,231	55,150	114,277	118,399	184,006	190,648	197,531	204,664	212,058	219,721	227,663	235,895	244,427	337,695	349,917	362,585	375,717	389,329	403,438	418,064
Lead Worker + Supervisor	129,764	134,419	139,241	144,238	149,415	154,779	160,337	166,097	172,065	178,248	184,656	191,296	198,176	205,306	212,694	220,350	228,284	236,506	245,026	253,856
Facilities Rent	116,000	120,060	124,262	128,611	133,113	137,772	142,594	147,584	152,750	158,096	163,629	169,356	175,284	181,419	187,769	194,340	201,142	208,182	215,469	223,010
Reading Equipment Maintenance	11,400	10,660	11,189	11,469	12,032	12,332	12,641	12,957	13,281	13,613	13,953	14,302	14,659	15,370	15,755	16,149	16,552	16,966	17,390	17,825
Meter Reading Operating Budget	$ 356,013	$ 367,559	$ 437,952	$ 453,476	$ 531,165	$ 550,038	$ 569,588	$ 589,838	$ 610,814	$ 632,543	$ 655,050	$ 678,366	$ 702,519	$ 812,307	$ 916,447	$ 949,209	$ 983,153	$ 1,018,322	$ 1,054,761	$ 1,092,516
Customer Service Related																				
Total Customer Service	$ 925,359	$ 1,482,858	$ 2,250,392	$ 3,071,151	$ 3,947,966	$ 4,163,780	$ 4,391,396	$ 4,631,468	$ 4,884,645	$ 5,151,651	$ 5,433,249	$ 5,730,243	$ 6,043,483	$ 6,373,863	$ 6,722,277	$ 7,089,766	$ 7,477,325	$ 7,886,053	$ 8,317,167	$ 8,771,835
Total Meter Reading Related	$ 1,281,372	$ 1,850,416	$ 2,688,345	$ 3,524,627	$ 4,479,131	$ 4,713,819	$ 4,960,984	$ 5,221,306	$ 5,495,459	$ 5,784,193	$ 6,088,299	$ 6,408,610	$ 6,746,002	$ 7,186,170	$ 7,638,724	$ 8,038,975	$ 8,460,478	$ 8,904,375	$ 9,371,928	$ 9,864,350

City of Fresno
Meter Reading Feasibility 20-Year Planning Horizon Model Bi-Monthly
4-Year Deployment
Fixed Radio Frequency
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Operating Cost per Read																				
Regular Meter Read	$0.25	$0.17	$0.12	$0.09	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	$0.09	$0.09	$0.09	$0.09	$0.18	$0.19	$0.19	$0.19	$0.20	$0.20
Field Service Read	$2.33	$1.56	$2.20	$1.73	$2.17	$2.20	$2.24	$2.28	$2.32	$2.35	$2.39	$2.43	$2.48	$3.36	$3.41	$3.47	$3.53	$3.59	$3.65	$3.71
Regular + Field Service	$1.73	$1.15	$0.94	$0.74	$0.69	$0.71	$0.72	$0.73	$0.74	$0.75	$0.77	$0.78	$0.79	$0.90	$0.99	$1.01	$1.03	$1.04	$1.06	$1.08
Reg + Field Serv. + Cust. Serv.	$6.23	$5.81	$5.76	$5.73	$5.86	$6.05	$6.25	$6.45	$6.67	$6.89	$7.11	$7.35	$7.59	$7.93	$8.28	$8.55	$8.83	$9.12	$9.42	$9.73
Capital Items																				
Meters and Pits																				
Meters to be Installed	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Pits to be Installed	(0)	12,713	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Vehicles																				
Vehicles Req'd	4	4	5	5	6	6	6	6	6	6	6	6	6	7	8	8	8	8	8	8
Vehicles in Service	13	4	4	5	5	6	6	6	6	6	6	6	6	6	7	8	8	8	8	8
New Vehicles (Retirements)	(9)	-	1	-	1	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-
Potential In-Service Replacement	2	2	2	2	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Potential Vehicle Replacements					-	-	-	-	2	3	2	3	2	1	-	2	3	2	3	2
New Vehicle Purchases	-	2	3	2	3	2	1	-	2	3	2	3	2	2	1	2	3	2	3	2
Vehicle Retirements	9	2	2	2	2	2	1	-	2	3	2	3	2	1	-	2	3	2	3	2
Reading Equipment																				
# of Handhelds	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
# of Spare Handhelds	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Purchases (Retirements)	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Potential Replacements					-	2	-	-	-	-	2	-	-	-	-	2	-	-	-	-
Purchases + Replacements	2	-	-	-	-	2	-	-	-	-	2	-	-	-	-	2	-	-	-	-
Installation Programmers Req'd	2	2	3	3	4	4	4	4	4	4	4	4	4	5	5	5	5	5	5	5
Programmers Purchased (Retired)	2	-	1	-	1	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
Calculated Prog. Replacements					-	2	-	1	-	1	2	-	1	-	1	2	-	1	1	1
Purchases + Replacements	2	-	1	-	1	2	-	1	-	1	2	-	1	1	1	2	-	1	1	1
Calculated Fixed Units Req'd	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Fixed Units Required	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Fixed Units Purchased (Retired)	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Calculated Replacements						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Purchases + Replacements	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mobile Interface Unit																				
Years to Install MIU	4																			
MIU's Replaced/Year	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Cummulative Replaced	30,465	47,168	69,161	91,194	113,265	115,417	117,610	119,845	122,122	124,442	126,806	129,215	131,670	134,172	136,721	139,319	141,966	144,663	147,412	150,213
New Services Installed	-	1,996	2,034	2,073	2,112	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
MIU's Installed & Replaced	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Cummulative Replaced & Installed	30,465	47,168	69,161	91,194	113,265	115,417	117,610	119,845	122,122	124,442	126,806	129,215	131,670	134,172	136,721	139,319	141,966	144,663	147,412	150,213
MIU Cost	$85.00	$87.13	$89.30	$91.54	$93.82	$96.17	$98.57	$101.04	$103.56	$106.15	$108.81	$111.53	$114.32	$117.17	$120.10	$123.11	$126.18	$129.34	$132.57	$135.89
Installation Cost	$ 15.00	$ 15.53	$ 16.07	$ 16.63	$ 17.21	$ 17.82	$ 18.44	$ 19.08	$ 19.75	$ 20.44	$ 21.16	$ 21.90	$ 22.67	$ 23.46	$ 24.28	$ 25.13	$ 26.01	$ 26.92	$ 27.86	$ 28.84

City of Fresno
Meter Reading Feasibility 20-Year Planning Horizon Model Bi-Monthly
4-Year Deployment
Fixed Radio Frequency
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Capital Budget (to be Borrowed)																				
Meters Installed	$ 2,132,516	$ 1,198,439	$ 1,617,484	$ 1,660,861	$ 1,705,396	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Pits & Boxes Installed	$ -	$ 4,886,552	$ 8,665,095	$ 8,897,472	$ 9,136,052	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Program Management	$ 304,645	$ 167,030	$ 219,935	$ 220,325	$ 220,715	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Vehicle Purchases (Retirements)	$ (21,857)	$ 30,163	$ 49,429	$ 32,311	$ 52,950	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Reading Equipment Purchases (Ret.)																				
Handhelds	$ 9,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Installation Programmers	$ 5,000	$ -	$ 2,627	$ -	$ 2,760	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Fixed Unit	$ 160,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Fixed Interface Unit	$ 3,046,452	$ 1,714,561	$ 2,317,488	$ 2,383,178	$ 2,450,752	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Capital Budget	$ 5,635,756	$ 7,996,745	$ 12,872,059	$ 13,194,148	$ 13,568,625	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Debt Service Payments	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375
Capital Budget (Out of Pocket)																				
Meters Installed	$ -	$ -	$ -	$ -	$ -	$ 170,435	$ 178,025	$ 185,970	$ 194,201	$ 202,815	$ 211,828	$ 221,257	$ 231,119	$ 241,432	$ 252,117	$ 263,388	$ 275,064	$ 287,266	$ 300,125	$ 313,447
Pits & Boxes Installed	$ -	$ -	$ -	$ -	$ -	$ 913,046	$ 953,703	$ 996,267	$ 1,040,364	$ 1,086,511	$ 1,134,795	$ 1,185,306	$ 1,238,138	$ 1,293,388	$ 1,350,626	$ 1,411,004	$ 1,473,557	$ 1,538,927	$ 1,607,813	$ 1,679,182
Vehicle Purchases (Retirements)	$ -	$ -	$ -	$ -	$ -	$ 34,613	$ 17,912	$ -	$ 38,376	$ 59,578	$ 41,109	$ 63,822	$ 44,037	$ 49,376	$ 27,518	$ 48,824	$ 75,800	$ 52,302	$ 81,199	$ 56,027
Reading Equipment Purchases (Ret.)																				
Handhelds	$ -	$ -	$ -	$ -	$ -	$ 10,183	$ -	$ -	$ -	$ -	$ 11,521	$ -	$ -	$ -	$ -	$ 13,035	$ -	$ -	$ -	$ -
Installation Programmers	$ -	$ -	$ -	$ -	$ -	$ 5,657	$ -	$ 2,972	$ -	$ 3,122	$ 6,400	$ -	$ 3,362	$ 3,446	$ 3,532	$ 7,241	$ -	$ 3,804	$ 3,899	$ 3,997
Fixed Unit	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Fixed Interface Unit	$ -	$ -	$ -	$ -	$ -	$ 245,296	$ 256,609	$ 268,474	$ 280,791	$ 293,705	$ 307,240	$ 321,425	$ 336,290	$ 351,863	$ 368,033	$ 385,116	$ 402,854	$ 421,427	$ 441,031	$ 461,389
Total Capital Budget	$ -	$ -	$ -	$ -	$ -	$ 1,379,230	$ 1,406,248	$ 1,453,683	$ 1,553,732	$ 1,645,731	$ 1,712,893	$ 1,791,810	$ 1,852,946	$ 1,939,506	$ 2,001,826	$ 2,128,609	$ 2,227,276	$ 2,303,726	$ 2,434,067	$ 2,514,042
Total Budget (Operating + Capital)	$ 5,991,769	$ 8,364,303	$ 13,310,011	$ 13,647,623	$ 14,099,790	$ 1,929,268	$ 1,975,836	$ 2,043,520	$ 2,164,546	$ 2,278,273	$ 2,367,944	$ 2,470,177	$ 2,555,465	$ 2,751,814	$ 2,918,273	$ 3,077,818	$ 3,210,429	$ 3,322,048	$ 3,488,828	$ 3,606,557
Does Not Include Customer Service or Debt Service																				
Long-Term Budget	4,813,388	4,824,933	4,895,327	4,910,850	4,988,540	6,386,643	6,433,211	6,500,895	6,621,921	6,735,648	6,825,319	6,927,551	7,012,840	7,209,188	7,375,648	7,535,193	7,667,804	7,779,423	7,946,203	8,063,932
Includes Debt Service, Capital Out of Pocket and Operating Costs)																				
NPV Annually	$ 4,540,932	$ 4,294,174	$ 4,110,211	$ 3,889,853	$ 3,727,727	$ 4,502,331	$ 4,278,453	$ 4,078,742	$ 3,919,505	$ 3,761,151	$ 3,595,493	$ 3,442,781	$ 3,287,893	$ 3,188,631	$ 3,077,600	$ 2,966,201	$ 2,847,549	$ 2,725,473	$ 2,626,324	$ 2,514,372
Total Capital	$ 53,267,333																			
Includes Debt Service, Capital Out of Pocket and Operating Costs)																				
Total Operating Budget (thru deployment)	$ 2,146,164																			
Total Capital	$ 53,267,333																			
Total Deployment	$ 55,413,497																			
Total Debt Service (20 years)	$ 89,147,494																			
Long-Term Cost																				
Total Debt Service	$ 89,147,494																			
Total Operating Budget (20 years)	$ 13,961,636																			
Total Out of Pocket Capital	$ 28,345,326																			
Total Long-Term Cost	$ 131,454,456																			
Net Present Value																				
Discount Rate	6.0%																			
NPV Capital	$43,831,721																			
NPV Deployment	$ 52,276,884																			
NPV Long-Term Cost	$ 71,375,394																			
Total Cost per Read	$ 23.41	$ 15.15	$ 10.49	$ 7.98	$ 6.52	$ 8.20	$ 8.10	$ 8.04	$ 8.03	$ 8.02	$ 7.97	$ 7.94	$ 7.89	$ 7.96	$ 7.99	$ 8.01	$ 8.00	$ 7.97	$ 7.99	$ 7.95

NPV	
total debt service	$51,125,737
operating budget	$7,176,237
out of pocket capital	$13,073,420

City of Fresno

Meter Reading Feasibility 20-Year Planning Horizon Model Bi-Monthly

4-Year Deployment

Drive-By Radio Frequency

(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Meter Reading																				
Meters																				
Total Meters	30,465	47,168	69,161	91,194	113,265	115,417	117,610	119,845	122,122	124,442	126,806	129,215	131,670	134,172	136,721	139,319	141,966	144,663	147,412	150,213
Meters to be Installed	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Pits & Boxes to be Installed*	(0)	12,713	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
*Year 2008 total is 31,732 minus 24,232 pits already in the ground																				
Installations include annual growth of 1.3%																				
Read Frequency																				
Quarterly %	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%	0.0%	0.0%	0.0%
Bi-monthly %	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%	100.0%	100.0%
Monthly %	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%	0.0%	0.0%	0.0%
Total	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%	100.0%	100.0%
Annual Reads																				
Quarterly	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bi-monthly	182,787	283,005	414,966	547,161	679,590	692,502	705,660	719,070	732,732	746,652	760,836	775,290	790,020	805,032	820,326	835,914	851,796	867,978	884,472	901,278
Monthly	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	182,787	283,005	414,966	547,161	679,590	692,502	705,660	719,070	732,732	746,652	760,836	775,290	790,020	805,032	820,326	835,914	851,796	867,978	884,472	901,278
Reading Days/Year																				
Reading Days/Man Week	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Holidays/Year	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Vacation Days/Year	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Sick Days/Year	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Total Reading Days/Year	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222
Reads/Man Day	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000
Field Service (Meter Reading Related)																				
Field Service Reads per Year																				
Cust. Serv. Request % of Reads	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%
Final Reads % of Meters	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%
Annual Customer Service Req.	18,279	28,301	41,497	54,716	67,959	69,250	70,566	71,907	73,273	74,665	76,084	77,529	79,002	80,503	82,033	83,591	85,180	86,798	88,447	90,128
Annual Final Reads	4,570	7,075	10,374	13,679	16,990	17,313	17,642	17,977	18,318	18,666	19,021	19,382	19,751	20,126	20,508	20,898	21,295	21,699	22,112	22,532
Total Annual Field Service Reads	22,848	35,376	51,871	68,395	84,949	86,563	88,208	89,884	91,592	93,332	95,105	96,911	98,753	100,629	102,541	104,489	106,475	108,497	110,559	112,660
Field Service Days/Year																				
Service Days/Man Week	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Holidays/Year	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Vacation Days/Year	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Sick Days/Year	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Total Reading Days/Year	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222
Visits/Man Day	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
Meters/FTE	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000
Personnel Required																				
Calculated Meter Readers*	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.1	2.1	2.1	2.2	2.2	2.3
Calculated Field Service Techs	1.0	1.2	1.7	2.3	2.8	2.9	2.9	3.0	3.1	3.1	3.2	3.2	3.3	3.4	3.4	3.5	3.5	3.6	3.7	3.8
Meter Readers (FTE)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Field Techs (FTE)	1.0	1.0	2.0	2.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Calculated Lead Worker(s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Actual Lead Workers	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Supervisor Collections Section	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

* Meter readers take field service reads. Field Service Techs become responsible for the radio system including the meter interface units.

City of Fresno
Meter Reading Feasibility 20-Year Planning Horizon Model Bi-Monthly
4-Year Deployment
Drive-By Radio Frequency
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Operating Expenses																				
Meter Related																				
Salary																				
Readers	$ 78,666	$ 81,419	$ 84,269	$ 87,218	$ 90,271	$ 93,430	$ 96,700	$ 100,085	$ 103,588	$ 107,213	$ 110,966	$ 114,849	$ 118,869	$ 123,030	$ 127,336	$ 131,792	$ 136,405	$ 141,179	$ 146,121	$ 151,235
Field Service Techs	46,946	48,589	100,579	104,099	161,613	167,270	173,124	179,184	185,455	191,946	198,664	205,617	212,814	293,683	303,962	314,601	325,612	337,008	348,804	361,012
Lead Worker	53,213	55,076	57,004	58,999	61,064	63,201	65,413	67,702	70,072	72,525	75,063	77,690	80,409	83,224	86,136	89,151	92,271	95,501	98,843	102,303
Supervisor Collections	63,851	66,086	68,399	70,793	73,270	75,835	78,489	81,236	84,080	87,022	90,068	93,221	96,483	99,860	103,355	106,973	110,717	114,592	118,603	122,754
Total Salary	$ 242,676	$ 251,169	$ 310,250	$ 321,108	$ 386,218	$ 399,736	$ 413,727	$ 428,207	$ 443,194	$ 458,706	$ 474,761	$ 491,377	$ 508,576	$ 599,797	$ 620,790	$ 642,517	$ 665,005	$ 688,280	$ 712,370	$ 737,303
Education																				
Readers	$ 370	$ 385	$ 400	$ 416	$ 433	$ 450	$ 468	$ 487	$ 506	$ 527	$ 548	$ 570	$ 592	$ 616	$ 641	$ 666	$ 693	$ 721	$ 750	$ 780
Field Service Techs	185	192	400	416	649	675	702	730	760	790	822	854	889	1,232	1,281	1,333	1,386	1,441	1,499	1,559
Lead Worker + Supervisor	500	520	541	562	585	608	633	658	684	712	740	770	801	833	866	900	936	974	1,013	1,053
Total Education	$ 1,055	$ 1,097	$ 1,341	$ 1,395	$ 1,667	$ 1,734	$ 1,803	$ 1,875	$ 1,950	$ 2,028	$ 2,109	$ 2,194	$ 2,281	$ 2,681	$ 2,788	$ 2,900	$ 3,015	$ 3,136	$ 3,262	$ 3,392
M & S																				
Readers	$ 2,000	$ 2,070	$ 2,142	$ 2,217	$ 2,295	$ 2,375	$ 2,459	$ 2,545	$ 2,634	$ 2,726	$ 2,821	$ 2,920	$ 3,022	$ 3,128	$ 3,237	$ 3,351	$ 3,468	$ 3,589	$ 3,715	$ 3,845
Field Service Techs	1,000	1,035	2,142	2,217	3,443	3,563	3,688	3,817	3,950	4,089	4,232	4,380	4,533	6,256	6,475	6,701	6,936	7,179	7,430	7,690
Lead Worker + Supervisor	2,000	2,070	2,142	2,217	2,295	2,375	2,459	2,545	2,634	2,726	2,821	2,920	3,022	3,128	3,237	3,351	3,468	3,589	3,715	3,845
Total M&S	$ 5,000	$ 5,175	$ 6,427	$ 6,652	$ 8,033	$ 8,314	$ 8,605	$ 8,906	$ 9,218	$ 9,540	$ 9,874	$ 10,220	$ 10,577	$ 12,512	$ 12,950	$ 13,403	$ 13,872	$ 14,357	$ 14,860	$ 15,380
Contract Services																				
Readers	$ 200	$ 207	$ 214	$ 222	$ 230	$ 238	$ 246	$ 254	$ 263	$ 273	$ 282	$ 292	$ 302	$ 313	$ 324	$ 335	$ 347	$ 359	$ 371	$ 385
Field Service Techs	100	104	214	222	344	356	369	382	395	409	423	438	453	626	647	670	694	718	743	769
Lead Worker + Supervisor	200	207	214	222	230	238	246	254	263	273	282	292	302	313	324	335	347	359	371	385
Total Contract Services	$ 500	$ 518	$ 643	$ 665	$ 803	$ 831	$ 860	$ 891	$ 922	$ 954	$ 987	$ 1,022	$ 1,058	$ 1,251	$ 1,295	$ 1,340	$ 1,387	$ 1,436	$ 1,486	$ 1,538
Vehicles (Fuel + Maintenance)																				
Readers	$ 8,000	$ 8,360	$ 8,736	$ 9,129	$ 9,540	$ 9,969	$ 10,418	$ 10,887	$ 11,377	$ 11,889	$ 12,424	$ 12,983	$ 13,567	$ 14,178	$ 14,816	$ 15,482	$ 16,179	$ 16,907	$ 17,668	$ 18,463
Field Service Techs	4,000	4,180	8,736	9,129	14,310	14,954	15,627	16,330	17,065	17,833	18,636	19,474	20,351	28,355	29,631	30,965	32,358	33,814	35,336	36,926
Lead Worker + Supervisor	8,000	8,360	8,736	9,129	9,540	9,969	10,418	10,887	11,377	11,889	12,424	12,983	13,567	14,178	14,816	15,482	16,179	16,907	17,668	18,463
Total Fuel	$ 20,000	$ 20,900	$ 26,209	$ 27,388	$ 33,391	$ 34,893	$ 36,463	$ 38,104	$ 39,819	$ 41,611	$ 43,483	$ 45,440	$ 47,485	$ 56,710	$ 59,262	$ 61,929	$ 64,716	$ 67,628	$ 70,671	$ 73,852
Insurance																				
Readers	$ 2,000	$ 2,100	$ 2,205	$ 2,315	$ 2,431	$ 2,553	$ 2,680	$ 2,814	$ 2,955	$ 3,103	$ 3,258	$ 3,421	$ 3,592	$ 3,771	$ 3,960	$ 4,158	$ 4,366	$ 4,584	$ 4,813	$ 5,054
Field Service Techs	1,000	1,050	2,205	2,315	3,647	3,829	4,020	4,221	4,432	4,654	4,887	5,131	5,388	7,543	7,920	8,316	8,731	9,168	9,626	10,108
Lead Worker + Supervisor	2,000	2,100	2,205	2,315	2,431	2,553	2,680	2,814	2,955	3,103	3,258	3,421	3,592	3,771	3,960	4,158	4,366	4,584	4,813	5,054
Total Insurance	$ 5,000	$ 5,250	$ 6,615	$ 6,946	$ 8,509	$ 8,934	$ 9,381	$ 9,850	$ 10,342	$ 10,859	$ 11,402	$ 11,972	$ 12,571	$ 15,085	$ 15,839	$ 16,631	$ 17,463	$ 18,336	$ 19,253	$ 20,216
Misc.																				
Readers	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Field Service Techs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead Worker + Supervisor	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Miscellaneous	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Meter Reading Equipment Maintenance																				
Hand-held	$ 900	$ 923	$ 946	$ 969	$ 993	$ 1,018	$ 1,044	$ 1,070	$ 1,097	$ 1,124	$ 1,152	$ 1,181	$ 1,210	$ 1,241	$ 1,272	$ 1,303	$ 1,336	$ 1,369	$ 1,404	$ 1,439
Drive-by	2,000	2,050	2,101	2,154	2,208	2,263	2,319	2,377	2,437	2,498	2,560	2,624	2,690	2,757	2,826	2,897	2,969	3,043	3,119	3,197
Software	1,000	1,025	1,051	1,077	1,104	1,131	1,160	1,189	1,218	1,249	1,280	1,312	1,345	1,379	1,413	1,448	1,485	1,522	1,560	1,599
Installation Programmer	500	513	788	808	1,104	1,131	1,160	1,189	1,218	1,249	1,280	1,312	1,345	1,723	1,766	1,810	1,856	1,902	1,950	1,998
Total Annual Meter Reading Budget																				
Readers	$ 91,236	$ 94,541	$ 97,967	$ 101,518	$ 105,199	$ 109,015	$ 112,971	$ 117,072	$ 121,323	$ 125,730	$ 130,298	$ 135,034	$ 139,945	$ 145,035	$ 150,313	$ 155,785	$ 161,458	$ 167,339	$ 173,438	$ 179,761
Field Service Techs	53,231	55,150	114,277	118,399	184,006	190,648	197,531	204,664	212,058	219,721	227,663	235,895	244,427	337,695	349,917	362,585	375,717	389,329	403,438	418,064
Lead Worker + Supervisor	129,764	134,419	139,241	144,238	149,415	154,779	160,337	166,097	172,065	178,248	184,656	191,296	198,176	205,306	212,694	220,350	228,284	236,506	245,026	253,856
Facilities Rent	116,000	120,060	124,262	128,611	133,113	137,772	142,594	147,584	152,750	158,096	163,629	169,356	175,284	181,419	187,769	194,340	201,142	208,182	215,469	223,010
Reading Equipment Maintenance	4,400	4,510	4,885	5,008	5,409	5,544	5,682	5,825	5,970	6,119	6,272	6,429	6,590	7,099	7,277	7,459	7,645	7,836	8,032	8,233
Meter Reading Operating Budget	$ 394,631	$ 408,679	$ 480,632	$ 497,773	$ 577,142	$ 597,757	$ 619,115	$ 641,242	$ 664,165	$ 687,914	$ 712,519	$ 738,011	$ 764,422	$ 876,554	$ 907,969	$ 940,519	$ 974,246	$ 1,009,193	$ 1,045,403	$ 1,082,924
Customer Service Related																				
Total Customer Service	$ 925,359	$ 1,482,858	$ 2,250,392	$ 3,071,151	$ 3,947,966	$ 4,163,780	$ 4,391,396	$ 4,631,468	$ 4,884,645	$ 5,151,651	$ 5,433,249	$ 5,730,243	$ 6,043,483	$ 6,373,863	$ 6,722,277	$ 7,089,766	$ 7,477,325	$ 7,886,053	$ 8,317,167	$ 8,771,835
Total Meter Reading Related	$ 1,319,990	$ 1,891,537	$ 2,731,024	$ 3,568,925	$ 4,525,108	$ 4,761,538	$ 5,010,511	$ 5,272,709	$ 5,548,810	$ 5,839,565	$ 6,145,768	$ 6,468,254	$ 6,807,905	$ 7,250,417	$ 7,630,246	$ 8,030,285	$ 8,451,571	$ 8,895,246	$ 9,362,570	$ 9,854,759

City of Fresno
Meter Reading Feasibility 20-Year Planning Horizon Model Bi-Monthly
4-Year Deployment
Drive-By Radio Frequency
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Operating Cost per Read																				
Regular Meter Read	$0.50	$0.33	$0.24	$0.19	$0.15	$0.16	$0.16	$0.16	$0.17	$0.17	$0.17	$0.17	$0.18	$0.18	$0.18	$0.19	$0.19	$0.19	$0.20	$0.20
Field Service Read	$2.33	$1.56	$2.20	$1.73	$2.17	$2.20	$2.24	$2.28	$2.32	$2.35	$2.39	$2.43	$2.48	$3.36	$3.41	$3.47	$3.53	$3.59	$3.65	$3.71
Regular + Field Service	$1.92	$1.28	$1.03	$0.81	$0.75	$0.77	$0.78	$0.79	$0.81	$0.82	$0.83	$0.85	$0.86	$0.97	$0.98	$1.00	$1.02	$1.03	$1.05	$1.07
Reg + Field Serv. + Cust. Serv.	$6.42	$5.94	$5.85	$5.80	$5.92	$6.11	$6.31	$6.52	$6.73	$6.95	$7.18	$7.42	$7.66	$8.01	$8.27	$8.54	$8.82	$9.11	$9.41	$9.72
Capital Items																				
Meters and Pits																				
Meters to be Installed	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Pits to be Installed	(0)	12,713	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Vehicles																				
Vehicles Req'd	5	5	6	6	7	7	7	7	7	7	7	7	7	8	8	8	8	8	8	8
Vehicles in Service	13	5	5	6	6	7	7	7	7	7	7	7	7	7	8	8	8	8	8	8
New Vehicles (Retirements)	(8)	-	1	-	1	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
Potential In-Service Replacement	2	2	2	2	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Potential Vehicle Replacements					-	-	-	-	2	3	2	3	2	1	-	2	3	2	3	2
New Vehicle Purchases	-	2	3	2	3	2	1	-	2	3	2	3	2	2	-	2	3	2	3	2
Vehicle Retirements	8	2	2	2	2	2	1	-	2	3	2	3	2	1	-	2	3	2	3	2
Reading Equipment																				
# of Handhelds (1/Meter Read)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
# of Spare Handhelds	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Purchases (Retirements)	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Potential Replacements					-	2	-	-	-	-	2	-	-	-	-	2	-	-	-	-
Purchases + Replacements	2	-	-	-	-	2	-	-	-	-	2	-	-	-	-	2	-	-	-	-
Installation Programmers Req'd	2	2	3	3	4	4	4	4	4	4	4	4	4	5	5	5	5	5	5	5
Programmers Purchased (Retired)	2	-	1	-	1	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
Potential Replacements					-	2	-	1	-	1	2	-	1	-	1	2	-	1	1	1
Purchases + Replacements	2	-	1	-	1	2	-	1	-	1	2	-	1	1	1	2	-	1	1	1
Drive-by Units Required	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Drive-by Units Purchased	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Drive-by Units Replaced					-	-	2	-	-	-	-	-	2	-	-	-	-	-	2	-
Purchases + Replacements	2	-	-	-	-	-	2	-	-	-	-	-	2	-	-	-	-	-	2	-
Mobile Interface Unit																				
Years to Install MIU	4																			
MIU's Replaced/Year	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Cummulative Replaced	30,465	47,168	69,161	91,194	113,265	115,417	117,610	119,845	122,122	124,442	126,806	129,215	131,670	134,172	136,721	139,319	141,966	144,663	147,412	150,213
New Services Installed	-	1,996	2,034	2,073	2,112	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
MIU's Installed & Replaced	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Cummulative Replaced & Installed	30,465	47,168	69,161	91,194	113,265	115,417	117,610	119,845	122,122	124,442	126,806	129,215	131,670	134,172	136,721	139,319	141,966	144,663	147,412	150,213
MIU Cost	$ 75.00	$ 76.88	$ 78.80	$ 80.77	$ 82.79	$ 84.86	$ 86.98	$ 89.15	$ 91.38	$ 93.66	$ 96.01	$ 98.41	$ 100.87	$ 103.39	$ 105.97	$ 108.62	$ 111.34	$ 114.12	$ 116.97	$ 119.90
Installation Cost	$ 15.00	$ 15.53	$ 16.07	$ 16.63	$ 17.21	$ 17.82	$ 18.44	$ 19.08	$ 19.75	$ 20.44	$ 21.16	$ 21.90	$ 22.67	$ 23.46	$ 24.28	$ 25.13	$ 26.01	$ 26.92	$ 27.86	$ 28.84

City of Fresno
Meter Reading Feasibility 20-Year Planning Horizon Model Bi-Monthly
4-Year Deployment
Drive-By Radio Frequency
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Capital Budget (to be Borrowed)																				
Meters Installed	$ 2,132,516	$ 1,198,439	$ 1,617,484	$ 1,660,861	$ 1,705,396	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Pits & Boxes Installed	$ -	$ 4,886,552	$ 8,665,095	$ 8,897,472	$ 9,136,052	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Program Management	$ 304,645	$ 167,030	$ 219,935	$ 220,325	$ 220,715	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Vehicle Purchases (Retirements)	$ (19,429)	$ 30,163	$ 49,429	$ 32,311	$ 52,950	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Reading Equipment Purchases (Ret.)																				
Handhelds	$ 5,600	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Installation Programmer	$ 5,000	$ -	$ 2,627	$ -	$ 2,760	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Drivey-by	$ 85,000	$ -	$ -	$ -	$ -															
Mobile Interfact Unit	2,741,807	1,543,355	2,086,419	2,145,912	2,207,124	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Capital Budget	$ 5,255,140	$ 7,825,539	$ 12,640,990	$ 12,956,882	$ 13,324,997	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Debt Service Payments	4,351,622	4,351,622	4,351,622	4,351,622	4,351,622	4,351,622	4,351,622	4,351,622	4,351,622	4,351,622	4,351,622	4,351,622	4,351,622	4,351,622	4,351,622	4,351,622	4,351,622	4,351,622	4,351,622	4,351,622
Capital Budget (Out of Pocket)																				
Meters Installed	$ -	$ -	$ -	$ -	$ -	$ 170,435	$ 178,025	$ 185,970	$ 194,201	$ 202,815	$ 211,828	$ 221,257	$ 231,119	$ 241,432	$ 252,117	$ 263,388	$ 275,064	$ 287,266	$ 300,125	$ 313,447
Pits & Boxes Installed	$ -	$ -	$ -	$ -	$ -	$ 913,046	$ 953,703	$ 996,267	$ 1,040,364	$ 1,086,511	$ 1,134,795	$ 1,185,306	$ 1,238,138	$ 1,293,388	$ 1,350,626	$ 1,411,004	$ 1,473,557	$ 1,538,927	$ 1,607,813	$ 1,679,182
Vehicle Purchases (Retirements)	$ -	$ -	$ -	$ -	$ -	$ 34,613	$ 17,912	$ -	$ 38,376	$ 59,578	$ 41,109	$ 63,822	$ 44,037	$ 49,376	$ -	$ 48,824	$ 75,800	$ 52,302	$ 81,199	$ 56,027
Reading Equipment Purchases (Ret.)																				
Handhelds	$ -	$ -	$ -	$ -	$ -	$ 6,336	$ -	$ -	$ -	$ -	$ 7,168	$ -	$ -	$ -	$ -	$ 8,110	$ -	$ -	$ -	$ -
Installation Programmer	$ -	$ -	$ -	$ -	$ -	$ 5,657	$ -	$ 2,972	$ -	$ 3,122	$ 6,400	$ -	$ 3,362	$ 3,446	$ 3,532	$ 7,241	$ -	$ 3,804	$ 3,899	$ 3,997
Drivey-by	$ -	$ -	$ -	$ -	$ -	$ -	$ 98,574	$ -	$ -	$ -	$ -	$ -	$ 114,316	$ -	$ -	$ -	$ -	$ -	$ 132,571	$ -
Mobile Interfact Unit	-	-	-	-	-	220,948	231,177	241,907	253,048	264,731	276,979	289,817	303,273	317,373	332,016	347,489	363,559	380,389	398,156	416,610
Total Capital Budget	$ -	$ -	$ -	$ -	$ -	$ 1,351,035	$ 1,479,390	$ 1,427,115	$ 1,525,989	$ 1,616,757	$ 1,678,280	$ 1,760,202	$ 1,934,245	$ 1,905,016	$ 1,938,292	$ 2,086,058	$ 2,187,981	$ 2,262,688	$ 2,523,763	$ 2,469,264
Total Budget (Operating + Capital)	$ 4,746,253	$ 4,760,301	$ 4,832,254	$ 4,849,395	$ 4,928,764	$ 6,300,414	$ 6,450,127	$ 6,419,979	$ 6,541,776	$ 6,656,293	$ 6,742,421	$ 6,849,835	$ 7,050,289	$ 7,133,192	$ 7,197,883	$ 7,378,199	$ 7,513,849	$ 7,623,503	$ 7,920,788	$ 7,903,809
Does Not Include Customer Service or Debt Service																				
Long-Term Budget	$4,746,253	$4,760,301	$4,832,254	$4,849,395	$4,928,764	$6,300,414	$6,450,127	$6,419,979	$6,541,776	$6,656,293	$6,742,421	$6,849,835	$7,050,289	$7,133,192	$7,197,883	$7,378,199	$7,513,849	$7,623,503	$7,920,788	$7,903,809
Includes Debt Service, Capital Out of Pocket and Operating Costs)																				
NPV Annually	$ 4,477,597	$ 4,236,651	$ 4,057,254	$ 3,841,175	$ 3,683,059	$ 4,441,544	$ 4,289,703	$ 4,027,974	$ 3,872,067	$ 3,716,840	$ 3,551,823	$ 3,404,158	$ 3,305,450	$ 3,155,018	$ 3,003,425	$ 2,904,401	$ 2,790,376	$ 2,670,847	$ 2,617,924	$ 2,464,445
Total Capital	$ 52,003,547																			
Total Operating Budget (thru deployment)	$ 2,358,856																			
Total Capital	$ 52,003,547																			
Total Deployment	$ 54,362,404																			
Total Debt Service (20 years)	$ 87,032,440																			
Long-Term Cost																				
Total Debt Service	$ 87,032,440																			
Total Operating Budget (20 years)	$ 14,620,809																			
Total Out of Pocket Capital	$ 28,146,075																			
Total Long-Term Cost	$ 129,799,324																			
Net Present Value																				
Discount Rate	0.0%																			
NPV Capital	$ 42,756,276																			
NPV Deployment	$ 51,285,286																			
NPV Long-Term Cost	$ 70,511,730																			
Total Cost per Read	$ 23.08	$ 14.95	$ 10.35	$ 7.88	$ 6.45	$ 8.09	$ 8.12	$ 7.94	$ 7.94	$ 7.92	$ 7.88	$ 7.85	$ 7.93	$ 7.88	$ 7.80	$ 7.85	$ 7.84	$ 7.81	$ 7.96	$ 7.80

NPV	
total debt service	$49,912,761
operating budget	$7,613,679
out of pocket capital	$12,985,290

City of Fresno
Meter Reading Feasibility 20-Year Planning Horizon Model Bi-Monthly
4-Year Deployment
Touch Read
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Meter Reading																				
Meters																				
Total Meters	30,465	47,168	69,161	91,194	113,265	115,417	117,610	119,845	122,122	124,442	126,806	129,215	131,670	134,172	136,721	139,319	141,966	144,663	147,412	150,213
Meters to be Installed	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Pits & Boxes to be Installed*	(0)	12,713	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
*Year 2008 total is 31,732 minus 24,232 pits already in the ground																				
Installations include annual growth of 1.3%																				
Read Frequency																				
Quarterly %	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%	0.0%	0.0%	0.0%
Bi-monthly %	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%	100.0%	100.0%
Monthly %	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%	0.0%	0.0%	0.0%
Total	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%	100.0%	100.0%
Annual Reads																				
Quarterly	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bi-monthly	182,787	283,005	414,966	547,161	679,590	692,502	705,660	719,070	732,732	746,652	760,836	775,290	790,020	805,032	820,326	835,914	851,796	867,978	884,472	901,278
Monthly	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	182,787	283,005	414,966	547,161	679,590	692,502	705,660	719,070	732,732	746,652	760,836	775,290	790,020	805,032	820,326	835,914	851,796	867,978	884,472	901,278
Reading Days/Year																				
Reading Days/Man Week	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Holidays/Year	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Vacation Days/Year	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Sick Days/Year	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Total Reading Days/Year	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170
Reads/Man Day	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320
Field Service (Meter Reading Related)																				
Field Service Reads per Year																				
Cust. Serv. Request % of Reads	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%
Final Reads % of Meters	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%
Annual Customer Service Req.	18,279	28,301	41,497	54,716	67,959	69,250	70,566	71,907	73,273	74,665	76,084	77,529	79,002	80,503	82,033	83,591	85,180	86,798	88,447	90,128
Annual Final Reads	4,570	7,075	10,374	13,679	16,990	17,313	17,642	17,977	18,318	18,666	19,021	19,382	19,751	20,126	20,508	20,898	21,295	21,699	22,112	22,532
Total Annual Field Service Reads	22,848	35,376	51,871	68,395	84,949	86,563	88,208	89,884	91,592	93,332	95,105	96,911	98,753	100,629	102,541	104,489	106,475	108,497	110,559	112,660
Field Service Days/Year																				
Service Days/Man Week	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Holidays/Year	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Vacation Days/Year	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Sick Days/Year	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Total Reading Days/Year	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222
Visits/Man Day	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35
Personnel Required																				
Calculated Meter Readers	3.4	5.2	7.6	10.1	12.5	12.7	13.0	13.2	13.5	13.7	14.0	14.3	14.5	14.8	15.1	15.4	15.7	16.0	16.3	16.6
Calculated Field Service Techs *	2.5	3.8	5.6	7.3	9.1	9.3	9.5	9.6	9.8	10.0	10.2	10.4	10.6	10.8	11.0	11.2	11.4	11.6	11.9	12.1
Meter Readers (FTE)	4.0	5.0	8.0	10.0	13.0	13.0	13.0	13.0	14.0	14.0	14.0	14.0	15.0	15.0	15.0	16.0	16.0	16.0	16.0	17.0
Field Techs (FTE)	3.0	4.0	6.0	7.0	9.0	9.0	10.0	10.0	10.0	10.0	10.0	11.0	11.0	11.0	11.0	11.0	12.0	12.0	12.0	12.0
Calculated Lead Worker(s)	1.0	1.0	1.3	1.5	2.0	2.0	2.1	2.1	2.2	2.2	2.2	2.3	2.4	2.4	2.4	2.5	2.5	2.5	2.5	2.6
Actual Lead Workers	1.0	1.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.0	3.0	3.0	3.0
Supervisor Collections Section	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

* Field Service Techs are supported by meter readers on any off-reading days.

City of Fresno
Meter Reading Feasibility 20-Year Planning Horizon Model Bi-Monthly
4-Year Deployment
Touch Read
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Operating Expenses																				
Meter Related																				
Salary																				
Readers	$ 157,331	$ 203,547	$ 337,074	$ 436,090	$ 586,759	$ 607,295	$ 628,551	$ 650,550	$ 725,113	$ 750,492	$ 776,759	$ 803,946	$ 891,518	$ 922,722	$ 955,017	$ 1,054,339	$ 1,091,240	$ 1,129,434	$ 1,168,964	$ 1,285,495
Field Service Techs	140,837	194,355	301,736	364,346	484,840	501,810	577,081	597,279	618,184	639,820	662,214	753,931	780,318	807,629	835,896	865,153	976,836	1,011,025	1,046,411	1,083,036
Lead Worker	53,213	55,076	57,004	117,997	122,127	126,402	130,826	135,405	140,144	145,049	150,126	155,380	160,818	166,447	172,273	178,302	276,814	286,503	296,530	306,909
Supervisor Collections	63,851	66,086	68,399	70,793	73,270	75,835	78,489	81,236	84,080	87,022	90,068	93,221	96,483	99,860	103,355	106,973	110,717	114,592	118,603	122,754
Total Salary	$ 415,232	$ 519,064	$ 764,212	$ 989,226	$ 1,266,997	$ 1,311,342	$ 1,414,947	$ 1,464,470	$ 1,567,520	$ 1,622,384	$ 1,679,167	$ 1,806,477	$ 1,929,138	$ 1,996,658	$ 2,066,541	$ 2,204,766	$ 2,455,608	$ 2,541,554	$ 2,630,508	$ 2,798,193
Education																				
Readers	$ 740	$ 962	$ 1,601	$ 2,081	$ 2,814	$ 2,926	$ 3,043	$ 3,165	$ 3,545	$ 3,686	$ 3,834	$ 3,987	$ 4,443	$ 4,621	$ 4,805	$ 5,331	$ 5,544	$ 5,766	$ 5,996	$ 6,626
Field Service Techs	555	770	1,201	1,457	1,948	2,026	2,341	2,434	2,532	2,633	2,738	3,133	3,258	3,388	3,524	3,665	4,158	4,324	4,497	4,677
Lead Worker + Supervisor	500	520	541	844	877	912	949	987	1,026	1,067	1,110	1,155	1,201	1,249	1,299	1,351	1,873	1,948	2,026	2,107
Total Education	$ 1,795	$ 2,252	$ 3,342	$ 4,381	$ 5,639	$ 5,864	$ 6,333	$ 6,586	$ 7,103	$ 7,387	$ 7,682	$ 8,275	$ 8,902	$ 9,258	$ 9,628	$ 10,346	$ 11,575	$ 12,038	$ 12,520	$ 13,410
M & S																				
Readers	$ 4,000	$ 5,175	$ 8,570	$ 11,087	$ 14,918	$ 15,440	$ 15,980	$ 16,540	$ 18,435	$ 19,081	$ 19,748	$ 20,440	$ 22,666	$ 23,459	$ 24,280	$ 26,806	$ 27,744	$ 28,715	$ 29,720	$ 32,683
Field Service Techs	3,000	4,140	6,427	7,761	10,328	10,689	12,293	12,723	13,168	13,629	14,106	16,060	16,622	17,204	17,806	18,429	20,808	21,536	22,290	23,070
Lead Worker + Supervisor	2,000	2,070	2,142	3,326	3,443	3,563	3,688	3,817	3,950	4,089	4,232	4,380	4,533	4,692	4,856	5,026	6,936	7,179	7,430	7,690
Total M&S	$ 9,000	$ 11,385	$ 17,140	$ 22,174	$ 28,688	$ 29,692	$ 31,961	$ 33,079	$ 35,554	$ 36,798	$ 38,086	$ 40,879	$ 43,821	$ 45,355	$ 46,942	$ 50,260	$ 55,488	$ 57,430	$ 59,440	$ 63,443
Contract Services																				
Readers	$ 400	$ 518	$ 857	$ 1,109	$ 1,492	$ 1,544	$ 1,598	$ 1,654	$ 1,844	$ 1,908	$ 1,975	$ 2,044	$ 2,267	$ 2,346	$ 2,428	$ 2,681	$ 2,774	$ 2,871	$ 2,972	$ 3,268
Field Service Techs	300	414	643	776	1,033	1,069	1,229	1,272	1,317	1,363	1,411	1,606	1,662	1,720	1,781	1,843	2,081	2,154	2,229	2,307
Lead Worker + Supervisor	200	207	214	333	344	356	369	382	395	409	423	438	453	469	486	503	694	718	743	769
Total Contract Services	$ 900	$ 1,139	$ 1,714	$ 2,217	$ 2,869	$ 2,969	$ 3,196	$ 3,308	$ 3,555	$ 3,680	$ 3,809	$ 4,088	$ 4,382	$ 4,535	$ 4,694	$ 5,026	$ 5,549	$ 5,743	$ 5,944	$ 6,344
Vehicles (Fuel + Maintenance)																				
Readers	$ 16,000	$ 20,900	$ 34,945	$ 45,647	$ 62,011	$ 64,801	$ 67,718	$ 70,765	$ 79,638	$ 83,221	$ 86,966	$ 90,880	$ 101,753	$ 106,332	$ 111,117	$ 123,858	$ 129,432	$ 135,256	$ 141,343	$ 156,935
Field Service Techs	12,000	16,720	26,209	31,953	42,931	44,863	52,090	54,434	56,884	59,444	62,119	71,406	74,619	77,977	81,486	85,152	97,074	101,442	106,007	110,777
Lead Worker + Supervisor	8,000	8,360	8,736	13,694	14,310	14,954	15,627	16,330	17,065	17,833	18,636	19,474	20,351	21,266	22,223	23,223	32,358	33,814	35,336	36,926
Total Fuel	$ 36,000	$ 45,980	$ 69,890	$ 91,293	$ 119,252	$ 124,618	$ 135,435	$ 141,530	$ 153,587	$ 160,498	$ 167,721	$ 181,760	$ 196,722	$ 205,575	$ 214,826	$ 232,234	$ 258,863	$ 270,512	$ 282,685	$ 304,638
Insurance																				
Readers	$ 4,000	$ 5,250	$ 8,820	$ 11,576	$ 15,802	$ 16,592	$ 17,421	$ 18,292	$ 20,684	$ 21,719	$ 22,805	$ 23,945	$ 26,938	$ 28,285	$ 29,699	$ 33,263	$ 34,926	$ 36,672	$ 38,506	$ 42,958
Field Service Techs	3,000	4,200	6,615	8,103	10,940	11,487	13,401	14,071	14,775	15,513	16,289	18,814	19,754	20,742	21,779	22,868	26,194	27,504	28,879	30,323
Lead Worker + Supervisor	2,000	2,100	2,205	3,473	3,647	3,829	4,020	4,221	4,432	4,654	4,887	5,131	5,388	5,657	5,940	6,237	8,731	9,168	9,626	10,108
Total Insurance	$ 9,000	$ 11,550	$ 17,640	$ 23,153	$ 30,388	$ 31,907	$ 34,842	$ 36,585	$ 39,891	$ 41,886	$ 43,980	$ 47,890	$ 52,080	$ 54,684	$ 57,418	$ 62,368	$ 69,852	$ 73,345	$ 77,012	$ 83,389
Misc.																				
Readers	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Field Service Techs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead Worker + Supervisor	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Miscellaneous	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Meter Reading Equipment Maintenance																				
Hand-held	$ 1,400	$ 2,009	$ 2,942	$ 3,920	$ 5,254	$ 5,386	$ 5,520	$ 5,658	$ 6,141	$ 6,294	$ 6,452	$ 6,613	$ 7,155	$ 7,334	$ 7,517	$ 8,110	$ 8,313	$ 8,521	$ 8,734	$ 9,848
Software	1,000	1,025	1,051	1,077	1,104	1,131	1,160	1,189	1,218	1,249	1,280	1,312	1,345	1,379	1,413	1,448	1,485	1,522	1,560	1,599
Total Annual Meter Reading Budget																				
Readers	$ 182,471	$ 236,352	$ 391,867	$ 507,590	$ 683,794	$ 708,598	$ 734,311	$ 760,966	$ 849,258	$ 880,107	$ 912,087	$ 945,241	$ 1,049,585	$ 1,087,764	$ 1,127,346	$ 1,246,276	$ 1,291,660	$ 1,338,714	$ 1,387,501	$ 1,527,965
Field Service Techs	159,692	220,598	342,830	414,396	552,019	571,943	658,435	682,214	706,859	732,402	758,877	864,948	896,234	928,660	962,271	997,110	1,127,151	1,167,986	1,210,314	1,254,191
Lead Worker + Supervisor	129,764	134,419	139,241	210,459	218,019	225,852	233,968	242,378	251,093	260,124	269,481	279,178	289,227	299,640	310,432	321,614	438,123	453,921	470,294	487,262
Facilities Rent	116,000	120,060	124,262	128,611	133,113	137,772	142,594	147,584	152,750	158,096	163,629	169,356	175,284	181,419	187,769	194,340	201,142	208,182	215,469	223,010
Reading Equipment Maintenance	2,400	3,034	3,992	4,997	6,358	6,517	6,680	6,847	7,359	7,543	7,732	7,925	8,500	8,712	8,930	9,559	9,798	10,043	10,294	11,446
Meter Reading Operating Budget	$ 590,327	$ 714,463	$ 1,002,192	$ 1,266,053	$ 1,593,303	$ 1,650,681	$ 1,775,988	$ 1,839,989	$ 1,967,320	$ 2,038,272	$ 2,111,806	$ 2,266,649	$ 2,418,829	$ 2,506,196	$ 2,596,748	$ 2,768,900	$ 3,067,874	$ 3,178,846	$ 3,293,871	$ 3,503,874
Customer Service Related																				
Total Customer Service	$ 925,359	$ 1,482,858	$ 2,250,392	$ 3,071,151	$ 3,947,966	$ 4,163,780	$ 4,391,396	$ 4,631,468	$ 4,884,645	$ 5,151,651	$ 5,433,249	$ 5,730,243	$ 6,043,483	$ 6,373,863	$ 6,722,277	$ 7,089,766	$ 7,477,325	$ 7,886,053	$ 8,317,167	$ 8,771,835
Total Reading + Techs + Cust. Serv.	$ 1,515,687	$ 2,197,321	$ 3,252,585	$ 4,337,204	$ 5,541,269	$ 5,814,462	$ 6,167,384	$ 6,471,457	$ 6,851,965	$ 7,189,923	$ 7,545,055	$ 7,996,893	$ 8,462,312	$ 8,880,059	$ 9,319,025	$ 9,858,666	$ 10,545,199	$ 11,064,899	$ 11,611,038	$ 12,275,709

City of Fresno
Meter Reading Feasibility 20-Year Planning Horizon Model Bi-Monthly
4-Year Deployment
Touch Read
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Operating Cost per Read																				
Regular Meter Read	$1.00	$0.84	$0.94	$0.93	$1.01	$1.02	$1.04	$1.06	$1.16	$1.18	$1.20	$1.22	$1.33	$1.35	$1.37	$1.49	$1.52	$1.54	$1.57	$1.70
Field Service Read	$6.99	$6.24	$6.61	$6.06	$6.50	$6.61	$7.46	$7.59	$7.72	$7.85	$7.98	$8.93	$9.08	$9.23	$9.38	$9.54	$10.59	$10.77	$10.95	$11.13
Regular + Field Service	$2.87	$2.24	$2.15	$2.06	$2.08	$2.12	$2.24	$2.27	$2.39	$2.43	$2.47	$2.60	$2.72	$2.77	$2.81	$2.94	$3.20	$3.26	$3.31	$3.46
Reg + Field Serv. + Cust. Serv.	$7.37	$6.90	$6.97	$7.05	$7.25	$7.46	$7.77	$8.00	$8.31	$8.56	$8.81	$9.17	$9.52	$9.81	$10.10	$10.48	$11.00	$11.33	$11.67	$12.11
Capital Items																				
Meters and Pits																				
Meters to be Installed	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Pits to be Installed	(0)	12,713	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Vehicles																				
Vehicles Req'd	9	11	16	20	25	25	26	26	27	27	27	28	29	29	29	30	32	32	32	33
Vehicles in Service	13	9	11	16	20	25	25	26	26	27	27	27	28	29	29	29	30	32	32	32
New Vehicles (Retirements)	(4)	2	5	4	5	-	1	-	1	-	-	1	1	-	-	1	2	-	-	1
Potential In-Service Replacement	2	2	2	2	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Potential Vehicle Replacements					-	-	-	-	4	7	6	7	2	2	-	5	7	6	8	3
New Vehicle Purchases	-	4	7	6	7	2	2	-	5	7	6	8	3	2	-	6	9	6	8	4
Vehicle Retirements	4	2	2	2	2	2	1	-	4	7	6	7	2	2	-	5	7	6	8	3
Reading Equipment																				
# of Handhelds (1/Meter Read)	4	5	8	10	13	13	13	13	14	14	14	14	15	15	15	16	16	16	16	17
# of Spare Handhelds	1	2	2	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	5
Purchases (Retirements)	5	2	3	3	4	-	-	-	1	-	-	-	1	-	-	1	-	-	-	2
Potential Replacements					-	5	2	3	3	4	5	2	3	4	4	5	2	4	4	4
Purchases + Replacements	5	2	3	3	4	5	2	3	4	4	5	2	4	4	4	6	2	4	4	6
# of Pocket Pro (1/Field Service)	3	4	6	7	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12
# of Spare Pocket Pro	1	1	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Purchases (Retirements)	4	1	3	1	3	-	1	-	-	-	-	1	-	-	-	-	1	-	-	-
Potential Replacements					-	4	1	3	1	3	4	2	3	1	3	4	3	3	1	3
Purchases + Replacements	4	1	3	1	3	4	2	3	1	3	4	3	3	1	3	4	4	3	1	3
Touch Pad																				
Years to Install Pads	4																			
Pads Replaced/Year	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Cummulative Replaced	30,465	47,168	69,161	91,194	113,265	115,417	117,610	119,845	122,122	124,442	126,806	129,215	131,670	134,172	136,721	139,319	141,966	144,663	147,412	150,213
New Services Installed	-	1,996	2,034	2,073	2,112	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Total Pads Installed & Replaced	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Cummulative Replaced & Installed	30,465	47,168	69,161	91,194	113,265	115,417	117,610	119,845	122,122	124,442	126,806	129,215	131,670	134,172	136,721	139,319	141,966	144,663	147,412	150,213
Touch Pad Cost	$15.00	$15.38	$15.76	$16.15	$16.56	$16.97	$17.40	$17.83	$18.28	$18.73	$19.20	$19.68	$20.17	$20.68	$21.19	$21.72	$22.27	$22.82	$23.39	$23.98
Installation Cost	$15.00	$15.53	$16.07	$16.63	$17.21	$17.82	$18.44	$19.08	$19.75	$20.44	$21.16	$21.90	$22.67	$23.46	$24.28	$25.13	$26.01	$26.92	$27.86	$28.84

City of Fresno
Meter Reading Feasibility 20-Year Planning Horizon Model Bi-Monthly
4-Year Deployment
Touch Read
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Capital Budget (to be Borrowed)																				
Meters Installed	$ 2,132,516	$ 1,198,439	$ 1,617,484	$ 1,660,861	$ 1,705,396	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Pits & Boxes Installed	$ -	$ 4,886,552	$ 8,665,095	$ 8,897,472	$ 9,136,052	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Program Management	$ 304,645	$ 167,030	$ 219,935	$ 220,325	$ 220,715	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Vehicle Purchases (Retirements)	$ (9,714)	$ 65,353	$ 122,273	$ 107,704	$ 130,982	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Reading Equipment Purchases (Ret.)																				
Handhelds	$ 14,000	$ 5,740	$ 8,825	$ 9,046	$ 12,363	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Pocket Pro	$ 1,600	$ 410	$ 1,261	$ 431	$ 1,325	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Touch Pad	$ 913,936	$ 516,122	$ 700,004	$ 722,316	$ 745,355	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Capital Budget	$ 3,356,983	$ 6,839,646	$ 11,334,877	$ 11,618,156	$ 11,952,188	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Debt Service Payments	3,774,093	3,774,093	3,774,093	3,774,093	3,774,093	3,774,093	3,774,093	3,774,093	3,774,093	3,774,093	3,774,093	3,774,093	3,774,093	3,774,093	3,774,093	3,774,093	3,774,093	3,774,093	3,774,093	3,774,093
Capital Budget (Out of Pocket)																				
Meters Installed	$ -	$ -	$ -	$ -	$ -	$ 170,435	$ 178,025	$ 185,970	$ 194,201	$ 202,815	$ 211,828	$ 221,257	$ 231,119	$ 241,432	$ 252,117	$ 263,388	$ 275,064	$ 287,266	$ 300,125	$ 313,447
Pits & Boxes Installed	$ -	$ -	$ -	$ -	$ -	$ 913,046	$ 953,703	$ 996,267	$ 1,040,364	$ 1,086,511	$ 1,134,795	$ 1,185,306	$ 1,238,138	$ 1,293,388	$ 1,350,626	$ 1,411,004	$ 1,473,557	$ 1,538,927	$ 1,607,813	$ 1,679,182
Vehicle Purchases (Retirements)	$ -	$ -	$ -	$ -	$ -	$ 34,613	$ 38,809	$ -	$ 99,137	$ 139,016	$ 123,327	$ 173,736	$ 69,725	$ 45,578	$ -	$ 150,542	$ 235,822	$ 156,906	$ 216,530	$ 116,723
Reading Equipment Purchases (Ret.)																				
Handhelds	$ -	$ -	$ -	$ -	$ -	$ 15,840	$ 6,494	$ 9,985	$ 13,646	$ 13,987	$ 17,921	$ 7,348	$ 15,063	$ 15,439	$ 15,825	$ 24,331	$ 8,313	$ 17,042	$ 17,468	$ 26,857
Pocket Pro	$ -	$ -	$ -	$ -	$ -	$ 1,810	$ 928	$ 1,426	$ 487	$ 1,499	$ 2,048	$ 1,575	$ 1,614	$ 551	$ 1,696	$ 2,317	$ 2,375	$ 1,826	$ 624	$ 1,918
Touch Pad	-	-	-	-	-	$ 74,860	$ 78,584	$ 82,504	$ 86,590	$ 90,889	$ 95,412	$ 100,168	$ 105,171	$ 110,431	$ 115,916	$ 121,729	$ 127,790	$ 134,161	$ 140,906	$ 147,941
Total Capital Budget	$ -	$ -	$ -	$ -	$ -	$ 1,210,605	$ 1,256,543	$ 1,276,152	$ 1,434,426	$ 1,534,717	$ 1,585,331	$ 1,689,390	$ 1,660,830	$ 1,706,820	$ 1,736,180	$ 1,973,311	$ 2,122,922	$ 2,136,128	$ 2,283,467	$ 2,286,070
Total Budget (Operating + Capital)	$ 3,947,310	$ 7,554,109	$ 12,337,069	$ 12,884,209	$ 13,545,491	$ 2,861,286	$ 3,032,531	$ 3,116,141	$ 3,401,745	$ 3,572,989	$ 3,697,137	$ 3,956,040	$ 4,079,659	$ 4,213,016	$ 4,332,928	$ 4,742,212	$ 5,190,797	$ 5,314,974	$ 5,577,338	$ 5,789,943
Does Not Include Customer Service or Debt Service																				
Long-Term Budget	$ 4,364,420	$ 4,488,555	$ 4,776,285	$ 5,040,145	$ 5,367,395	$ 6,635,379	$ 6,806,623	$ 6,890,234	$ 7,175,838	$ 7,347,081	$ 7,471,230	$ 7,730,132	$ 7,853,751	$ 7,987,108	$ 8,107,020	$ 8,516,304	$ 8,964,889	$ 9,089,066	$ 9,351,430	$ 9,564,036
Includes Debt Service, Capital Out of Pocket and Operating Costs)																				
NPV Annually	$ 4,117,377	$ 3,994,798	$ 4,010,261	$ 3,992,267	$ 4,010,830	$ 4,677,680	$ 4,526,793	$ 4,323,018	$ 4,247,367	$ 4,102,572	$ 3,935,751	$ 3,841,639	$ 3,682,145	$ 3,532,706	$ 3,382,776	$ 3,352,411	$ 3,329,241	$ 3,184,298	$ 3,090,769	$ 2,982,112
Total Capital	$ 45,101,849																			
Total Operating Budget (thru deployment)	$ 5,166,338																			
Total Capital	$ 45,101,849																			
Total Deployment	$ 50,268,188																			
Total Debt Service (20 years)	$ 75,481,851																			
Long-Term Cost																				
Total Debt Service	$ 75,481,851																			
Total Operating Budget (20 years)	$ 42,152,182																			
Total Out of Pocket Capital	$ 25,892,891																			
Total Long-Term Cost	$ 143,526,924																			
Net Present Value																				
Discount Rate	6.0%																			
NPV Capital	$36,905,244																			
NPV Deployment	$ 47,422,819																			
NPV Long-Term Cost	$ 76,316,812																			
Total Cost per Read	$ 21.22	$ 14.10	$ 10.23	$ 8.19	$ 7.02	$ 8.52	$ 8.57	$ 8.52	$ 8.71	$ 8.75	$ 8.73	$ 8.86	$ 8.84	$ 8.82	$ 8.78	$ 9.06	$ 9.36	$ 9.31	$ 9.40	$ 9.43

NPV	
total debt service	$43,288,544
operating budget	$21,118,670
out of pocket capital	$11,909,599

City of Fresno
Meter Reading Feasibility 20-Year Planning Horizon Model Bi-Monthly
4-Year Deployment
Manual Read
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Meter Reading																				
Meters																				
Total Meters	30,465	47,168	69,161	91,194	113,265	115,417	117,610	119,845	122,122	124,442	126,806	129,215	131,670	134,172	136,721	139,319	141,966	144,663	147,412	150,213
Meters to be Installed	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Pits & Boxes to be Installed*	(0)	12,713	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
*Year 2008 total is 31,732 minus 24,232 pits already in the ground																				
Installations include annual growth of 1.3%																				
Read Frequency																				
Quarterly %	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%	0.0%	0.0%	0.0%
Bi-monthly %	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%	100.0%	100.0%
Monthly %	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%	0.0%	0.0%	0.0%
Total	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%	100.0%	100.0%
Annual Reads																				
Quarterly	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bi-monthly	182,787	283,005	414,966	547,161	679,590	692,502	705,660	719,070	732,732	746,652	760,836	775,290	790,020	805,032	820,326	835,914	851,796	867,978	884,472	901,278
Monthly	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	182,787	283,005	414,966	547,161	679,590	692,502	705,660	719,070	732,732	746,652	760,836	775,290	790,020	805,032	820,326	835,914	851,796	867,978	884,472	901,278
Reading Days/Year																				
Reading Days/Man Week	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Holidays/Year	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Vacation Days/Year	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Sick Days/Year	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Total Reading Days/Year	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170
Reads/Man Day	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160
Field Service (Meter Reading Related)																				
Field Service Reads per Year																				
Cust. Serv. Request % of Reads	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%
Final Reads % of Meters	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%
Annual Customer Service Req.	18,279	28,301	41,497	54,716	67,959	69,250	70,566	71,907	73,273	74,665	76,084	77,529	79,002	80,503	82,033	83,591	85,180	86,798	88,447	90,128
Annual Final Reads	4,570	7,075	10,374	13,679	16,990	17,313	17,642	17,977	18,318	18,666	19,021	19,382	19,751	20,126	20,508	20,898	21,295	21,699	22,112	22,532
Total Annual Field Service Reads	22,848	35,376	51,871	68,395	84,949	86,563	88,208	89,884	91,592	93,332	95,105	96,911	98,753	100,629	102,541	104,489	106,475	108,497	110,559	112,660
Field Service Days/Year																				
Service Days/Man Week	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Holidays/Year	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Vacation Days/Year	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Sick Days/Year	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Total Reading Days/Year	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222
Visits/Man Day	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Personnel Required																				
Calculated Meter Readers	6.7	10.4	15.3	20.1	25.0	25.5	25.9	26.4	26.9	27.5	28.0	28.5	29.0	29.6	30.2	30.7	31.3	31.9	32.5	33.1
Calculated Field Service Techs *	3.4	5.3	7.8	10.3	12.8	13.0	13.2	13.5	13.8	14.0	14.3	14.6	14.8	15.1	15.4	15.7	16.0	16.3	16.6	16.9
Meter Readers (FTE)	7.0	11.0	15.0	20.0	25.0	26.0	26.0	26.0	27.0	28.0	28.0	29.0	29.0	30.0	30.0	31.0	31.0	32.0	33.0	33.0
Field Techs (FTE)	4.0	5.0	8.0	10.0	13.0	13.0	13.0	14.0	14.0	14.0	14.0	15.0	15.0	15.0	16.0	16.0	16.0	16.0	17.0	17.0
Calculated Lead Worker(s)	1.0	1.5	2.1	2.7	3.5	3.5	3.5	3.6	3.7	3.8	3.8	4.0	4.0	4.1	4.2	4.3	4.3	4.4	4.5	4.5
Actual Lead Workers	1.0	1.0	2.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	5.0	5.0
Supervisor Collections Section	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

* Field Service Techs are supported by meter readers on any off-reading days.

City of Fresno
Meter Reading Feasibility 20-Year Planning Horizon Model Bi-Monthly
4-Year Deployment
Manual Read
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Operating Expenses																				
Meter Related																				
Salary																				
Readers	$ 275,330	$ 447,804	$ 632,014	$ 872,180	$ 1,128,382	$ 1,214,591	$ 1,257,101	$ 1,301,100	$ 1,398,432	$ 1,500,984	$ 1,553,518	$ 1,665,316	$ 1,723,602	$ 1,845,443	$ 1,910,034	$ 2,042,781	$ 2,114,278	$ 2,258,868	$ 2,410,988	$ 2,495,373
Field Service Techs	187,782	242,943	402,314	520,494	700,325	724,836	750,206	836,191	865,457	895,748	927,100	1,028,087	1,064,070	1,101,313	1,215,849	1,258,404	1,302,448	1,348,034	1,482,416	1,534,301
Lead Worker	53,213	55,076	114,007	176,996	183,191	252,804	261,652	270,810	280,288	290,098	300,251	310,760	321,637	332,894	344,545	356,605	369,086	382,004	494,217	511,515
Supervisor Collections	63,851	66,086	68,399	70,793	73,270	75,835	78,489	81,236	84,080	87,022	90,068	93,221	96,483	99,860	103,355	106,973	110,717	114,592	118,603	122,754
Total Salary	$ 580,176	$ 811,909	$ 1,216,735	$ 1,640,463	$ 2,085,169	$ 2,268,066	$ 2,347,448	$ 2,489,337	$ 2,628,257	$ 2,773,853	$ 2,870,938	$ 3,097,384	$ 3,205,793	$ 3,379,510	$ 3,573,784	$ 3,764,762	$ 3,896,529	$ 4,103,497	$ 4,506,224	$ 4,663,942
Education																				
Readers	$ 1,295	$ 2,116	$ 3,001	$ 4,162	$ 5,411	$ 5,852	$ 6,086	$ 6,330	$ 6,836	$ 7,373	$ 7,668	$ 8,259	$ 8,590	$ 9,241	$ 9,611	$ 10,328	$ 10,742	$ 11,532	$ 12,368	$ 12,862
Field Service Techs	740	962	1,601	2,081	2,814	2,926	3,043	3,408	3,545	3,686	3,834	4,272	4,443	4,621	5,126	5,331	5,544	5,766	6,371	6,626
Lead Worker + Supervisor	500	520	811	1,125	1,170	1,521	1,582	1,645	1,711	1,779	1,850	1,924	2,001	2,081	2,165	2,251	2,341	2,435	3,039	3,160
Total Education	$ 2,535	$ 3,598	$ 5,413	$ 7,368	$ 9,394	$ 10,299	$ 10,711	$ 11,383	$ 12,091	$ 12,838	$ 13,352	$ 14,455	$ 15,034	$ 15,943	$ 16,901	$ 17,910	$ 18,627	$ 19,732	$ 21,778	$ 22,649
M & S																				
Readers	$ 7,000	$ 11,385	$ 16,068	$ 22,174	$ 28,688	$ 30,880	$ 31,961	$ 33,079	$ 35,554	$ 38,161	$ 39,497	$ 42,339	$ 43,821	$ 46,919	$ 48,561	$ 51,936	$ 53,754	$ 57,430	$ 61,297	$ 63,443
Field Service Techs	4,000	5,175	8,570	11,087	14,918	15,440	15,980	17,812	18,435	19,081	19,748	21,900	22,666	23,459	25,899	26,806	27,744	28,715	31,577	32,683
Lead Worker + Supervisor	2,000	2,070	3,214	4,435	4,590	5,938	6,146	6,361	6,584	6,814	7,053	7,300	7,555	7,820	8,093	8,377	8,670	8,973	11,145	11,535
Total M&S	$ 13,000	$ 18,630	$ 27,852	$ 37,696	$ 48,196	$ 52,258	$ 54,087	$ 57,253	$ 60,573	$ 64,056	$ 66,298	$ 71,539	$ 74,042	$ 78,198	$ 82,553	$ 87,118	$ 90,167	$ 95,118	$ 104,019	$ 107,660
Contract Services																				
Readers	$ 700	$ 1,139	$ 1,607	$ 2,217	$ 2,869	$ 3,088	$ 3,196	$ 3,308	$ 3,555	$ 3,816	$ 3,950	$ 4,234	$ 4,382	$ 4,692	$ 4,856	$ 5,194	$ 5,375	$ 5,743	$ 6,130	$ 6,344
Field Service Techs	400	518	857	1,109	1,492	1,544	1,598	1,781	1,844	1,908	1,975	2,190	2,267	2,346	2,590	2,681	2,774	2,871	3,158	3,268
Lead Worker + Supervisor	200	207	321	443	459	594	615	636	658	681	705	730	756	782	809	838	867	897	1,114	1,154
Total Contract Services	$ 1,300	$ 1,863	$ 2,785	$ 3,770	$ 4,820	$ 5,226	$ 5,409	$ 5,725	$ 6,057	$ 6,406	$ 6,630	$ 7,154	$ 7,404	$ 7,820	$ 8,255	$ 8,712	$ 9,017	$ 9,512	$ 10,402	$ 10,766
Vehicles (Fuel + Maintenance)																				
Readers	$ 28,000	$ 45,980	$ 65,522	$ 91,293	$ 119,252	$ 129,603	$ 135,435	$ 141,530	$ 153,587	$ 166,443	$ 173,933	$ 188,251	$ 196,722	$ 212,664	$ 222,233	$ 239,975	$ 250,774	$ 270,512	$ 291,519	$ 304,638
Field Service Techs	16,000	20,900	34,945	45,647	62,011	64,801	67,718	76,208	79,638	83,221	86,966	97,371	101,753	106,332	118,524	123,858	129,432	135,256	150,177	156,935
Lead Worker + Supervisor	8,000	8,360	13,104	18,259	19,080	24,924	26,045	27,217	28,442	29,722	31,059	32,457	33,918	35,444	37,039	38,706	40,447	42,268	53,003	55,389
Total Fuel	$ 52,000	$ 75,240	$ 113,571	$ 155,199	$ 200,343	$ 219,328	$ 229,198	$ 244,955	$ 261,667	$ 279,386	$ 291,958	$ 318,079	$ 332,393	$ 354,439	$ 377,797	$ 402,539	$ 420,653	$ 448,036	$ 494,699	$ 516,961
Insurance																				
Readers	$ 7,000	$ 11,550	$ 16,538	$ 23,153	$ 30,388	$ 33,183	$ 34,842	$ 36,585	$ 39,891	$ 43,437	$ 45,609	$ 49,600	$ 52,080	$ 56,569	$ 59,398	$ 64,447	$ 67,669	$ 73,345	$ 79,418	$ 83,389
Field Service Techs	4,000	5,250	8,820	11,576	15,802	16,592	17,421	19,699	20,684	21,719	22,805	25,655	26,938	28,285	31,679	33,263	34,926	36,672	40,913	42,958
Lead Worker + Supervisor	2,000	2,100	3,308	4,631	4,862	6,381	6,700	7,036	7,387	7,757	8,144	8,552	8,979	9,428	9,900	10,395	10,914	11,460	14,440	15,162
Total Insurance	$ 13,000	$ 18,900	$ 28,665	$ 39,359	$ 51,051	$ 56,156	$ 58,964	$ 63,320	$ 67,963	$ 72,912	$ 76,558	$ 83,807	$ 87,997	$ 94,282	$ 100,977	$ 108,104	$ 113,509	$ 121,477	$ 134,771	$ 141,509
Misc.																				
Readers	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Field Service Techs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead Worker + Supervisor	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Miscellaneous	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Meter Reading Equipment Maintenance																				
Hand-held	$ 2,520	$ 4,018	$ 5,589	$ 7,538	$ 9,890	$ 10,454	$ 10,716	$ 10,983	$ 11,599	$ 12,239	$ 12,545	$ 13,593	$ 13,933	$ 14,667	$ 15,034	$ 15,815	$ 16,211	$ 17,042	$ 18,342	$ 18,800
Software	1,000	1,025	1,051	1,077	1,104	1,131	1,160	1,189	1,218	1,249	1,280	1,312	1,345	1,379	1,413	1,448	1,485	1,522	1,560	1,599
Total Annual Meter Reading Budget																				
Readers	$ 319,325	$ 519,974	$ 734,750	$ 1,015,179	$ 1,314,989	$ 1,417,197	$ 1,468,622	$ 1,521,931	$ 1,637,856	$ 1,760,214	$ 1,824,174	$ 1,957,999	$ 2,029,197	$ 2,175,528	$ 2,254,693	$ 2,414,661	$ 2,502,592	$ 2,677,429	$ 2,861,720	$ 2,966,049
Field Service Techs	212,922	275,748	457,107	591,994	797,361	826,139	855,966	955,100	989,603	1,025,363	1,062,428	1,179,475	1,222,137	1,266,355	1,399,668	1,450,342	1,502,868	1,557,314	1,714,611	1,776,770
Lead Worker + Supervisor	129,764	134,419	203,164	276,681	286,623	367,997	381,229	394,941	409,150	423,874	439,132	454,944	471,329	488,310	505,907	524,143	543,042	562,629	695,561	720,668
Facilities Rent	116,000	120,060	124,262	128,611	133,113	137,772	142,594	147,584	152,750	158,096	163,629	169,356	175,284	181,419	187,769	194,340	201,142	208,182	215,469	223,010
Reading Equipment Maintenance	3,520	5,043	6,640	8,615	10,994	11,586	11,875	12,172	12,818	13,488	13,825	14,905	15,278	16,046	16,447	17,264	17,695	18,564	19,901	20,399
Meter Reading Operating Budget	$ 781,531	$ 1,055,244	$ 1,525,923	$ 2,021,081	$ 2,543,079	$ 2,760,690	$ 2,860,286	$ 3,031,728	$ 3,202,176	$ 3,381,035	$ 3,503,188	$ 3,776,680	$ 3,913,225	$ 4,127,657	$ 4,364,482	$ 4,600,750	$ 4,767,340	$ 5,024,118	$ 5,507,263	$ 5,706,896
Customer Service Related																				
Total Customer Service	$ 925,359	$ 1,482,858	$ 2,250,392	$ 3,071,151	$ 3,947,966	$ 4,163,780	$ 4,391,396	$ 4,631,468	$ 4,884,645	$ 5,151,651	$ 5,433,249	$ 5,730,243	$ 6,043,483	$ 6,373,863	$ 6,722,277	$ 7,089,766	$ 7,477,325	$ 7,886,053	$ 8,317,167	$ 8,771,835
Total Reading + Techs + Cust. Serv.	$ 1,706,891	$ 2,538,101	$ 3,776,315	$ 5,092,232	$ 6,491,046	$ 6,924,471	$ 7,251,682	$ 7,663,196	$ 8,086,821	$ 8,532,686	$ 8,936,437	$ 9,506,923	$ 9,956,708	$ 10,501,520	$ 11,086,760	$ 11,690,515	$ 12,244,664	$ 12,910,171	$ 13,824,430	$ 14,478,731

City of Fresno
Meter Reading Feasibility 20-Year Planning Horizon Model Bi-Monthly
4-Year Deployment
Manual Read
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Operating Cost per Read																				
Regular Meter Read	$1.75	$1.84	$1.77	$1.86	$1.93	$2.05	$2.08	$2.12	$2.24	$2.36	$2.40	$2.53	$2.57	$2.70	$2.75	$2.89	$2.94	$3.08	$3.24	$3.29
Field Service Read	$9.32	$7.79	$8.81	$8.66	$9.39	$9.54	$9.70	$10.63	$10.80	$10.99	$11.17	$12.17	$12.38	$12.58	$13.65	$13.88	$14.11	$14.35	$15.51	$15.77
Regular + Field Service	$3.80	$3.31	$3.27	$3.28	$3.33	$3.54	$3.60	$3.75	$3.88	$4.03	$4.09	$4.33	$4.40	$4.56	$4.73	$4.89	$4.97	$5.15	$5.53	$5.63
Reg + Field Serv. + Cust. Serv.	$8.30	$7.97	$8.09	$8.27	$8.49	$8.89	$9.13	$9.47	$9.81	$10.16	$10.44	$10.90	$11.20	$11.60	$12.01	$12.43	$12.78	$13.22	$13.89	$14.28
Capital Items																				
Meters and Pits																				
Meters to be Installed	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Pits to be Installed	(0)	12,713	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Vehicles																				
Vehicles Req'd	13	18	26	34	42	44	44	45	46	47	47	49	49	50	51	52	52	53	56	56
Vehicles in Service	13	13	18	26	34	42	44	44	45	46	47	47	49	49	50	51	52	52	53	56
New Vehicles (Retirements)	-	5	8	8	8	2	-	1	1	1	-	2	-	1	1	1	-	1	3	-
Potential In-Service Replacement	2	2	2	2	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Potential Vehicle Replacements					-	-	-	2	7	10	10	10	4	1	3	8	11	10	12	4
New Vehicle Purchases	2	7	10	10	10	4	1	3	8	11	10	12	4	2	4	9	11	11	15	4
Vehicle Retirements	2	2	2	2	2	2	1	2	7	10	10	10	4	1	3	8	11	10	12	4
Reading Equipment																				
# of Handhelds (1/Meter Read)	7	11	15	20	25	26	26	26	27	28	28	29	29	30	30	31	31	32	33	33
# of Spare Handhelds	2	3	4	5	7	7	7	7	7	7	7	8	8	8	8	8	8	8	9	9
Purchases (Retirements)	9	5	5	6	7	1	-	-	1	1	-	2	-	1	-	1	-	1	2	-
Potential Replacements					-	9	5	5	6	7	10	5	5	7	8	10	7	5	8	8
Purchases + Replacements	9	5	5	6	7	10	5	5	7	8	10	7	5	8	8	11	7	6	10	8
# of Pocket Pro (1/Field Service)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
# of Spare Pocket Pro	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Purchases (Retirements)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Calculated Replacements					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Purchases + Replacements					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lenses (Not used in this model)																				
Years to Replace Existing Lenses	4																			
Lenses Replaced/Year	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Cummulative Replaced	30,465	47,168	69,161	91,194	113,265	115,417	117,610	119,845	122,122	124,442	126,806	129,215	131,670	134,172	136,721	139,319	141,966	144,663	147,412	150,213
New Services Installed	-	1,996	2,034	2,073	2,112	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Total Lenses Installed & Replaced	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Cummulative Replaced & Installed	30,465	47,168	69,161	91,194	113,265	115,417	117,610	119,845	122,122	124,442	126,806	129,215	131,670	134,172	136,721	139,319	141,966	144,663	147,412	150,213
Lens Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Installation Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

City of Fresno
Meter Reading Feasibility 20-Year Planning Horizon Model Bi-Monthly
4-Year Deployment
Manual Read
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Capital Budget (to be Borrowed)																				
Meters Installed	$ 2,132,516	$ 1,198,439	$ 1,617,484	$ 1,660,861	$ 1,705,396	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Pits & Boxes Installed	$ -	$ 4,886,552	$ 8,665,095	$ 8,897,472	$ 9,136,052	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Program Management	$ 304,645	$ 167,030	$ 219,935	$ 220,325	$ 220,715	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Vehicle Purchases (Retirements)	$ 29,143	$ 118,138	$ 176,905	$ 183,097	$ 189,505	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Reading Equipment Purchases (Ret.)																				
Handhelds	$ 25,200	$ 14,350	$ 14,709	$ 18,092	$ 21,635	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Pocket Pro	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Lens	-	-	-	-	-	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Capital Budget	$ 2,491,504	$ 6,384,509	$ 10,694,129	$ 10,979,847	$ 11,273,304	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Debt Service Payments	$3,499,745	$3,499,745	$3,499,745	$3,499,745	$3,499,745	$3,499,745	$3,499,745	$3,499,745	$3,499,745	$3,499,745	$3,499,745	$3,499,745	$3,499,745	$3,499,745	$3,499,745	$3,499,745	$3,499,745	$3,499,745	$3,499,745	$3,499,745
Capital Budget (out of Pocket)																				
Meters Installed	$ -	$ -	$ -	$ -	$ -	$ 170,435	$ 178,025	$ 185,970	$ 194,201	$ 202,815	$ 211,828	$ 221,257	$ 231,119	$ 241,432	$ 252,117	$ 263,388	$ 275,064	$ 287,266	$ 300,125	$ 313,447
Pits & Boxes Installed	$ -	$ -	$ -	$ -	$ -	$ 913,046	$ 953,703	$ 996,267	$ 1,040,364	$ 1,086,511	$ 1,134,795	$ 1,185,306	$ 1,238,138	$ 1,293,388	$ 1,350,626	$ 1,411,004	$ 1,473,557	$ 1,538,927	$ 1,607,813	$ 1,679,182
Vehicle Purchases (Retirements)	$ -	$ -	$ -	$ -	$ -	$ 74,994	$ 17,912	$ 58,707	$ 156,700	$ 221,763	$ 205,544	$ 262,377	$ 88,074	$ 49,376	$ 98,278	$ 223,779	$ 277,933	$ 292,019	$ 419,527	$ 112,054
Reading Equipment Purchases (Ret.)																				
Handhelds	$ -	$ -	$ -	$ -	$ -	$ 31,679	$ 16,236	$ 16,642	$ 23,881	$ 27,975	$ 35,842	$ 25,717	$ 18,828	$ 30,879	$ 31,651	$ 44,608	$ 29,096	$ 25,563	$ 43,670	$ 35,810
Pocket Pro	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Lens	$ -	$ -	$ -	$ -	$ -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Capital Budget	$0	$0	$0	$0	$0	$1,190,155	$1,165,875	$1,257,585	$1,415,146	$1,539,064	$1,588,010	$1,694,658	$1,576,160	$1,615,075	$1,732,672	$1,942,778	$2,055,651	$2,143,776	$2,371,136	$2,140,494
Total Budget (Operating + Capital)	$ 3,273,036	$ 7,439,752	$ 12,220,051	$ 13,000,928	$ 13,816,383	$ 2,760,690	$ 2,860,286	$ 3,031,728	$ 3,202,176	$ 3,381,035	$ 3,503,188	$ 3,776,680	$ 3,913,225	$ 4,127,657	$ 4,364,482	$ 4,600,750	$ 4,767,340	$ 5,024,118	$ 5,507,263	$ 5,706,896
Does Not Include Customer Service or Debt Service																				
Long-Term Budget	$ 4,281,277	$ 4,554,989	$ 5,025,668	$ 5,520,826	$ 6,042,825	$ 7,450,591	$ 7,525,906	$ 7,789,059	$ 8,117,067	$ 8,419,844	$ 8,590,943	$ 8,971,083	$ 8,989,129	$ 9,242,478	$ 9,596,899	$ 10,043,273	$ 10,322,736	$ 10,667,639	$ 11,378,144	$ 11,347,134
Includes Debt Service, Capital Out of Pocket and Operating Costs)																				
NPV Annually	$ 4,038,940	$ 4,053,924	$ 4,219,648	$ 4,373,011	$ 4,515,550	$ 5,252,372	$ 5,005,157	$ 4,886,952	$ 4,804,480	$ 4,701,597	$ 4,525,602	$ 4,458,353	$ 4,214,455	$ 4,087,957	$ 4,004,451	$ 3,953,497	$ 3,833,497	$ 3,737,341	$ 3,760,625	$ 3,538,090
Total Capital	$ 41,823,293																			
Total Operating Budget (thru deployment)	$ 7,926,858																			
Total Capital	$ 41,823,293																			
Total Deployment	$ 49,750,151																			
Total Debt Service (20 years)	$ 69,994,902																			
Long-Term Cost																				
Total Debt Service	$ 69,994,902																			
Total Operating Budget (20 years)	$ 68,454,372																			
Total Out of Pocket Capital	$ 25,428,234																			
Total Long-Term Cost	$ 163,877,508																			
Net Present Value																				
Discount Rate	6.0%																			
NPV Capital	$34,132,798																			
NPV Deployment	$ 46,934,105																			
NPV Long-Term Cost	$ 85,965,498																			
Total Cost per Read	$ 20.82	$ 14.31	$ 10.77	$ 8.97	$ 7.90	$ 9.56	$ 9.48	$ 9.63	$ 9.85	$ 10.02	$ 10.04	$ 10.29	$ 10.11	$ 10.21	$ 10.40	$ 10.68	$ 10.77	$ 10.92	$ 11.43	$ 11.19

NPV	
total debt service	$40,141,801
operating budget	$34,137,895
out of pocket capital	$11,685,802

City of Fresno

Meter Reading Feasibility 20-Year Planning Horizon Model Bi-Monthly

4-Year Deployment

Model Inputs

(Updated: September 17, 2007)

	2008 Year 1	2009 Year 2	2010 Year 3	2011 Year 4	2012 Year 5	2013 Year 6	2014 Year 7	2015 Year 8	2016 Year 9	2017 Year 10	2018 Year 11	2019 Year 12	2020 Year 13	2021 Year 14	2022 Year 15	2023 Year 16	2024 Year 17	2025 Year 18	2026 Year 19	2027 Year 20
Meters																				
Growth Factor		1.9%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%
Total Meter Accounts	105,050	107,046	109,080	111,153	113,265	115,417	117,610	119,845	122,122	124,442	126,806	129,215	131,670	134,172	136,721	139,319	141,966	144,663	147,412	150,213
Meters Installed at Year End	30,465	47,168	69,161	91,194	113,265	115,417	117,610	119,845	122,122	124,442	126,806	129,215	131,670	134,172	136,721	139,319	141,966	144,663	147,412	150,213
Pits & Boxes Installed Annually	(0)	12,713	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Meters Installed Annually	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Read Frequency (Monthly % of Meters)																				
Manual	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%	0.0%	0.0%	0.0%
Touch Read	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%	0.0%	0.0%	0.0%
Mobile Drive-by	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%	0.0%	0.0%	0.0%
Fixed Radio	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%	0.0%	0.0%	0.0%
Read Frequency (Bi-monthly % of Meters)																				
Manual	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%	100.0%	100.0%
Touch Read	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%	100.0%	100.0%
Mobile Drive-by	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%	100.0%	100.0%
Fixed Radio	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%	100.0%	100.0%
Field Service Visits																				
Customer Service/Billing (% of Reads)	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%
Final Reads (% of Meters)	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%
Reading and Field Visit Productivity																				
Meter Reading																				
Manual Read Days per Week	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Touch Read Days per Week	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Mobile Drive-by Days per Week	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Fixed Radio Days per Week	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Manual Reads per Day	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160
Touch Reads per Day	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320
Mobile Drive-by Reads per Day	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000
Mobile Drive-by Rounding Factor	0.25	Any mobile drive-by unit calculation greater than				0.25	will round up to the next integer													
Meters per Meter Reader (Fixed)	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
Field Visits																				
Manual Read Days per Week	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Touch Read Days per Week	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Mobile Drive-by Days per Week	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Fixed Radio Days per Week	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Manual Read Visits per Day	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Touch Read Visits per Day	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35
Mobile Drive-by Visits per Day	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
Meters/Field Service (Drive + Fixed)	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000
Reading and Field Visit Paid Time Off																				
Meter Reading + Field Service																				
Holidays/Year	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Vacation Days/Year (avg.)	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Sick Days/Year (avg.)	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Lead Worker																				
Holidays/Year	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Vacation Days/Year	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Sick Days/Year	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Readers Rounding factor	0.40	Any personnel calculation greater than or equal to				0.40	will round up to the next integer													
Field Service Tech Rounding factor	0.40	Any personnel calculation greater than or equal to				0.40	will round up to the next integer													
Lead Worker Rounding factor	0.50	Any personnel calculation greater than or equal to				0.50	will round up to the next integer													

City of Fresno

Meter Reading Feasibility 20-Year Planning Horizon Model Bi-Monthly

4-Year Deployment

Model Inputs

(Updated: September 17, 2007)

	2008 Year 1	2009 Year 2	2010 Year 3	2011 Year 4	2012 Year 5	2013 Year 6	2014 Year 7	2015 Year 8	2016 Year 9	2017 Year 10	2018 Year 11	2019 Year 12	2020 Year 13	2021 Year 14	2022 Year 15	2023 Year 16	2024 Year 17	2025 Year 18	2026 Year 19	2027 Year 20
Operating Expenses																				
Meter Related																				
Salary																				
Growth Factor (Inflation)		3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Paid Hours per Year	2,080	2,080	2,080	2,080	2,080	2,080	2,080	2,080	2,080	2,080	2,080	2,080	2,080	2,080	2,080	2,080	2,080	2,080	2,080	2,080
Meter Readers Hourly Rate (avg.)	$15.50	$16.04	$16.60	$17.19	$17.79	$18.41	$19.05	$19.72	$20.41	$21.12	$21.86	$22.63	$23.42	$24.24	$25.09	$25.97	$26.88	$27.82	$28.79	$29.80
Field Service Tech Hourly Rate (avg.)	$18.50	$19.15	$19.82	$20.51	$21.23	$21.97	$22.74	$23.54	$24.36	$25.21	$26.10	$27.01	$27.95	$28.93	$29.95	$30.99	$32.08	$33.20	$34.36	$35.57
Read & FS Benefits Multiplier	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22
Loaded Meter Reading Rate	$18.91	$19.57	$20.26	$20.97	$21.70	$22.46	$23.25	$24.06	$24.90	$25.77	$26.67	$27.61	$28.57	$29.57	$30.61	$31.68	$32.79	$33.94	$35.13	$36.35
Loaded Field Service Tech Rate	$22.57	$23.36	$24.18	$25.02	$25.90	$26.81	$27.74	$28.72	$29.72	$30.76	$31.84	$32.95	$34.10	$35.30	$36.53	$37.81	$39.14	$40.51	$41.92	$43.39
Lead Worker Hourly Rate	$20.97	$21.70	$22.46	$23.25	$24.06	$24.91	$25.78	$26.68	$27.61	$28.58	$29.58	$30.62	$31.69	$32.80	$33.94	$35.13	$36.36	$37.63	$38.95	$40.31
Lead Worker Benefits Multiplier	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22
Lead Worker Loaded Hourly Rate	$25.58	$26.48	$27.41	$28.36	$29.36	$30.39	$31.45	$32.55	$33.69	$34.87	$36.09	$37.35	$38.66	$40.01	$41.41	$42.86	$44.36	$45.91	$47.52	$49.18
Supervisor Collections Section	$63,851.00	$66,085.79	$68,398.79	$70,792.75	$73,270.49	$75,834.96	$78,489.18	$81,236.30	$84,079.57	$87,022.36	$90,068.14	$93,220.53	$96,483.24	$99,860.16	$103,355.26	$106,972.70	$110,716.74	$114,591.83	$118,602.54	$122,753.63
FTE/Lead Worker	11																			
Supervisor Collections	1																			
Education																				
Growth Factor (Inflation)		4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
Meter Readers $/FTE	$185.00	$192.40	$200.10	$208.10	$216.42	$225.08	$234.08	$243.45	$253.19	$263.31	$273.85	$284.80	$296.19	$308.04	$320.36	$333.17	$346.50	$360.36	$374.78	$389.77
Field Service Techs $/FTE	$185.00	$192.40	$200.10	$208.10	$216.42	$225.08	$234.08	$243.45	$253.19	$263.31	$273.85	$284.80	$296.19	$308.04	$320.36	$333.17	$346.50	$360.36	$374.78	$389.77
Lead Worker + Super. $/FTE	$250.00	$260.00	$270.40	$281.22	$292.46	$304.16	$316.33	$328.98	$342.14	$355.83	$370.06	$384.86	$400.26	$416.27	$432.92	$450.24	$468.25	$486.98	$506.45	$526.71
Material & Supplies																				
Growth Factor (Inflation)		3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Meter Readers $/FTE	$1,000.00	$1,035.00	$1,071.23	$1,108.72	$1,147.52	$1,187.69	$1,229.26	$1,272.28	$1,316.81	$1,362.90	$1,410.60	$1,459.97	$1,511.07	$1,563.96	$1,618.69	$1,675.35	$1,733.99	$1,794.68	$1,857.49	$1,922.50
Field Service Techs $/FTE	$1,000.00	$1,035.00	$1,071.23	$1,108.72	$1,147.52	$1,187.69	$1,229.26	$1,272.28	$1,316.81	$1,362.90	$1,410.60	$1,459.97	$1,511.07	$1,563.96	$1,618.69	$1,675.35	$1,733.99	$1,794.68	$1,857.49	$1,922.50
Lead Worker + Super. $/FTE	$1,000.00	$1,035.00	$1,071.23	$1,108.72	$1,147.52	$1,187.69	$1,229.26	$1,272.28	$1,316.81	$1,362.90	$1,410.60	$1,459.97	$1,511.07	$1,563.96	$1,618.69	$1,675.35	$1,733.99	$1,794.68	$1,857.49	$1,922.50
Contract Services																				
Growth Factor (Inflation)		3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Meter Readers $/FTE	$100.00	$103.50	$107.12	$110.87	$114.75	$118.77	$122.93	$127.23	$131.68	$136.29	$141.06	$146.00	$151.11	$156.40	$161.87	$167.53	$173.40	$179.47	$185.75	$192.25
Field Service Techs $/FTE	$100.00	$103.50	$107.12	$110.87	$114.75	$118.77	$122.93	$127.23	$131.68	$136.29	$141.06	$146.00	$151.11	$156.40	$161.87	$167.53	$173.40	$179.47	$185.75	$192.25
Lead Worker + Super. $/FTE	$100.00	$103.50	$107.12	$110.87	$114.75	$118.77	$122.93	$127.23	$131.68	$136.29	$141.06	$146.00	$151.11	$156.40	$161.87	$167.53	$173.40	$179.47	$185.75	$192.25
Vehicle Fuel + Maint.																				
Growth Factor (Inflation)		4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%
Meter Readers $/FTE	$4,000.00	$4,180.00	$4,368.10	$4,564.66	$4,770.07	$4,984.73	$5,209.04	$5,443.45	$5,688.40	$5,944.38	$6,211.88	$6,491.41	$6,783.53	$7,088.78	$7,407.78	$7,741.13	$8,089.48	$8,453.51	$8,833.92	$9,231.44
Field Service Techs $/FTE	$4,000.00	$4,180.00	$4,368.10	$4,564.66	$4,770.07	$4,984.73	$5,209.04	$5,443.45	$5,688.40	$5,944.38	$6,211.88	$6,491.41	$6,783.53	$7,088.78	$7,407.78	$7,741.13	$8,089.48	$8,453.51	$8,833.92	$9,231.44
Lead Worker + Super. $/FTE	$4,000.00	$4,180.00	$4,368.10	$4,564.66	$4,770.07	$4,984.73	$5,209.04	$5,443.45	$5,688.40	$5,944.38	$6,211.88	$6,491.41	$6,783.53	$7,088.78	$7,407.78	$7,741.13	$8,089.48	$8,453.51	$8,833.92	$9,231.44
Insurance																				
Growth Factor (Inflation)		5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
Meter Readers $/FTE	$1,000.00	$1,050.00	$1,102.50	$1,157.63	$1,215.51	$1,276.28	$1,340.10	$1,407.10	$1,477.46	$1,551.33	$1,628.89	$1,710.34	$1,795.86	$1,885.65	$1,979.93	$2,078.93	$2,182.87	$2,292.02	$2,406.62	$2,526.95
Field Service Techs $/FTE	$1,000.00	$1,050.00	$1,102.50	$1,157.63	$1,215.51	$1,276.28	$1,340.10	$1,407.10	$1,477.46	$1,551.33	$1,628.89	$1,710.34	$1,795.86	$1,885.65	$1,979.93	$2,078.93	$2,182.87	$2,292.02	$2,406.62	$2,526.95
Lead Worker + Super. $/FTE	$1,000.00	$1,050.00	$1,102.50	$1,157.63	$1,215.51	$1,276.28	$1,340.10	$1,407.10	$1,477.46	$1,551.33	$1,628.89	$1,710.34	$1,795.86	$1,885.65	$1,979.93	$2,078.93	$2,182.87	$2,292.02	$2,406.62	$2,526.95
Misc.																				
Growth Factor (Inflation)		3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Meter Readers $/FTE	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Field Service Techs $/FTE	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Lead Worker + Super. $/FTE	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00

City of Fresno

Meter Reading Feasibility 20-Year Planning Horizon Model Bi-Monthly

4-Year Deployment

Model Inputs

(Updated: September 17, 2007)

	2008 Year 1	2009 Year 2	2010 Year 3	2011 Year 4	2012 Year 5	2013 Year 6	2014 Year 7	2015 Year 8	2016 Year 9	2017 Year 10	2018 Year 11	2019 Year 12	2020 Year 13	2021 Year 14	2022 Year 15	2023 Year 16	2024 Year 17	2025 Year 18	2026 Year 19	2027 Year 20
Facilities Rent	$116,000.00	$120,060.00	$124,262.10	$128,611.27	$133,112.67	$137,771.61	$142,593.62	$147,584.39	$152,749.85	$158,096.09	$163,629.46	$169,356.49	$175,283.96	$181,418.90	$187,768.56	$194,340.46	$201,142.38	$208,182.36	$215,468.75	$223,010.15
Meter Reading Equipment Maintenance																				
Growth Factor (Inflation)		2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
Touch Read Hand-held	$280.00	$287.00	$294.18	$301.53	$309.07	$316.79	$324.71	$332.83	$341.15	$349.68	$358.42	$367.38	$376.57	$385.98	$395.63	$405.52	$415.66	$426.05	$436.70	$447.62
Mobile Hand-held	$450.00	$461.25	$472.78	$484.60	$496.72	$509.13	$521.86	$534.91	$548.28	$561.99	$576.04	$590.44	$605.20	$620.33	$635.84	$651.73	$668.03	$684.73	$701.85	$719.39
Drive-by	$1,000.00	$1,025.00	$1,050.63	$1,076.89	$1,103.81	$1,131.41	$1,159.69	$1,188.69	$1,218.40	$1,248.86	$1,280.08	$1,312.09	$1,344.89	$1,378.51	$1,412.97	$1,448.30	$1,484.51	$1,521.62	$1,559.66	$1,598.65
Collectors	$200.00	$205.00	$210.13	$215.38	$220.76	$226.28	$231.94	$237.74	$243.68	$249.77	$256.02	$262.42	$268.98	$275.70	$282.59	$289.66	$296.90	$304.32	$311.93	$319.73
Touch and Mobile Software	$1,000.00	$1,025.00	$1,050.63	$1,076.89	$1,103.81	$1,131.41	$1,159.69	$1,188.69	$1,218.40	$1,248.86	$1,280.08	$1,312.09	$1,344.89	$1,378.51	$1,412.97	$1,448.30	$1,484.51	$1,521.62	$1,559.66	$1,598.65
Fixed Software	$2,000.00	$2,050.00	$2,101.25	$2,153.78	$2,207.63	$2,262.82	$2,319.39	$2,377.37	$2,436.81	$2,497.73	$2,560.17	$2,624.17	$2,689.78	$2,757.02	$2,825.95	$2,896.60	$2,969.01	$3,043.24	$3,119.32	$3,197.30
Installation Programmers	$250.00	$256.25	$262.66	$269.22	$275.95	$282.85	$289.92	$297.17	$304.60	$312.22	$320.02	$328.02	$336.22	$344.63	$353.24	$362.07	$371.13	$380.40	$389.91	$399.66
Customer Service Related																				
Growth Factor		3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Cost per Read	$ 4.50	$ 4.66	$ 4.82	$ 4.99	$ 5.16	$ 5.34	$ 5.53	$ 5.73	$ 5.93	$ 6.13	$ 6.35	$ 6.57	$ 6.80	$ 7.04	$ 7.28	$ 7.54	$ 7.80	$ 8.08	$ 8.36	$ 8.65
Capital Related																				
Vehicles																				
Current Vehicles in Service	13																			
Currnet Vehicle Replacement Factor	2.00	vehicles per year																		
Cost Growth Factor		3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Vehicle Cost	$17,000	$17,595	$18,211	$18,848	$19,508	$20,191	$20,897	$21,629	$22,386	$23,169	$23,980	$24,819	$25,688	$26,587	$27,518	$28,481	$29,478	$30,509	$31,577	$32,683
Vehicle Life in Years	7	**Inputs restricted to values of 4 to 10 years**																		
Reading Equipment																				
Cost Growth Factor		2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
Touch Pad Handheld Cost	$2,800	$2,870	$2,942	$3,015	$3,091	$3,168	$3,247	$3,328	$3,412	$3,497	$3,584	$3,674	$3,766	$3,860	$3,956	$4,055	$4,157	$4,261	$4,367	$4,476
Touch Pad Handheld Life	5	**Inputs restricted to values of 4 to 10 years**																		
Touch Pad Pocket Pro Cost	$400	$410	$420	$431	$442	$453	$464	$475	$487	$500	$512	$525	$538	$551	$565	$579	$594	$609	$624	$639
Touch Pad Pocket Pro Life	5	**Inputs restricted to values of 4 to 10 years**																		
Mobile Handheld Cost	$4,500	$4,613	$4,728	$4,846	$4,967	$5,091	$5,219	$5,349	$5,483	$5,620	$5,760	$5,904	$6,052	$6,203	$6,358	$6,517	$6,680	$6,847	$7,018	$7,194
Mobile Handheld Life	5	**Inputs restricted to values of 4 to 10 years**																		
Handheld Spares % of FTE	25%																			
Touch Spare for Mobile and Fixed	1																			
Installation Programmer Cost	$2,500	$2,563	$2,627	$2,692	$2,760	$2,829	$2,899	$2,972	$3,046	$3,122	$3,200	$3,280	$3,362	$3,446	$3,532	$3,621	$3,711	$3,804	$3,899	$3,997
Installation Programmer Life	5	**Inputs restricted to values of 4 to 10 years**																		
Mobile Walk																				
System Computer	$2,500																			
Software and Training	$10,000																			
Total Mobile Walk Startup Cost	$12,500	$12,813	$13,133	$13,461	$13,798	$14,143	$14,496	$14,859	$15,230	$15,611	$16,001	$16,401	$16,811	$17,231	$17,662	$18,104	$18,556	$19,020	$19,496	$19,983
	6	**Inputs restricted to values of 4 to 10 years**																		
Drive-by																				
Mobile Collector	$ 30,000																			
System Computer	$ 2,500																			
Software and Training	$ 10,000																			
Total Drive-by Mobile Unit Cost	$ 42,500	$ 43,563	$ 44,652	$ 45,768	$ 46,912	$ 48,085	$ 49,287	$ 50,519	$ 51,782	$ 53,077	$ 54,404	$ 55,764	$ 57,158	$ 58,587	$ 60,051	$ 61,553	$ 63,091	$ 64,669	$ 66,285	$ 67,943
Drive-by Unit Life in Years	6	**Inputs restricted to values of 4 to 10 years**																		

City of Fresno

Meter Reading Feasibility 20-Year Planning Horizon Model Bi-Monthly

4-Year Deployment

Model Inputs

(Updated: September 17, 2007)

	2008 Year 1	2009 Year 2	2010 Year 3	2011 Year 4	2012 Year 5	2013 Year 6	2014 Year 7	2015 Year 8	2016 Year 9	2017 Year 10	2018 Year 11	2019 Year 12	2020 Year 13	2021 Year 14	2022 Year 15	2023 Year 16	2024 Year 17	2025 Year 18	2026 Year 19	2027 Year 20
Fixed Radio																				
Collector Units	40																			
Cost per Collector	$2,500																			
Network Control Computer	$40,000																			
Sotware and Training	$20,000																			
Fixed Unit Infrastructure Cost	$160,000	$164,000	$168,100	$172,303	$176,610	$181,025	$185,551	$190,190	$194,944	$199,818	$204,814	$209,934	$215,182	$220,562	$226,076	$231,728	$237,521	$243,459	$249,545	$255,784
Fixed Unit Infrastructure Life	20	**Inputs restricted to values of 5, 10, 15 & 20 years**																		
Touch Pad and MIU																				
Initial Replacement Time in Years	4	**year deployment**																		
Manual Read	4																			
Touch Read	4																			
Mobile Drive-by	4																			
Fixed Radio	4																			
Pad and MIU Cost																				
Manual Read Cost Growth Factor		2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
Lens Cost	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Touch Read Cost Growth Factor		2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
Touch Pad Cost	$15.00	$15.38	$15.76	$16.15	$16.56	$16.97	$17.40	$17.83	$18.28	$18.73	$19.20	$19.68	$20.17	$20.68	$21.19	$21.72	$22.27	$22.82	$23.39	$23.98
Mobile Drive-by Growth Factor		2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
Mobile Drive-by MIU Cost	$75.00	$76.88	$78.80	$80.77	$82.79	$84.86	$86.98	$89.15	$91.38	$93.66	$96.01	$98.41	$100.87	$103.39	$105.97	$108.62	$111.34	$114.12	$116.97	$119.90
Fixed Radio Growth Factor		2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
Fixed MIU Cost	$85.00	$87.13	$89.30	$91.54	$93.82	$96.17	$98.57	$101.04	$103.56	$106.15	$108.81	$111.53	$114.32	$117.17	$120.10	$123.11	$126.18	$129.34	$132.57	$135.89
Pad and MIU Installation Cost																				
Manual Read Cost Growth Factor		3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Lens Installation Cost	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Touch Read Cost Growth Factor		3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Touch Pad Installation Cost	$15.00	$15.53	$16.07	$16.63	$17.21	$17.82	$18.44	$19.08	$19.75	$20.44	$21.16	$21.90	$22.67	$23.46	$24.28	$25.13	$26.01	$26.92	$27.86	$28.84
Mobile Drive-by Growth Factor		3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Mobile Drive-by MIU Installation Cost	$15.00	$15.53	$16.07	$16.63	$17.21	$17.82	$18.44	$19.08	$19.75	$20.44	$21.16	$21.90	$22.67	$23.46	$24.28	$25.13	$26.01	$26.92	$27.86	$28.84
Fixed Radio Growth Factor		3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Fixed MIU Installation Cost	$15.00	$15.53	$16.07	$16.63	$17.21	$17.82	$18.44	$19.08	$19.75	$20.44	$21.16	$21.90	$22.67	$23.46	$24.28	$25.13	$26.01	$26.92	$27.86	$28.84
Meter and Pit Installation Cost																				
Meter Cost Growth Factor		2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
Meter Cost	$70.00	$71.75	$73.54	$75.38	$77.27	$79.20	$81.18	$83.21	$85.29	$87.42	$89.61	$91.85	$94.14	$96.50	$98.91	$101.38	$103.92	$106.51	$109.18	$111.91
Pit & Box Installation Growth Factor		2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
Pit & Box Installation Cost	$375.00	$384.38	$393.98	$403.83	$413.93	$424.28	$434.89	$445.76	$456.90	$468.32	$480.03	$492.03	$504.33	$516.94	$529.87	$543.11	$556.69	$570.61	$584.87	$599.49
Program Management	$10.00																			
Discount Rate	6.0%																			

City of Fresno

Meter Reading Feasibility 20-Year Planning Horizon Model Monthly
4-Year Deployment
Summary of Results
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Operating Budget (Does Not Include Customer Service)																				
Manual Read	$ 1,269,401	$ 1,930,835	$ 2,786,215	$ 3,709,037	$ 4,755,420	$ 4,981,910	$ 5,284,469	$ 5,534,570	$ 5,866,261	$ 6,141,541	$ 6,505,035	$ 6,896,499	$ 7,297,891	$ 7,634,985	$ 8,074,514	$ 8,524,039	$ 9,008,045	$ 9,418,737	$ 10,061,441	$ 10,516,815
Touch Read	$ 834,762	$ 1,227,247	$ 1,640,199	$ 2,198,679	$ 2,795,690	$ 3,014,887	$ 3,123,660	$ 3,236,393	$ 3,484,920	$ 3,673,996	$ 3,806,739	$ 4,091,206	$ 4,239,128	$ 4,465,352	$ 4,812,137	$ 5,064,600	$ 5,341,906	$ 5,619,486	$ 5,910,701	$ 6,229,475
Mobile Drive-by	$ 394,631	$ 408,679	$ 480,632	$ 549,609	$ 630,845	$ 653,396	$ 676,760	$ 760,691	$ 787,924	$ 816,141	$ 845,377	$ 875,670	$ 907,056	$ 1,024,346	$ 1,061,108	$ 1,099,201	$ 1,138,673	$ 1,179,575	$ 1,221,960	$ 1,265,881
Fixed Radio	$ 356,013	$ 367,559	$ 437,952	$ 453,476	$ 531,165	$ 550,038	$ 569,588	$ 589,838	$ 610,814	$ 632,543	$ 655,050	$ 678,366	$ 702,519	$ 812,307	$ 916,447	$ 949,209	$ 983,153	$ 1,018,322	$ 1,054,761	$ 1,092,516
Capital Outlay to be Borrowed (Does Not Include Customer Service or Debt Service)																				
Manual Read	$ 2,686,704	$ 6,519,154	$ 10,842,197	$ 11,126,861	$ 11,447,911	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Touch Read	$ 3,425,240	$ 6,936,641	$ 11,377,603	$ 11,722,735	$ 12,039,492	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Mobile Drive-by	$ 5,255,140	$ 7,825,539	$ 12,640,990	$ 13,021,498	$ 13,324,997	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Fixed Radio	$ 5,635,756	$ 7,996,745	$ 12,872,059	$ 13,194,148	$ 13,568,625	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Capital Cost out of Pocket (Does Not Include Customer Service or Debt Service)																				
Manual Read	$ -	$ -	$ -	$ -	$ -	$ 1,198,476	$ 1,223,906	$ 1,472,929	$ 1,588,904	$ 1,699,060	$ 1,815,694	$ 1,883,218	$ 1,643,174	$ 1,679,953	$ 2,023,751	$ 2,215,220	$ 2,316,413	$ 2,421,740	$ 2,609,501	$ 2,237,000
Touch Read	$ -	$ -	$ -	$ -	$ -	$ 1,269,089	$ 1,245,387	$ 1,338,901	$ 1,564,934	$ 1,611,592	$ 1,708,584	$ 1,817,674	$ 1,683,482	$ 1,728,263	$ 1,878,366	$ 2,142,957	$ 2,190,621	$ 2,306,522	$ 2,479,073	$ 2,324,315
Mobile Drive-by	$ -	$ -	$ -	$ -	$ -	$ 1,351,035	$ 1,479,390	$ 1,499,263	$ 1,525,989	$ 1,669,834	$ 1,698,834	$ 1,760,202	$ 1,934,245	$ 1,963,603	$ 1,961,878	$ 2,147,610	$ 2,187,981	$ 2,288,839	$ 2,523,763	$ 2,537,206
Fixed Radio	$ -	$ -	$ -	$ -	$ -	$ 1,379,230	$ 1,406,248	$ 1,453,683	$ 1,553,732	$ 1,645,731	$ 1,712,893	$ 1,791,810	$ 1,852,946	$ 1,939,506	$ 2,001,826	$ 2,128,609	$ 2,227,276	$ 2,303,726	$ 2,434,067	$ 2,514,042
Debt Service Payments																				
Manual Read	$ 3,566,650	$ 3,566,650	$ 3,566,650	$ 3,566,650	$ 3,566,650	$ 3,566,650	$ 3,566,650	$ 3,566,650	$ 3,566,650	$ 3,566,650	$ 3,566,650	$ 3,566,650	$ 3,566,650	$ 3,566,650	$ 3,566,650	$ 3,566,650	$ 3,566,650	$ 3,566,650	$ 3,566,650	$ 3,566,650
Touch Read	$ 3,807,553	$ 3,807,553	$ 3,807,553	$ 3,807,553	$ 3,807,553	$ 3,807,553	$ 3,807,553	$ 3,807,553	$ 3,807,553	$ 3,807,553	$ 3,807,553	$ 3,807,553	$ 3,807,553	$ 3,807,553	$ 3,807,553	$ 3,807,553	$ 3,807,553	$ 3,807,553	$ 3,807,553	$ 3,807,553
Mobile Drive-by	$ 4,357,029	$ 4,357,029	$ 4,357,029	$ 4,357,029	$ 4,357,029	$ 4,357,029	$ 4,357,029	$ 4,357,029	$ 4,357,029	$ 4,357,029	$ 4,357,029	$ 4,357,029	$ 4,357,029	$ 4,357,029	$ 4,357,029	$ 4,357,029	$ 4,357,029	$ 4,357,029	$ 4,357,029	$ 4,357,029
Fixed Radio	$ 4,457,375	$ 4,457,375	$ 4,457,375	$ 4,457,375	$ 4,457,375	$ 4,457,375	$ 4,457,375	$ 4,457,375	$ 4,457,375	$ 4,457,375	$ 4,457,375	$ 4,457,375	$ 4,457,375	$ 4,457,375	$ 4,457,375	$ 4,457,375	$ 4,457,375	$ 4,457,375	$ 4,457,375	$ 4,457,375
Long-Term Budget (Does Not Include Customer Service)																				
Manual Read	$ 4,836,050	$ 5,497,484	$ 6,352,865	$ 7,275,686	$ 8,322,070	$ 9,747,035	$ 10,075,024	$ 10,574,149	$ 11,021,815	$ 11,407,251	$ 11,887,379	$ 12,346,366	$ 12,507,715	$ 12,881,588	$ 13,664,915	$ 14,305,909	$ 14,891,107	$ 15,407,126	$ 16,237,592	$ 16,320,464
Touch Read	$ 4,642,315	$ 5,034,800	$ 5,447,752	$ 6,006,232	$ 6,603,242	$ 8,091,528	$ 8,176,600	$ 8,382,847	$ 8,857,407	$ 9,093,141	$ 9,322,876	$ 9,716,433	$ 9,730,162	$ 10,001,168	$ 10,498,056	$ 11,015,110	$ 11,340,079	$ 11,733,561	$ 12,197,326	$ 12,361,342
Mobile Drive-by	$ 4,751,660	$ 4,765,708	$ 4,837,661	$ 4,906,638	$ 4,987,874	$ 6,361,460	$ 6,513,179	$ 6,616,983	$ 6,670,942	$ 6,843,004	$ 6,901,241	$ 6,992,901	$ 7,198,330	$ 7,344,978	$ 7,380,015	$ 7,603,840	$ 7,683,683	$ 7,825,443	$ 8,102,752	$ 8,160,117
Fixed Radio	$ 4,813,388	$ 4,824,933	$ 4,895,327	$ 4,910,850	$ 4,988,540	$ 6,386,643	$ 6,433,211	$ 6,500,895	$ 6,621,921	$ 6,735,648	$ 6,825,319	$ 6,927,551	$ 7,012,840	$ 7,209,188	$ 7,375,648	$ 7,535,193	$ 7,667,804	$ 7,779,423	$ 7,946,203	$ 8,063,932

Results and Inputs	**NPV Capital**	**Rank Capital**	**NPV Deployment**	**Rank Deployment**	**NPV Long-Term**	**Rank Long-Term**	Yrs to Impl.	Reads/Day	Visits/Day	$/Pad, MIU	Startup-Infra.	Read Eq. Life
Manual Read	**$ 34,808,029**	1	**$ 53,843,146**	4	**$116,546,683**	4	4	160	25	$ -		5
Touch Read	**$ 37,239,911**	2	**$ 51,130,460**	1	**$93,497,883**	3	4	320	35	$ 15.00		5
Mobile Drive-by	**$ 42,807,458**	3	**$ 51,445,810**	2	**$71,761,521**	2	4	7,000	300	$ 75.00	$ 42,500	6
Fixed Radio	**$ 43,831,721**	4	**$ 52,276,884**	3	**$71,375,394**	1	4			$ 85.00	$ 160,000	20

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Cost per Read																				
Meter Readings																				
Meter Readers	365,574	566,010	829,932	1,094,322	1,359,180	1,385,004	1,411,320	1,438,140	1,465,464	1,493,304	1,521,672	1,550,580	1,580,040	1,610,064	1,640,652	1,671,828	1,703,592	1,735,956	1,768,944	1,802,556
Field Service	41,127	63,676	93,367	123,111	152,908	155,813	158,774	161,791	164,865	167,997	171,188	174,440	177,755	181,132	184,573	188,081	191,654	195,295	199,006	202,788
Operating Cost/Read (Meter Readers + Field Service + Customer Service)																				
Manual Read	$ 3.47	$ 3.41	$ 3.36	$ 3.39	$ 3.50	$ 3.60	$ 3.74	$ 3.85	$ 4.00	$ 4.11	$ 4.27	$ 4.45	$ 4.62	$ 4.74	$ 4.92	$ 5.10	$ 5.29	$ 5.43	$ 5.69	$ 5.83
Touch Read	$ 2.28	$ 2.17	$ 1.98	$ 2.01	$ 2.06	$ 2.18	$ 2.21	$ 2.25	$ 2.38	$ 2.46	$ 2.50	$ 2.64	$ 2.68	$ 2.77	$ 2.93	$ 3.03	$ 3.14	$ 3.24	$ 3.34	$ 3.46
Mobile Drive-by	$ 1.08	$ 0.72	$ 0.58	$ 0.50	$ 0.46	$ 0.47	$ 0.48	$ 0.53	$ 0.54	$ 0.55	$ 0.56	$ 0.56	$ 0.57	$ 0.64	$ 0.65	$ 0.66	$ 0.67	$ 0.68	$ 0.69	$ 0.70
Fixed Radio	$ 0.97	$ 0.65	$ 0.53	$ 0.41	$ 0.39	$ 0.40	$ 0.40	$ 0.41	$ 0.42	$ 0.42	$ 0.43	$ 0.44	$ 0.44	$ 0.50	$ 0.56	$ 0.57	$ 0.58	$ 0.59	$ 0.60	$ 0.61
Op.+Cap. Cost/Read																				
Manual Read	$ 13.23	$ 9.71	$ 7.65	$ 6.65	$ 6.12	$ 7.04	$ 7.14	$ 7.35	$ 7.52	$ 7.64	$ 7.81	$ 7.96	$ 7.92	$ 8.00	$ 8.33	$ 8.56	$ 8.74	$ 8.88	$ 9.18	$ 9.05
Touch Read	$ 12.70	$ 8.90	$ 6.56	$ 5.49	$ 4.86	$ 5.84	$ 5.79	$ 5.83	$ 6.04	$ 6.09	$ 6.13	$ 6.27	$ 6.16	$ 6.21	$ 6.40	$ 6.59	$ 6.66	$ 6.76	$ 6.90	$ 6.86
Mobile Drive-by	$ 13.00	$ 8.42	$ 5.83	$ 4.48	$ 3.67	$ 4.59	$ 4.61	$ 4.60	$ 4.55	$ 4.58	$ 4.54	$ 4.51	$ 4.56	$ 4.56	$ 4.50	$ 4.55	$ 4.51	$ 4.51	$ 4.58	$ 4.53
Fixed Radio	$ 13.17	$ 8.52	$ 5.90	$ 4.49	$ 3.67	$ 4.61	$ 4.56	$ 4.52	$ 4.52	$ 4.51	$ 4.49	$ 4.47	$ 4.44	$ 4.48	$ 4.50	$ 4.51	$ 4.50	$ 4.48	$ 4.49	$ 4.47

City of Fresno
Meter Reading Feasibility 20-Year Planning Horizon Model Monthly
4-Year Deployment
Fixed Radio Frequency
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Meter Reading																				
Meters																				
Total Meters	30,465	47,168	69,161	91,194	113,265	115,417	117,610	119,845	122,122	124,442	126,806	129,215	131,670	134,172	136,721	139,319	141,966	144,663	147,412	150,213
Meters to be Installed	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Pits & Boxes to be Installed*	(0)	12,713	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
*Year 2008 total is 31,732 minus 24,232 pits already in the ground																				
Installations include annual growth of 1.3%																				
Read Frequency																				
Quarterly %	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%	0.0%	0.0%	0.0%
Bi-monthly %	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%	0.0%	0.0%	0.0%
Monthly %	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%	100.0%	100.0%
Total	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%	100.0%	100.0%
Annual Reads																				
Quarterly	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bi-monthly	182,787	283,005	414,966	547,161	679,590	692,502	705,660	719,070	732,732	746,652	760,836	775,290	790,020	805,032	820,326	835,914	851,796	867,978	884,472	901,278
Monthly	365,574	566,010	829,932	1,094,322	1,359,180	1,385,004	1,411,320	1,438,140	1,465,464	1,493,304	1,521,672	1,550,580	1,580,040	1,610,064	1,640,652	1,671,828	1,703,592	1,735,956	1,768,944	1,802,556
Total	548,361	849,015	1,244,898	1,641,483	2,038,770	2,077,506	2,116,980	2,157,210	2,198,196	2,239,956	2,282,508	2,325,870	2,370,060	2,415,096	2,460,978	2,507,742	2,555,388	2,603,934	2,653,416	2,703,834
Reading Days/Year																				
Reading Days/Man Week	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Holidays/Year	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Vacation Days/Year	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Sick Days/Year	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Total Reading Days/Year	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222
Meters/FTE	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
Field Service (Meter Reading Related)																				
Field Service Reads per Year																				
Cust. Serv. Request % of Reads	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%
Final Reads % of Meters	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%
Annual Customer Service Req.	54,836	84,902	124,490	164,148	203,877	207,751	211,698	215,721	219,820	223,996	228,251	232,587	237,006	241,510	246,098	250,774	255,539	260,393	265,342	270,383
Annual Final Reads	4,570	7,075	10,374	13,679	16,990	17,313	17,642	17,977	18,318	18,666	19,021	19,382	19,751	20,126	20,508	20,898	21,295	21,699	22,112	22,532
Total Annual Field Service Reads	59,406	91,977	134,864	177,827	220,867	225,063	229,340	233,698	238,138	242,662	247,272	251,969	256,757	261,635	266,606	271,672	276,834	282,093	287,453	292,915
Field Service Days/Year																				
Service Days/Man Week	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Holidays/Year	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Vacation Days/Year	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Sick Days/Year	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Total Reading Days/Year	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222
Meters/FTE	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000
Personnel Required																				
Calculated Meter Readers	1.0	1.0	1.0	1.0	1.1	1.2	1.2	1.2	1.2	1.2	1.3	1.3	1.3	1.3	1.4	1.4	1.4	1.4	1.5	1.5
Calculated Field Service Techs	1.0	1.2	1.7	2.3	2.8	2.9	2.9	3.0	3.1	3.1	3.2	3.2	3.3	3.4	3.4	3.5	3.5	3.6	3.7	3.8
Meter Readers (FTE)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0
Field Techs (FTE)	1.0	1.0	2.0	2.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Calculated Lead Worker(s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Actual Lead Workers	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Supervisor Collections Section	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

* Meter readers take field service reads. Field Service Techs become responsible for the radio system including the meter interface units.

City of Fresno
Meter Reading Feasibility 20-Year Planning Horizon Model Monthly
4-Year Deployment
Fixed Radio Frequency
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Operating Expenses																				
Meter Related																				
Salary																				
Readers	$ 39,333	$ 40,709	$ 42,134	$ 43,609	$ 45,135	$ 46,715	$ 48,350	$ 50,042	$ 51,794	$ 53,607	$ 55,483	$ 57,425	$ 59,435	$ 61,515	$ 127,336	$ 131,792	$ 136,405	$ 141,179	$ 146,121	$ 151,235
Field Service Techs	46,946	48,589	100,579	104,099	161,613	167,270	173,124	179,184	185,455	191,946	198,664	205,617	212,814	293,683	303,962	314,601	325,612	337,008	348,804	361,012
Lead Worker	53,213	55,076	57,004	58,999	61,064	63,201	65,413	67,702	70,072	72,525	75,063	77,690	80,409	83,224	86,136	89,151	92,271	95,501	98,843	102,303
Supervisor Collections	63,851	66,086	68,399	70,793	73,270	75,835	78,489	81,236	84,080	87,022	90,068	93,221	96,483	99,860	103,355	106,973	110,717	114,592	118,603	122,754
Total Salary	$ 203,343	$ 210,460	$ 268,115	$ 277,499	$ 341,083	$ 353,021	$ 365,377	$ 378,165	$ 391,401	$ 405,100	$ 419,278	$ 433,953	$ 449,141	538,282	620,790	642,517	665,005	688,280	712,370	737,303
Education																				
Readers	$ 185	$ 192	$ 200	$ 208	$ 216	$ 225	$ 234	$ 243	$ 253	$ 263	$ 274	$ 285	$ 296	$ 308	$ 641	$ 666	$ 693	$ 721	$ 750	$ 780
Field Service Techs	185	192	400	416	649	675	702	730	760	790	822	854	889	1,232	1,281	1,333	1,386	1,441	1,499	1,559
Lead Worker + Supervisor	500	520	541	562	585	608	633	658	684	712	740	770	801	833	866	900	936	974	1,013	1,053
Total Education	$ 870	$ 905	$ 1,141	$ 1,187	$ 1,451	$ 1,509	$ 1,569	$ 1,632	$ 1,697	$ 1,765	$ 1,836	$ 1,909	$ 1,985	$ 2,373	$ 2,788	$ 2,900	$ 3,015	$ 3,136	$ 3,262	$ 3,392
M & S																				
Readers	$ 1,000	$ 1,035	$ 1,071	$ 1,109	$ 1,148	$ 1,188	$ 1,229	$ 1,272	$ 1,317	$ 1,363	$ 1,411	$ 1,460	$ 1,511	$ 1,564	$ 3,237	$ 3,351	$ 3,468	$ 3,589	$ 3,715	$ 3,845
Field Service Techs	1,000	1,035	2,142	2,217	3,443	3,563	3,688	3,817	3,950	4,089	4,232	4,380	4,533	6,256	6,475	6,701	6,936	7,179	7,430	7,690
Lead Worker + Supervisor	2,000	2,070	2,142	2,217	2,295	2,375	2,459	2,545	2,634	2,726	2,821	2,920	3,022	3,128	3,237	3,351	3,468	3,589	3,715	3,845
Total M&S	$ 4,000	$ 4,140	$ 5,356	$ 5,544	$ 6,885	$ 7,126	$ 7,376	$ 7,634	$ 7,901	$ 8,177	$ 8,464	$ 8,760	$ 9,066	$ 10,948	$ 12,950	$ 13,403	$ 13,872	$ 14,357	$ 14,860	$ 15,380
Contract Services																				
Readers	$ 100	$ 104	$ 107	$ 111	$ 115	$ 119	$ 123	$ 127	$ 132	$ 136	$ 141	$ 146	$ 151	$ 156	$ 324	$ 335	$ 347	$ 359	$ 371	$ 385
Field Service Techs	100	104	214	222	344	356	369	382	395	409	423	438	453	626	647	670	694	718	743	769
Lead Worker + Supervisor	200	207	214	222	230	238	246	254	263	273	282	292	302	313	324	335	347	359	371	385
Total Contract Services	$ 400	$ 414	$ 536	$ 554	$ 689	$ 713	$ 738	$ 763	$ 790	$ 818	$ 846	$ 876	$ 907	$ 1,095	$ 1,295	$ 1,340	$ 1,387	$ 1,436	$ 1,486	$ 1,538
Vehicles (Fuel + Maintenance)																				
Readers	$ 4,000	$ 4,180	$ 4,368	$ 4,565	$ 4,770	$ 4,985	$ 5,209	$ 5,443	$ 5,688	$ 5,944	$ 6,212	$ 6,491	$ 6,784	$ 7,089	$ 14,816	$ 15,482	$ 16,179	$ 16,907	$ 17,668	$ 18,463
Field Service Techs	4,000	4,180	8,736	9,129	14,310	14,954	15,627	16,330	17,065	17,833	18,636	19,474	20,351	28,355	29,631	30,965	32,358	33,814	35,336	36,926
Lead Worker + Supervisor	8,000	8,360	8,736	9,129	9,540	9,969	10,418	10,887	11,377	11,889	12,424	12,983	13,567	14,178	14,816	15,482	16,179	16,907	17,668	18,463
Total Fuel	$ 16,000	$ 16,720	$ 21,841	$ 22,823	$ 28,620	$ 29,908	$ 31,254	$ 32,661	$ 34,130	$ 35,666	$ 37,271	$ 38,948	$ 40,701	$ 49,621	$ 59,262	$ 61,929	$ 64,716	$ 67,628	$ 70,671	$ 73,852
Insurance																				
Readers	$ 1,000	$ 1,050	$ 1,103	$ 1,158	$ 1,216	$ 1,276	$ 1,340	$ 1,407	$ 1,477	$ 1,551	$ 1,629	$ 1,710	$ 1,796	$ 1,886	$ 3,960	$ 4,158	$ 4,366	$ 4,584	$ 4,813	$ 5,054
Field Service Techs	1,000	1,050	2,205	2,315	3,647	3,829	4,020	4,221	4,432	4,654	4,887	5,131	5,388	7,543	7,920	8,316	8,731	9,168	9,626	10,108
Lead Worker + Supervisor	2,000	2,100	2,205	2,315	2,431	2,553	2,680	2,814	2,955	3,103	3,258	3,421	3,592	3,771	3,960	4,158	4,366	4,584	4,813	5,054
Total Insurance	4,000	4,200	5,513	5,788	7,293	7,658	8,041	8,443	8,865	9,308	9,773	10,262	10,775	13,200	15,839	16,631	17,463	18,336	19,253	20,216
Misc.																				
Readers	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Field Service Techs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead Worker + Supervisor	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Miscellaneous	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Meter Reading Equipment Maintenance																				
Hand-held	$ 900	$ 923	$ 946	$ 969	$ 993	$ 1,018	$ 1,044	$ 1,070	$ 1,097	$ 1,124	$ 1,152	$ 1,181	$ 1,210	$ 1,241	$ 1,272	$ 1,303	$ 1,336	$ 1,369	$ 1,404	$ 1,439
Collectors	$ 8,000	$ 8,200	$ 8,405	$ 8,615	$ 8,831	$ 9,051	$ 9,278	$ 9,509	$ 9,747	$ 9,991	$ 10,241	$ 10,497	$ 10,759	$ 11,028	$ 11,304	$ 11,586	$ 11,876	$ 12,173	$ 12,477	$ 12,789
Software	2,000	1,025	1,051	1,077	1,104	1,131	1,160	1,189	1,218	1,249	1,280	1,312	1,345	1,379	1,413	1,448	1,485	1,522	1,560	1,599
Installation Programmer	500	513	788	808	1,104	1,131	1,160	1,189	1,218	1,249	1,280	1,312	1,345	1,723	1,766	1,810	1,856	1,902	1,950	1,998
Total Annual Meter Reading Budget																				
Readers	$ 45,618	$ 47,270	$ 48,983	$ 50,759	$ 52,600	$ 54,508	$ 56,485	$ 58,536	$ 60,661	$ 62,865	$ 65,149	$ 67,517	$ 69,972	$ 72,518	$ 150,313	$ 155,785	$ 161,458	$ 167,339	$ 173,438	$ 179,761
Field Service Techs	53,231	55,150	114,277	118,399	184,006	190,648	197,531	204,664	212,058	219,721	227,663	235,895	244,427	337,695	349,917	362,585	375,717	389,329	403,438	418,064
Lead Worker + Supervisor	129,764	134,419	139,241	144,238	149,415	154,779	160,337	166,097	172,065	178,248	184,656	191,296	198,176	205,306	212,694	220,350	228,284	236,506	245,026	253,856
Facilities Rent	116,000	120,060	124,262	128,611	133,113	137,772	142,594	147,584	152,750	158,096	163,629	169,356	175,284	181,419	187,769	194,340	201,142	208,182	215,469	223,010
Reading Equipment Maintenance	11,400	10,660	11,189	11,469	12,032	12,332	12,641	12,957	13,281	13,613	13,953	14,302	14,659	15,370	15,755	16,149	16,552	16,966	17,390	17,825
Meter Reading Operating Budget	$ 356,013	$ 367,559	$ 437,952	$ 453,476	$ 531,165	$ 550,038	$ 569,588	$ 589,838	$ 610,814	$ 632,543	$ 655,050	$ 678,366	$ 702,519	$ 812,307	$ 916,447	$ 949,209	$ 983,153	$ 1,018,322	$ 1,054,761	$ 1,092,516
Customer Service Related																				
Total Customer Service	$ 2,734,951	$ 4,382,668	$ 6,651,160	$ 9,076,958	$ 11,668,433	$ 12,306,284	$ 12,979,016	$ 13,688,561	$ 14,436,839	$ 15,225,990	$ 16,058,268	$ 16,936,053	$ 17,861,850	$ 18,838,306	$ 19,868,063	$ 20,954,196	$ 22,099,648	$ 23,307,668	$ 24,581,849	$ 25,925,646
Total Meter Reading Related	$ 3,090,963	$ 4,750,227	$ 7,089,112	$ 9,530,434	$ 12,199,598	$ 12,856,323	$ 13,548,604	$ 14,278,398	$ 15,047,653	$ 15,858,533	$ 16,713,319	$ 17,614,419	$ 18,564,369	$ 19,650,614	$ 20,784,510	$ 21,903,406	$ 23,082,801	$ 24,325,991	$ 25,636,610	$ 27,018,161

City of Fresno
Meter Reading Feasibility 20-Year Planning Horizon Model Monthly
4-Year Deployment
Fixed Radio Frequency
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Operating Cost per Read																				
Regular Meter Read	$0.08	$0.06	$0.04	$0.03	$0.03	$0.03	$0.03	$0.03	$0.03	$0.03	$0.03	$0.03	$0.03	$0.03	$0.06	$0.06	$0.06	$0.06	$0.07	$0.07
Field Service Read	$0.90	$0.60	$0.85	$0.67	$0.83	$0.85	$0.86	$0.88	$0.89	$0.91	$0.92	$0.94	$0.95	$1.29	$1.31	$1.33	$1.36	$1.38	$1.40	$1.43
Regular + Field Service	$0.59	$0.39	$0.32	$0.25	$0.24	$0.24	$0.24	$0.25	$0.25	$0.25	$0.26	$0.26	$0.27	$0.30	$0.34	$0.34	$0.35	$0.35	$0.36	$0.36
Reg + Field Serv. + Cust. Serv.	$5.09	$5.05	$5.14	$5.24	$5.40	$5.58	$5.77	$5.97	$6.18	$6.39	$6.61	$6.83	$7.07	$7.34	$7.62	$7.88	$8.15	$8.43	$8.72	$9.02
Capital Items																				
Meters and Pits																				
Meters to be Installed	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Pits to be Installed	(0)	12,713	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Vehicles																				
Vehicles Req'd	4	4	5	5	6	6	6	6	6	6	6	6	6	7	8	8	8	8	8	8
Vehicles in Service	13	4	4	5	5	6	6	6	6	6	6	6	6	6	7	8	8	8	8	8
New Vehicles (Retirements)	(9)	-	1	-	1	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-
Potential In-Service Replacement	2	2	2	2	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Potential Vehicle Replacements					-	-	-	-	2	3	2	3	2	1	-	2	3	2	3	2
New Vehicle Purchases	-	2	3	2	3	2	1	-	2	3	2	3	2	2	1	2	3	2	3	2
Vehicle Retirements	9	2	2	2	2	2	1	-	2	3	2	3	2	1	-	2	3	2	3	2
Reading Equipment																				
# of Handhelds	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
# of Spare Handhelds	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Purchases (Retirements)	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Potential Replacements					-	2	-	-	-	-	2	-	-	-	-	2	-	-	-	-
Purchases + Replacements	2	-	-	-	-	2	-	-	-	-	2	-	-	-	-	2	-	-	-	-
Installation Programmers Req'd	2	2	3	3	4	4	4	4	4	4	4	4	4	5	5	5	5	5	5	5
Programmers Purchased (Retired)	2	-	1	-	1	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
Calculated Prog. Replacements					-	2	-	1	-	1	2	-	1	-	1	2	-	1	1	1
Purchases + Replacements	2	-	1	-	1	2	-	1	-	1	2	-	1	1	1	2	-	1	1	1
Calculated Fixed Units Req'd	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Fixed Units Required	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Fixed Units Purchased (Retired)	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Calculated Replacements						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Purchases + Replacements	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mobile Interface Unit																				
Years to Install MIU	4																			
MIU's Replaced/Year	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Cummulative Replaced	30,465	47,168	69,161	91,194	113,265	115,417	117,610	119,845	122,122	124,442	126,806	129,215	131,670	134,172	136,721	139,319	141,966	144,663	147,412	150,213
New Services Installed	-	1,996	2,034	2,073	2,112	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
MIU's Installed & Replaced	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Cummulative Replaced & Installed	30,465	47,168	69,161	91,194	113,265	115,417	117,610	119,845	122,122	124,442	126,806	129,215	131,670	134,172	136,721	139,319	141,966	144,663	147,412	150,213
MIU Cost	$85.00	$87.13	$89.30	$91.54	$93.82	$96.17	$98.57	$101.04	$103.56	$106.15	$108.81	$111.53	$114.32	$117.17	$120.10	$123.11	$126.18	$129.34	$132.57	$135.89
Installation Cost	$ 15.00	$ 15.53	$ 16.07	$ 16.63	$ 17.21	$ 17.82	$ 18.44	$ 19.08	$ 19.75	$ 20.44	$ 21.16	$ 21.90	$ 22.67	$ 23.46	$ 24.28	$ 25.13	$ 26.01	$ 26.92	$ 27.86	$ 28.84

City of Fresno
Meter Reading Feasibility 20-Year Planning Horizon Model Monthly
4-Year Deployment
Fixed Radio Frequency
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Capital Budget (to be Borrowed)																				
Meters Installed	$ 2,132,516	$ 1,198,439	$ 1,617,484	$ 1,660,861	$ 1,705,396	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Pits & Boxes Installed	$ -	$ 4,886,552	$ 8,665,095	$ 8,897,472	$ 9,136,052	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Program Management	$ 304,645	$ 167,030	$ 219,935	$ 220,325	$ 220,715	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Vehicle Purchases (Retirements)	$ (21,857)	$ 30,163	$ 49,429	$ 32,311	$ 52,950	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Reading Equipment Purchases (Ret.)																				
Handhelds	$ 9,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Installation Programmers	$ 5,000	$ -	$ 2,627	$ -	$ 2,760	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Fixed Unit	$ 160,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Fixed Interface Unit	$ 3,046,452	$ 1,714,561	$ 2,317,488	$ 2,383,178	$ 2,450,752	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Capital Budget	$ 5,635,756	$ 7,996,745	$ 12,872,059	$ 13,194,148	$ 13,568,625	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Debt Service Payments	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375	4,457,375
Capital Budget (Out of Pocket)																				
Meters Installed	$ -	$ -	$ -	$ -	$ -	170,435	178,025	185,970	194,201	202,815	211,828	221,257	231,119	241,432	252,117	263,388	275,064	287,266	300,125	313,447
Pits & Boxes Installed	$ -	$ -	$ -	$ -	$ -	913,046	953,703	996,267	1,040,364	1,086,511	1,134,795	1,185,306	1,238,138	1,293,388	1,350,626	1,411,004	1,473,557	1,538,927	1,607,813	1,679,182
Vehicle Purchases (Retirements)	$ -	$ -	$ -	$ -	$ -	34,613	17,912	0	38,376	59,578	41,109	63,822	44,037	49,376	27,518	48,824	75,800	52,302	81,199	56,027
Reading Equipment Purchases (Ret.)																				
Handhelds	$ -	$ -	$ -	$ -	$ -	10,183	0	0	0	0	11,521	0	0	0	0	13,035	0	0	0	0
Installation Programmers	$ -	$ -	$ -	$ -	$ -	5,657	0	2,972	0	3,122	6,400	0	3,362	3,446	3,532	7,241	0	3,804	3,899	3,997
Fixed Unit	$ -	$ -	$ -	$ -	$ -	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fixed Interface Unit	$ -	$ -	$ -	$ -	$ -	245,296	256,609	268,474	280,791	293,705	307,240	321,425	336,290	351,863	368,033	385,116	402,854	421,427	441,031	461,389
Total Capital Budget	$ -	$ -	$ -	$ -	$ -	$ 1,379,230	$ 1,406,248	$ 1,453,683	$ 1,553,732	$ 1,645,731	$ 1,712,893	$ 1,791,810	$ 1,852,946	$ 1,939,506	$ 2,001,826	$ 2,128,609	$ 2,227,276	$ 2,303,726	$ 2,434,067	$ 2,514,042
Total Budget (Operating + Capital)	$ 5,991,769	$ 8,364,303	$ 13,310,011	$ 13,647,623	$ 14,099,790	$ 1,929,268	$ 1,975,836	$ 2,043,520	$ 2,164,546	$ 2,278,273	$ 2,367,944	$ 2,470,177	$ 2,555,465	$ 2,751,814	$ 2,918,273	$ 3,077,818	$ 3,210,429	$ 3,322,048	$ 3,488,828	$ 3,606,557
Does Not Include Customer Service or Debt Service																				
Long-Term Budget	4,813,388	4,824,933	4,895,327	4,910,850	4,988,540	6,386,643	6,433,211	6,500,895	6,621,921	6,735,648	6,825,319	6,927,551	7,012,840	7,209,188	7,375,648	7,535,193	7,667,804	7,779,423	7,946,203	8,063,932
Includes Debt Service, Capital Out of Pocket and Operating Costs)																				
NPV Annually	$ 4,540,932	$ 4,294,174	$ 4,110,211	$ 3,889,853	$ 3,727,727	$ 4,502,331	$ 4,278,453	$ 4,078,742	$ 3,919,505	$ 3,761,151	$ 3,595,493	$ 3,442,781	$ 3,287,893	$ 3,188,631	$ 3,077,600	$ 2,966,201	$ 2,847,549	$ 2,725,473	$ 2,626,324	$ 2,514,372
Total Capital	$ 53,267,333																			
Total Operating Budget (thru deployment)	$ 2,146,164																			
Total Capital	$ 53,267,333																			
Total Deployment	$ 55,413,497																			
Total Debt Service (20 years)	$ 89,147,494																			
Long-Term Cost																				
Total Debt Service	$ 89,147,494																			
Total Operating Budget (20 years)	$ 13,961,636																			
Total Out of Pocket Capital	$ 28,345,326																			
Total Long-Term Cost	$ 131,454,456																			
Net Present Value																				
Discount Rate	0.0%																			
NPV Capital	$43,831,721																			
NPV Deployment	$52,276,884																			
NPV Long-Term Cost	$ 71,375,394																			
Total Cost per Read	$ 7.92	$ 5.13	$ 3.55	$ 2.70	$ 2.21	$ 2.77	$ 2.74	$ 2.72	$ 2.72	$ 2.71	$ 2.70	$ 2.69	$ 2.67	$ 2.69	$ 2.70	$ 2.71	$ 2.71	$ 2.70	$ 2.70	$ 2.69

NPV	
total debt service	$51,125,737
operating budget	$7,176,237
out of pocket capital	$13,073,420

City of Fresno
Meter Reading Feasibility 20-Year Planning Horizon Model Monthly
4-Year Deployment
Drive-By Radio Frequency
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Meter Reading																				
Meters																				
Total Meters	30,465	47,168	69,161	91,194	113,265	115,417	117,610	119,845	122,122	124,442	126,806	129,215	131,670	134,172	136,721	139,319	141,966	144,663	147,412	150,213
Meters to be Installed	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Pits & Boxes to be Installed*	(0)	12,713	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
*Year 2008 total is 31,732 minus 24,232 pits already in the ground																				
Installations include annual growth of 1.3%																				
Read Frequency																				
Quarterly %	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%	0.0%	0.0%	0.0%
Bi-monthly %	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%	0.0%	0.0%	0.0%
Monthly %	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%	100.0%	100.0%
Total	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%	100.0%	100.0%
Annual Reads																				
Quarterly	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bi-monthly	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Monthly	365,574	566,010	829,932	1,094,322	1,359,180	1,385,004	1,411,320	1,438,140	1,465,464	1,493,304	1,521,672	1,550,580	1,580,040	1,610,064	1,640,652	1,671,828	1,703,592	1,735,956	1,768,944	1,802,556
Total	365,574	566,010	829,932	1,094,322	1,359,180	1,385,004	1,411,320	1,438,140	1,465,464	1,493,304	1,521,672	1,550,580	1,580,040	1,610,064	1,640,652	1,671,828	1,703,592	1,735,956	1,768,944	1,802,556
Reading Days/Year																				
Reading Days/Man Week	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Holidays/Year	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Vacation Days/Year	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Sick Days/Year	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Total Reading Days/Year	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222
Reads/Man Day	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000
Field Service (Meter Reading Related)																				
Field Service Reads per Year																				
Cust. Serv. Request % of Reads	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%
Final Reads % of Meters	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%
Annual Customer Service Req.	36,557	56,601	82,993	109,432	135,918	138,500	141,132	143,814	146,546	149,330	152,167	155,058	158,004	161,006	164,065	167,183	170,359	173,596	176,894	180,256
Annual Final Reads	4,570	7,075	10,374	13,679	16,990	17,313	17,642	17,977	18,318	18,666	19,021	19,382	19,751	20,126	20,508	20,898	21,295	21,699	22,112	22,532
Total Annual Field Service Reads	41,127	63,676	93,367	123,111	152,908	155,813	158,774	161,791	164,865	167,997	171,188	174,440	177,755	181,132	184,573	188,081	191,654	195,295	199,006	202,788
Field Service Days/Year																				
Service Days/Man Week	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Holidays/Year	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Vacation Days/Year	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Sick Days/Year	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Total Reading Days/Year	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222
Visits/Man Day	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
Meters/FTE	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000
Personnel Required																				
Calculated Meter Readers*	2.0	2.0	2.0	2.6	3.2	3.2	3.3	3.4	3.4	3.5	3.5	3.6	3.7	3.8	3.8	3.9	4.0	4.0	4.1	4.2
Calculated Field Service Techs	1.0	1.2	1.7	2.3	2.8	2.9	2.9	3.0	3.1	3.1	3.2	3.2	3.3	3.4	3.4	3.5	3.5	3.6	3.7	3.8
Meter Readers (FTE)	2.0	2.0	2.0	3.0	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Field Techs (FTE)	1.0	1.0	2.0	2.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Calculated Lead Worker(s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Actual Lead Workers	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Supervisor Collections Section	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

* Meter readers take field service reads. Field Service Techs become responsible for the radio system including the meter interface units.

City of Fresno
Meter Reading Feasibility 20-Year Planning Horizon Model Monthly
4-Year Deployment
Drive-By Radio Frequency
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Operating Expenses																				
Meter Related																				
Salary																				
Readers	$ 78,666	$ 81,419	$ 84,269	$ 130,827	$ 135,406	$ 140,145	$ 145,050	$ 200,169	$ 207,175	$ 214,426	$ 221,931	$ 229,699	$ 237,738	$ 246,059	$ 254,671	$ 263,585	$ 272,810	$ 282,358	$ 292,241	$ 302,469
Field Service Techs	46,946	48,589	100,579	104,099	161,613	167,270	173,124	179,184	185,455	191,946	198,664	205,617	212,814	293,683	303,962	314,601	325,612	337,008	348,804	361,012
Lead Worker	53,213	55,076	57,004	58,999	61,064	63,201	65,413	67,702	70,072	72,525	75,063	77,690	80,409	83,224	86,136	89,151	92,271	95,501	98,843	102,303
Supervisor Collections	63,851	66,086	68,399	70,793	73,270	75,835	78,489	81,236	84,080	87,022	90,068	93,221	96,483	99,860	103,355	106,973	110,717	114,592	118,603	122,754
Total Salary	242,676	251,169	310,250	364,717	431,354	446,451	462,077	528,292	546,782	565,919	585,726	606,227	627,445	722,826	748,125	774,309	801,410	829,460	858,491	888,538
Education																				
Readers	$ 370	$ 385	$ 400	$ 624	$ 649	$ 675	$ 702	$ 974	$ 1,013	$ 1,053	$ 1,095	$ 1,139	$ 1,185	$ 1,232	$ 1,281	$ 1,333	$ 1,386	$ 1,441	$ 1,499	$ 1,559
Field Service Techs	185	192	400	416	649	675	702	730	760	790	822	854	889	1,232	1,281	1,333	1,386	1,441	1,499	1,559
Lead Worker + Supervisor	500	520	541	562	585	608	633	658	684	712	740	770	801	833	866	900	936	974	1,013	1,053
Total Education	$ 1,055	$ 1,097	$ 1,341	$ 1,603	$ 1,883	$ 1,959	$ 2,037	$ 2,362	$ 2,457	$ 2,555	$ 2,657	$ 2,763	$ 2,874	$ 3,297	$ 3,429	$ 3,566	$ 3,709	$ 3,857	$ 4,011	$ 4,172
M & S																				
Readers	$ 2,000	$ 2,070	$ 2,142	$ 3,326	$ 3,443	$ 3,563	$ 3,688	$ 5,089	$ 5,267	$ 5,452	$ 5,642	$ 5,840	$ 6,044	$ 6,256	$ 6,475	$ 6,701	$ 6,936	$ 7,179	$ 7,430	$ 7,690
Field Service Techs	1,000	1,035	2,142	2,217	3,443	3,563	3,688	3,817	3,950	4,089	4,232	4,380	4,533	6,256	6,475	6,701	6,936	7,179	7,430	7,690
Lead Worker + Supervisor	2,000	2,070	2,142	2,217	2,295	2,375	2,459	2,545	2,634	2,726	2,821	2,920	3,022	3,128	3,237	3,351	3,468	3,589	3,715	3,845
Total M&S	$ 5,000	$ 5,175	$ 6,427	$ 7,761	$ 9,180	$ 9,501	$ 9,834	$ 11,451	$ 11,851	$ 12,266	$ 12,695	$ 13,140	$ 13,600	$ 15,640	$ 16,187	$ 16,753	$ 17,340	$ 17,947	$ 18,575	$ 19,225
Contract Services																				
Readers	$ 200	$ 207	$ 214	$ 333	$ 344	$ 356	$ 369	$ 509	$ 527	$ 545	$ 564	$ 584	$ 604	$ 626	$ 647	$ 670	$ 694	$ 718	$ 743	$ 769
Field Service Techs	100	104	214	222	344	356	369	382	395	409	423	438	453	626	647	670	694	718	743	769
Lead Worker + Supervisor	200	207	214	222	230	238	246	254	263	273	282	292	302	313	324	335	347	359	371	385
Total Contract Services	$ 500	$ 518	$ 643	$ 776	$ 918	$ 950	$ 983	$ 1,145	$ 1,185	$ 1,227	$ 1,270	$ 1,314	$ 1,360	$ 1,564	$ 1,619	$ 1,675	$ 1,734	$ 1,795	$ 1,857	$ 1,923
Vehicles (Fuel + Maintenance)																				
Readers	$ 8,000	$ 8,360	$ 8,736	$ 13,694	$ 14,310	$ 14,954	$ 15,627	$ 21,774	$ 22,754	$ 23,778	$ 24,848	$ 25,966	$ 27,134	$ 28,355	$ 29,631	$ 30,965	$ 32,358	$ 33,814	$ 35,336	$ 36,926
Field Service Techs	4,000	4,180	8,736	9,129	14,310	14,954	15,627	16,330	17,065	17,833	18,636	19,474	20,351	28,355	29,631	30,965	32,358	33,814	35,336	36,926
Lead Worker + Supervisor	8,000	8,360	8,736	9,129	9,540	9,969	10,418	10,887	11,377	11,889	12,424	12,983	13,567	14,178	14,816	15,482	16,179	16,907	17,668	18,463
Total Fuel	$ 20,000	$ 20,900	$ 26,209	$ 31,953	$ 38,161	$ 39,878	$ 41,672	$ 48,991	$ 51,196	$ 53,499	$ 55,907	$ 58,423	$ 61,052	$ 70,888	$ 74,078	$ 77,411	$ 80,895	$ 84,535	$ 88,339	$ 92,314
Insurance																				
Readers	$ 2,000	$ 2,100	$ 2,205	$ 3,473	$ 3,647	$ 3,829	$ 4,020	$ 5,628	$ 5,910	$ 6,205	$ 6,516	$ 6,841	$ 7,183	$ 7,543	$ 7,920	$ 8,316	$ 8,731	$ 9,168	$ 9,626	$ 10,108
Field Service Techs	1,000	1,050	2,205	2,315	3,647	3,829	4,020	4,221	4,432	4,654	4,887	5,131	5,388	7,543	7,920	8,316	8,731	9,168	9,626	10,108
Lead Worker + Supervisor	2,000	2,100	2,205	2,315	2,431	2,553	2,680	2,814	2,955	3,103	3,258	3,421	3,592	3,771	3,960	4,158	4,366	4,584	4,813	5,054
Total Insurance	5,000	5,250	6,615	8,103	9,724	10,210	10,721	12,664	13,297	13,962	14,660	15,393	16,163	18,856	19,799	20,789	21,829	22,920	24,066	25,270
Misc.																				
Readers	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Field Service Techs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead Worker + Supervisor	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Miscellaneous	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Meter Reading Equipment Maintenance																				
Hand-held	$ 900	$ 923	$ 946	$ 969	$ 993	$ 1,018	$ 1,044	$ 1,070	$ 1,097	$ 1,124	$ 1,152	$ 1,181	$ 1,210	$ 1,241	$ 1,272	$ 1,303	$ 1,336	$ 1,369	$ 1,404	$ 1,439
Drive-by	2,000	2,050	2,101	3,231	3,311	3,394	3,479	4,755	4,874	4,995	5,120	5,248	5,380	5,514	5,652	5,793	5,938	6,086	6,239	6,395
Software	1,000	1,025	1,051	1,077	1,104	1,131	1,160	1,189	1,218	1,249	1,280	1,312	1,345	1,379	1,413	1,448	1,485	1,522	1,560	1,599
Installation Programmer	500	513	788	808	1,104	1,131	1,160	1,189	1,218	1,249	1,280	1,312	1,345	1,723	1,766	1,810	1,856	1,902	1,950	1,998
Total Annual Meter Reading Budget																				
Readers	$ 91,236	$ 94,541	$ 97,967	$ 152,277	$ 157,799	$ 163,523	$ 169,456	$ 234,143	$ 242,645	$ 251,459	$ 260,596	$ 270,069	$ 279,889	$ 290,070	$ 300,626	$ 311,569	$ 322,915	$ 334,679	$ 346,875	$ 359,521
Field Service Techs	53,231	55,150	114,277	118,399	184,006	190,648	197,531	204,664	212,058	219,721	227,663	235,895	244,427	337,695	349,917	362,585	375,717	389,329	403,438	418,064
Lead Worker + Supervisor	129,764	134,419	139,241	144,238	149,415	154,779	160,337	166,097	172,065	178,248	184,656	191,296	198,176	205,306	212,694	220,350	228,284	236,506	245,026	253,856
Facilities Rent	116,000	120,060	124,262	128,611	133,113	137,772	142,594	147,584	152,750	158,096	163,629	169,356	175,284	181,419	187,769	194,340	201,142	208,182	215,469	223,010
Reading Equipment Maintenance	4,400	4,510	4,885	6,084	6,512	6,675	6,842	8,202	8,407	8,617	8,833	9,053	9,280	9,856	10,103	10,355	10,614	10,880	11,152	11,430
Meter Reading Operating Budget	$ 394,631	$ 408,679	$ 480,632	$ 549,609	$ 630,845	$ 653,396	$ 676,760	$ 760,691	$ 787,924	$ 816,141	$ 845,377	$ 875,670	$ 907,056	$ 1,024,346	$ 1,061,108	$ 1,099,201	$ 1,138,673	$ 1,179,575	$ 1,221,960	$ 1,265,881
Customer Service Related																				
Total Customer Service	$ 1,830,155	$ 2,932,763	$ 4,450,776	$ 6,074,055	$ 7,808,200	$ 8,235,032	$ 8,685,206	$ 9,160,014	$ 9,660,742	$ 10,188,820	$ 10,745,759	$ 11,333,148	$ 11,952,667	$ 12,606,085	$ 13,295,170	$ 14,021,981	$ 14,788,486	$ 15,596,861	$ 16,449,508	$ 17,348,740
Total Meter Reading Related	$ 2,224,786	$ 3,341,442	$ 4,931,408	$ 6,623,664	$ 8,439,045	$ 8,888,429	$ 9,361,966	$ 9,920,705	$ 10,448,666	$ 11,004,962	$ 11,591,136	$ 12,208,817	$ 12,859,723	$ 13,630,431	$ 14,356,278	$ 15,121,182	$ 15,927,159	$ 16,776,436	$ 17,671,468	$ 18,614,622

City of Fresno
Meter Reading Feasibility 20-Year Planning Horizon Model Monthly
4-Year Deployment
Drive-By Radio Frequency
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Operating Cost per Read																				
Regular Meter Read	$0.25	$0.17	$0.12	$0.14	$0.12	$0.12	$0.12	$0.16	$0.17	$0.17	$0.17	$0.17	$0.18	$0.18	$0.18	$0.19	$0.19	$0.19	$0.20	$0.20
Field Service Read	$1.29	$0.87	$1.22	$0.96	$1.20	$1.22	$1.24	$1.26	$1.29	$1.31	$1.33	$1.35	$1.38	$1.86	$1.90	$1.93	$1.96	$1.99	$2.03	$2.06
Regular + Field Service	$0.97	$0.65	$0.52	$0.45	$0.42	$0.42	$0.43	$0.48	$0.48	$0.49	$0.50	$0.51	$0.52	$0.57	$0.58	$0.59	$0.60	$0.61	$0.62	$0.63
Reg + Field Serv. + Cust. Serv.	$5.47	$5.31	$5.34	$5.44	$5.58	$5.77	$5.96	$6.20	$6.41	$6.62	$6.85	$7.08	$7.32	$7.61	$7.87	$8.13	$8.40	$8.69	$8.98	$9.28
Capital Items																				
Meters and Pits																				
Meters to be Installed	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Pits to be Installed	(0)	12,713	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Vehicles																				
Vehicles Req'd	5	5	6	7	8	8	8	9	9	9	9	9	9	10	10	10	10	10	10	10
Vehicles in Service	13	5	5	6	7	8	8	8	9	9	9	9	9	9	10	10	10	10	10	10
New Vehicles (Retirements)	(8)	-	1	1	1	-	-	1	-	-	-	-	-	1	-	-	-	-	-	-
Potential In-Service Replacement	2	2	2	2	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Potential Vehicle Replacements					-	-	-	-	2	3	3	3	2	1	1	2	3	3	3	2
New Vehicle Purchases	-	2	3	3	3	2	1	1	2	3	3	3	2	2	1	2	3	3	3	2
Vehicle Retirements	8	2	2	2	2	2	1	-	2	3	3	3	2	1	1	2	3	3	3	2
Reading Equipment																				
# of Handhelds (1/Meter Read)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
# of Spare Handhelds	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Purchases (Retirements)	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Potential Replacements					-	2	-	-	-	-	2	-	-	-	-	2	-	-	-	-
Purchases + Replacements	2	-	-	-	-	2	-	-	-	-	2	-	-	-	-	2	-	-	-	-
Installation Programmers Req'd	2	2	3	3	4	4	4	4	4	4	4	4	4	5	5	5	5	5	5	5
Programmers Purchased (Retired)	2	-	1	-	1	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
Potential Replacements					-	2	-	1	-	1	2	-	1	-	1	2	-	1	1	1
Purchases + Replacements	2	-	1	-	1	2	-	1	-	1	2	-	1	1	1	2	-	1	1	1
Drive-by Units Required	2	2	2	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4
Drive-by Units Purchased	2	-	-	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Drive-by Units Replaced					-	-	2	-	-	1	-	-	2	1	-	1	-	-	2	1
Purchases + Replacements	2	-	-	1	-	-	2	1	-	1	-	-	2	1	-	1	-	-	2	1
Mobile Interface Unit																				
Years to Install MIU	4																			
MIU's Replaced/Year	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Cummulative Replaced	30,465	47,168	69,161	91,194	113,265	115,417	117,610	119,845	122,122	124,442	126,806	129,215	131,670	134,172	136,721	139,319	141,966	144,663	147,412	150,213
New Services Installed	-	1,996	2,034	2,073	2,112	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
MIU's Installed & Replaced	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Cummulative Replaced & Installed	30,465	47,168	69,161	91,194	113,265	115,417	117,610	119,845	122,122	124,442	126,806	129,215	131,670	134,172	136,721	139,319	141,966	144,663	147,412	150,213
MIU Cost	$ 75.00	$ 76.88	$ 78.80	$ 80.77	$ 82.79	$ 84.86	$ 86.98	$ 89.15	$ 91.38	$ 93.66	$ 96.01	$ 98.41	$ 100.87	$ 103.39	$ 105.97	$ 108.62	$ 111.34	$ 114.12	$ 116.97	$ 119.90
Installation Cost	$ 15.00	$ 15.53	$ 16.07	$ 16.63	$ 17.21	$ 17.82	$ 18.44	$ 19.08	$ 19.75	$ 20.44	$ 21.16	$ 21.90	$ 22.67	$ 23.46	$ 24.28	$ 25.13	$ 26.01	$ 26.92	$ 27.86	$ 28.84

City of Fresno
Meter Reading Feasibility 20-Year Planning Horizon Model Monthly
4-Year Deployment
Drive-By Radio Frequency
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Capital Budget (to be Borrowed)																				
Meters Installed	$ 2,132,516	$ 1,198,439	$ 1,617,484	$ 1,660,861	$ 1,705,396	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Pits & Boxes Installed	$ -	$ 4,886,552	$ 8,665,095	$ 8,897,472	$ 9,136,052	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Program Management	$ 304,645	$ 167,030	$ 219,935	$ 220,325	$ 220,715	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Vehicle Purchases (Retirements)	$ (19,429)	$ 30,163	$ 49,429	$ 51,159	$ 52,950	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Reading Equipment Purchases (Ret.)																				
Handhelds	$ 5,600	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Installation Programmer	$ 5,000	$ -	$ 2,627	$ -	$ 2,760	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Drivey-by	$ 85,000	$ -	$ -	$ 45,768	$ -															
Mobile Interfact Unit	2,741,807	1,543,355	2,086,419	2,145,912	2,207,124	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Capital Budget	$ 5,255,140	$ 7,825,539	$ 12,640,990	$ 13,021,498	$ 13,324,997	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Debt Service Payments	4,357,029	4,357,029	4,357,029	4,357,029	4,357,029	4,357,029	4,357,029	4,357,029	4,357,029	4,357,029	4,357,029	4,357,029	4,357,029	4,357,029	4,357,029	4,357,029	4,357,029	4,357,029	4,357,029	4,357,029
Capital Budget (Out of Pocket)																				
Meters Installed	$ -	$ -	$ -	$ -	$ -	$ 170,435	$ 178,025	$ 185,970	$ 194,201	$ 202,815	$ 211,828	$ 221,257	$ 231,119	$ 241,432	$ 252,117	$ 263,388	$ 275,064	$ 287,266	$ 300,125	$ 313,447
Pits & Boxes Installed	$ -	$ -	$ -	$ -	$ -	$ 913,046	$ 953,703	$ 996,267	$ 1,040,364	$ 1,086,511	$ 1,134,795	$ 1,185,306	$ 1,238,138	$ 1,293,388	$ 1,350,626	$ 1,411,004	$ 1,473,557	$ 1,538,927	$ 1,607,813	$ 1,679,182
Vehicle Purchases (Retirements)	$ -	$ -	$ -	$ -	$ -	34,613	17,912	21,629	38,376	59,578	61,663	63,822	44,037	49,376	23,587	48,824	75,800	78,453	81,199	56,027
Reading Equipment Purchases (Ret.)																				
Handhelds	$ -	$ -	$ -	$ -	$ -	6,336	0	0	0	0	7,168	0	0	0	0	8,110	0	0	0	0
Installation Programmer	$ -	$ -	$ -	$ -	$ -	5,657	0	2,972	0	3,122	6,400	0	3,362	3,446	3,532	7,241	0	3,804	3,899	3,997
Drive-by	$ -	$ -	$ -	$ -	$ -	0	98,574	50,519	0	53,077	0	0	114,316	58,587	0	61,553	0	0	132,571	67,943
Mobile Interfact Unit	-	-	-	-	-	220,948	231,177	241,907	253,048	264,731	276,979	289,817	303,273	317,373	332,016	347,489	363,559	380,389	398,156	416,610
Total Capital Budget	$ -	$ -	$ -	$ -	$ -	$ 1,351,035	$ 1,479,390	$ 1,499,263	$ 1,525,989	$ 1,669,834	$ 1,698,834	$ 1,760,202	$ 1,934,245	$ 1,963,603	$ 1,961,878	$ 2,147,610	$ 2,187,981	$ 2,288,839	$ 2,523,763	$ 2,537,206
Total Budget (Operating + Capital)	$ 5,649,770	$ 8,234,218	$ 13,121,622	$ 13,571,107	$ 13,955,842	$ 2,004,431	$ 2,156,150	$ 2,259,954	$ 2,313,913	$ 2,485,975	$ 2,544,212	$ 2,635,872	$ 2,841,301	$ 2,987,949	$ 3,022,986	$ 3,246,811	$ 3,326,654	$ 3,468,414	$ 3,745,723	$ 3,803,088
Does Not Include Customer Service or Debt Service																				
Long-Term Budget	4,751,660	4,765,708	4,837,661	4,906,638	4,987,874	6,361,460	6,513,179	6,616,983	6,670,942	6,843,004	6,901,241	6,992,901	7,198,330	7,344,978	7,380,015	7,603,840	7,683,683	7,825,443	8,102,752	8,160,117
Includes Debt Service, Capital Out of Pocket and Operating Costs)																				
NPV Annually	$ 4,482,698	$ 4,241,463	$ 4,061,793	$ 3,886,517	$ 3,727,230	$ 4,484,579	$ 4,331,636	$ 4,151,577	$ 3,948,521	$ 3,821,098	$ 3,635,488	$ 3,475,257	$ 3,374,858	$ 3,248,691	$ 3,079,423	$ 2,993,223	$ 2,853,446	$ 2,741,595	$ 2,678,065	$ 2,544,363
Total Capital	$ 52,068,163																			
Total Operating Budget (thru deployment)	$ 2,464,396																			
Total Capital	$ 52,068,163																			
Total Deployment	$ 54,532,559																			
Total Debt Service (20 years)	$ 87,140,580																			
Long-Term Cost																				
Total Debt Service	$ 87,140,580																			
Total Operating Budget (20 years)	$ 16,778,156																			
Total Out of Pocket Capital	$ 28,529,674																			
Total Long-Term Cost	$ 132,448,410																			
Net Present Value																				
Discount Rate	0.0%																			
NPV Capital	$42,807,458																			
NPV Deployment	$51,445,810																			
NPV Long-Term Cost	$ 71,761,521																			
Total Cost per Read	$ 11.68	$ 7.57	$ 5.24	$ 4.03	$ 3.30	$ 4.13	$ 4.15	$ 4.14	$ 4.09	$ 4.12	$ 4.08	$ 4.05	$ 4.10	$ 4.10	$ 4.04	$ 4.09	$ 4.05	$ 4.05	$ 4.12	$ 4.07

NPV	
total debt service	$49,974,780
operating budget	$8,625,388
out of pocket capital	$13,161,354

City of Fresno
Meter Reading Feasibility 20-Year Planning Horizon Model Monthly
4-Year Deployment
Touch Read
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Meter Reading																				
Meters																				
Total Meters	30,465	47,168	69,161	91,194	113,265	115,417	117,610	119,845	122,122	124,442	126,806	129,215	131,670	134,172	136,721	139,319	141,966	144,663	147,412	150,213
Meters to be Installed	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Pits & Boxes to be Installed*	(0)	12,713	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
*Year 2008 total is 31,732 minus 24,232 pits already in the ground																				
Installations include annual growth of 1.3%																				
Read Frequency																				
Quarterly %	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%	0.0%	0.0%	0.0%
Bi-monthly %	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%	0.0%	0.0%	0.0%
Monthly %	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%	100.0%	100.0%
Total	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%	100.0%	100.0%
Annual Reads																				
Quarterly	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bi-monthly	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Monthly	365,574	566,010	829,932	1,094,322	1,359,180	1,385,004	1,411,320	1,438,140	1,465,464	1,493,304	1,521,672	1,550,580	1,580,040	1,610,064	1,640,652	1,671,828	1,703,592	1,735,956	1,768,944	1,802,556
Total	365,574	566,010	829,932	1,094,322	1,359,180	1,385,004	1,411,320	1,438,140	1,465,464	1,493,304	1,521,672	1,550,580	1,580,040	1,610,064	1,640,652	1,671,828	1,703,592	1,735,956	1,768,944	1,802,556
Reading Days/Year																				
Reading Days/Man Week	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Holidays/Year	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Vacation Days/Year	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Sick Days/Year	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Total Reading Days/Year	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170
Reads/Man Day	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320
Field Service (Meter Reading Related)																				
Field Service Reads per Year																				
Cust. Serv. Request % of Reads	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%
Final Reads % of Meters	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%
Annual Customer Service Req.	36,557	56,601	82,993	109,432	135,918	138,500	141,132	143,814	146,546	149,330	152,167	155,058	158,004	161,006	164,065	167,183	170,359	173,596	176,894	180,256
Annual Final Reads	4,570	7,075	10,374	13,679	16,990	17,313	17,642	17,977	18,318	18,666	19,021	19,382	19,751	20,126	20,508	20,898	21,295	21,699	22,112	22,532
Total Annual Field Service Reads	41,127	63,676	93,367	123,111	152,908	155,813	158,774	161,791	164,865	167,997	171,188	174,440	177,755	181,132	184,573	188,081	191,654	195,295	199,006	202,788
Field Service Days/Year																				
Service Days/Man Week	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Holidays/Year	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Vacation Days/Year	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Sick Days/Year	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Total Reading Days/Year	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222
Visits/Man Day	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35
Personnel Required																				
Calculated Meter Readers	6.7	10.4	15.3	20.1	25.0	25.5	25.9	26.4	26.9	27.5	28.0	28.5	29.0	29.6	30.2	30.7	31.3	31.9	32.5	33.1
Calculated Field Service Techs *	4.4	6.8	10.0	13.2	16.4	16.7	17.0	17.4	17.7	18.0	18.4	18.7	19.1	19.4	19.8	20.2	20.6	20.9	21.3	21.7
Meter Readers (FTE)	7.0	11.0	15.0	20.0	25.0	26.0	26.0	26.0	27.0	28.0	28.0	29.0	29.0	30.0	30.0	31.0	31.0	32.0	33.0	33.0
Field Techs (FTE)	5.0	7.0	10.0	13.0	16.0	17.0	17.0	17.0	18.0	18.0	18.0	19.0	19.0	19.0	20.0	20.0	21.0	21.0	21.0	22.0
Calculated Lead Worker(s)	1.1	1.6	2.3	3.0	3.7	3.9	3.9	3.9	4.1	4.2	4.2	4.4	4.4	4.5	4.5	4.6	4.7	4.8	4.9	5.0
Actual Lead Workers	1.0	2.0	2.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	5.0	5.0	5.0	5.0	5.0	5.0
Supervisor Collections Section	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

* Field Service Techs are supported by meter readers on any off-reading days.

City of Fresno
Meter Reading Feasibility 20-Year Planning Horizon Model Monthly
4-Year Deployment
Touch Read
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Operating Expenses																				
Meter Related																				
Salary																				
Readers	$ 275,330	$ 447,804	$ 632,014	$ 872,180	$ 1,128,382	$ 1,214,591	$ 1,257,101	$ 1,301,100	$ 1,398,432	$ 1,500,984	$ 1,553,518	$ 1,665,316	$ 1,723,602	$ 1,845,443	$ 1,910,034	$ 2,042,781	$ 2,114,278	$ 2,258,868	$ 2,410,988	$ 2,495,373
Field Service Techs	234,728	340,121	502,893	676,643	861,938	947,863	981,038	1,015,375	1,112,731	1,151,677	1,191,985	1,302,244	1,347,822	1,394,996	1,519,812	1,573,005	1,709,463	1,769,295	1,831,220	1,985,566
Lead Worker	53,213	110,152	114,007	176,996	244,255	252,804	261,652	270,810	280,288	290,098	300,251	310,760	321,637	332,894	430,682	445,756	461,357	477,505	494,217	511,515
Supervisor Collections	63,851	66,086	68,399	70,793	73,270	75,835	78,489	81,236	84,080	87,022	90,068	93,221	96,483	99,860	103,355	106,973	110,717	114,592	118,603	122,754
Total Salary	627,122	964,162	1,317,313	1,796,611	2,307,846	2,491,092	2,578,281	2,668,520	2,875,531	3,029,781	3,135,823	3,371,541	3,489,545	3,673,194	3,963,882	4,168,514	4,395,815	4,620,259	4,855,028	5,115,207
Education																				
Readers	$ 1,295	$ 2,116	$ 3,001	$ 4,162	$ 5,411	$ 5,852	$ 6,086	$ 6,330	$ 6,836	$ 7,373	$ 7,668	$ 8,259	$ 8,590	$ 9,241	$ 9,611	$ 10,328	$ 10,742	$ 11,532	$ 12,368	$ 12,862
Field Service Techs	925	1,347	2,001	2,705	3,463	3,826	3,979	4,139	4,557	4,740	4,929	5,411	5,628	5,853	6,407	6,663	7,277	7,568	7,870	8,575
Lead Worker + Supervisor	500	780	811	1,125	1,462	1,521	1,582	1,645	1,711	1,779	1,850	1,924	2,001	2,081	2,598	2,701	2,809	2,922	3,039	3,160
Total Education	$ 2,720	$ 4,243	$ 5,814	$ 7,992	$ 10,336	$ 11,199	$ 11,647	$ 12,113	$ 13,104	$ 13,892	$ 14,447	$ 15,595	$ 16,218	$ 17,175	$ 18,616	$ 19,693	$ 20,828	$ 22,021	$ 23,277	$ 24,597
M & S																				
Readers	$ 7,000	$ 11,385	$ 16,068	$ 22,174	$ 28,688	$ 30,880	$ 31,961	$ 33,079	$ 35,554	$ 38,161	$ 39,497	$ 42,339	$ 43,821	$ 46,919	$ 48,561	$ 51,936	$ 53,754	$ 57,430	$ 61,297	$ 63,443
Field Service Techs	5,000	7,245	10,712	14,413	18,360	20,191	20,897	21,629	23,703	24,532	25,391	27,739	28,710	29,715	32,374	33,507	36,414	37,688	39,007	42,295
Lead Worker + Supervisor	2,000	3,105	3,214	4,435	5,738	5,938	6,146	6,361	6,584	6,814	7,053	7,300	7,555	7,820	9,712	10,052	10,404	10,768	11,145	11,535
Total M&S	$ 14,000	$ 21,735	$ 29,994	$ 41,023	$ 52,786	$ 57,009	$ 59,004	$ 61,069	$ 65,840	$ 69,508	$ 71,941	$ 77,378	$ 80,087	$ 84,454	$ 90,647	$ 95,495	$ 100,571	$ 105,886	$ 111,449	$ 117,273
Contract Services																				
Readers	$ 700	$ 1,139	$ 1,607	$ 2,217	$ 2,869	$ 3,088	$ 3,196	$ 3,308	$ 3,555	$ 3,816	$ 3,950	$ 4,234	$ 4,382	$ 4,692	$ 4,856	$ 5,194	$ 5,375	$ 5,743	$ 6,130	$ 6,344
Field Service Techs	500	725	1,071	1,441	1,836	2,019	2,090	2,163	2,370	2,453	2,539	2,774	2,871	2,972	3,237	3,351	3,641	3,769	3,901	4,230
Lead Worker + Supervisor	200	311	321	443	574	594	615	636	658	681	705	730	756	782	971	1,005	1,040	1,077	1,114	1,154
Total Contract Services	$ 1,400	$ 2,174	$ 2,999	$ 4,102	$ 5,279	$ 5,701	$ 5,900	$ 6,107	$ 6,584	$ 6,951	$ 7,194	$ 7,738	$ 8,009	$ 8,445	$ 9,065	$ 9,549	$ 10,057	$ 10,589	$ 11,145	$ 11,727
Vehicles (Fuel + Maintenance)																				
Readers	$ 28,000	$ 45,980	$ 65,522	$ 91,293	$ 119,252	$ 129,603	$ 135,435	$ 141,530	$ 153,587	$ 166,443	$ 173,933	$ 188,251	$ 196,722	$ 212,664	$ 222,233	$ 239,975	$ 250,774	$ 270,512	$ 291,519	$ 304,638
Field Service Techs	20,000	29,260	43,681	59,341	76,321	84,740	88,554	92,539	102,391	106,999	111,814	123,337	128,887	134,687	148,156	154,823	169,879	177,524	185,512	203,092
Lead Worker + Supervisor	8,000	12,540	13,104	18,259	23,850	24,924	26,045	27,217	28,442	29,722	31,059	32,457	33,918	35,444	44,447	46,447	48,537	50,721	53,003	55,389
Total Fuel	$ 56,000	$ 87,780	$ 122,307	$ 168,893	$ 219,423	$ 239,267	$ 250,034	$ 261,285	$ 284,420	$ 303,163	$ 316,806	$ 344,045	$ 359,527	$ 382,794	$ 414,836	$ 441,244	$ 469,190	$ 498,757	$ 530,035	$ 563,118
Insurance																				
Readers	$ 7,000	$ 11,550	$ 16,538	$ 23,153	$ 30,388	$ 33,183	$ 34,842	$ 36,585	$ 39,891	$ 43,437	$ 45,609	$ 49,600	$ 52,080	$ 56,569	$ 59,398	$ 64,447	$ 67,669	$ 73,345	$ 79,418	$ 83,389
Field Service Techs	5,000	7,350	11,025	15,049	19,448	21,697	22,782	23,921	26,594	27,924	29,320	32,496	34,121	35,827	39,599	41,579	45,840	48,132	50,539	55,593
Lead Worker + Supervisor	2,000	3,150	3,308	4,631	6,078	6,381	6,700	7,036	7,387	7,757	8,144	8,552	8,979	9,428	11,880	12,474	13,097	13,752	14,440	15,162
Total Insurance	14,000	22,050	30,870	42,832	55,913	61,262	64,325	67,541	73,873	79,118	83,074	90,648	95,180	101,825	110,876	118,499	126,607	135,229	144,397	154,144
Misc.																				
Readers	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Field Service Techs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead Worker + Supervisor	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Miscellaneous	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Meter Reading Equipment Maintenance																				
Hand-held	$ 2,520	$ 4,018	$ 5,589	$ 7,538	$ 9,890	$ 10,454	$ 10,716	$ 10,983	$ 11,599	$ 12,239	$ 12,545	$ 13,593	$ 13,933	$ 14,667	$ 15,034	$ 15,815	$ 16,211	$ 17,042	$ 18,342	$ 18,800
Software	1,000	1,025	1,051	1,077	1,104	1,131	1,160	1,189	1,218	1,249	1,280	1,312	1,345	1,379	1,413	1,448	1,485	1,522	1,560	1,599
Total Annual Meter Reading Budget																				
Readers	$ 319,325	$ 519,974	$ 734,750	$ 1,015,179	$ 1,314,989	$ 1,417,197	$ 1,468,622	$ 1,521,931	$ 1,637,856	$ 1,760,214	$ 1,824,174	$ 1,957,999	$ 2,029,197	$ 2,175,528	$ 2,254,693	$ 2,414,661	$ 2,502,592	$ 2,677,429	$ 2,861,720	$ 2,966,049
Field Service Techs	266,153	386,047	571,383	769,592	981,367	1,080,336	1,119,340	1,159,764	1,272,347	1,318,324	1,365,978	1,494,002	1,548,040	1,604,050	1,749,584	1,812,927	1,972,514	2,043,975	2,118,049	2,299,350
Lead Worker + Supervisor	129,764	196,123	203,164	276,681	355,227	367,997	381,229	394,941	409,150	423,874	439,132	454,944	471,329	488,310	603,644	625,407	647,962	671,336	695,561	720,668
Facilities Rent	116,000	120,060	124,262	128,611	133,113	137,772	142,594	147,584	152,750	158,096	163,629	169,356	175,284	181,419	187,769	194,340	201,142	208,182	215,469	223,010
Reading Equipment Maintenance	3,520	5,043	6,640	8,615	10,994	11,586	11,875	12,172	12,818	13,488	13,825	14,905	15,278	16,046	16,447	17,264	17,695	18,564	19,901	20,399
Meter Reading Operating Budget	$ 834,762	$ 1,227,247	$ 1,640,199	$ 2,198,679	$ 2,795,690	$ 3,014,887	$ 3,123,660	$ 3,236,393	$ 3,484,920	$ 3,673,996	$ 3,806,739	$ 4,091,206	$ 4,239,128	$ 4,465,352	$ 4,812,137	$ 5,064,600	$ 5,341,906	$ 5,619,486	$ 5,910,701	$ 6,229,475
Customer Service Related																				
Total Customer Service	$ 1,830,155	$ 2,932,763	$ 4,450,776	$ 6,074,055	$ 7,808,200	$ 8,235,032	$ 8,685,206	$ 9,160,014	$ 9,660,742	$ 10,188,820	$ 10,745,759	$ 11,333,148	$ 11,952,667	$ 12,606,085	$ 13,295,170	$ 14,021,981	$ 14,788,486	$ 15,596,861	$ 16,449,508	$ 17,348,740
Total Reading + Techs + Cust. Serv.	$ 2,664,917	$ 4,160,010	$ 6,090,975	$ 8,272,734	$ 10,603,889	$ 11,249,919	##########	$ 12,396,407	$ 13,145,662	$ 13,862,816	$ 14,552,497	$ 15,424,354	$ 16,191,795	$ 17,071,437	$ 18,107,307	$ 19,086,581	$ 20,130,392	$ 21,216,347	$ 22,360,209	$ 23,578,215

City of Fresno
Meter Reading Feasibility 20-Year Planning Horizon Model Monthly
4-Year Deployment
Touch Read
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Operating Cost per Read																				
Regular Meter Read	$0.87	$0.92	$0.89	$0.93	$0.97	$1.02	$1.04	$1.06	$1.12	$1.18	$1.20	$1.26	$1.28	$1.35	$1.37	$1.44	$1.47	$1.54	$1.62	$1.65
Field Service Read	$6.47	$6.06	$6.12	$6.25	$6.42	$6.93	$7.05	$7.17	$7.72	$7.85	$7.98	$8.56	$8.71	$8.86	$9.48	$9.64	$10.29	$10.47	$10.64	$11.34
Regular + Field Service	$2.05	$1.95	$1.78	$1.81	$1.85	$1.96	$1.99	$2.02	$2.14	$2.21	$2.25	$2.37	$2.41	$2.49	$2.64	$2.72	$2.82	$2.91	$3.00	$3.11
Reg + Field Serv. + Cust. Serv.	$6.55	$6.61	$6.60	$6.80	$7.01	$7.30	$7.52	$7.75	$8.06	$8.34	$8.60	$8.94	$9.21	$9.53	$9.92	$10.26	$10.62	$10.99	$11.36	$11.76
Capital Items																				
Meters and Pits																				
Meters to be Installed	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Pits to be Installed	(0)	12,713	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Vehicles																				
Vehicles Req'd	14	21	28	37	46	48	48	48	50	51	51	53	53	54	56	57	58	59	60	61
Vehicles in Service	13	14	21	28	37	46	48	48	48	50	51	51	53	53	54	56	57	58	59	60
New Vehicles (Retirements)	1	7	7	9	9	2	-	-	2	1	-	2	-	1	2	1	1	1	1	1
Potential In-Service Replacement	2	2	2	2	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Potential Vehicle Replacements					-	-	-	3	9	9	11	11	4	1	3	11	10	11	13	4
New Vehicle Purchases	3	9	9	11	11	4	1	3	11	10	11	13	4	2	5	12	11	12	14	5
Vehicle Retirements	2	2	2	2	2	2	1	3	9	9	11	11	4	1	3	11	10	11	13	4
Reading Equipment																				
# of Handhelds (1/Meter Read)	7	11	15	20	25	26	26	26	27	28	28	29	29	30	30	31	31	32	33	33
# of Spare Handhelds	2	3	4	5	7	7	7	7	7	7	7	8	8	8	8	8	8	8	9	9
Purchases (Retirements)	9	5	5	6	7	1	-	-	1	1	-	2	-	1	-	1	-	1	2	-
Potential Replacements					-	9	5	5	6	7	10	5	5	7	8	10	7	5	8	8
Purchases + Replacements	9	5	5	6	7	10	5	5	7	8	10	7	5	8	8	11	7	6	10	8
# of Pocket Pro (1/Field Service)	5	7	10	13	16	17	17	17	18	18	18	19	19	19	20	20	21	21	21	22
# of Spare Pocket Pro	2	2	3	4	4	5	5	5	5	5	5	5	5	5	5	5	6	6	6	6
Purchases (Retirements)	7	2	4	4	3	2	-	-	1	-	-	1	-	-	1	-	2	-	-	1
Potential Replacements					-	7	2	4	4	3	9	2	4	5	3	9	3	4	5	4
Purchases + Replacements	7	2	4	4	3	9	2	4	5	3	9	3	4	5	4	9	5	4	5	5
Touch Pad																				
Years to Install Pads	4																			
Pads Replaced/Year	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Cummulative Replaced	30,465	47,168	69,161	91,194	113,265	115,417	117,610	119,845	122,122	124,442	126,806	129,215	131,670	134,172	136,721	139,319	141,966	144,663	147,412	150,213
New Services Installed	-	1,996	2,034	2,073	2,112	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Total Pads Installed & Replaced	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Cummulative Replaced & Installed	30,465	47,168	69,161	91,194	113,265	115,417	117,610	119,845	122,122	124,442	126,806	129,215	131,670	134,172	136,721	139,319	141,966	144,663	147,412	150,213
Touch Pad Cost	$15.00	$15.38	$15.76	$16.15	$16.56	$16.97	$17.40	$17.83	$18.28	$18.73	$19.20	$19.68	$20.17	$20.68	$21.19	$21.72	$22.27	$22.82	$23.39	$23.98
Installation Cost	$15.00	$15.53	$16.07	$16.63	$17.21	$17.82	$18.44	$19.08	$19.75	$20.44	$21.16	$21.90	$22.67	$23.46	$24.28	$25.13	$26.01	$26.92	$27.86	$28.84

City of Fresno
Meter Reading Feasibility 20-Year Planning Horizon Model Monthly
4-Year Deployment
Touch Read
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Capital Budget (to be Borrowed)																				
Meters Installed	$ 2,132,516	$ 1,198,439	$ 1,617,484	$ 1,660,861	$ 1,705,396	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Pits & Boxes Installed	$ -	$ 4,886,552	$ 8,665,095	$ 8,897,472	$ 9,136,052	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Program Management	$ 304,645	$ 167,030	$ 219,935	$ 220,325	$ 220,715	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Vehicle Purchases (Retirements)	$ 46,143	$ 153,328	$ 158,694	$ 201,945	$ 209,013	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Reading Equipment Purchases (Ret.)																				
Handhelds	$ 25,200	$ 14,350	$ 14,709	$ 18,092	$ 21,635	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Pocket Pro	$ 2,800	$ 820	$ 1,681	$ 1,723	$ 1,325	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Touch Pad	$ 913,936	$ 516,122	$ 700,004	$ 722,316	$ 745,355	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Capital Budget	$ 3,425,240	$ 6,936,641	$ 11,377,603	$ 11,722,735	$ 12,039,492	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Debt Service Payments	3,807,553	3,807,553	3,807,553	3,807,553	3,807,553	3,807,553	3,807,553	3,807,553	3,807,553	3,807,553	3,807,553	3,807,553	3,807,553	3,807,553	3,807,553	3,807,553	3,807,553	3,807,553	3,807,553	3,807,553
Capital Budget (Out of Pocket)																				
Meters Installed	$ -	$ -	$ -	$ -	$ -	$ 170,435	$ 178,025	$ 185,970	$ 194,201	$ 202,815	$ 211,828	$ 221,257	$ 231,119	$ 241,432	$ 252,117	$ 263,388	$ 275,064	$ 287,266	$ 300,125	$ 313,447
Pits & Boxes Installed	$ -	$ -	$ -	$ -	$ -	$ 913,046	$ 953,703	$ 996,267	$ 1,040,364	$ 1,086,511	$ 1,134,795	$ 1,185,306	$ 1,238,138	$ 1,293,388	$ 1,350,626	$ 1,411,004	$ 1,473,557	$ 1,538,927	$ 1,607,813	$ 1,679,182
Vehicle Purchases (Retirements)	$ -	$ -	$ -	$ -	$ -	74,994	17,912	55,617	217,462	201,904	226,099	283,651	88,074	49,376	125,796	297,015	282,144	318,170	383,439	144,737
Reading Equipment Purchases (Ret.)																				
Handhelds	$ -	$ -	$ -	$ -	$ -	31,679	16,236	16,642	23,881	27,975	35,842	25,717	18,828	30,879	31,651	44,608	29,096	25,563	43,670	35,810
Pocket Pro	$ -	$ -	$ -	$ -	$ -	4,073	928	1,902	2,437	1,499	4,608	1,575	2,152	2,757	2,261	5,214	2,969	2,435	3,119	3,197
Touch Pad	-	-	-	-	-	74,860	78,584	82,504	86,590	90,889	95,412	100,168	105,171	110,431	115,916	121,729	127,790	134,161	140,906	147,941
Total Capital Budget	$ -	$ -	$ -	$ -	$ -	$ 1,269,089	$ 1,245,387	$ 1,338,901	$ 1,564,934	$ 1,611,592	$ 1,708,584	$ 1,817,674	$ 1,683,482	$ 1,728,263	$ 1,878,366	$ 2,142,957	$ 2,190,621	$ 2,306,522	$ 2,479,073	$ 2,324,315
Total Budget (Operating + Capital)	$ 4,260,002	$ 8,163,888	$ 13,017,802	$ 13,921,414	$ 14,835,181	$ 3,014,887	$ 3,123,660	$ 3,236,393	$ 3,484,920	$ 3,673,996	$ 3,806,739	$ 4,091,206	$ 4,239,128	$ 4,465,352	$ 4,812,137	$ 5,064,600	$ 5,341,906	$ 5,619,486	$ 5,910,701	$ 6,229,475
Does Not Include Customer Service or Debt Service																				
Long-Term Budget	4,642,315	5,034,800	5,447,752	6,006,232	6,603,242	8,091,528	8,176,600	8,382,847	8,857,407	9,093,141	9,322,876	9,716,433	9,730,162	10,001,168	10,498,056	11,015,110	11,340,079	11,733,561	12,197,326	12,361,342
Includes Debt Service, Capital Out of Pocket and Operating Costs																				
NPV Annually	$ 4,379,542	$ 4,480,954	$ 4,574,038	$ 4,757,498	$ 4,934,327	$ 5,704,208	$ 5,437,906	$ 5,259,502	$ 5,242,685	$ 5,077,562	$ 4,911,175	$ 4,828,770	$ 4,561,880	$ 4,423,526	$ 4,380,472	$ 4,336,057	$ 4,211,302	$ 4,110,780	$ 4,031,375	$ 3,854,325
Total Capital	$ 45,501,710																			
Total Operating Budget (thru deployment)	$ 8,696,577																			
Total Capital	$ 45,501,710																			
Total Deployment	$ 54,198,287																			
Total Debt Service (20 years)	$ 76,151,052																			
Long-Term Cost																				
Total Debt Service	$ 76,151,052																			
Total Operating Budget (20 years)	$ 74,811,162																			
Total Out of Pocket Capital	$ 27,289,762																			
Total Long-Term Cost	$ 178,251,975																			
Net Present Value																				
Discount Rate	6.0%																			
NPV Capital	$37,239,911																			
NPV Deployment	$51,130,460																			
NPV Long-Term Cost	$ 93,497,883																			
Total Cost per Read	$ 11.41	$ 8.00	$ 5.90	$ 4.93	$ 4.37	$ 5.25	$ 5.21	$ 5.24	$ 5.43	$ 5.47	$ 5.51	$ 5.63	$ 5.54	$ 5.58	$ 5.75	$ 5.92	$ 5.98	$ 6.08	$ 6.20	$ 6.16

NPV	
total debt service	$43,672,328
operating budget	$37,286,293
out of pocket capital	$12,539,261

City of Fresno
Meter Reading Feasibility 20-Year Planning Horizon Model Monthly
4-Year Deployment
Manual Read
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Meter Reading																				
Meters																				
Total Meters	30,465	47,168	69,161	91,194	113,265	115,417	117,610	119,845	122,122	124,442	126,806	129,215	131,670	134,172	136,721	139,319	141,966	144,663	147,412	150,213
Meters to be Installed	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Pits & Boxes to be Installed*	(0)	12,713	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
*Year 2008 total is 31,732 minus 24,232 pits already in the ground																				
Installations include annual growth of 1.3%																				
Read Frequency																				
Quarterly %	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%	0.0%	0.0%	0.0%
Bi-monthly %	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%	0.0%	0.0%	0.0%
Monthly %	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%	100.0%	100.0%
Total	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%	100.0%	100.0%
Annual Reads																				
Quarterly	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bi-monthly	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Monthly	365,574	566,010	829,932	1,094,322	1,359,180	1,385,004	1,411,320	1,438,140	1,465,464	1,493,304	1,521,672	1,550,580	1,580,040	1,610,064	1,640,652	1,671,828	1,703,592	1,735,956	1,768,944	1,802,556
Total	365,574	566,010	829,932	1,094,322	1,359,180	1,385,004	1,411,320	1,438,140	1,465,464	1,493,304	1,521,672	1,550,580	1,580,040	1,610,064	1,640,652	1,671,828	1,703,592	1,735,956	1,768,944	1,802,556
Reading Days/Year																				
Reading Days/Man Week	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Holidays/Year	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Vacation Days/Year	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Sick Days/Year	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Total Reading Days/Year	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170
Reads/Man Day	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160
Field Service (Meter Reading Related)																				
Field Service Reads per Year																				
Cust. Serv. Request % of Reads	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%
Final Reads % of Meters	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%
Annual Customer Service Req.	36,557	56,601	82,993	109,432	135,918	138,500	141,132	143,814	146,546	149,330	152,167	155,058	158,004	161,006	164,065	167,183	170,359	173,596	176,894	180,256
Annual Final Reads	4,570	7,075	10,374	13,679	16,990	17,313	17,642	17,977	18,318	18,666	19,021	19,382	19,751	20,126	20,508	20,898	21,295	21,699	22,112	22,532
Total Annual Field Service Reads	41,127	63,676	93,367	123,111	152,908	155,813	158,774	161,791	164,865	167,997	171,188	174,440	177,755	181,132	184,573	188,081	191,654	195,295	199,006	202,788
Field Service Days/Year																				
Service Days/Man Week	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Holidays/Year	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Vacation Days/Year	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Sick Days/Year	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Total Reading Days/Year	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222
Visits/Man Day	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Personnel Required																				
Calculated Meter Readers	13.4	20.8	30.5	40.2	50.0	50.9	51.9	52.9	53.9	54.9	55.9	57.0	58.1	59.2	60.3	61.5	62.6	63.8	65.0	66.3
Calculated Field Service Techs *	6.2	9.6	14.0	18.5	23.0	23.4	23.8	24.3	24.8	25.2	25.7	26.2	26.7	27.2	27.7	28.2	28.8	29.3	29.9	30.4
Meter Readers (FTE)	14.0	21.0	31.0	40.0	50.0	51.0	52.0	53.0	54.0	55.0	56.0	57.0	58.0	59.0	60.0	62.0	63.0	64.0	65.0	66.0
Field Techs (FTE)	6.0	10.0	14.0	19.0	23.0	23.0	24.0	24.0	25.0	25.0	26.0	26.0	27.0	27.0	28.0	28.0	29.0	29.0	30.0	30.0
Calculated Lead Worker(s)	1.8	2.8	4.1	5.4	6.6	6.7	6.9	7.0	7.2	7.3	7.5	7.5	7.7	7.8	8.0	8.2	8.4	8.5	8.6	8.7
Actual Lead Workers	2.0	3.0	4.0	5.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	9.0	9.0
Supervisor Collections Section	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

* Field Service Techs are supported by meter readers on any off-reading days.

City of Fresno
Meter Reading Feasibility 20-Year Planning Horizon Model Monthly
4-Year Deployment
Manual Read
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Operating Expenses																				
Meter Related																				
Salary																				
Readers	$ 550,659	$ 854,898	$ 1,306,163	$ 1,744,359	$ 2,256,765	$ 2,382,466	$ 2,514,203	$ 2,652,242	$ 2,796,864	$ 2,948,361	$ 3,107,037	$ 3,273,208	$ 3,447,205	$ 3,629,371	$ 3,820,067	$ 4,085,562	$ 4,296,759	$ 4,517,735	$ 4,748,916	$ 4,990,746
Field Service Techs	281,674	485,887	704,050	988,939	1,239,037	1,282,403	1,384,995	1,433,470	1,545,460	1,599,551	1,721,757	1,782,018	1,915,327	1,982,363	2,127,736	2,202,207	2,360,687	2,443,311	2,616,028	2,707,589
Lead Worker	106,427	165,228	228,014	294,994	427,446	442,406	457,891	473,917	490,504	507,672	525,440	621,520	643,274	665,788	689,091	713,209	738,171	764,007	889,591	920,727
Supervisor Collections	63,851	66,086	68,399	70,793	73,270	75,835	78,489	81,236	84,080	87,022	90,068	93,221	96,483	99,860	103,355	106,973	110,717	114,592	118,603	122,754
Total Salary	1,002,611	1,572,099	2,306,626	3,099,085	3,996,517	4,183,111	4,435,578	4,640,865	4,916,908	5,142,606	5,444,301	5,769,967	6,102,288	6,377,383	6,740,250	7,107,951	7,506,335	7,839,646	8,373,138	8,741,815
Education																				
Readers	$ 2,590	$ 4,040	$ 6,203	$ 8,324	$ 10,821	$ 11,479	$ 12,172	$ 12,903	$ 13,672	$ 14,482	$ 15,335	$ 16,234	$ 17,179	$ 18,174	$ 19,222	$ 20,657	$ 21,830	$ 23,063	$ 24,360	$ 25,725
Field Service Techs	1,110	1,924	2,801	3,954	4,978	5,177	5,618	5,843	6,330	6,583	7,120	7,405	7,997	8,317	8,970	9,329	10,049	10,450	11,243	11,693
Lead Worker + Supervisor	750	1,040	1,352	1,687	2,340	2,433	2,531	2,632	2,737	2,847	2,960	3,464	3,602	3,746	3,896	4,052	4,214	4,383	5,065	5,267
Total Education	$ 4,450	$ 7,004	$ 10,356	$ 13,965	$ 18,139	$ 19,089	$ 20,321	$ 21,377	$ 22,739	$ 23,912	$ 25,416	$ 27,102	$ 28,779	$ 30,238	$ 32,088	$ 34,038	$ 36,092	$ 37,896	$ 40,668	$ 42,685
M & S																				
Readers	$ 14,000	$ 21,735	$ 33,208	$ 44,349	$ 57,376	$ 60,572	$ 63,921	$ 67,431	$ 71,108	$ 74,959	$ 78,994	$ 83,218	$ 87,642	$ 92,273	$ 97,122	$ 103,872	$ 109,241	$ 114,859	$ 120,737	$ 126,885
Field Service Techs	6,000	10,350	14,997	21,066	26,393	27,317	29,502	30,535	32,920	34,072	36,676	37,959	40,799	42,227	45,323	46,910	50,286	52,046	55,725	57,675
Lead Worker + Supervisor	3,000	4,140	5,356	6,652	9,180	9,501	9,834	10,178	10,534	10,903	11,285	13,140	13,600	14,076	14,568	15,078	15,606	16,152	18,575	19,225
Total M&S	$ 23,000	$ 36,225	$ 53,561	$ 72,067	$ 92,949	$ 97,390	$ 103,257	$ 108,144	$ 114,562	$ 119,935	$ 126,954	$ 134,317	$ 142,040	$ 148,576	$ 157,013	$ 165,860	$ 175,133	$ 183,057	$ 195,036	$ 203,785
Contract Services																				
Readers	$ 1,400	$ 2,174	$ 3,321	$ 4,435	$ 5,738	$ 6,057	$ 6,392	$ 6,743	$ 7,111	$ 7,496	$ 7,899	$ 8,322	$ 8,764	$ 9,227	$ 9,712	$ 10,387	$ 10,924	$ 11,486	$ 12,074	$ 12,689
Field Service Techs	600	1,035	1,500	2,107	2,639	2,732	2,950	3,053	3,292	3,407	3,668	3,796	4,080	4,223	4,532	4,691	5,029	5,205	5,572	5,768
Lead Worker + Supervisor	300	414	536	665	918	950	983	1,018	1,053	1,090	1,128	1,314	1,360	1,408	1,457	1,508	1,561	1,615	1,857	1,923
Total Contract Services	$ 2,300	$ 3,623	$ 5,356	$ 7,207	$ 9,295	$ 9,739	$ 10,326	$ 10,814	$ 11,456	$ 11,993	$ 12,695	$ 13,432	$ 14,204	$ 14,858	$ 15,701	$ 16,586	$ 17,513	$ 18,306	$ 19,504	$ 20,379
Vehicles (Fuel + Maintenance)																				
Readers	$ 56,000	$ 87,780	$ 135,411	$ 182,587	$ 238,504	$ 254,221	$ 270,870	$ 288,503	$ 307,174	$ 326,941	$ 347,865	$ 370,010	$ 393,444	$ 418,238	$ 444,467	$ 479,950	$ 509,637	$ 541,024	$ 574,204	$ 609,275
Field Service Techs	24,000	41,800	61,153	86,729	109,712	114,649	125,017	130,643	142,210	148,610	161,509	168,777	183,155	191,397	207,418	216,752	234,595	245,152	265,017	276,943
Lead Worker + Supervisor	12,000	16,720	21,841	27,388	38,161	39,878	41,672	43,548	45,507	47,555	49,695	58,423	61,052	63,799	66,670	69,670	72,805	76,082	88,339	92,314
Total Fuel	$ 92,000	$ 146,300	$ 218,405	$ 296,703	$ 386,376	$ 408,748	$ 437,559	$ 462,693	$ 494,891	$ 523,105	$ 559,069	$ 597,210	$ 637,651	$ 673,435	$ 718,555	$ 766,372	$ 817,038	$ 862,258	$ 927,561	$ 978,533
Insurance																				
Readers	$ 14,000	$ 22,050	$ 34,178	$ 46,305	$ 60,775	$ 65,090	$ 69,685	$ 74,576	$ 79,783	$ 85,323	$ 91,218	$ 97,489	$ 104,160	$ 111,253	$ 118,796	$ 128,894	$ 137,521	$ 146,689	$ 156,430	$ 166,779
Field Service Techs	6,000	10,500	15,435	21,995	27,957	29,354	32,162	33,770	36,936	38,783	42,351	44,469	48,488	50,913	55,438	58,210	63,303	66,469	72,199	75,809
Lead Worker + Supervisor	3,000	4,200	5,513	6,946	9,724	10,210	10,721	11,257	11,820	12,411	13,031	15,393	16,163	16,971	17,819	18,710	19,646	20,628	24,066	25,270
Total Insurance	23,000	36,750	55,125	75,246	98,456	104,655	112,568	119,604	128,539	136,517	146,601	157,351	168,810	179,137	192,053	205,814	220,470	233,786	252,695	267,857
Misc.																				
Readers	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Field Service Techs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead Worker + Supervisor	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Miscellaneous	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Meter Reading Equipment Maintenance																				
Hand-held	$ 5,040	$ 7,749	$ 11,473	$ 15,076	$ 19,471	$ 20,275	$ 21,106	$ 22,300	$ 23,198	$ 24,128	$ 25,090	$ 26,452	$ 27,490	$ 28,563	$ 29,672	$ 31,631	$ 32,837	$ 34,084	$ 35,810	$ 37,153
Software	1,000	1,025	1,051	1,077	1,104	1,131	1,160	1,189	1,218	1,249	1,280	1,312	1,345	1,379	1,413	1,448	1,485	1,522	1,560	1,599
Total Annual Meter Reading Budget																				
Readers	$ 638,649	$ 992,677	$ 1,518,483	$ 2,030,358	$ 2,629,979	$ 2,779,886	$ 2,937,244	$ 3,102,398	$ 3,275,711	$ 3,457,563	$ 3,648,348	$ 3,848,481	$ 4,058,394	$ 4,278,538	$ 4,509,385	$ 4,829,321	$ 5,085,912	$ 5,354,857	$ 5,636,722	$ 5,932,098
Field Service Techs	319,384	551,496	799,937	1,124,789	1,410,715	1,461,631	1,580,245	1,637,314	1,767,148	1,831,006	1,973,080	2,044,423	2,199,846	2,279,439	2,449,418	2,538,098	2,723,948	2,822,632	3,025,785	3,135,477
Lead Worker + Supervisor	189,328	257,828	331,010	409,125	561,039	581,214	602,121	623,785	646,235	669,500	693,608	806,474	835,533	865,648	896,857	929,200	962,720	997,459	1,146,096	1,187,479
Facilities Rent	116,000	120,060	124,262	128,611	133,113	137,772	142,594	147,584	152,750	158,096	163,629	169,356	175,284	181,419	187,769	194,340	201,142	208,182	215,469	223,010
Reading Equipment Maintenance	6,040	8,774	12,523	16,153	20,575	21,406	22,266	23,488	24,417	25,377	26,370	27,764	28,834	29,941	31,085	33,079	34,322	35,606	37,369	38,751
Meter Reading Operating Budget	$ 1,269,401	$ 1,930,835	$ 2,786,215	$ 3,709,037	$ 4,755,420	$ 4,981,910	$ 5,284,469	$ 5,534,570	$ 5,866,261	$ 6,141,541	$ 6,505,035	$ 6,896,499	$ 7,297,891	$ 7,634,985	$ 8,074,514	$ 8,524,039	$ 9,008,045	$ 9,418,737	$ 10,061,441	$ 10,516,815
Customer Service Related																				
Total Customer Service	$ 1,830,155	$ 2,932,763	$ 4,450,776	$ 6,074,055	$ 7,808,200	$ 8,235,032	$ 8,685,206	$ 9,160,014	$ 9,660,742	$ 10,188,820	$ 10,745,759	$ 11,333,148	$ 11,952,667	$ 12,606,085	$ 13,295,170	$ 14,021,981	$ 14,788,486	$ 15,596,861	$ 16,449,508	$ 17,348,740
Total Reading + Techs + Cust. Serv.	$ 3,099,556	$ 4,863,598	$ 7,236,991	$ 9,783,091	$ 12,563,620	$ 13,216,942	$ 13,969,675	$ 14,694,584	$ 15,527,003	$ 16,330,362	$ 17,250,794	$ 18,229,647	$ 19,250,558	$ 20,241,070	$ 21,369,685	$ 22,546,021	$ 23,796,531	$ 25,015,598	$ 26,510,949	$ 27,865,555

City of Fresno
Meter Reading Feasibility 20-Year Planning Horizon Model Monthly
4-Year Deployment
Manual Read
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Operating Cost per Read																				
Regular Meter Read	$1.75	$1.75	$1.83	$1.86	$1.93	$2.01	$2.08	$2.16	$2.24	$2.32	$2.40	$2.48	$2.57	$2.66	$2.75	$2.89	$2.99	$3.08	$3.19	$3.29
Field Service Read	$7.77	$8.66	$8.57	$9.14	$9.23	$9.38	$9.95	$10.12	$10.72	$10.90	$11.53	$11.72	$12.38	$12.58	$13.27	$13.49	$14.21	$14.45	$15.20	$15.46
Regular + Field Service	$3.12	$3.07	$3.02	$3.05	$3.14	$3.23	$3.37	$3.46	$3.60	$3.70	$3.84	$4.00	$4.15	$4.26	$4.42	$4.58	$4.75	$4.88	$5.11	$5.24
Reg + Field Serv. + Cust. Serv.	$7.62	$7.72	$7.84	$8.04	$8.31	$8.58	$8.90	$9.18	$9.52	$9.83	$10.19	$10.57	$10.95	$11.30	$11.71	$12.12	$12.56	$12.95	$13.47	$13.90
Capital Items																				
Meters and Pits																				
Meters to be Installed	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Pits to be Installed	(0)	12,713	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Vehicles																				
Vehicles Req'd	23	35	50	65	81	82	84	85	87	88	90	92	94	95	97	99	101	102	105	106
Vehicles in Service	13	23	35	50	65	81	82	84	85	87	88	90	92	94	95	97	99	101	102	105
New Vehicles (Retirements)	10	12	15	15	16	1	2	1	2	1	2	2	2	1	2	2	2	1	3	1
Potential In-Service Replacement	2	2	2	2	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Potential Vehicle Replacements					-	-	-	12	14	17	17	18	3	3	13	16	18	19	20	5
New Vehicle Purchases	12	14	17	17	18	3	3	13	16	18	19	20	5	4	15	18	20	20	23	6
Vehicle Retirements	2	2	2	2	2	2	1	12	14	17	17	18	3	3	13	16	18	19	20	5
Reading Equipment																				
# of Handhelds (1/Meter Read)	14	21	31	40	50	51	52	53	54	55	56	57	58	59	60	62	63	64	65	66
# of Spare Handhelds	4	6	8	10	13	13	13	14	14	14	14	15	15	15	15	16	16	16	17	17
Purchases (Retirements)	18	9	12	11	13	1	1	2	1	1	1	2	1	1	1	3	1	1	2	1
Potential Replacements					-	18	9	12	11	13	19	10	14	12	14	20	12	15	13	15
Purchases + Replacements	18	9	12	11	13	19	10	14	12	14	20	12	15	13	15	23	13	16	15	16
# of Pocket Pro (1/Field Service)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
# of Spare Pocket Pro	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Purchases (Retirements)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Calculated Replacements					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Purchases + Replacements					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lenses (Not used in this model)																				
Years to Replace Existing Lenses	4																			
Lenses Replaced/Year	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Cummulative Replaced	30,465	47,168	69,161	91,194	113,265	115,417	117,610	119,845	122,122	124,442	126,806	129,215	131,670	134,172	136,721	139,319	141,966	144,663	147,412	150,213
New Services Installed	-	1,996	2,034	2,073	2,112	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Total Lenses Installed & Replaced	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Cummulative Replaced & Installed	30,465	47,168	69,161	91,194	113,265	115,417	117,610	119,845	122,122	124,442	126,806	129,215	131,670	134,172	136,721	139,319	141,966	144,663	147,412	150,213
Lens Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Installation Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

City of Fresno
Meter Reading Feasibility 20-Year Planning Horizon Model Monthly
4-Year Deployment
Manual Read
(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Capital Budget (to be Borrowed)																				
Meters Installed	$ 2,132,516	$ 1,198,439	$ 1,617,484	$ 1,660,861	$ 1,705,396	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Pits & Boxes Installed	$ -	$ 4,886,552	$ 8,665,095	$ 8,897,472	$ 9,136,052	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Program Management	$ 304,645	$ 167,030	$ 219,935	$ 220,325	$ 220,715	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Vehicle Purchases (Retirements)	$ 199,143	$ 241,303	$ 304,381	$ 315,034	$ 345,568	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Reading Equipment Purchases (Ret.)																				
Handhelds	$ 50,400	$ 25,830	$ 35,301	$ 33,168	$ 40,179	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Pocket Pro	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Lens	-	-	-	-	-	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Capital Budget	$ 2,686,704	$ 6,519,154	$ 10,842,197	$ 11,126,861	$ 11,447,911	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Debt Service Payments	$3,566,650	$3,566,650	$3,566,650	$3,566,650	$3,566,650	$3,566,650	$3,566,650	$3,566,650	$3,566,650	$3,566,650	$3,566,650	$3,566,650	$3,566,650	$3,566,650	$3,566,650	$3,566,650	$3,566,650	$3,566,650	$3,566,650	$3,566,650
Capital Budget (out of Pocket)																				
Meters Installed	$ -	$ -	$ -	$ -	$ -	170,435	178,025	185,970	194,201	202,815	211,828	221,257	231,119	241,432	252,117	263,388	275,064	287,266	300,125	313,447
Pits & Boxes Installed	$ -	$ -	$ -	$ -	$ -	913,046	953,703	996,267	1,040,364	1,086,511	1,134,795	1,185,306	1,238,138	1,293,388	1,350,626	1,411,004	1,473,557	1,538,927	1,607,813	1,679,182
Vehicle Purchases (Retirements)	$ -	$ -	$ -	$ -	$ -	54,803	59,707	244,096	313,401	360,778	397,386	432,568	117,432	94,954	361,663	447,557	513,755	527,378	636,057	172,750
Reading Equipment Purchases (Ret.)																				
Handhelds	$ -	$ -	$ -	$ -	$ -	60,191	32,471	46,596	40,938	48,955	71,685	44,086	56,485	50,178	59,345	93,270	54,036	68,168	65,506	71,620
Pocket Pro	$ -	$ -	$ -	$ -	$ -	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lens	$ -	$ -	$ -	$ -	$ -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Capital Budget	$ -	$ -	$ -	$ -	$ -	$ 1,198,476	$ 1,223,906	$ 1,472,929	$ 1,588,904	$ 1,699,060	$ 1,815,694	$ 1,883,218	$ 1,643,174	$ 1,679,953	$ 2,023,751	$ 2,215,220	$ 2,316,413	$ 2,421,740	$ 2,609,501	$ 2,237,000
Total Budget (Operating + Capital)	$ 3,956,105	$ 8,449,989	$ 13,628,412	$ 14,835,898	$ 16,203,331	$ 4,981,910	$ 5,284,469	$ 5,534,570	$ 5,866,261	$ 6,141,541	$ 6,505,035	$ 6,896,499	$ 7,297,891	$ 7,634,985	$ 8,074,514	$ 8,524,039	$ 9,008,045	$ 9,418,737	$ 10,061,441	$ 10,516,815
Does Not Include Customer Service or Debt Service																				
Long-Term Budget	4,836,050	5,497,484	6,352,865	7,275,686	8,322,070	9,747,035	10,075,024	10,574,149	11,021,815	11,407,251	11,887,379	12,346,366	12,507,715	12,881,588	13,664,915	14,305,909	14,891,107	15,407,126	16,237,592	16,320,464
Includes Debt Service, Capital Out of Pocket and Operating Costs)																				
NPV Annually	$ 4,562,312	$ 4,892,742	$ 5,333,988	$ 5,763,025	$ 6,218,735	$ 6,871,275	$ 6,700,467	$ 6,634,352	$ 6,523,795	$ 6,369,749	$ 6,262,123	$ 6,135,766	$ 5,864,105	$ 5,697,539	$ 5,701,892	$ 5,631,468	$ 5,530,027	$ 5,397,791	$ 5,366,735	$ 5,088,798
Total Capital	$ 42,622,827																			
Total Operating Budget (thru deployment)	$ 14,450,908																			
Total Capital	$ 42,622,827																			
Total Deployment	$ 57,073,735																			
Total Debt Service (20 years)	$ 71,332,992																			
Long-Term Cost																				
Total Debt Service	$ 71,332,992																			
Total Operating Budget (20 years)	$ 126,197,662																			
Total Out of Pocket Capital	$ 28,028,937																			
Total Long-Term Cost	$ 225,559,591																			
Net Present Value																				
Discount Rate	6.0%																			
NPV Capital	$34,808,029																			
NPV Deployment	$53,843,146																			
NPV Long-Term Cost	$ 116,546,683																			
Total Cost per Read	$ 11.89	$ 8.73	$ 6.88	$ 5.98	$ 5.50	$ 6.33	$ 6.42	$ 6.61	$ 6.76	$ 6.87	$ 7.02	$ 7.16	$ 7.12	$ 7.19	$ 7.49	$ 7.69	$ 7.86	$ 7.98	$ 8.25	$ 8.14

NPV	
total debt service	$40,909,190
operating budget	$62,774,372
out of pocket capital	$12,863,120

City of Fresno

Meter Reading Feasibility 20-Year Planning Horizon Model Monthly

4-Year Deployment

Model Inputs

(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Meters																				
Growth Factor		1.9%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%
Total Meter Accounts	105,050	107,046	109,080	111,153	113,265	115,417	117,610	119,845	122,122	124,442	126,806	129,215	131,670	134,172	136,721	139,319	141,966	144,663	147,412	150,213
Meters Installed at Year End	30,465	47,168	69,161	91,194	113,265	115,417	117,610	119,845	122,122	124,442	126,806	129,215	131,670	134,172	136,721	139,319	141,966	144,663	147,412	150,213
Pits & Boxes Installed Annually	(0)	12,713	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Meters Installed Annually	30,465	16,703	21,994	22,033	22,072	2,152	2,193	2,235	2,277	2,320	2,364	2,409	2,455	2,502	2,549	2,598	2,647	2,697	2,749	2,801
Read Frequency (Monthly % of Meters)																				
Manual	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%	100.0%	100.0%
Touch Read	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%	100.0%	100.0%
Mobile Drive-by	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%	100.0%	100.0%
Fixed Radio	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%	100.0%	100.0%
Read Frequency (Bi-monthly % of Meters)																				
Manual	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%	0.0%	0.0%	0.0%
Touch Read	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%	0.0%	0.0%	0.0%
Mobile Drive-by	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%	0.0%	0.0%	0.0%
Fixed Radio	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%	0.0%	0.0%	0.0%
Field Service Visits																				
Customer Service/Billing (% of Reads)	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%
Final Reads (% of Meters)	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%
Reading and Field Visit Productivity																				
Meter Reading																				
Manual Read Days per Week	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Touch Read Days per Week	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Mobile Drive-by Days per Week	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Fixed Radio Days per Week	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Manual Reads per Day	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160
Touch Reads per Day	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320
Mobile Drive-by Reads per Day	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000
Mobile Drive-by Rounding Factor	0.25	Any mobile drive-by unit calculation greater than				0.25	will round up to the next integer													
Meters per Meter Reader (Fixed)	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
Field Visits																				
Manual Read Days per Week	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Touch Read Days per Week	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Mobile Drive-by Days per Week	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Fixed Radio Days per Week	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Manual Read Visits per Day	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Touch Read Visits per Day	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35
Mobile Drive-by Visits per Day	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
Meters/Field Service (Drive + Fixed)	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000
Reading and Field Visit Paid Time Off																				
Meter Reading + Field Service																				
Holidays/Year	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Vacation Days/Year (avg.)	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Sick Days/Year (avg.)	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Lead Worker																				
Holidays/Year	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Vacation Days/Year	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Sick Days/Year	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Readers Rounding factor	0.40	Any personnel calculation greater than or equal to				0.40	will round up to the next integer													
Field Service Tech Rounding factor	0.40	Any personnel calculation greater than or equal to				0.40	will round up to the next integer													
Lead Worker Rounding factor	0.50	Any personnel calculation greater than or equal to				0.50	will round up to the next integer													

City of Fresno

Meter Reading Feasibility 20-Year Planning Horizon Model Monthly

4-Year Deployment

Model Inputs

(Updated: September 17, 2007)

	2008 Year 1	2009 Year 2	2010 Year 3	2011 Year 4	2012 Year 5	2013 Year 6	2014 Year 7	2015 Year 8	2016 Year 9	2017 Year 10	2018 Year 11	2019 Year 12	2020 Year 13	2021 Year 14	2022 Year 15	2023 Year 16	2024 Year 17	2025 Year 18	2026 Year 19	2027 Year 20
Operating Expenses																				
Meter Related																				
Salary																				
Growth Factor (Inflation)		3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Paid Hours per Year	2,080	2,080	2,080	2,080	2,080	2,080	2,080	2,080	2,080	2,080	2,080	2,080	2,080	2,080	2,080	2,080	2,080	2,080	2,080	2,080
Meter Readers Hourly Rate (avg.)	$15.50	$16.04	$16.60	$17.19	$17.79	$18.41	$19.05	$19.72	$20.41	$21.12	$21.86	$22.63	$23.42	$24.24	$25.09	$25.97	$26.88	$27.82	$28.79	$29.80
Field Service Tech Hourly Rate (avg.)	$18.50	$19.15	$19.82	$20.51	$21.23	$21.97	$22.74	$23.54	$24.36	$25.21	$26.10	$27.01	$27.95	$28.93	$29.95	$30.99	$32.08	$33.20	$34.36	$35.57
Read & FS Benefits Multiplier	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22
Loaded Meter Reading Rate	$18.91	$19.57	$20.26	$20.97	$21.70	$22.46	$23.25	$24.06	$24.90	$25.77	$26.67	$27.61	$28.57	$29.57	$30.61	$31.68	$32.79	$33.94	$35.13	$36.35
Loaded Field Service Tech Rate	$22.57	$23.36	$24.18	$25.02	$25.90	$26.81	$27.74	$28.72	$29.72	$30.76	$31.84	$32.95	$34.10	$35.30	$36.53	$37.81	$39.14	$40.51	$41.92	$43.39
Lead Worker Hourly Rate	$20.97	$21.70	$22.46	$23.25	$24.06	$24.91	$25.78	$26.68	$27.61	$28.58	$29.58	$30.62	$31.69	$32.80	$33.94	$35.13	$36.36	$37.63	$38.95	$40.31
Lead Worker Benefits Multiplier	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22
Lead Worker Loaded Hourly Rate	$25.58	$26.48	$27.41	$28.36	$29.36	$30.39	$31.45	$32.55	$33.69	$34.87	$36.09	$37.35	$38.66	$40.01	$41.41	$42.86	$44.36	$45.91	$47.52	$49.18
Supervisor Collections Section	$63,851.00	$66,085.79	$68,398.79	$70,792.75	$73,270.49	$75,834.96	$78,489.18	$81,236.30	$84,079.57	$87,022.36	$90,068.14	$93,220.53	$96,483.24	$99,860.16	$103,355.26	$106,972.70	$110,716.74	$114,591.83	$118,602.54	$122,753.63
FTE/Lead Worker	11																			
Supervisor Collections	1																			
Education																				
Growth Factor (Inflation)		4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
Meter Readers $/FTE	$185.00	$192.40	$200.10	$208.10	$216.42	$225.08	$234.08	$243.45	$253.19	$263.31	$273.85	$284.80	$296.19	$308.04	$320.36	$333.17	$346.50	$360.36	$374.78	$389.77
Field Service Techs $/FTE	$185.00	$192.40	$200.10	$208.10	$216.42	$225.08	$234.08	$243.45	$253.19	$263.31	$273.85	$284.80	$296.19	$308.04	$320.36	$333.17	$346.50	$360.36	$374.78	$389.77
Lead Worker + Super. $/FTE	$250.00	$260.00	$270.40	$281.22	$292.46	$304.16	$316.33	$328.98	$342.14	$355.83	$370.06	$384.86	$400.26	$416.27	$432.92	$450.24	$468.25	$486.98	$506.45	$526.71
Material & Supplies																				
Growth Factor (Inflation)		3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Meter Readers $/FTE	$1,000.00	$1,035.00	$1,071.23	$1,108.72	$1,147.52	$1,187.69	$1,229.26	$1,272.28	$1,316.81	$1,362.90	$1,410.60	$1,459.97	$1,511.07	$1,563.96	$1,618.69	$1,675.35	$1,733.99	$1,794.68	$1,857.49	$1,922.50
Field Service Techs $/FTE	$1,000.00	$1,035.00	$1,071.23	$1,108.72	$1,147.52	$1,187.69	$1,229.26	$1,272.28	$1,316.81	$1,362.90	$1,410.60	$1,459.97	$1,511.07	$1,563.96	$1,618.69	$1,675.35	$1,733.99	$1,794.68	$1,857.49	$1,922.50
Lead Worker + Super. $/FTE	$1,000.00	$1,035.00	$1,071.23	$1,108.72	$1,147.52	$1,187.69	$1,229.26	$1,272.28	$1,316.81	$1,362.90	$1,410.60	$1,459.97	$1,511.07	$1,563.96	$1,618.69	$1,675.35	$1,733.99	$1,794.68	$1,857.49	$1,922.50
Contract Services																				
Growth Factor (Inflation)		3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Meter Readers $/FTE	$100.00	$103.50	$107.12	$110.87	$114.75	$118.77	$122.93	$127.23	$131.68	$136.29	$141.06	$146.00	$151.11	$156.40	$161.87	$167.53	$173.40	$179.47	$185.75	$192.25
Field Service Techs $/FTE	$100.00	$103.50	$107.12	$110.87	$114.75	$118.77	$122.93	$127.23	$131.68	$136.29	$141.06	$146.00	$151.11	$156.40	$161.87	$167.53	$173.40	$179.47	$185.75	$192.25
Lead Worker + Super. $/FTE	$100.00	$103.50	$107.12	$110.87	$114.75	$118.77	$122.93	$127.23	$131.68	$136.29	$141.06	$146.00	$151.11	$156.40	$161.87	$167.53	$173.40	$179.47	$185.75	$192.25
Vehicle Fuel + Maint.																				
Growth Factor (Inflation)		4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%
Meter Readers $/FTE	$4,000.00	$4,180.00	$4,368.10	$4,564.66	$4,770.07	$4,984.73	$5,209.04	$5,443.45	$5,688.40	$5,944.38	$6,211.88	$6,491.41	$6,783.53	$7,088.78	$7,407.78	$7,741.13	$8,089.48	$8,453.51	$8,833.92	$9,231.44
Field Service Techs $/FTE	$4,000.00	$4,180.00	$4,368.10	$4,564.66	$4,770.07	$4,984.73	$5,209.04	$5,443.45	$5,688.40	$5,944.38	$6,211.88	$6,491.41	$6,783.53	$7,088.78	$7,407.78	$7,741.13	$8,089.48	$8,453.51	$8,833.92	$9,231.44
Lead Worker + Super. $/FTE	$4,000.00	$4,180.00	$4,368.10	$4,564.66	$4,770.07	$4,984.73	$5,209.04	$5,443.45	$5,688.40	$5,944.38	$6,211.88	$6,491.41	$6,783.53	$7,088.78	$7,407.78	$7,741.13	$8,089.48	$8,453.51	$8,833.92	$9,231.44
Insurance																				
Growth Factor (Inflation)		5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
Meter Readers $/FTE	$1,000.00	$1,050.00	$1,102.50	$1,157.63	$1,215.51	$1,276.28	$1,340.10	$1,407.10	$1,477.46	$1,551.33	$1,628.89	$1,710.34	$1,795.86	$1,885.65	$1,979.93	$2,078.93	$2,182.87	$2,292.02	$2,406.62	$2,526.95
Field Service Techs $/FTE	$1,000.00	$1,050.00	$1,102.50	$1,157.63	$1,215.51	$1,276.28	$1,340.10	$1,407.10	$1,477.46	$1,551.33	$1,628.89	$1,710.34	$1,795.86	$1,885.65	$1,979.93	$2,078.93	$2,182.87	$2,292.02	$2,406.62	$2,526.95
Lead Worker + Super. $/FTE	$1,000.00	$1,050.00	$1,102.50	$1,157.63	$1,215.51	$1,276.28	$1,340.10	$1,407.10	$1,477.46	$1,551.33	$1,628.89	$1,710.34	$1,795.86	$1,885.65	$1,979.93	$2,078.93	$2,182.87	$2,292.02	$2,406.62	$2,526.95
Misc.																				
Growth Factor (Inflation)		3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Meter Readers $/FTE	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Field Service Techs $/FTE	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Lead Worker + Super. $/FTE	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00

City of Fresno

Meter Reading Feasibility 20-Year Planning Horizon Model Monthly

4-Year Deployment

Model Inputs

(Updated: September 17, 2007)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Facilities Rent	$116,000.00	$120,060.00	$124,262.10	$128,611.27	$133,112.67	$137,771.61	$142,593.62	$147,584.39	$152,749.85	$158,096.09	$163,629.46	$169,356.49	$175,283.96	$181,418.90	$187,768.56	$194,340.46	$201,142.38	$208,182.36	$215,468.75	$223,010.15
Meter Reading Equipment Maintenance																				
Growth Factor (Inflation)		2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
Touch Read Hand-held	$280.00	$287.00	$294.18	$301.53	$309.07	$316.79	$324.71	$332.83	$341.15	$349.68	$358.42	$367.38	$376.57	$385.98	$395.63	$405.52	$415.66	$426.05	$436.70	$447.62
Mobile Hand-held	$450.00	$461.25	$472.78	$484.60	$496.72	$509.13	$521.86	$534.91	$548.28	$561.99	$576.04	$590.44	$605.20	$620.33	$635.84	$651.73	$668.03	$684.73	$701.85	$719.39
Drive-by	$1,000.00	$1,025.00	$1,050.63	$1,076.89	$1,103.81	$1,131.41	$1,159.69	$1,188.69	$1,218.40	$1,248.86	$1,280.08	$1,312.09	$1,344.89	$1,378.51	$1,412.97	$1,448.30	$1,484.51	$1,521.62	$1,559.66	$1,598.65
Collectors	$200.00	$205.00	$210.13	$215.38	$220.76	$226.28	$231.94	$237.74	$243.68	$249.77	$256.02	$262.42	$268.98	$275.70	$282.59	$289.66	$296.90	$304.32	$311.93	$319.73
Touch and Mobile Software	$1,000.00	$1,025.00	$1,050.63	$1,076.89	$1,103.81	$1,131.41	$1,159.69	$1,188.69	$1,218.40	$1,248.86	$1,280.08	$1,312.09	$1,344.89	$1,378.51	$1,412.97	$1,448.30	$1,484.51	$1,521.62	$1,559.66	$1,598.65
Fixed Software	$2,000.00	$2,050.00	$2,101.25	$2,153.78	$2,207.63	$2,262.82	$2,319.39	$2,377.37	$2,436.81	$2,497.73	$2,560.17	$2,624.17	$2,689.78	$2,757.02	$2,825.95	$2,896.60	$2,969.01	$3,043.24	$3,119.32	$3,197.30
Installation Programmers	$250.00	$256.25	$262.66	$269.22	$275.95	$282.85	$289.92	$297.17	$304.60	$312.22	$320.02	$328.02	$336.22	$344.63	$353.24	$362.07	$371.13	$380.40	$389.91	$399.66
Customer Service Related																				
Growth Factor		3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Cost per Read	$ 4.50	$ 4.66	$ 4.82	$ 4.99	$ 5.16	$ 5.34	$ 5.53	$ 5.73	$ 5.93	$ 6.13	$ 6.35	$ 6.57	$ 6.80	$ 7.04	$ 7.28	$ 7.54	$ 7.80	$ 8.08	$ 8.36	$ 8.65
Capital Related																				
Vehicles																				
Current Vehicles in Service	13																			
Currnet Vehicle Replacement Factor	2.00	vehicles per year																		
Cost Growth Factor		3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Vehicle Cost	$17,000	$17,595	$18,211	$18,848	$19,508	$20,191	$20,897	$21,629	$22,386	$23,169	$23,980	$24,819	$25,688	$26,587	$27,518	$28,481	$29,478	$30,509	$31,577	$32,683
Vehicle Life in Years	7	**Inputs restricted to values of 4 to 10 years**																		
Reading Equipment																				
Cost Growth Factor		2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
Touch Pad Handheld Cost	$2,800	$2,870	$2,942	$3,015	$3,091	$3,168	$3,247	$3,328	$3,412	$3,497	$3,584	$3,674	$3,766	$3,860	$3,956	$4,055	$4,157	$4,261	$4,367	$4,476
Touch Pad Handheld Life	5	**Inputs restricted to values of 4 to 10 years**																		
Touch Pad Pocket Pro Cost	$400	$410	$420	$431	$442	$453	$464	$475	$487	$500	$512	$525	$538	$551	$565	$579	$594	$609	$624	$639
Touch Pad Pocket Pro Life	5	**Inputs restricted to values of 4 to 10 years**																		
Mobile Handheld Cost	$4,500	$4,613	$4,728	$4,846	$4,967	$5,091	$5,219	$5,349	$5,483	$5,620	$5,760	$5,904	$6,052	$6,203	$6,358	$6,517	$6,680	$6,847	$7,018	$7,194
Mobile Handheld Life	5	**Inputs restricted to values of 4 to 10 years**																		
Handheld Spares % of FTE	25%																			
Touch Spare for Mobile and Fixed	1																			
Installation Programmer Cost	$2,500	$2,563	$2,627	$2,692	$2,760	$2,829	$2,899	$2,972	$3,046	$3,122	$3,200	$3,280	$3,362	$3,446	$3,532	$3,621	$3,711	$3,804	$3,899	$3,997
Installation Programmer Life	5	**Inputs restricted to values of 4 to 10 years**																		
Mobile Walk																				
System Computer	$2,500																			
Software and Training	$10,000																			
Total Mobile Walk Startup Cost	$12,500	$12,813	$13,133	$13,461	$13,798	$14,143	$14,496	$14,859	$15,230	$15,611	$16,001	$16,401	$16,811	$17,231	$17,662	$18,104	$18,556	$19,020	$19,496	$19,983
	6	**Inputs restricted to values of 4 to 10 years**																		
Drive-by																				
Mobile Collector	$ 30,000																			
System Computer	$ 2,500																			
Software and Training	$ 10,000																			
Total Drive-by Mobile Unit Cost	$ 42,500	$ 43,563	$ 44,652	$ 45,768	$ 46,912	$ 48,085	$ 49,287	$ 50,519	$ 51,782	$ 53,077	$ 54,404	$ 55,764	$ 57,158	$ 58,587	$ 60,051	$ 61,553	$ 63,091	$ 64,669	$ 66,285	$ 67,943
Drive-by Unit Life in Years	6	**Inputs restricted to values of 4 to 10 years**																		

City of Fresno

Meter Reading Feasibility 20-Year Planning Horizon Model Monthly

4-Year Deployment

Model Inputs

(Updated: September 17, 2007)

	2008 Year 1	2009 Year 2	2010 Year 3	2011 Year 4	2012 Year 5	2013 Year 6	2014 Year 7	2015 Year 8	2016 Year 9	2017 Year 10	2018 Year 11	2019 Year 12	2020 Year 13	2021 Year 14	2022 Year 15	2023 Year 16	2024 Year 17	2025 Year 18	2026 Year 19	2027 Year 20
Fixed Radio																				
Collector Units	40																			
Cost per Collector	$2,500																			
Network Control Computer	$40,000																			
Sotware and Training	$20,000																			
Fixed Unit Infrastructure Cost	$160,000	$164,000	$168,100	$172,303	$176,610	$181,025	$185,551	$190,190	$194,944	$199,818	$204,814	$209,934	$215,182	$220,562	$226,076	$231,728	$237,521	$243,459	$249,545	$255,784
Fixed Unit Infrastructure Life	20	**Inputs restricted to values of 5, 10, 15 & 20 years**																		
Touch Pad and MIU																				
Initial Replacement Time in Years	4	**year deployment**																		
Manual Read	4																			
Touch Read	4																			
Mobile Drive-by	4																			
Fixed Radio	4																			
Pad and MIU Cost																				
Manual Read Cost Growth Factor		2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
Lens Cost	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Touch Read Cost Growth Factor		2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
Touch Pad Cost	$15.00	$15.38	$15.76	$16.15	$16.56	$16.97	$17.40	$17.83	$18.28	$18.73	$19.20	$19.68	$20.17	$20.68	$21.19	$21.72	$22.27	$22.82	$23.39	$23.98
Mobile Drive-by Growth Factor		2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
Mobile Drive-by MIU Cost	$75.00	$76.88	$78.80	$80.77	$82.79	$84.86	$86.98	$89.15	$91.38	$93.66	$96.01	$98.41	$100.87	$103.39	$105.97	$108.62	$111.34	$114.12	$116.97	$119.90
Fixed Radio Growth Factor		2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
Fixed MIU Cost	$85.00	$87.13	$89.30	$91.54	$93.82	$96.17	$98.57	$101.04	$103.56	$106.15	$108.81	$111.53	$114.32	$117.17	$120.10	$123.11	$126.18	$129.34	$132.57	$135.89
Pad and MIU Installation Cost																				
Manual Read Cost Growth Factor		3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Lens Installation Cost	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Touch Read Cost Growth Factor		3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Touch Pad Installation Cost	$15.00	$15.53	$16.07	$16.63	$17.21	$17.82	$18.44	$19.08	$19.75	$20.44	$21.16	$21.90	$22.67	$23.46	$24.28	$25.13	$26.01	$26.92	$27.86	$28.84
Mobile Drive-by Growth Factor		3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Mobile Drive-by MIU Installation Cost	$15.00	$15.53	$16.07	$16.63	$17.21	$17.82	$18.44	$19.08	$19.75	$20.44	$21.16	$21.90	$22.67	$23.46	$24.28	$25.13	$26.01	$26.92	$27.86	$28.84
Fixed Radio Growth Factor		3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Fixed MIU Installation Cost	$15.00	$15.53	$16.07	$16.63	$17.21	$17.82	$18.44	$19.08	$19.75	$20.44	$21.16	$21.90	$22.67	$23.46	$24.28	$25.13	$26.01	$26.92	$27.86	$28.84
Meter and Pit Installation Cost																				
Meter Cost Growth Factor		2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
Meter Cost	$70.00	$71.75	$73.54	$75.38	$77.27	$79.20	$81.18	$83.21	$85.29	$87.42	$89.61	$91.85	$94.14	$96.50	$98.91	$101.38	$103.92	$106.51	$109.18	$111.91
Pit & Box Installation Growth Factor		2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
Pit & Box Installation Cost	$375.00	$384.38	$393.98	$403.83	$413.93	$424.28	$434.89	$445.76	$456.90	$468.32	$480.03	$492.03	$504.33	$516.94	$529.87	$543.11	$556.69	$570.61	$584.87	$599.49
Program Management	$10.00																			
Discount Rate	6.0%																			
Debt Service																				
Interest Rate	5.5%																			
Term years	20																			

Appendix D

Las Vegas Valley Water District Study

CASE STUDY: LAS VEGAS VALLEY WATER DISTRICT

By: Andy Kercher

The Las Vegas Valley Water District (LVVWD) is a not-for-profit agency that provides water to much of the Las Vegas Valley. Since 1998, the region has experienced an extraordinary level of development and growth in both the residential and business landscape.

An economic boom and unprecedented population growth has created a significant challenge for the area's water district. Over the last eight years, LVVWD has added approximately 2,000 water meters per month, which are largely located in outside meter boxes. Collecting data from each of these new meters, in addition to monitoring ongoing water conservation efforts, has placed a significant strain on the system and its employees. In order to keep up with the current, as well as pending growth, the District was forced to increase the number of employees to cover the developing areas, as well as address the potential for water shortages as people continue to move into the highly arid, desert region.

Finding a Solution in AMR Technology

As growth continued to mount, the LVVWD Board of Directors made a critical decision. Instead of focusing on increasing the size of its staff, the District would focus on key technologies that would lessen their dependency on new hires while concurrently providing a viable solution for the future development. After significant research and a thorough analysis, the LVVWD determined that Automatic Meter Reading (AMR) technology would offer the most practical and affordable solution for their needs.

"A cost/benefit analysis identified some $32,000,000 in direct hard cost savings over the life of the hardware with an additional $44,000,000 in related benefits to our Customer Service and Conservation Divisions," stated Meter Services Manager Mike Kebles. "The District's goal after full deployment is to reduce the number of manual meter readers from 25 to a Mobile Reading workforce of six."

To ensure the best technology was implemented, the LVVWD created an open bidding process for purchasing water meters. This gave the District a strong base of diverse meter manufacturers and types from across the country. After reviewing key research, the LVVWD determined that it would not be cost-effective to replace the recently installed straight-read units, without the electronic output needed for many AMR systems, because they were functioning accurately and reliably. This led to a directive that any new AMR products purchased by the District must be compatible with all existing brands and types of meters already deployed.

Over the course of several months, the LVVWD explored a large variety of AMR alternatives and concluded that Datamatic, an AMR manufacturer based in Plano, Texas, was the only supplier that could meet its AMR system criteria. "When considering the cost effectiveness of adding an AMR to an existing system, meter independence is often a critical factor," explained Datamatic President and CEO Ken Kercher. "We were able to help the LVWWD in two important ways. First, we provided the key product technology that limited the need to replace all of the District's new meters; Secondly, we provided them with the product and installation within their budget constraints."

What is AMR?

The LVVWD selected the unlicensed Datamatic FIREFLY® AMR system with mobile ROADRUNNER data collection hardware and software. The FIREFLY technology can read today's pulse and encoded registers and can optically recognize the passage of the sweep-hand on LVVWD's majority of standard meter registers.

"An added bonus of this system is its capability to store and provide water usage history profiles," noted Kebles. "The FIREFLY units are programmed to capture 74 days of hourly reads, giving the LVVWD the capability to analyze the data for leaks and other consumption anomalies."

Handheld and mobile computers are used to collect meter data during the transition from manual meter reading to AMR. Upon completion, all meters will be read using vehicle-mounted data collection units. The LVVWD has experienced minimal problems with radio reception of the meter data transmitted from within the meter boxes. Installation was outsourced to Datamatic to create single-source accountability for the overall operation of the AMR system, and Datamatic sub-contracted the installation of the AMR meter modules.

"Each mobile Meter Reading Route currently reads from 2,500 to 3,000 meters per day versus 600 manually," stated Kebles. "Manual Meter Reading Routes are being combined to form new larger AMR Routes, but the historical geographic design of the Routes has not been re-evaluated. The ultimate goal is 6,000 to 7,000 reads per mobile unit per day. Currently, 260,000 meters have been retrofitted since 2000, with an additional 125,000 meters scheduled to complete the project. Current rate of deployment is 2,500 meters per week."

"Once Datamatic had delivered the system to the LVVWD, its maintenance was handed over to the District's in-house staff," noted Andy Kercher, Datamatic Vice President. "The system is virtually self-sustaining and, to date, we know the District has experienced little operational problems with the equipment. An important point to emphasize is that the expected battery life of the FIREFLY units are between 10 to 15 years because of the low-power requirements of our optic technology.."

Overcoming Implementation Issues

The District experienced some initial "growing pains" when some FIREFLY electrical connections were not properly waterproofed. Scratched and dirty lenses also contributed to problems tuning the FIREFLY's optical sensors to address variable conditions of existing meter registers**.** However, these problems were easily remedied through a collaboration between the LVVWD and Datamatic**.**

In addition, a sub-contractor was chosen to install Datamatic's FIREFLY units, which led to some preliminary programming issues that were not addressed in a timely manner. The sub-contractor also experienced some difficulty in properly programming the units in the field with the meter reading of the meter. Datamatic, however, quickly overcame the issues by modifying the contract to offer clear incentives to correct the problem.

In addition, improved processes resolved some problems that occurred when meter data was outdated by the time the installation contractor arrived at the site of each meter to be retrofitted. This was due to interim meter exchanges occurring between the time the work orders were created and the time the work was performed.

Employees have been kept well informed of the progression of the AMR project and Meter Readers have responded by re-training to higher-level positions. Extensive communication has been focused on customers and response has generally been positive.

Best Practices

According to Kebles, utilities need to keep the following in mind:

- Collaboration between the utility and the AMR supplier is needed to fit the right technology to the organization, modify hardware and software as needed along the way, and work with meter manufacturers to optimize overall system performance. For example, the LVVWD and Datamatic are working together to upgrade the FIREFLY modules to be "self-provisioning" during installation. This will reduce the manual programming processes now required of the installation contractor. Further, installation would be significantly streamlined if meter suppliers installed the AMR modules during the manufacturing process, avoiding the need to retrofit the meters after delivery to the utility.

- Load profiling capability of the AMR system enables LVVWD employees to resolve customer-billing concerns by sharing graphs of hourly consumption to customers. In many cases this allows pinpointing of specific consumption events that represent leakage or other consumption anomalies.

- Critical success factors for AMR implementation are selection of the right AMR product to meet organization requirements, and hiring of the right contractors to perform implementation activities. In order to accomplish these objectives, the organization must know precisely what it is trying to achieve

and identify the specific data it needs to do that. During implementation, the most challenging task is data management and administration, both for meter inventory and work order tracking, as well as for meter reading data.

- Accountability for successful accomplishment of AMR implementation tasks is critical to project achievement. This was accomplished by LVVWD assigning responsibility for both meter reading and meter maintenance to a single manager.

Lessons Learned

The LVVWD and Datamatic worked closely with another to build and install an AMR system that empowers the District to manage its growth, improve productivity, streamline processes and improve customer service. The District's methodical approach will pay dividends for the city and its customers for decades to come.

Appendix E

Ascent Group White Paper

How Does Your Meter Reading Performance Compare?

What Does it Take to Be A "Best Performer"?

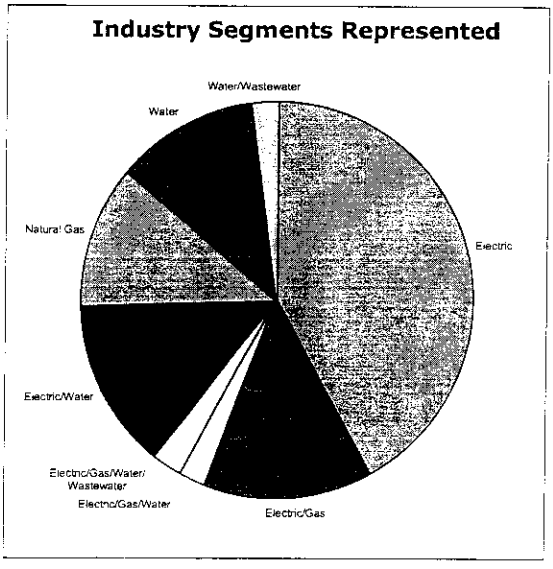
To better understand the state of utility meter reading, the Ascent Group conducted a benchmarking project to evaluate Meter Reading performance and practices. The main objective of the study was to evaluate the tactics and strategies used today to read customer meters and to identify best practices or opportunities for improvement. Secondary objectives included understanding:

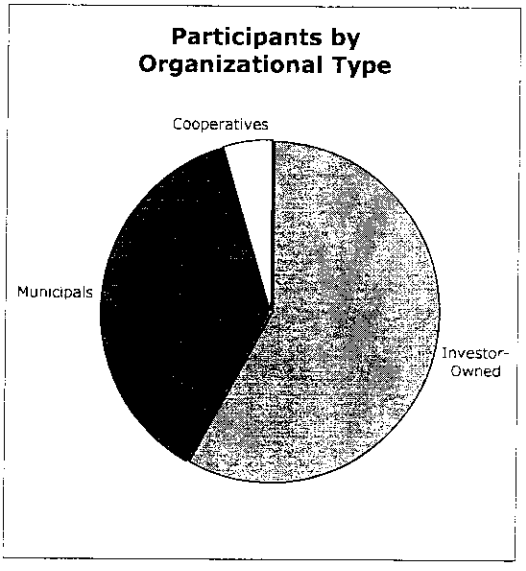
- The range of performance by utility and by industry segment;
- How utilities are using technology to reduce costs and improve performance;
- How utilities measure individual, team, and center-level performance and encourage high productivity and performance;
- The role of meter reading training and its impact on performance.
- Other effective process improvement or cost-reduction techniques;

Participants were asked to share any system or process improvements leading to a gain in performance. We also asked utilities to include considerations, successes, and plans moving forward.

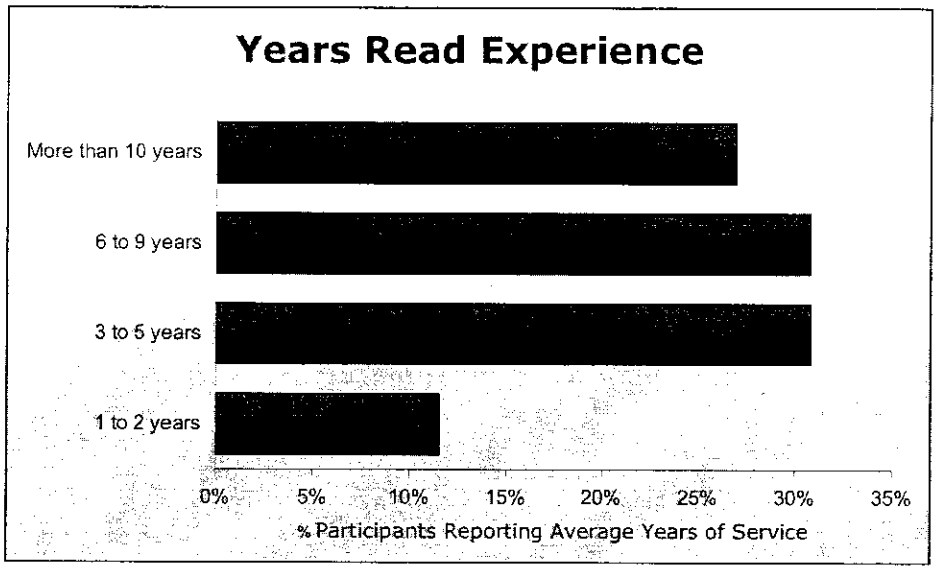
Panel Participants

Forty-seven utilities participated in the research. Study participants range in size from 3,750 meters to be read to as many as 4.5 million. Three-fourths of participants read less than the participant average of 722,000 meters per month. The majority of study participants were from the United States, however we did have two utilities from Canada. Nearly sixty percent of participants' meter readers are bargaining-unit represented.

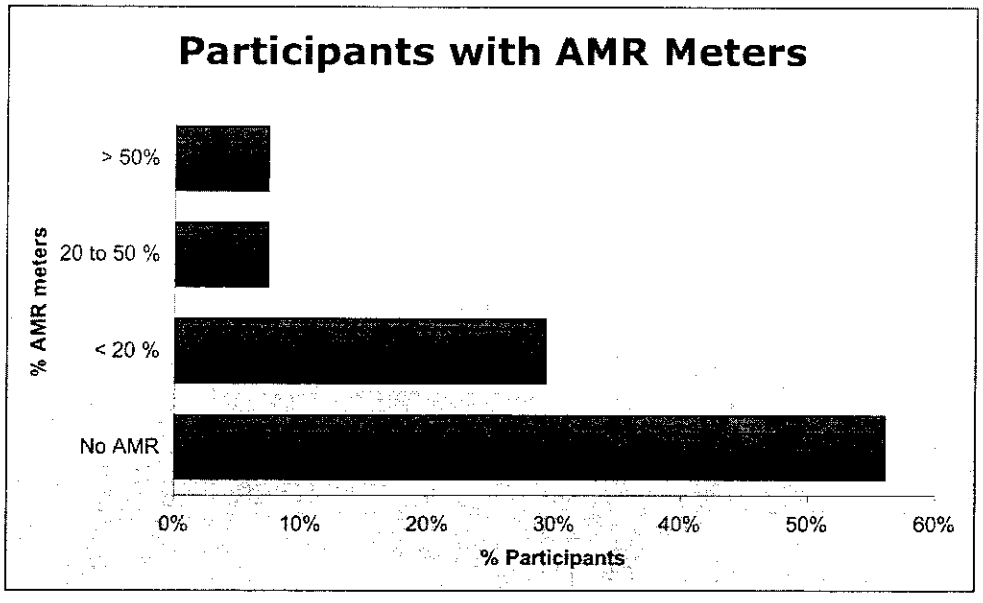




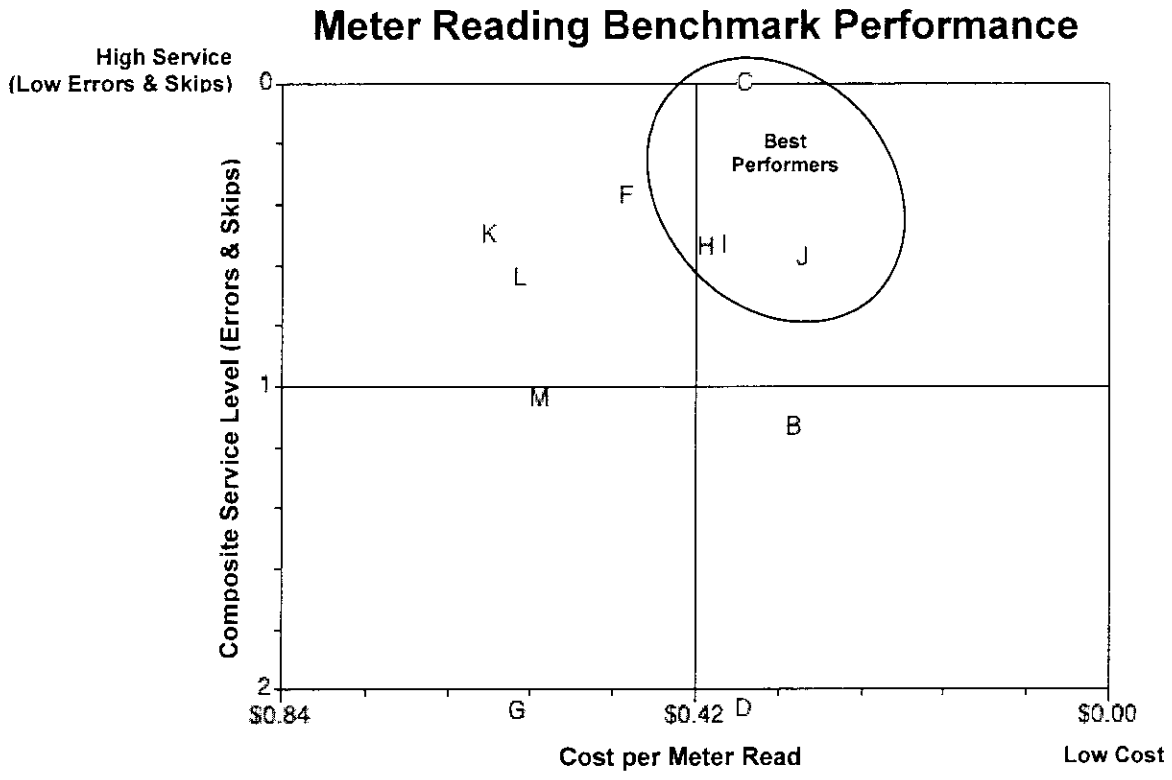
Average years of meter reading experience ranged from 1 to 20 years, with an average for the group of 7.5 years.



Natural Gas Utilities reported the highest percentage of AMR meters in our panel, followed by Electric Utilities. None of our Water/Wastewater utilities reported any meter reading automation. Fifteen utilities reported AMR installations, ranging from 1 percent of total meters to be read to 95 percent. As a group, panel participants reported an 8.3 percent AMR installation (total AMR meters divided by total meters).



Among our participant group, AMR maturity (years installed) ranges from 2 to 17 years. As a group, Natural Gas and Combination Utilities have the most mature AMR systems, averaging about 7 years. The Electric Utilities average an AMR installation of 4 years.



We applied the Ascent Group's proprietary benchmark performance framework to identify high performing Meter Reading organizations. Company performance was evaluated on three levels—Productivity, Cost, and Service. Companies delivering high productivity, low cost, and high service were identified as "best performers" in this study.

Once we identified the "best performers" for each industry-segment (electric, natural gas, combination utility, and water/wastewater)—above average companies that deliver low cost meter reading, high productivity, and high service (low errors, low skips), we calculated a "best performer" average for these high performing companies, by industry segment.

We also calculated an industry-segment average for each of the benchmark metrics, to demonstrate the performance of the "rest" of the panel, those companies who were not "best performers", for comparison.

We then interviewed companies and analyzed meter reading practices to identify the characteristics contributing to "best practice" performance.

Study Findings

1. *Best Performing Companies Use Automated Meter Reading (AMR) Strategically to Address Access-Problem Meters.* The majority of AMR implementations represented by utilities in this survey indicated an AMR implementation rate of less than 20 percent. In terms of total meters, our group reported an AMR implementation of 8.3 percent. Clearly, the majority of AMR implementations have been to address high-cost-read meters. Only 3 utilities reported AMR implementations of more than 50 percent of total meters. While a few were in the process of implementing a company-wide AMR program, most indicated taking a strategic approach at cost reduction through AMR.

2. *Best Performing Companies Reroute Continuously.* The "best performers" identified in this study (above average performance — low cost, high productivity, high service) reported continuous or frequent rerouting and route optimization to maximize productivity and reduce costs. Companies with AMR implementations also stressed the importance of route consolidation and optimization throughout the transition to automation.

3. *Best Performing Companies Implement Clear and Concise Measures of Meter Reader Performance* – The "best performers" identified in this study were deliberate in their measurement of employee, group, and departmental performance—cost, service, and productivity. Best performers reported providing employees with a clear idea of job expectations and performance. Nearly half of our participants did not have a measurement program in place for individual meter reader performance.

4. *Best Performing Companies Encourage High Performance through Incentives and Rewards* – The "best performers" identified in this study encouraged excellence through incentive programs and/or informal or formal reward programs. Programs varied from bonus pay, special recognition, gift certificates, "bucks" redeemable at the company store, steak dinners, and other non-cash awards.

5. *New Meter Readers Reach Standard on Average in 80 Days.* Utilities reported that new meter readers reach standard levels of performance in about 80 days. Our "best performing" utilities reported reaching standard at about 60 days. Meter reading is an entry-level job for many utilities—a way into the company. Costs rise and service can suffer with higher turnover and lengthier time to standard.

6. *Best performing Companies Tended to Experience Higher than Average Turnover.* The companies identified as best performers in this study reported an average annual turnover ranging from 11 to 50 percent while the rest of the panel averaged from 7 to 15 percent.

7. *Effective Classroom and On-the-Job Training Reduces Time to Standard.* "Best performing" companies in this study reported an average of 1 to 2 days of classroom training and 12 to 13 days of OJT. Best performers' meter readers reach standard 20 days sooner than average. These same companies reported the fewest errors and skipped meters, the highest productivity, in combination with the lowest unit cost. Our analysis shows a

direct correlation between increased training, especially OJT, and reduced errors, up to a point. Companies reporting shorter than average training programs tended to have higher error rates, skip rates, and increased unit cost.

8. *Most Utilities are Not Testing New Meter Readers as Part of the New Hire Training Process.* Only 40 percent of utilities report the use of testing during the new hire training process. Testing is an effective technique to assess training comprehension and to determine readiness. Testing also reinforces training content through application. Testing can be incorporated through manual tests or computer-based testing.

9. *Computer-based Training Plays an Active Role in New Meter Reader Training.* More than one-third of respondents reported the use of computer-based training in the new hire meter reading training process. More than 80% of respondents that offer refresher training incorporate computer-based training. Computer-based training offers a self-paced training program to help meter readers learn at their own pace, thereby facilitating better comprehension and recall.

10. *Few utilities Offer Refresher Training.* Only 15 percent of participants reported delivering refresher training to meter readers. Refresher training is an effective way to keep employees up-to-date on technical and customer service skills as well as address seasonal challenges, difficult customers, bad dogs, and other work challenges.

11. *Pepper Spray is the Most Popular Dog Control Technique.* Pepper spray was the most used dog control technique. Nearly 35 percent of utilities are using pepper spray. Other dog control techniques include focused training, dog sticks, umbrellas, and dog biscuits. The effective use of dog control techniques can help reduce the percentage of re-reads and lower operating costs.

Recommendations

1. *Optimize Routes Continually, Especially Throughout the Transition to AMR.* As long as there are routes to be read, whether manually or not, there will be room for optimization. Utilities can gain 10 to 20 percent efficiency on a company-wide rerouting. Rerouting is critical in areas of high growth, after an acquisition or merger, and during the transition to AMR. Many AMR technologies require route reading, either with a walk-by or drive-by technology. In many instances, achieving the gains of AMR on a mixed route requires rerouting. Software is available to help with the route optimization, however it's not essential.

2. *Utilize AMR for High-Read-Cost, Unsafe Meters, and High Turnover Premises.* Strategic deployment of AMR technology is an effective way to reduce cost, improve safety, and increase customer satisfaction. Best performing companies are utilizing AMR to tackle the problem-meters and high-read-cost meters first. Companies have also automated meter reading for large businesses and commercial customers, in preparation of deregulation. While a company-wide implementation may not be feasible, a strategic deployment to address problem meters can be very effective.

3. *Measure and Communicate Employee Performance Regularly.* Employees want to perform to expectation – make sure they clearly understand what is expected, the measures that will be used, how they are collected and calculated, and how they impact their performance. Performance measures will change in the transition to AMR—route expectations change, employees may be performing other duties in addition to reading meters, emphasis will be shifting to other priorities—make sure your expectations and measures change accordingly.

4. *Use Rewards and Incentives To Encourage High Performance.* Incentives and rewards do increase performance and morale. Make sure you are encouraging the right behavior and encouraging high performance in the right areas. Incentives and rewards can be come stale with time, be sure to rotate emphasis on various measures to keep interest in the program. Also make sure the rewards are fair and worth the extra effort – ask employees for suggestions on types of rewards. Involvement is key to any successful process.

5. *Train and Equip Meter Readers to Effectively and Safely Read Meters.* Invest in your front-line—provide them with the tools, equipment, and training to get the job done right the first time. Make sure they are equipped and trained to handle all situations. Help them understand the customer perspective and how their job fits into the overall picture of customer service and satisfaction.

6. *Incorporate classroom and OJT into your training program to reinforce techniques. Take advantage of testing and computer-based instruction to increase learning comprehension. Refresh training periodically to keep employees in top performance and up-to-date on customer service and technical skills. Training is recognized as a key factor for success in reducing error rates, detecting tampering and lost meters, improving safety, and improving customer service.*

Characteristics of a "Best Performer"

1. *Use AMR Strategically* – to address inaccessible meters, unsafe meter locations, high turnover premises, and other high-read cost meters.

2. *Continually Optimize Routes* – to maximize productivity and reduce costs.

3. *Implement Clear and Concise Measures of Meter Reader Performance* – give employees a clear idea of job expectations and performance.

4. *Encourage High Performance through Incentives and Rewards* – encourage the right behavior through incentive programs and/or informal or formal reward programs.

5. *Train and Equip Meter Readers* – provide employees with the tools, safety equipment, clothing, and training to do the job right the first time.

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Role of Meter Reading in Today's Utility

Meter reading is still one of the more labor-intensive utility activities. While the use of automated meter reading technologies (AMR) is increasing, most utilities are reading the majority of their meters manually. Our panel reported an overall AMR implementation rate of 8.3 percent — only 8.3 percent of our panel's meters have been automated. The remaining 91.7 meters are read manually, usually on a monthly basis.

With all the changes in the utility industry and the economy, most utilities have been forced to reduce operating costs. At the same time, companies are being asked by regulators, customers, members, and shareholders to increase customer service and satisfaction. Essentially to "do more with less"—a daunting challenge for any organization.

The Meter Reading organization is effectively the cash register of the utility. Utilities must measure and bill energy or water use monthly (in most cases). Meter reading is the usage collection process that makes billing possible. Errors in meter reading result in billing errors or unbilled accounts that ultimately result in lowering customer satisfaction. In addition, skipped meter readings result in estimated bills or no-bills, which also usually impact customer satisfaction negatively.

For many companies, the meter reader is an entry-level job, a planned stepping-stone into the company. And as such, meter reading departments can incur high turnover, thereby increasing the costs incurred to hire and train effective and efficient meter readers, and ultimately, increasing the cost to read a meter.

Not only is it critical to effectively and efficiently read meters every month, the meter reader also plays an important community relations role — the "gatekeeper" who looks for leaks, problems, hazards, safety issues, and effectively becomes a neighborhood watch. For many customers, the meter reader is the only company employee ever seen.

Clearly the meter reading organization is evolving with the introduction of automation. The diversity of metering and AMR equipment, complexity of accounts and billing, the challenges of service territory, and needs of different customer classes dictate different solutions for different companies.

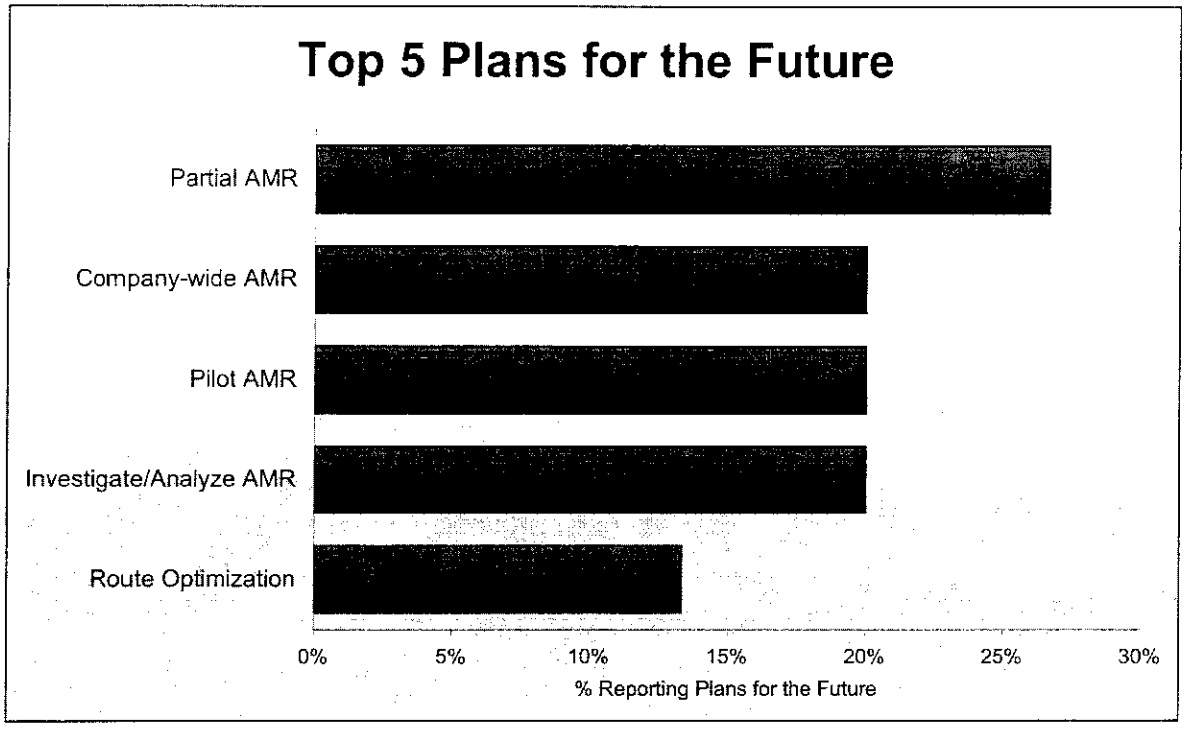
Regardless of the AMR implementation rate, the transition from manual to automation is challenging from a technology and people perspective. Routes must be consolidated and optimized, employee roles and responsibilities change with changing priorities, performance measurement metrics must shift to accommodate the mix of automation and manual effort, processes and systems change… it's a challenging time for any organization. Even after automation, metering devices must be visited periodically to ensure the device is working properly and to protect assets.

In this transition to automation and the quest for reduced operating expenses, most utilities are focusing on three approaches to meter reading improvement:

- Reducing costs of manual reads through contract negotiations, rerouting, more sophisticated hand-held equipment and meters, productivity improvement, and lowering overhead; many have maxed out these options; Some have reduced costs to a point that makes it difficult to justify AMR, for residential accounts.
- Contract meter reading to reduce overhead, tackle seasonal peaks, and as a strategy to transition to automated meter reading.
- Automated meter reading – some large-scale implementation as well as several strategies to pinpoint "high read cost" meters, unsafe meter locations, and high-turnover premises. Some companies have automated "key accounts" and commercial accounts to accommodate real-time pricing and/or prepare for the competitive market.

The promise of automation

For our study participants, AMR implementation remains *the* top plan for the future, whether it's a partial or complete implementation, or just investigating the technology's potential.



Take-Aways

What can you take away from all of this? Utilities are still reading meters manually and are likely to be reading them manually for some time. In the mean time, companies are challenged to read meters efficiently and effectively. As a cost reduction and service improvement initiative, many utilities are strategically deploying AMR, especially in high-read-cost situations. This trend will likely continue until the cost of AMR becomes more attractive for the residential meter.

Best performing companies are strategically implementing AMR, continually optimizing routes, and effectively training and encouraging high performance. Employees are trained, encourage, and equipped with the tools, safety equipment, and clothing to do the job right the first time. Employee performance in best performing companies is measured and reported clearly and concisely—employees have a clear idea of job expectations and performance.

In order to improve, meter reading performance must be measured and tracked. This includes individual measures of performance as well as group or departmental measures. Employees must understand the importance of their role in customer satisfaction—through accurate readings and bills, good company relations, and efficiently read routes. This importance should be communicated clearly and reinforced through performance metrics and rewards and incentives.

Make sure your meter reading processes, both the people and technology-driven processes are effective and efficient. Review work tasks, route standards, and systems periodically to identify opportunities for improvement.

Benchmarking performance is an effective technique to understand your meter reading department's level of performance and opportunities. Be sure to compare cost and service for a balanced view of performance (like the metrics in this study).

You can purchase the results from this benchmarking study, ***Meter Reading Profiles and Best Practices****, at our web site www.ascentgroup.com. Results are available in a printed and bound format, on CD-Rom, and online (downloadable pdfs). Contact Christine Kozlosky at the Ascent Group for more information 478-469-3950.*

Appendix F

Detailed Example Request for Proposal

Appendix F. Detailed AMR Equipment RFP - Example

SCOPE OF SERVICES:

Requirements will include the installation of a comprehensive AMR system and related appurtenances, including, but not limited to, new meters, meter interface units (MIUs), controllers, and meter pits and plumbing.

A. Meters

The Generic Utility (Utility) is in the process of implementing a meter installation strategy for their 5/8-inch, 1, and 2-inch water meters. The type of meters include turbine, turbine fire meters with metered by-pass, residential displacement, and compound meters. See Attachment C for a summary of the size and estimated number of meters to be supplied and installed as a part of the contract document. Replacement meters shall be removed and replaced with meters of the same flow characteristics (like-for-like replacement). A key element of the replacement strategy includes meter compatibility with the selected AMR system.

1. System Compatibility

a. All meters shall have a unique serial number stamped or embossed on the main case. The first two digits of the number shall indicate the year of manufacture.

b. All meters shall be warranted to meet or exceed American Water Works Association (AWWA) standards for capacity and accuracy for new meters for five years from the date of installation.

2. Lead in Meters

All meters and strainers must conform to NSF 61 standard.

3. Encoder-Type Remote Registration System

a. To be considered acceptable for use in the Generic Utility's water system, encoder-type remote registration devices shall be manufactured in strict accordance AWWA specification C 707-92 or latest revision for "Encoder-Type Remote Registration Systems for Cold-Water Meters". All encoder-type remote registration devices shall meet or exceed the requirements of AWWA C 707 as well as the supplemental specifications contained herein.

b. General

(i.) Each Proposing Firm shall submit an affidavit of compliance that all systems or components to be furnished are in compliance with AWWA C 707

standards, including the latest revision, as well as the supplemental specifications contained herein.

(ii.) The register shall be warranted to be free of defects for a period of five years from the date of installation. Any register that fails during the warranty period shall be replaced, at the Successful Proposing Firm's expense, not including field labor to change the register, with a new register. The Successful Proposing Firm shall specify the specifications of the encoder, and must agree that as long as any third party meets these specifications it will not affect the manufacturer's warranty.

(iii.) Connection cable shall be supplied by the Successful Proposing Firm on self-feeding spools. Cable shall be supplied in sufficient quantity to allow for a total footage of six feet per residential meter purchased.

(iv.) The encoder-type remote registration system shall supply a digital system and shall encode a minimum of the six most significant meter registration digits.

(v.) The outside remote reading device shall be made of suitable plastic for outdoor use.

c. Design

(i.) The meter register assembly shall have a minimum of six wheels, which registers in cubic feet.

(ii.) The register shall be interchangeable with other registers of the same manufacturer based on size and type.

(iii.) The meter register assembly shall be factory set, tamper resistant, and hermetically sealed.

(iv.) The register shall be secured to the meter case with a tamper-proof seal pin or tamper-proof screw.

(v.) Registers shall be straight reading, equipped with a test (leak indicator) sweephand.

(vi.) The register shall be designed in a manner that prevents the formation of condensation within the register.

4. Residential Displacement Meters

a. To be considered acceptable for use in the Generic Utility's water system, displacement type residential meters (5/8, 1, 1 ½ and 2 inch) shall be manufactured in strict accordance with American Water Works Association (AWWA) specification "C 700-95, or latest revision, for Cold-Water Meters – Displacement Type, Bronze Main Case". In addition, all displacement meters shall meet or exceed the supplemental specifications contained herein.

b. General

(i.) The Successful Proposing Firm shall submit an affidavit of compliance that the displacement meters to be furnished are in compliance with AWWA C 700, latest revision, as well as the supplemental specifications contained herein.

(ii.) The Successful Proposing Firm shall submit a certificate showing that each displacement meter has been tested for accuracy and capacity, and that each meter's accuracy and capacity is within the parameters set forth in AWWA C 700, s. 4.2.2 and 4.2.8. Such certificate shall be attached to each meter.

(iii.) Residential Displacement Meters shall be packaged in cartons or crates consecutively numbered, and marked with the serial number of the meter contained therein. Such cartons or crates shall be secured on 39" x 44" wooden skids or pallets to facilitate handling by forklift.

c. Materials

(i.) Bottom main case covers on 5/8 and 1-inch meters shall be breakable (frost protection) cast iron, in accordance with AWWA C 700, s. 4.1.9. Such cover shall be plastic or rubber lined, in addition to the non-corrosive treatment given the bottom.

(ii.) All external fasteners shall be made of stainless steel.

d. Design

(i.) All meters shall be the nutating disc or piston type and shall be provided with a removable stainless steel or plastic strainer in accordance with AWWA

C 700, s.4.3.6. All meters shall have magnetically coupled drive.

B. AMR System Overall

Utility requires that all the water meters be equipped with an automatic meter reading system that will enable it to obtain timely and accurate meter readings for all of its customers. The Utility will not require an AMR device on metered fire service check valves. This system will incorporate mobile or fixed technology, or some combination of both (i.e., a “hybrid” system). Utility recognizes that AMR system features, characteristics, and performance that result from the interaction of components are to be addressed in this section. Component requirements and characteristics specific to individual components are to be addressed in the appropriate sections following. It shall be the Proposing Firm’s responsibility to propose any components, ancillary services, etc., not addressed in this Request for Proposal to ensure that the Utility obtains a complete and working system.

The Utility may determine that its needs are best met with a combination of more than one system (e.g., fixed systems in some areas, mobile systems in others). If you are proposing more than one technology, include a separate section in your proposal for each system corresponding to the relevant requirements sections below, and follow the pricing instructions in Attachment C – ***Insert utility specific pricing instructions per purchasing standards***.

The Utility will allow separate proposals for different AMR options (e.g., mobile and fixed network systems), provided that each proposal is completely responsive to the RFP and submitted individually.

1. Mode of operation. Describe the system’s normal mode of operation (i.e., for obtaining periodic readings for billing and other purposes).

2. Frequency of reading. How often are meter readings normally obtained? Describe any options for the frequency (that is, number of reads per time interval) at which meter readings may be obtained.

3. System capacity. Describe the capacity of each system component in terms of the number of meter readings stored and/or the number of meter readings that can be transmitted or received in a given time interval.

4. Read on demand. Describe how the system obtains "off-cycle", special or on-demand readings from a particular meter.

5. Demand profiling. Can the system obtain short-interval readings (e.g., hourly or several times per day) to monitor and profile water

consumption patterns from a particular meter or group of meters? If so, describe what and how.

6. Communication channels. Indicate what radio frequencies are used for interactions between the MIUs and DCUs. What licenses are required?

7. Data transmission accuracy and security. The system shall include provisions to ensure data transmission accuracy, security and immunity from outside interference as well as signal degeneration, to prevent accidental loss or interception of customer or meter reading data.

8. Stored data system integrity and security. The system must ensure data integrity and data security. The system must ensure against loss of data. Describe how the system addresses these issues.

9. Tamper detection. The system shall contain tamper detection capability which, when the meter, MIU or any wiring between components has been tampered (cut wire, tilting of meter, etc.) with, shall cause a tamper message to be indicated when the MIU transmits its data. Indicate how quickly tampering with each component will be reported and how will it be reported.

10. Leak detection. The system should monitor water consumption through the meter and specifically indicate when there is an abnormal increase in water consumption or when there is a suspected leak.

11. Environmental tolerances. All system components (except the meter chamber) must operate over a temperature range of -20º F to 120º F, and a humidity range of 0% to 100% non-condensing.

12. FCC Licensed. All applicable system components must be FCC licensed and approved.

13. Component firmware. Vendor shall include firmware for all system components, including MIUs, DCUs and portable interrogator/programming/testing units, at no additional cost. Vendor shall provide any available upgrades or patches to such firmware to correct problems, add new standard features, and ensure system compatibility and full functionality for 15 years at no additional cost, including installation.

C. Meter Interface Unit (MIU)

Meter interface units, designed to capture meter readings or accumulated consumption and other information from the meters and transmit this information to data collectors, shall be installed at all water meter locations. The information provided by the MIUs must be sufficient to

enable the AMR system to replace the routine reading and physical inspection of meters by Utility staff. For remote (touchpad) proposals, the touchpad device will be considered as the MIU.

1. Physical characteristics. Is the MIU a stand-alone device or integrated with the meter register? Describe the physical characteristics of the MIU, including height, length, width and weight.

2. Multiple meters/registers. Describe any provisions of the MIU to handle dual-register compound meters, and multiple meters in close proximity.

3. Batteries. What type of battery does the MIU use? What is the expected battery life? Is the battery removable and replaceable? If so, what is the current cost of replacement batteries? Can the battery be replaced in the field? If so, describe the process. How will the system prevent loss of programming or data if the battery expires? Describe any special MIU battery disposal provisions, and indicate the current cost of providing battery disposal if special handling is required.

4. ID Number. Each MIU shall have a unique, permanent ID number that is transmitted with the meter readings.

5. Programmability. Describe all MIU programmability options, features and procedures.

6. Environmental tolerance. Describe features of the MIU that prevent corrosion or degradation of mechanical or electrical performance. The MIU must operate in conditions subject to water submergence (i.e., meter boxes or vaults).

7. Labeling. The MIU shall be permanently labeled with manufacturer's name, model number, "Generic Utility Department of Public Utilities," a tamper warning, MIU identification number, required FCC labeling, input/output connections, and date of manufacture.

8. Ease of Installation. Briefly describe installation procedures. Indicate design provisions to avoid installers' mistakes in installation, connection to meters, and programming.

9. Meter pit installation. The Utility uses cast iron meter pit lids, as well as manhole covers and plates for meter vaults. All MIUs installed in meter pits should be mounted under the meter box lid or cover. If any part of the MIU protrudes above the meter lid surface, provide the dimensions (maximum height, minimum height, diameter, etc.) of such protrusion. The cost of any lid replacements/modifications must be included in the Proposing

Firm's bid pricing, Attachment C - ***Insert utility specific pricing instructions per purchasing standards***.

10. Connections to meter registers. Describe the connection between the MIU and the meter register(s), and provisions to prevent misconnection, corrosion or disruption of any connections.

11. Interoperability. The MIU must read at least two different makes of meter registers for all sizes of meters. Indicate these in the following table, as well as any needed programming or modifications to either the MIU or meter. Are different MIUs needed for different makes and models of meters? Proposing Firms may be requested to demonstrate compatibility.

Manufacturer	AMR compatible register model	Programming or modification required (Describe or indicate “None”)
AMCO	Digital	
AMCO	Absolute Encoder	
Badger	ADE	
Badger	RTR	
Hersey	Translator	
Neptune	E-coder	
Neptune	Pro-read	
Sensus	ICE	
Other	Other	
Other	Other	

D. Mobile Interrogator

If all or part of the AMR system uses mobile radio technology, then the Utility requires vehicle-based mobile interrogators for normal meter readings. The mobile interrogators should be designed to be easily installed and removed from Utility vehicles. The mobile interrogator should safely and efficiently interact with the Utility employee driving the vehicle to guide him or her in obtaining readings from all the meters on a route and identifying meters that cannot be read. The Utility will provide the vehicles used for mobile meter reading.

1. Mounting and power. A mobile interrogator may be either a portable interrogator designed to operate from within a vehicle, or a separate device mounted in a vehicle. Specify the dimensions and weight of the interrogator. There must be a back-up battery to preserve internal memory. If meter readings or critical system data are stored in the mobile interrogator, indicate the life of the back-up battery.

2. Mode of operation. Describe all reading mode(s) using the mobile interrogator (e.g., individual alerting of MIUs, blanket alerting of any MIUs within range, simple reception of any MIU signals while passing by, etc.). Indicate how the driver will be given meter route information. The mobile interrogator must indicate to the driver/meter reader which meters within the route being read have been missed. The mobile data collector must be capable of reading the MIUs in random order. The system must be capable of merging data collected from the mobile data collector together with data collected from handheld reading units into files to be uploaded to the Utility's billing system.

3. Capacity. Describe the capacity of the mobile unit in terms of total meter readings that can be captured, and rate of capture.

4. Signals to driver. The mobile interrogator must provide signals to the driver during the reading of a route. The AMR system and mobile interrogator should incorporate or interface with a geopositioning system to enable the driver to see his/her position in relation to meters to be read.

E. Handheld Data Collector

The Utility requires handheld data collectors that are equipped with AMR capabilities for manual meter reading where only a portion of the meters on the route have been equipped with AMR transmitters, for capturing meter readings from MIUs that are in radio "weak spots," for final and special reads, and for other purposes requiring individual readings. The handheld data collectors must enable Utility staff to manually read meters and key in meter readings, and will replace the Utility's existing handheld meter reading devices while being compatible with the AMR system. A separate control computer may be required to manage the data transfer to and from the handheld devices.

1. System Functions. The Utility requires handheld meter reading devices, cradle/data transfer units, control computer, software, etc., to read meters equipped with MIUs as well as capture manual meter readings. The handheld device must present to the meter reader unambiguous and appropriate information needed to locate a water meter. It must also inform the meter reader of the next meter to read, any upcoming hazard (e.g., dog), special routing information, and special instructions (including the presence of an AMR-equipped meter, which is not manually read).

   a. Time stamp. The handheld device must automatically time stamp each meter reading with unalterable date and time of read.

   b. Searching. The handheld device must allow for searching and viewing of data within the handheld meter reading device, by several fields or keys, including meter location

address, meter number, unread account, sequence number and manually-entered flag/tag/bookmark.

c. Out-of range warning. The handheld device must visually and audibly warn the meter reader of a meter reading entry that is out of range, including no consumption for an active account, or of an inactive account that has consumption since the previous reading. The device must allow the meter reader to override an out-of-range warning, to enter an unusual reading, or skip a reading and make a notation of the fact, if a meter has been removed from service.

d. Data displayed. The handheld device must be capable of displaying the following information on the primary screen:

(i.) Route number

(ii.) Meter reading sequence number

(iii.) Account identification number

(iv.) Customer name

(v.) Billing cycle day (date when account will be read)

(vi.) Metered service code (telling system what to do with the volume recorded by the meter; examples are bill water and sewer, bill only water, deduct before calculating sewer volume, etc.)

(vii.) Meter number

(viii.) Meter address

(ix.) Meter location description, hazard descriptions, additional special instructions

(x.) Previous unable-to-read code (two-digit codes entered by the meter reader to explain why the meter was not read; this is converted to one letter in the billing system)

(xi.) Account status code

(xii.) Meter status code

(xiii.) Meter encoder ID number

(xiv.) Current date and time

e. Data entry by meter reader. The handheld device must allow for field entry of data, including meter readings, and

information on meters that are out of sequence or that were not transferred into the handheld meter reading device. The handheld device must allow the meter reader to modify or correct certain fields, including meter location, hazard, and special instructions to update the associated billing system data.

f. Codes and comments entry by meter reader. The handheld device must allow for entering an unable-to-read code and up to two additional special reporting codes and comments for each meter reading record.

2. Handheld Physical and Environmental Characteristics

a. Size and weight. Indicate the size and weight (with batteries installed) of the handheld meter-reading device.

b. Resistance to dropping. The handheld unit must be able to withstand an impact of a five-foot drop onto a concrete surface without breaking or losing data.

c. Display. Must have a multi-line alpha/numeric display, large enough for easy reading of route data, readable in normal daylight, and have an internal display light for reading the display under low-light conditions.

d. Environmental. Indicate the temperature and humidity operating ranges for the handheld unit. The unit must be capable of being submerged for up to 20 seconds without loss of functionality.

e. Carrying. The handheld device must be able to be carried by hand (left or right hand equally) and secured by a hand strap or supported by a belt and/or shoulder strap, to free up both hands when device is not in use.

f. Keypad. The handheld device must have alpha/numeric/special function keys that allow a meter reader to easily enter data correctly while wearing gloves.

g. Batteries. Rechargeable batteries must power the handheld device. These batteries should be user-replaceable. The unit must have provisions to retain all data while the primary batteries are being replaced. The handheld device batteries must be able to be fully recharged in eight hours.

h. Data/meter reading capacity. Describe the capacity of the handheld device, in terms of the number of meter readings that may be captured under normal circumstances.

i. Data fields. The handheld meter reading device must keep the following data internally, for use in calculations and validations:

(i.) Time and date of reading

(ii.) Handheld meter reading device identification code

(iii.) Meter reader identification code

(iv.) High reading limit

(v.) Low reading limit

(vi.) Table of utility-defined codes, with associated code descriptions

3. Handheld Device/Control Computer Data Transfer

a. Data transfer method. Indicate the method used to transfer data between the handheld device and the control computer.

b. Data transfer rate. Indicate how long it normally takes to upload the data from a 200-meter route, and how long to download the next 200-meter route. How long for a 500-meter route?

c. Data protection in transfer process. Data sent to the handheld meter reading device must overwrite existing data, with proper warning and the opportunity to cancel the action before the transfer begins, so as not to allow the accidental erasure of untransferred meter reading data. The handheld meter reading device must display a message or other indications when data transfer is taking place and when the transfer is complete.

d. Device ID synchronization. The data transfer method must synchronize the meter reading data with the associated handheld meter-reading device, through identification validation, so that the handheld meter-reading device has the appropriate route data, for its assigned meter reader.

4. Handheld Meter Reading Control Computer

a. Database and database management system. The control computer must store data in an ODBC SQL-compliant database, such as Oracle or Microsoft SQL Server, which can be queried for ad hoc data analysis and reporting.

b. Manual entry of data. The control computer must permit manual entry of meter readings not transferred from the handheld meter-reading device.

c. Route selection and sequencing. The control computer must allow for the selection of route data to be sent to and retrieved from the handheld meter reading device, including merging of two or more routes and splitting one route into several other routes. The system must allow for the sequencing of meter locations based on billing system information, or the re-sequencing of a meter reading route, based on previous meter reading time stamps.

d. Data validation. The control computer must have the capability to analyze the transferred handheld meter reading device data, to separate valid data from suspect data, and to report exceptions.

e. Reports. The control computer must have built-in reporting capabilities that list all handheld meter reading device data, sort and list the data by various key fields, and list data that meets user-defined criteria. Report formats must be user-customizable, using a built-in report writer or a third-party commercially available report writer (such as Crystal Reports) that is included with the control computer software. Reports must be able to be directed to a printer, screen or data file.

F. Field Programming and Testing Devices.

Field programming units may be required to program MIUs or meter registers. Portable field test units may be required to diagnose problems with meter registers, MIUs or the system. Some or all of these functions may be incorporated into the handheld data collectors, or combined into one unit; e.g., programmer/tester. Proposing Firms shall respond to this subsection separately for each device, separate device, denoting the responses FA.1, FA.2, ..., FB.1, FB.2, etc.

1. Number of units. Proposing Firm shall supply all units required for Proposing Firm's sub contractor. Indicate how many units are required for maintenance by Utility employees after installation. Pricing and totals for these units shall be included as part of the proposal bid.

2. Functions/modes of operation. Describe all of the functions of each unit.

The field programmer must be capable of programming the MIU with any information required for operation. The portable field programmer must be capable of providing instructions to the MIU

concerning the make, model and data protocol of the meter being connected, should the MIU not be able to determine this itself.

The field tester must be able to locate and diagnose problems with a system component (meter register, MIU or DCU) unless the system incorporates an alternate way to make such diagnoses. The field tester should be able to ascertain the condition of the battery in a MIU. Can the field test unit simulate the functions of an MIU?

3. Interface to control computer. Describe the mechanism and procedure for downloading data from and uploading data to the AMR control computer.

4. Capacity. Describe the capacity of each unit. If the unit stores work order information, how much data, or how many work orders, can it accommodate?

5. Physical Characteristics. Indicate unit weight and dimensions. Describe any features, such as shoulder or belt strap, to facilitate carrying and preventing it from being dropped.

6. Accessories. What connecting hardware and software, including cables, modem, cradle, battery, charger, etc. are required for the unit to be fully functional?

7. Bar code reader. The unit should be capable of accommodating a bar code reader to capture meter or MIU numbers from bar codes pasted on these components.

8. Batteries. Does the unit use rechargeable batteries? If so, what type? If not, what does it use? How long does it take to fully recharge a battery after a full day of normal use? The unit must ensure against accidental data loss in case of a dead battery.

9. User interface. Indicate the display's overall dimensions, the number of characters displayed, and the height and width of the characters. Does the display allow alphanumeric characters? Include an illustration of the display screen and keypad. How does the unit enable the display to be easily readable in bright or dim light? Indicate the angular range readability. Describe any audible tones used by the unit, and their function (e.g., confirming a reading or successful programming, warning of an out-of-limits condition, low battery, etc.)?

10. Manual entry. Does the unit permit manual entry of meter readings and other information (for example, the information necessary to complete a meter or MIU investigation or repair work order)? If so, what other information? Describe its capability to record notes or comments.

G. Fixed Radio Data Collection Unit (the following requirements shall only apply to a fixed radio system)

This section will only apply if the Proposing Firm is proposing a fixed radio AMR system to read all or part of Utility's meters. Fixed radio data collection units should be mounted on roofs, utility poles, towers, etc., at sufficient density to enable the Utility to collect readings from all meters in that portion of its service territory designated for this system. The Utility recognizes that mobile radio AMR may be more suitable for some portions of its service even if fixed radio is proposed for others. Proposing Firm shall be responsible to estimating the number of fixed data collectors required in the Utility's service territory. While the Utility may assist the Proposing Firm in securing sites for collectors (e.g., roofs of schools and other county buildings), the Proposing Firm shall include total annual costs of leasing collector sites in its proposal.

1. Modes of operation. Indicate the mode of operation and schedule by which the DCU captures, stores and re-transmits data received from MIUs back to the AMR control computer.

2. Communication to control computer. Successful Proposing Firm shall be responsible for communication network or provisions to deliver meter readings and other AMR system data to the AMR control computer. The Proposing Firm must specify the capital, installation, operation and maintenance costs of such network or provisions. Indicate available options and proposed method for transmitting data.

3. Number of units. Indicate estimated number of data collection units. Successful Proposing Firm is responsible for providing a sufficient number of DCUs/repeaters so that 100% of all expected reads are obtained.

4. Mounting. Indicate options for mounting DCUs/repeaters, and recommended configuration. Indicate minimum required height. Proposing Firm must include the costs of mounting and any continuing rental costs in its proposal.

5. Power supply. How is the DCU/repeater powered? What are the estimated one-time and continuing costs for powering DCUs/repeaters? How does the system preserve data should power to a DCU/repeater be lost?

6. Programming. Describe any programmable features, such as reporting schedules, for DCUs/repeaters, and procedures for programming or configuring.

7. Electrical Isolation. Indicate how the DCU/repeater is protected against electrical surges such as lightning.

8. DCU site least costs. Proposing Firm shall provide not to exceed monthly lease costs for DCU sites on roofs, utility poles, towers, etc., with annual limits on increases in these costs for the life of the system. The Successful Proposing Firm shall negotiate lease arrangements and contracts for the DCU sites, and DCU shall provide all reasonable support to this effort. Leases shall be in the name of or transferred to the Utility before the end of the system installation.

H. AMR System Radio Licenses

The Utility expects Proposing Firm to secure on behalf of Utility all radio licenses necessary to operate the AMR system on frequencies that will be sufficiently free of noise and interference so as to provide all proposed capabilities over the life of this system.

1. FCC licenses. Indicate what FCC or other regulatory agency licenses, if any, the system will require. Indicate the expected length of time to acquire such licenses. Indicate what problems can occur in the process of obtaining such licenses.

2. Obtaining licenses. Successful Proposing Firm shall be responsible for obtaining all necessary licensees on behalf of the Utility. Licenses must be obtained and assigned radio frequencies verified as suitable for use with the AMR system(s) before any AMR equipment may be installed. If Successful Proposing Firm is unable to obtain the necessary licenses, the Utility reserves the right to cancel the contract and orders for all or part of the system, and receive a full refund from Successful Proposing Firm of all amounts paid.

I. AMR Control Unit

The AMR system will be operated from a dedicated control unit, which may be a PC or server. This unit may be the same one used to manage the handheld meter reading devices. It may be the same one used to control the AMR system installation. The unit must have sufficient capacity to handle all of the Utility's meter readings, including future expansion capability as the Utility grows.

The Proposing Firm shall propose the configuration most suitable for its system and application. The Utility will purchase the necessary hardware configured with the specification provided by the Successful Proposing Firm. The Utility technology standards must be met and are as follows:

PC – Dell laptop or desktop with Windows XP SP2 operating system, 2 G RAM, Microsoft Office 2003 (if required)

Server – Poweredge 2950 with Windows 2003 Server Standard Edition or Red Hat Enterprise Linux Version 4 and 4 G RAM

The specifications for the unit should include the following:

1. Operating system, memory, processor speed and hard drive requirements.

2. Indicate the number of units of the hardware items (computers, servers, printers, etc.) and software (operating system, communications, etc.) that the Utility must have to properly operate the AMR system.

3. The control unit must be capable of residing as a node on the existing Utility data communications network.

4. The control computer shall be capable of operating in a normal office environment and be easily relocatable. The system software and functions shall be quickly and easily movable to another computer/server in the event of failure on the primary control unit.

5. The control computer shall include an uninterruptible power supply (UPS). Please indicate the required capacity of this UPS.

J. AMR System Software

Proposing Firm must provide all software, including third party software such as operating system and database report generator, necessary for Utility staff to operate and manage the AMR system. This software must include interfaces to the Utility's customer information system to enable transfer of meter readings, synchronization of databases, customer service functions, measures to protect data security, etc. Software must be provided with all licenses, and must be maintained by the AMR system vendor over the life of the system. The Utility will provide the record layout for its CIS and expects the Successful Proposing Firm to tailor an interface from its AMR system software to the CIS. The Utility IT staff will work closely with the Successful Proposing Firm to ensure that this is accomplished efficiently.

1. Modes of operation. Proposing Firm to provide information on their system operating modes, including batch processing and single meter reading query processing. Describe the steps a system operator must perform to obtain meter readings for the meters at customers' premises. AMR software shall provide the user with reports of the current status and reading history of individual accounts and selectable groups of accounts. The software shall be able to sort and list accounts. The software shall be able to create user-defined account groups.

2. Interface to billing system. The AMR system shall automatically provide data, corresponding to all the accounts in a billing cycle, meter reading route or other grouping presented to it, to the CIS, in a standard, nonproprietary format (e.g., fixed field ASCII). The

system should be able to access and interface with Oracle or Microsoft SQL Server database systems. Each record provided to the CIS shall contain at a minimum: account number, MIU ID number and/or port number, billing cycle or route number, meter number, meter readings, error codes or flags, date and time for each meter reading, unable-to-read code, and tamper indications. Indicate what information is required by the AMR system from the CIS so that the former may respond; indicate what information is provided to the meter reading database; describe record layout, including field length and format. Describe any steps an operator must perform to initiate or schedule this process.

3. Updating account data. Indicate arrangements for synchronizing data between the meter reading database and CIS.

4. Recovery/restart. Describe procedures to recover/restart the system in the event of an interruption or software freeze.

5. Multiple users. How many concurrent users can the system accommodate?

6. User interface. Proposing Firm shall include menus, navigators and major screen shots in its proposals. Describe provisions and guidelines for customizing screens, menus and navigators.

7. User access. What provisions exist for data entry and editing by users? What restrictions are placed on such functions to ensure security and data integrity? The software shall include a security system, incorporating multiple levels of authorization and access to limit specific data, users, modules and/or specific tasks. The System Administrator must be able to modify the levels of security. Describe security features, logging and levels.

8. Meter reading database. Should Proposing Firm's AMR produce more than one reading per month under normal operations, the Utility requires as part of the AMR system an ODBC- and SQL–compliant meter reading database, such as Oracle or Microsoft SQL Server. This database will contain at a minimum: account number, MIU ID number and/or port number, billing cycle or route number, meter number, meter readings, date and time for each meter reading. If acquired as part of the AMR system, the meter-reading database may contain additional fields. The Utility's CIS will obtain information necessary for preparing bills from this database. The System must be ODBC/OLE compatible to permit manipulation and use of data through use of any of the current widely available desktop PC applications, i.e. MS Access, Paradox, dBase, Crystal Reports, Word, etc.

9. Capacity. Describe any capacity limitations on the number of accounts, number of readings per account, etc. for the

configuration proposed. Describe any provisions for archiving additional data.

10. Back-up. Describe data back-up capabilities and procedures to ensure that system and consumption data is not corrupted or lost.

11. Operating system. Client software should operate on Microsoft Windows XP version software. Client-server software should support Oracle or MS SQL compliant database application.

12. Reports. Provide a list, with brief descriptions and screen shots or sample pages, of the standard reports provided for system and component performance; missing or late data; errors, anomalies and alarm conditions; data transfer, management and administration; analysis of consumption for individual customers or groups of customers; and other major report categories.

13. Traps for questionable readings. Describe any system capabilities to validate meter readings for reasonableness, unusually high or low readings, and potential meter rollovers.

14. Software documentation. Documentation shall be provided with the software and shall include at a minimum: system overview, flow charts, file descriptions and record layouts, database structure diagrams, description of program function and logic, back-up and recovery procedures, operating procedures, screen layouts, data entry procedures, report descriptions, descriptions of all user options, and descriptions of all error messages.

15. Software license and warranty. All Proposing Firm supplied software must be supplied with a license indicating the software's designer, owner and licenser, and detailing the terms and conditions, including annual cost of maintenance by the Proposing Firm. Software license and warranty shall cover all patches and upgrades, including new versions, for the life of the system at no additional cost. Indicate how many workstations the software license will cover and the cost, if any, of additional workstation licenses.

16. Maintenance and escrow. The Proposing Firm supplied software shall be supported for 15 years with enhancements, patches and corrections of "bugs", at no additional cost to the Utility beyond the annual maintenance fee. Successful Proposing Firm shall be required to provide a "standard" source code escrow agreement and warranty.

17. Third-party software. Indicate third party software (operating system, database, report writer, etc.) specifically required to support Proposing Firm's application. Indicate the warranty, licensing and support provisions for any such packages.

18. Interface with GIS. Indicate any provisions in the database for integration with the Utility's current version of GIS data related to meter or premises location.

19. The system software should provide statistical reports on the usage of the product. The system must incorporate detailed incident reporting and logging feature. Methods of monitoring system performance shall be included.

20. The software should provide a test environment for testing prior to placing changes into production. The software should enable simulation of operating with sample data before permanent changes are incorporated into the code or processes.

21. The System must be capable of complete on-line, real-time record creation, maintenance, reporting, and retention.

K. Documentation

Utility must be provided with all documentation needed to install, operate, and maintain the AMR system and all of its components. Documentation must serve both for training and reference, and must be kept up to date with any system or software upgrades or corrections.

1. System manuals. Successful Proposing Firm shall provide manuals and customized written procedures sufficient for complete operation and maintenance – including installation, configuration, diagnostics and repair – of the system. This shall include 3 complete hard-copy sets as well as 3 copies on CD-ROM.

2. 3rd party software manuals. Successful Proposing Firm shall provide at least two (2) sets of manuals for any third-party software or components incorporated in its system.

3. Updates and revisions. Successful Proposing Firm shall promptly provide replacement pages and CD-ROMs whenever there are any revisions or additions to the manuals.

L. Training

The Utility requires training of all appropriate staff sufficient to enable them to effectively operate and maintain the system. To be effective, the Utility requires that training curriculum be provided in advance, that training be accompanied by course workbooks and materials, that training be provided by experienced instructors, and that all training be accompanied by tests or hands-on evaluation to ensure Utility employees have absorbed the content of the training.

1. Prerequisite to installation. Training must be sufficient to prepare the Utility staff to fully and completely administer and maintain the

system without further reliance on vendor staff beyond normal assistance covered by maintenance agreement. The Utility requires that its staff be trained prior to the commencement of installations.

2. Training on the Utility's installed equipment. The Successful Proposing Firm shall provide all additional training on the Utility's AMR system equipment (including the control computer and database) after it is installed, tested and accepted by the Utility. Training shall use real data from the Utility's own system.

3. Location. All training shall be done at the Utility's offices and facilities, or in the field.

4. Training curriculum. Successful Proposing Firm shall provide thorough training in each of the following areas for the designated number of people:

    a. All aspects of the AMR system's operation, including obtaining reads and consumption data from the system, transferring reads and other information between the AMR system and the CIS, creating performance reports, diagnosing potential problems with system components, changing or adding customer accounts/MIU/meters to the system; for a minimum of 30 Utility employees or agents for a minimum of 16 hours.

    b. Meter reading database management, for a minimum of 10 Utility employees or agents for a minimum of 8 hours.

    c. Installation management and project control, for a minimum of 15 Utility employees or agents for a minimum of 12 hours.

    d. Field installation, for a minimum of 30 the employees or agents for a minimum of 4 hours.

    e. Field diagnostics and maintenance, for a minimum of 30 Utility employees or agents for a minimum of 8 hours.

    f. Application software administration, for a minimum of 10 Utility employees or agents for a minimum of 12 hours.

    Successful Proposing Firm shall specify duration for each of these training sessions.

5. Training aids. User training will include detailed documentation and reference materials for each end-user. Successful Proposing Firm shall provide trainees' workbooks, training aids (including software and videotapes), and system technical manuals prior to or during the training session.

6. Supplemental Training. Successful Proposing Firm shall provide a schedule of costs for additional training beyond the initial training proposed.

7. Restore equipment. Successful Proposing Firm shall restore, repair or replace any Utility equipment damaged in training, and restore any hardware or software modified in training.

8. Instructors. The Successful Proposing Firm shall provide trained and experienced instructor(s), and ensure that they do not perform other duties during the training period that will interrupt instruction.

M. Support

The Successful Proposing Firm must provide on-site and telephone support as needed by the Utility over the life of the system to ensure its proposed performance. As this support will probably only be requested when software or equipment malfunctions, such must be rapid and efficient.

1. Initial support period. Successful Proposing Firm shall provide on-site support for a period of 2 years from the date of Notice to Proceed at no additional cost to the Utility beyond the annual component and software maintenance fees.

2. Extended support period. Successful Proposing Firm shall provide telephone and on-site support for 10 years from the date of Notice to Proceed. Successful Proposing Firm shall include in this proposal a schedule of support costs, terms and conditions. Support shall be renewed at the Utility's discretion on an annual basis. If normal warranty provisions do not extend to 10 years, please indicate the cost of converting to updated software in the price Table C4.

3. Telephone support. Successful Proposing Firm shall provide trained persons to answer technical questions and guide Utility employees through the use or diagnosis of the system through a toll-free number. Indicate telephone support hours proposed. Response time to a Utility telephone query shall be within 30 minutes.

4. On-site support. Successful Proposing Firm shall be required to provide on-site assistance at the request of the Utility for duration of 10 years after notice to proceed. On-site support shall be rendered within twenty four (24) hours of receiving a request for support. Include in the proposal an estimated number of service call visits and fees for all other visits as required.

5. Preventive maintenance provisions. Successful Proposing Firm shall describe in its proposal recommendations and requirements

for AMR system preventative maintenance, back up, archiving, etc.

N. Installation

Installation includes replacement of Utility's meters, installation of the AMR equipment, project management and control by the Successful Proposing Firm's Subcontractor to ensure that all equipment is installed properly and all information about the system is correct, and field inspection of installers' work to ensure that it is performed properly.

1. Project duration. Project duration shall be 6 years from the date of Notice to Proceed.

2. Installation sequence. Successful Proposing Firm's Subcontractor shall conduct installations in sequence to be by determined by the Utility in discussion with Successful Proposing Firm's Subcontractor. The Utility and Successful Proposing Firm's Subcontractor shall establish an overall schedule for installation of the entire project, based on the following approach:

   Year 1 30% of meters, including vault refurbishment

   Years 2-4 Approximately 20% of meters per year

   On the first workday of each week, Successful Proposing Firm's Subcontractor will provide the Utility an updated schedule of where work is planned for the next 3 weeks.

3. Work hours. No work shall be done between 6:00 pm and 7:00 am except where required or authorized by Utility. No work shall be done on Sundays and legal holidays. Legal holidays shall be defined as those holidays annually observed by the Utility. These are: Labor Day, Veterans Day, Thanksgiving (2 days), Christmas (1 ½ days), New Year's Day, Martin Luther King Day, Memorial Day, and Independence Day (a total of 9 ½ days).

   Work hours for replacement of large meters and valves shall be scheduled with property owner and Utility. This work may be required to be done during night or weekends to minimize disruption of customers.

4. Daily reports. At the end of each day, Successful Proposing Firm's Subcontractor shall transmit electronically to the Utility information on completed work orders, as well as a listing all installation appointments to be visited by Successful Proposing Firm's Subcontractor's Installers the next day.

5. 24-hour customer access. Successful Proposing Firm's Subcontractor must respond to calls from customers or the Utility concerning leaks, loss of service and other problems associated

with installations on a 24-hour per day basis. Successful Proposing Firm's Subcontractor must respond within one (1) hour of receiving the call and mobilize to correct any problems within three (3) hours of receiving the call.

6. Utility Project Manager. The Utility will designate an employee or agent who will manage the project on behalf of the Utility. The function of this Project Manager is to coordinate with the contractor and ensure compliance by the Successful Proposing Firm's Subcontractor with the specifications. The designation of a Project Manager shall not relieve the Successful Proposing Firm's Subcontractor of its full responsibility to comply with the terms of the Contract and/or all plans and specifications.

7. Installation acceptance. Each Installation will be accepted by the Utility conditioned upon (1) electronic submission of a list of completed installations containing for that installation the premise identification number, address, old and new meter ID numbers, old and new meter readings, MIU ID number, location of meter and MIU, Successful Proposing Firm's Subcontractor's name, Successful Proposing Firm's Subcontractor's inspector's name, and all other information relevant to the installation; (2) satisfactory inspection by the Utility; and (3) successful capture of a confirming meter reading or sequence of meter readings from that meter and MIU by the Utility operating the AMR system in a normal way.

8. Payments. Successful Proposing Firm shall provide to the Utility on a weekly basis its list of newly completed installations and any itemized additional work. The Utility will approve installations within ten business days after notification that the installation has been completed and is ready for Utility inspection. The Utility shall notify Successful Proposing Firm of any listed items that do not meet the conditions of Paragraph 7 above, so that Successful Proposing Firm may resolve any discrepancies. The Utility may at its discretion reject the entirety of any list on which there are discrepancies in more than 20% of the entries. Successful Proposing Firm shall submit and Utility will pay invoices monthly. The Utility will provide payment within 45 days of receipt of acceptable invoice. Indicate in your proposal any discount for prompt payment (amount of discount and applicable number of days).

   Payments will be based on the price schedules negotiated as part of this Proposal by the Utility and the Successful Proposing Firm's Subcontractor, Meter Vendor and AMR Equipment Vendor, based on prices submitted by the Proposing Firm.

9. Automated project control system. The Successful Proposing Firm's Subcontractor shall utilize an automated installation information management process, so that little or no information

has to be captured or entered manually. The system shall have a redundant backup process, so that all information is preserved in the event of a breakdown in the primary system. The system should enable the correction of any incorrect information pertaining to meter or service size, meter type, meter location, address, etc. Proposing Firm shall describe in detail its project control system in the proposal.

10. No solicitation. No Contractor, or its employees or agents, may solicit business from the Utility's water customers while engaged on any contract associated with this project.

11. Successful Proposing Firm's Subcontractor staff requirements.

    a. Contract Manager. Each contractor will designate a Contract Manager who is a direct employee of the selected firm for the duration of the contract, and who shall have the authority to handle and resolve any disputes or contract issues with the Utility. The Utility is seeking a sole point of contact for the entire project that will have direct oversight over all elements to include installation. Please indicate the percentage of the Contract Manager's time that will be dedicated to this project, and that will be spent on site. A change of Contract Manager may be made only with the approval of Utility.

    b. Installation manager. Successful Proposing Firm's Subcontractor will designate an Installation Manager, who shall be responsible for managing the entire installation project on a day-to-day basis on behalf of the Successful Proposing Firm's Subcontractor and for seeing that all installations are carried out in a professional manner and in compliance with the procedures required by the system vendor/manufacturer, the Utility, and all other applicable local, state and federal regulations. The Installation Manager shall be on site continuously throughout the duration of the project, except for holidays and vacations, during which the Successful Proposing Firm's Subcontractor shall provide a qualified substitute. The Installation Manager shall be experienced in supervising meter installation contracts, and familiar with applicable regulations and safe and proper installation procedures. The Utility shall approve the Installation Manager or a change in the Installation Manager.

    c. Installers. All AMR installations, retrofitting AMR-compatible registers on meters of any size, and meter changeouts must be performed by Successful Proposing Firm's Subcontractor's employees or subcontractors who are properly trained and experienced.

d. Licensed plumbers. Successful Proposing Firm's Subcontractor shall engage by employment or subcontract at least one person who shall maintain a Califorina Plumber's License. This person(s) shall be responsible for supervising the work of all Installers, and correcting any problems or damage to plumbing occasioned by the changing of meters under this contract. Proposing Firm shall provide references for each such person. The Utility reserves the right to approve licensed plumbers for work on this project.

e. Training of employees. Describe training procedure, and probation provisions for new employees.

f. Uniforms and identification. Successful Proposing Firm's Subcontractor's field personnel shall wear easily recognizable uniforms containing the Successful Proposing Firm's Subcontractor's name, as well as prominently displayed picture identification badges containing Successful Proposing Firm's Subcontractor's name, employee name, title and signature, employee picture and employee I.D. number. Employees shall also be issued and carry a letter. Successful Proposing Firm's Subcontractor's employees who are no longer employed by Successful Proposing Firm's Subcontractor shall be required to return their uniforms and letter immediately upon termination of employment and the Successful Proposing Firm's Subcontractor shall immediately notify the Utility of all such terminations.

12. Items to be supplied by Successful Proposing Firm's Subcontractor

a. General. Successful Proposing Firm's Subcontractor will supply the following components and aspects of installation: overall project management; training and direct supervision of installers; appointment scheduling; large meter vault refurbishment/replacement; problem solving and complaint handling; inspection, testing and quality control.

b. Tools and materials. The Successful Proposing Firm's Subcontractor shall furnish all supplies, materials, tools and equipment necessary for the successful and timely completion of all meter and AMR installations under this contract as specified herein.

c. Meter box lids. The AMR system shall be configured to obtain the maximum signal strength from MIUs installed in meter pits or vaults. Successful Proposing Firm's Subcontractor shall replace or retrofit all meter box lids and

any other lids needed to obtain the performance requirements specified herein. Under no circumstance will a meter pit or vault be left uncovered and unsupervised. The meter lids must have no holes to admit water to the meter box.

Lids may be replaced, drilled or left alone, depending on Proposing Firm's determination of what is required to ensure maximum signal output from MIUs installed in meter pits. Almost all lids are in grassy areas. Lids on meter boxes located in paved areas cannot be drilled.

Should a meter box lid need to be replaced, Proposing Firm must ensure that the ring or collar matches the lid for a secure fit.

The Utility does not have quantities for the various meter boxes in its system. The Utility does not have any residential sites that share a meter box. Meter box details and specifications are available on the Utility website ***insert utility website link.***

d. Vehicles. Successful Proposing Firm's Subcontractor shall be responsible for all vehicles it uses on the project. Successful Proposing Firm's Subcontractor shall provide service vehicles on site stocked with common fittings and supplies needed for normal service restoration and/or replacement. Successful Proposing Firm's Subcontractor's vehicles, including private vehicles used for the work, shall have the company logo prominently displayed on both sides of the vehicle. Any employee of the Successful Proposing Firm's Subcontractor or its subcontractors that drives a vehicle in connection with this project must have a valid driver's license for the class of vehicle being driven.

e. Parking. The Utility desires that Successful Proposing Firm's Subcontractor deploy vehicles to minimize parking problems and avoid blocking any streets. Successful Proposing Firm's Subcontractor shall be responsible for all parking violations.

f. Field communications. The Utility requires that the Successful Proposing Firm's Subcontractor's installers, plumbers, inspectors and supervisory personnel be equipped with cellular phones or radios so that problems or questions can be addressed immediately and that the Installation Manager can be contacted if needed.

g. Meter salvage. The Successful Proposing Firm will be responsible for disposing of meters removed for service. A credit for salvage value should be included in the pricing

Table C1. Salvage values should be fixed for the term of the contract, and not be tied to some prevailing rate at the time of salvage - ***Insert utility specific pricing instructions per purchasing standards***.

13. Account data and installation scheduling

a. Account data file. Prior to the start of the installations, the Project Manager will provide the Successful Proposing Firm's Subcontractor with an electronic file containing the information necessary to create work orders for meter/AMR installation. For each meter, the data file will indicate the account number, meter reading route number, meter size, make and serial number, the meter location (if known), access notes to the meter, and the name and phone number that may be listed on the account. Existing meter manufacturer is not known. Any unmetered accounts that may exist are not to be addressed. The Utility will be responsible for installing and automating new meters installed after the Notice to Proceed.

b. The Utility will provide Successful Proposing Firm's Subcontractor with weekly updates to this file for routes where the AMR system has not yet been installed. For each meter, the data file will indicate whether the meter register only is to be removed and an AMR-compatible retrofit register installed, or whether the meter is to be completely replaced; the location of the meter (inside or outside); and any third-party (e.g., landlord) who is responsible for the account.

c. Customer notification. At least two weeks prior to the commencement of installations on a particular route, Successful Proposing Firm's Subcontractor shall send notices (letters, post cards, door hangers, etc.) to the customers on that route indicating the approximate time when installations will occur and requesting that customers call the Successful Proposing Firm's Subcontractor for appointments if the meter is not readily accessible or if the customer has special needs regarding the momentary disruption of water service. The Utility shall approve in writing the text of all Successful Proposing Firm's Subcontractor letters, door hangers and other communications with customers. Successful Proposing Firm's Subcontractor shall also develop and submit to the Utility the scripts for any telephone conversations with customers for approval by the Utility Project Manager prior to use. The Utility will be responsible for mass media publicity and general notices to customers (e.g. bill stuffers)

d. Appointment scheduling. Successful Proposing Firm's Subcontractor shall be responsible for scheduling and handling all installation appointments. Whenever possible, Successful Proposing Firm's Subcontractor shall notify customers of any changes in schedule at least one day in advance of the original appointment. The Utility reserves the right to impose liquidated damages of $50 for each instance where the Successful Proposing Firm's Subcontractor has failed to properly notify the customer if an appointment cannot be kept on time.

e. Non-accessible meter. In the event a meter is obstructed or is not accessible, the Successful Proposing Firm's Subcontractor will make no less than two attempts at any reasonable time to contact the customer to gain access to the meter. These attempts must be documented on the work order. After two documented attempts to change the meter, Installation Manager may request the Utility Project Manager to schedule the meter changeout. The Successful Proposing Firm's Subcontractor shall only be paid for completed installations and is expected to provide all reasonable support in resolving installs that are difficult to schedule. Successful Proposing Firm's Subcontractor will be responsible for installation if the Utility secures an appointment within 4-weeks of receiving written or electronic notice from Successful Proposing Firm's Subcontractor.

14. Installation Procedures

a. Procedures approval. The Successful Proposing Firm's Subcontractor shall propose detailed scheduling and installation procedures to the Utility for approval prior to scheduling or commencing installations. The procedures shall be designed to optimize the work of the Installers, the Utility inspectors and all other staff working on the project.

b. Acceptance testing. Prior to the commencement of full-scale installation, but after Vendor shall have installed the AMR system control computer and a sufficient quantity of data collection units, Successful Proposing Firm's Subcontractor shall install the meters and meter reading equipment on two of Utility's routes (comprised of approximately – 400 meters) following the Successful Proposing Firm's Subcontractor proposed procedures. During this test and a period not longer than ten (10) business days following it, the Utility and the Successful Proposing Firm's Subcontractor shall evaluate the procedures for meter and MIU installation, data transfer to the Utility's billing system, meter reading over the system, installation data management and project control, and

problem resolution, to ensure they are working and effective. The Utility may require Successful Proposing Firm's Subcontractor to modify any procedures that it deems are deficient or ineffective. No work will be started on other routes until the AMR system equipment is determined to be working to performance requirements on the test routes, the project control procedures and systems are determined to be performing accurate, and the installation procedures have been approved by the Utility.

Utility IT staff will be available to provide assistance in the development and testing of data transfer procedures during installation and to establish operational transfers.

c. Work order processing. Successful Proposing Firm's Subcontractor shall be responsible for ensuring that all data transferred to and from the Utility's information systems is properly working before commencing any installations.

d. Work order data. The Installation Manager will provide work orders to Successful Proposing Firm's Subcontractor. Each work order will include at a minimum, the customer's address, premises identification number, meter location, designation of replacement or retrofit, existing meter number, existing register number, meter make, model and size, and most recent meter reading. The Utility desires that all work orders be electronic.

e. Site conditions. Before, or at the time of installation, the Successful Proposing Firm's Subcontractor shall inspect the existing water meter setting, including piping and shut-off valves. If the Successful Proposing Firm's Subcontractor determines that conditions are such that damage to the existing piping would result, the Installation Manager shall so inform the Utility, shall not attempt the installation until the site is inspected by an authorized the Utility representative, and shall postpone installation at that site until the Project Manager authorizes the Successful Proposing Firm's Subcontractor to proceed with the work.

There are very few meter yokes in the Utility system. Utility will replace any meter yokes found with copper meter setters. Selected Proposing Firm should notify Utility when meter yoke bars are found.

f. Location of meters. Utility personnel will be available to assist in locating meters in the field. Meter locations are not visually marked.

g. Location of MIU. On meter boxes that may bear traffic loads, the MIU shall not be installed in the lid. Depending on the Proposing Firm's specifications, the MIU may be installed on the sidewall of the vault, or in a small pit exterior to the vault and connected to the meter register(s) by shielded, weatherproof cable running through the wall of the vault.

h. Geopositioning coordinates. For each meter installed in an outdoor pit, box or vault, Successful Proposing Firm's Subcontractor shall capture GPS positioning with sub-meter accuracy (+/- 3 feet), using a geopositioning device. Describe how Proposing Firm intends to provide GPS data for each meter.

i. Digital photographs. The Utility requires that digital photographs be taken before and after installation to provide documentation of problematic pre-existing site conditions. Problematic site conditions are defined, as any condition that the Contractor believes requires some repair or Utility investigation before installation should proceed. Examples of problematic conditions are described in 14.k (Repairs), 14.l (Old Piping), 14.q (Plumbing Irregularities), and 14.s (Service Line Damage). The photo should have an accurate date and time stamp and the file name of the photo shall include the applicable register number. Digital photographs should be available to the Utility in a database searchable by address, premises identification number, and meter number or account number.

j. Old meter reading disputes. Successful Proposing Firm's Subcontractor shall provide procedures for ensuring that any dial meter is read properly and for providing evidence of the reading in the case of any customer disputes. Evidence of the reading is required at a minimum for any meter that fails a high/low audit check, or for any meter that shows any signs of a defect. The Utility requires that evidence be in the form of a digital photo clearly showing the register face.

k. Repairs. At its option, the Utility may authorize the Successful Proposing Firm's Subcontractor to make any necessary repairs to service lines or piping at Utility's expense, order the customer to make such repairs, or undertake such repairs itself. If the Utility elects to assume responsibility for repairs, it will make the repairs within 30 days of notification by the Successful Proposing Firm. Successful Proposing Firm shall not anticipate returning to any site requiring a repair in less time. Utility will notify the Successful Proposing Firm when repairs are complete.

l. Old piping. Only when old piping is leaking or deteriorated to a point that damage to it could reasonably be expected by changing the meter will poor piping be accepted as a reason for not replacing the meter during the installation period. Unless the Utility's Project Manager permanently remands the particular installation to the Utility, Successful Proposing Firm's Subcontractor is still required to install the meter and AMR equipment after the piping has been repaired or replaced at any time during the installation period.

m. Meter replacement. Successful Proposing Firm's Subcontractor shall ensure he is at correct location and meter, and check for running water prior to commencing meter change-out. If water is running, Installer must notify the customer before commencing meter changeout. Successful Proposing Firm's Subcontractor shall then replace the meter, using new gaskets or washers. Successful Proposing Firm's Subcontractor shall put plastic caps on the inlet and outlet of the old meter and handle meter with care in the event of post-removal testing. All conversion bushings or other hardware necessary to install the new water meter in the consumer's existing meter setup must be furnished by the Successful Proposing Firm's Subcontractor.

n. Strainers. If the meter to be replaced has a strainer, Successful Proposing Firm's Subcontractor shall be responsible for replacing the strainer along with the meter, unless conditions prevent such replacement. Successful Proposing Firm's Subcontractor shall otherwise be responsible for repairing or cleaning the strainer to ensure that is in good working order and will not adversely affect meter performance.

o. Verifying service working. Successful Proposing Firm's Subcontractor shall flush water line after installing a new meter to ensure the meter is registering properly and verify service restoration to the entire premise.

p. Valves. If Successful Proposing Firm's Subcontractor cannot shut off water using the valve at the meter (details must be documented on a work order), Successful Proposing Firm's Subcontractor shall have the option of closing the corporation stop, however, it must notify Utility's on-site inspector immediately before doing this. If the shut-off valve at the meter is inoperable, Successful Proposing Firm's Subcontractor shall immediately notify the Utility's on-site inspector to arrange for repair. Successful Proposing Firm's Subcontractor may not use a crimping

tool to stop the flow of water. Successful Proposing Firm's Subcontractor may use a non-Freon freezing tool.

q. Plumbing irregularities. The Successful Proposing Firm's Subcontractor shall report to the Project Manager, prior to the installation of a meter, any meter and/or plumbing irregularities including but not limited to meters installed backwards, registers are disconnected from meters, taps are located before a meter, there are unmetered connections of a customer's plumbing to a service lateral, fire pipe or water main or any other violations of the Utility's Regulations. The Successful Proposing Firm's Subcontractor shall not proceed with the installation of a meter until the Project Manager has authorized such installation.

r. Dirt or water around meter. Successful Proposing Firm's Subcontractor shall be responsible for removing and properly disposing of any reasonable amount of dirt needed to access a meter in a meter pit or vault. Dirt shall be removed only as necessary to prevent dirt from entering the line during the installation. If a water meter box or vault is flooded so that the meter is fully or partially submerged, the Installer must pump out the box before changing the meter. The Installer must ensure that the water service is not in any way contaminated, even intermittently, by standing water in the meter vault or box. All waste resulting from cleaning the meter pit as well as replacing the ring and lid must be cleaned up and hauled off by the Successful Proposing Firm's Subcontractor and disposed of in a legal manner. The existing ring and lid, if replaced, shall be disposed of by the Successful Proposing Firm's Subcontractor. If grass or shrubbery is damaged by the installation process, the Successful Proposing Firm's Subcontractor must repair the damage to original condition to the satisfaction of the consumer by replanting, resodding or reseeding. The Utility reserves the right to inspect any installation and clean-up work within 30 days after payment is made to the Successful Proposing Firm's Subcontractor for said work.

s. Service line damage. The Successful Proposing Firm's Subcontractor shall be responsible for the repair of any service lines it damages at its sole cost and expense, unless Installation Manager has reported (prior to commencement of installation) a condition of antiquated or inferior plumbing to the Project Manager and the Project Manager has authorized the Successful Proposing Firm's Subcontractor to proceed with the work. In the event a service line fails during the installation procedure, the Successful Proposing Firm's Subcontractor will notify

Utility's on-site inspector, who shall arrange for the repair by Utility. Reasonable direct labor and material costs for such repair will be deducted from Subcontractor's invoices for repair of service lines unless Utility's Project Manager authorized Subcontractor to proceed with the work.

t. Returned work orders. Returned work orders shall include: meter size and meter type, verification or correction of existing meter and account information, old meter serial number, final reading on old meter, new meter number, new meter register number, premises identification number, MIU ID number, reading on new meter register, date and time of installation, name of installer, notice of any problems encountered or repairs made. All information requested on the work order must be completely filled out for the installation to be considered complete and eligible for payment. An electronic copy of all the work order information must be provided to the Project Manager on a daily basis.

15. Quality control

a. The Successful Proposing Firm shall describe its quality control program for its installation crews, including the parameters and the numbers or percentages of installations to be inspected, minimum acceptable performance and provisions for dealing with unacceptable performance.

b. Response to complaints. Should the Installation Contractor receive a call or complaint from a customer or the Utility regarding installation, the Installation Contractor shall immediately log the call, including caller's name, address, account number if available, date and time of call, nature of problem and the action taken. Copies of all call logs shall be forwarded to the Utility's manager not less than once per day.

c. Improper installations. The Installation Contractor shall be responsible for replacing any meter, MIU or appurtenances improperly set by its Installer. The Installation Contractor shall correct any damage to couplings, threads, unions or meters by use of improper tools or cross threading by an Installer.

d. Leaks after installation. Installation Contractor shall be responsible for correcting any leaks at the valves, couplings or service lines that could reasonably be attributed to the meter installation if reported by the Utility or customers within 30 days of installation.

e. Regular meetings with the Utility. Contract Manager shall meet with Utility personnel periodically and not less than monthly to update them on progress against the installation schedule.

O. Warranties

1. Meter register warranties. All encoder registers supplied in connection with this proposal shall be guaranteed to be free from defects in workmanship for a period of at least 5 years from the date of installation. Any register that fails during this period shall be replaced at manufacturer's sole cost and expense.

2. AMR component warranties. Proposing Firm shall provide all information required in Attachment D to this Request for Proposal.

3. All AMR system components other than MIUs shall be guaranteed for one year from the date of installation, including parts and labor.

4. Installation warranties. All installation work, including materials used in the installation performed under this contract, shall be guaranteed against defects in workmanship for a period of one year or until acceptance of the entire project, or whichever is greater. Any installations that fail during this period shall be corrected at Contractor’s sole expense.

5. Failure Rates. Proposing Firm shall indicate the expected and maximum failures rates of AMR system components per thousand units installed, as required in Attachment D of this Request for Proposal.

6. System performance guarantees.

a. Each installation performed shall be guaranteed to read using a mobile or fixed collection device, as proposed. If a mobile system is proposed, the successful reading shall be obtained from a collection device positioned in a vehicle driving within the posted speed limits on the far side of the road from the meter. Any modifications of the installation (replacement of pit lid, repositioning or change of the MIU, use of repeater devices, etc.), necessary to provide this reading, shall be performed by Contractor at its sole expense.

b. The AMR system shall be guaranteed to produce meter reads at an overall success rate of 98% during and up to the point of contract closing.

These General Attachments are typically included at the end of an RFP. They are to be created for each utility outlining their own specific needs and policies regarding insurance, signatures, and how the utility would like to see the pricing detailed and broken down.

General Attachments.

Attachment A. – Utility Insurance Specifications
Attachment B. – Signature Sheets
Attachment C. – Component Pricing
Attachment D. – Failure Rates and Replacement Costs

Appendix G

Glossary

Appendix D. Glossary

Analog Signal: Of or pertaining to a mechanism that represents data by measurement of a continuous physical variable, as voltage or pressure.

AWWA: American Water Works Association

Automatic Meter Reading (AMR): A state of the art technology that enables a programmable logic controller (PLC) to read a meter remotely without the need to manually read the meter. This technology allows data to be transferred back and forth between meters and the PLC. AMR technology includes touch read, mobile radio read systems and fixed radio read systems for water, electric and gas utilities.

Billing Period: The elapsed time between two specific consecutive meter reads for billing purposes.

Bureau: United States Bureau of Reclamation

Direct Sequence Spread Spectrum (DSSS): One of two approaches to spread spectrum modulation for digital signal transmission over the airwaves. This technique transmits energy over a wide bandwidth. A conventional narrowband (NB) radio typically occupies 12.5 kHz of bandwidth, while a DSSS radio could occupy a 2 MHz bandwidth (160 times wider).

Encoder Register: A device that provides direct electronic transfer of meter reading information from a mechanical meter register to any of a number of AMR device options. This device is located directly on the meter to encode the numerical units to an electronic signal.

ERT: Encoder-receiver-transceiver, which is powered by a battery and converts the meter register reading to an RF signal. ERT is a trademark used by Itron, an AMR vendor. Same as a meter interface unit (MIU) and Recordall Transmitter Register (RTR).

Federal Communications Commission (FCC): Has the authority to regulate and license all interstate communications originating in the United States. The FCC determines which frequencies may be used and for what purposes.

Fixed Network RF: Meter readings are captured through a system of collectors and are transmitted to a central location.

Frequency Hopping (FH): The repeated switching of frequencies during radio transmission according to a specified algorithm, to minimize unauthorized interception or jamming of telecommunications.

GIS (Geographic Information System): An information system that is used to input, store, retrieve, manipulate, analyze and output geographically referenced data or geospatial data, in

order to support decision making for planning and management of land use, natural resources, environment, transportation, urban facilities, and other administrative records.

Inside Set Meter: A water meter that is placed within a building, typically for a multi-tenant building.

Interrogator: Used to collect readings from transponders. This interrogator establishes a two-way RF communication link with a transponder. The interrogator transmits requests and the transponder responds to each request.

Leak Detection: The procedure for determining if leakage is occurring from a pressurized pipe such as a water line.

Manual Read: Meter reading approach requiring an individual to physically look at and read the numbers on the top of the meter dial or on a remote registering head. Also referred to as Direct Read.

Mechanical Totalizer: Within the water meter register, that counts the totals flows based on a geared mechanical register assembly.

Meter Interface Unit (MIU): Attached to the meter and powered by a battery, the MIU converts a meter register reading to an RF signal. Also referred to as Encoder-receiver-transceiver (ERT) or Recordall Transmitter Register (RTR).

Meter Register: Mechanical device (sometimes used synonymously with the term "Face") that uses a system of gear reductions to integrate the rotation of the moving element of a meter's measuring chamber into numerical units.

Mobile Drive-By: An AMR technology that enables a meter reader to electronically capture readings by driving by the meter.

Multi-Family Unit: Residential housing with multiple dwelling units, such as apartments and condominiums.

Net Present Value (NPV): A financial analysis that allows for a direct comparison between the value of present dollars and future dollars. A NPV analysis is typically used in cost-benefit analyses to compare scenarios with different levels of investment and cash flow over time.

Radio Frequency (RF): Refers to that portion of the electromagnetic spectrum in which electromagnetic waves can be generated by alternating current fed to an antenna. The radio frequency spectrum ranges from extremely low frequency (submarine communication) to extremely high frequency (night vision). Water meter transmitters using RF technology usually operate in the medium to high frequency range.

Receiver: A device which indicates the result of a measurement. Most receivers in the water utility field use either a fixed scale and movable indicator (pointer) such as pressure gage or a movable scale and movable indicator like those used on a circular-flow recording charge. Also called an indicator.

Remote Read: A type of water meter that generates a signal to a remote location, which is read manually, by radio, telephone, or by use of a handheld computer.

Retrofit: Installation of Meter, Pit and Box

RTR : Recordall Transmitter Register is powered by a battery which converts a meter register reading to an RF signal. RTR is a registered trademark of Badger Meter, Inc. Also referred to as a MIU or RTR.

Single-Family Unit: A residential dwelling unit built with the intent of being occupied by one family. It may be detached or attached (e.g., townhouses).

Touch Read: A method of meter reading that involves touching a handheld meter-reading device to a sensor that is connected to the customer meter in order to download customer meter information.

Totalizer: A device or meter that continuously measures and calculates (adds) total flows in gallons, million gallons, cubic feet, or some other unit of volume measurement. Also called an integrator.

Transmitter: A radio frequency (RF) system component that sends usage data from a meter to a receiver.

Turbine Meter: A type of water meter that generally utilizes a propeller to measure high flows (such as for irrigation or commercial/industrial users).

Water Meter: A device that records the amount of water being used by a customer.

Watt: A standard unit of electrical power equal to one joule per second. The power of a current of one ampere flowing across a potential difference of one volt.

Wireless Fidelity (Wi-Fi): A set of product compatibility standards for wireless local area networks (WLAN) based on the IEEE 802.11 specifications. New standards beyond the 802.11 specifications are currently in the works and offer many enhancements, anywhere from longer range to greater transfer speeds.

Residential Water Meter Implementation Plan

Initial Study / Negative Declaration

May 2008

Prepared by:
HDR Engineering, Inc.

Initial Study / Negative Declaration

Residential Water Meter Implementation Plan

City of Fresno

May 2008

2365 Iron Point Road, Suite 300
Folsom, CA 95630

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Acronyms

AB	Assembly Bill
AMR	automatic meter reading
CARB	California Air Resources Board
CEQA	California Environmental Quality Act
City	City of Fresno
CVP	Central Valley Project
MIU	meter interface unit
RF	radio frequency
SCADA	Supervisory Control and Data Acquisition
SJVAB	San Joaquin Valley Air Basin
State	State of California

Chapter 1 - Introduction

The State of California (State) is trying to reduce the amount of water taken from the Colorado River in accordance with federal requirements. Because some cities are not monitoring their water use, and therefore, using an abundance of water, the State has mandated that all cities and municipalities install water meters and bill based on consumption.

Existing California law states that all residences built after January 1, 1992, must have a water meter installed on all new connections after that date within systems owned or operated by a water purveyor. The continued absence of water meters and billing based on use has prompted the State to pass another law, Assembly Bill (AB) 514 to legally mandate all residences to have a water meter installed and be billed based on water usage if they receive water from the Central Valley Project (CVP) through the U.S. Bureau of Reclamation. As a result of this legislation, the City of Fresno (City) is legally mandated to install water meters on all of their customers.

This Initial Study/Negative Declaration addresses the potential environmental effects of the implementation of the City's Residential Water Meter Implementation Plan (Project or Proposed Project). The purpose of the Proposed Project is to install as many as 113,000 residential water meters in the City to meet the legal requirements of AB 514.

This Initial Study has been prepared in accordance with the California Environmental Quality Act (CEQA). The City is the CEQA Lead Agency.

1.1 Project Background

AB 514 requires "urban water suppliers," who receive water from the federal CVP under a water service contract, install water meters on all service connections to "residential and non-agricultural commercial buildings" in their service areas on or before January 1, 2013. Those urban water suppliers who fail to install water meters are at risk of losing their federal water supply. AB 514 requires these urban water suppliers, according to the terms of their CVP contract, to charge customers for water based on their actual water usage as measured using a water meter by March 1, 2013. The bill authorizes the urban water suppliers to recover the cost of providing water services related to the "purchase, installation and operation and maintenance" of the water meters through rates, fees, or charges.

The City receives 60,000 acre-feet of high quality water annually through its CVP contract, and approximately 111,000 acre-feet of water from the Kings River through a contract with the Fresno Irrigation District. Water is delivered to ponding basins for recharging the groundwater supply, and also to the City's Surface Water Treatment Facility to treat and deliver water to customers. The CVP contract for the water supply is secured for nearly a 40-year term, expiring on February 28, 2045. A condition of renewal requires that the City measure (meter) all water deliveries to customers. To comply with the terms of the contract, the City would install meters in all single-family residences that do not already have meters.

AB 514 further states that water metering and volumetric pricing are among the most "efficient water conservation tools." AB 514 states that water metering provides the means to identify how much water is being used, and therefore, facilitates the means to incur a water rate structure which encourages water conservation. Water meters allow homeowners to know and regulate how much water they are using and give them the ability to control and manage their water use. AB 514 legally mandates the City to install water meters on all water services and charge a metered rate to all customers by March 1, 2013.

In response to AB 514, the City hired HDR Engineering, Inc. (HDR) to develop a residential metering plan (HDR, 2008). The development of this plan is intended to provide a detailed "roadmap" to keep the City moving forward on the implementation of water meters for the City. HDR reviewed a number of different areas related to the technology, engineering, operational, financial, and public outreach aspects of the overall Project.

1.2 Project Goals and Objectives

Policy E-22-j in the City's 2025 General Plan states, "Pursue Resource Conservation Water Quality and Quantity policies promoting water conservation efforts, including consideration of resubmitting the residential retrofit program for voter consideration."

Specific Project goals and objectives of the Proposed Project are identified below:

- Install as many as 113,000 water meters by 2013, which includes 80,818 residences without meters.
- Select a meter technology that is cost justified and will best serve the City over the life of the meters.
- Develop a plan for the installation that effectively uses the limited City resources.
- Allow the City to better plan for future water supply, identify leaks within the system more efficiently, and monitor consumption patterns during the year and by customer class.

1.3 Document Organization

This Initial Study/Negative Declaration is organized into the following chapters:

- **Chapter 1 - Introduction.** Chapter 1 describes the background and goals of the Proposed Project and the contents of the document.
- **Chapter 2 - Project Description.** Chapter 2 describes the City's proposed Residential Water Meter Implementation Plan, and the anticipated installation methods.
- **Chapter 3 - Environmental Setting.** Chapter 3 describes the existing environmental setting for each environmental issue area.

- **Chapter 4 - CEQA Initial Study Checklist.** Chapter 4 discusses the potential environmental impacts associated with the construction and operation of the Proposed Project.
- **Chapter 5 - Determination.** Chapter 5 provides the action that is proposed as a result of this Initial Study.
- **Chapter 6 - References.** Chapter 6 provides a list of reference materials and persons consulted during the preparation of the Initial Study.
- **Chapter 7 – List of Preparers**. Chapter 7 provides the list of preparers for preparation of the Initial Study.

Chapter 2 - Description of Proposed Project

This chapter presents the description of the Proposed Project to meet the goals and objectives as described in Chapter 1 of this document. The purpose of the Proposed Project is to install as many as 113,000 residential water meters in the City to meet the legal requirements of AB 514.

2.1 Project Location

As shown in Figure 2-1, the Project would be located in the City's service area.

2.2 Existing Conditions

The City is mandated to install meters on as many as 105,050 residences currently receiving flat rate bills. There are approximately 24,232 residential homes with meters in place that are not read, and an additional 10,223 pits and boxes installed with no meters. The City installed some of the existing meters nearly 15 years ago, while other meters were inherited when County Islands and other private utility districts were annexed. The annexed meters are up to 30 years old and will need to be replaced. Approximately 81,000 additional meters, excluding anticipated growth, need to be installed and read by 2013.

Table 2-1 Current Metering Program

Meter Reference and Definition	Number of Meters/Homes Affected
Current Flat Rate Bills Sent Out (2007)	105,050
Less: Residences with Meters Installed	24,232
Residences without Meters (2007)	80,818
Less: Current Residences with Pits and Boxes	10,223
Current Residences without Meter, Pit or Box (Complete meter and box needed)	70,595
Total Number of Meters to be Installed (including Growth by 2013)[1]	113,265

1. Growth was assumed at 1.9% annually

The City currently has approximately 24,000 commercial, industrial, municipal, irrigation, and multi-family meters, which are read by 12 meter readers. These meters are not included in the 105,050 meters to be installed and read by 2013. The commercial and industrial meters are billed on a bi-monthly basis.

2.3 Proposed Project

Presently commercial, industrial, and multi-family properties in the City are metered. The City's Water Division coordinates the planning, installation, testing, and maintenance of these water meters. The City now proposes to install water meters and read them with an automatic meter reading (AMR) system on all residences.

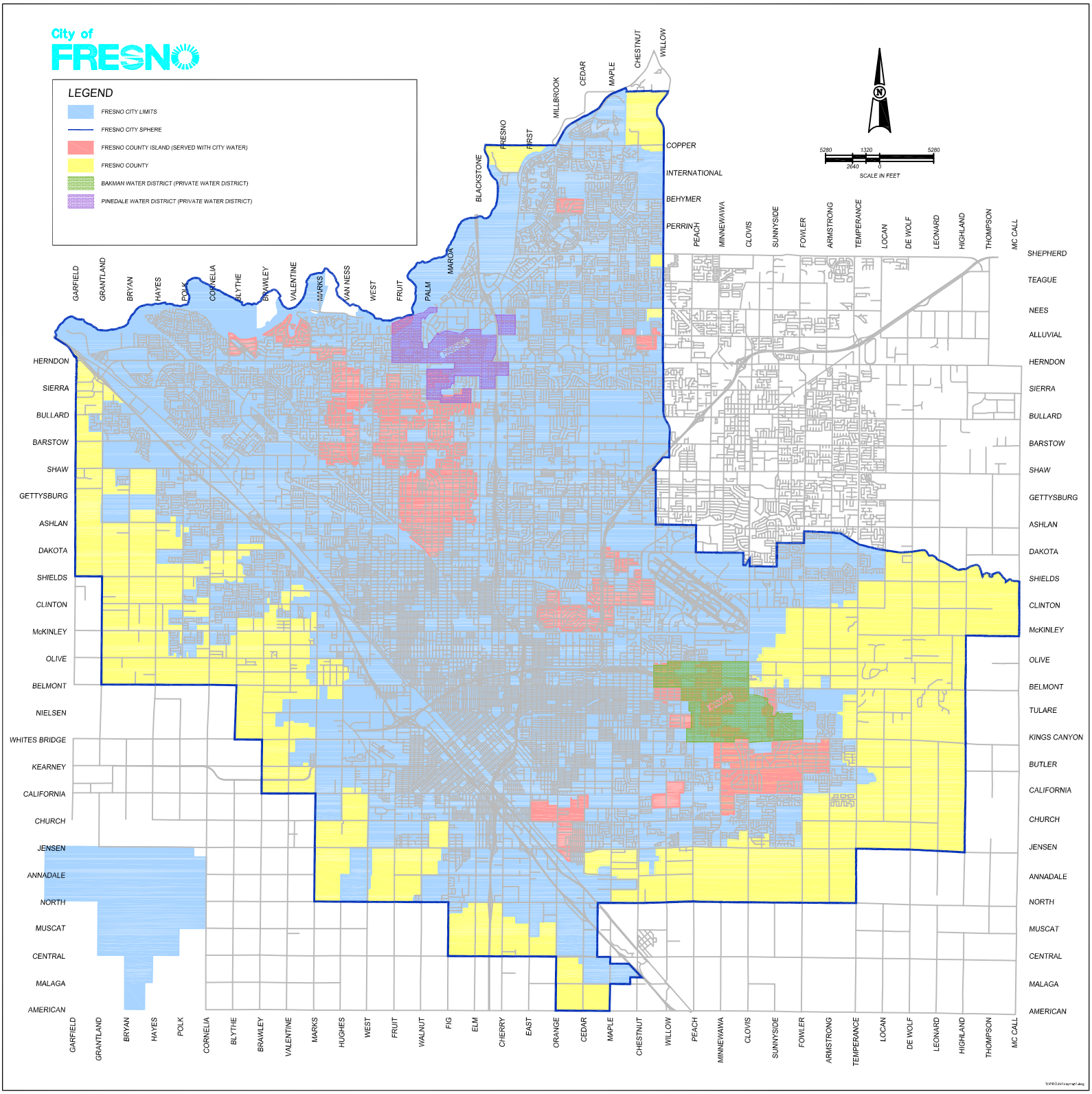

City of
FRESNO
LEGEND
FRESNO CITY LIMITS
FRESNO CITY SPHERE
FRESNO COUNTY ISLAND (SERVED WITH CITY WATER)
FRESNO COUNTY
BAKMAN WATER DISTRICT (PRIVATE WATER DISTRICT)
PINEDALE WATER DISTRICT (PRIVATE WATER DISTRICT)
SCALE IN FEET
5280
1320
2640
0
GARFIELD
GRANTLAND
BRYAN
HAYES
POLK
CORNELIA
BLYTHE
BRAWLEY
VALENTINE
MARKS
VAN NESS
WEST
FRUIT
PALM
MARGA
BLACKSTONE
FRESNO
FIRST
MILLBROOK
CEDAR
MAPLE
CHESTNUT
WILLOW
COPPER
INTERNATIONAL
BEHYMER
PERRIN
PEACH
MINNEWAWA
CLOVIS
SUNNYSIDE
FOWLER
ARMSTRONG
TEMPERANCE
LOCAN
DE WOLF
LEONARD
HIGHLAND
THOMPSON
MC CALL
SHEPHERD
TEAGUE
NEES
ALLUVIAL
HERNDON
SIERRA
BULLARD
BARSTOW
SHAW
GETTYSBURG
ASHLAN
DAKOTA
SHIELDS
CLINTON
McKINLEY
OLIVE
BELMONT
NIELSEN
WHITES BRIDGE
KEARNEY
CALIFORNIA
CHURCH
JENSEN
ANNADALE
NORTH
MUSCAT
CENTRAL
MALAGA
AMERICAN
TULARE
KINGS CANYON
BUTLER
HUGHES
WALNUT
FIG
ELM
CHERRY
EAST
ORANGE

Figure 2-1

Meters

The City's commercial, industrial, and multi-family meters currently in use range in size from 5/8 to 10 inches at their service connection. Meters for single-family residences would range from 5/8 to 2 inches at the service connection. Figure 2-2 shows a 1-inch service connection and meter box installation. This figure is a standard City drawing and is used to illustrate a proper meter and meter box installation.

An AMR system installation has an exterior appearance just like a typical meter. The only differences would be a register and a meter interface unit (MIU) installed along side the meter. Every meter vendor has their own design and configuration. The vendor would be selected through a competitive and evaluative bidding process.

Automatic Meter Reading System

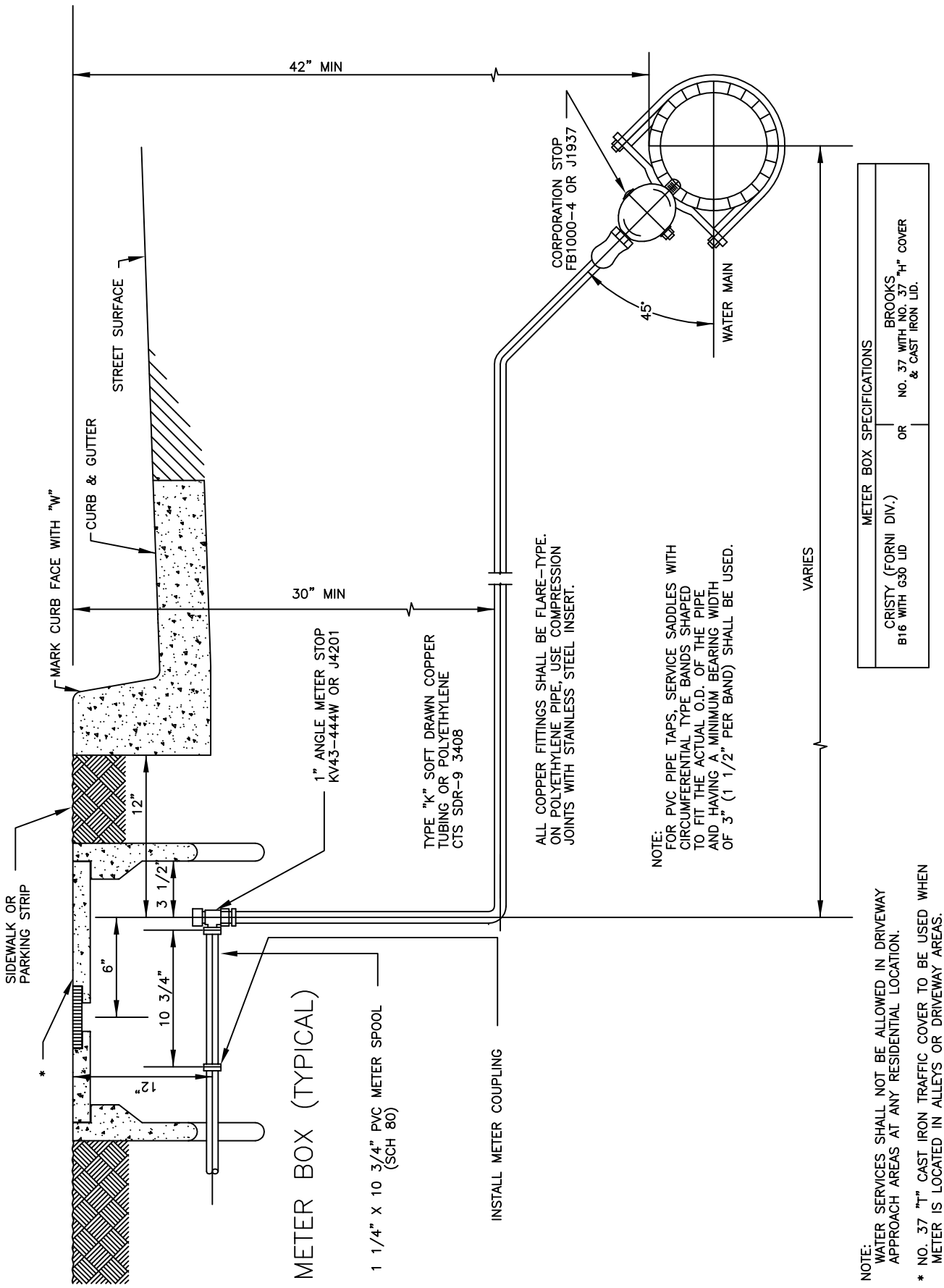
The City proposes to install an AMR system that would improve customer service while reducing the cost of reading meters. The water meters would be equipped with radio transmitting devices that would allow the meters to be read from either a mobile-radio (drive-by) system or a fixed network radio system. The AMR system would eliminate flat-rate bills and allow the City to provide timely and accurate responses to water meter reading inquiries.

The transmitting device would operate in compliance with Federal Communications Commission regulations to avoid interference with other electronic devices. The AMR system would operate independently at a low-power frequency reserved for this purpose and would not interfere with other equipment. The City proposes to install either a mobile radio system or a fixed radio system.

Mobile Radio (Drive-by) – A mobile radio (drive-by) system uses technology to minimize labor costs. This system enables the meter reader to collect meter readings while walking or driving by a meter equipped with a radio frequency (RF) reading device. The mobile reading system requires the addition of a RF reading device (also called a meter interface unit [MIU]) to the encoder meter register. The RF device is powered by a long-life battery that can be warranted for up to 20 years. The battery provides the electrical current to activate and transmit the meter's data to the computer in the passing vehicle.

The meter reading productivity for a mobile RF system is significantly better than manual (visual) or touch read systems. The actual productivity achieved by a utility is based upon many, ever-changing factors such as meter population density, location of the RF device, weather, temporary obstructions, and average driving speed. Typically, drive-by reading productivity has been in the range of 5,000 to 10,000 reads per day. With flatter terrain and improved signal strength, less travel time is required and reading productivity increases.

Figure 2-2



1" SERVICE CONNECTION & METER BOX INSTALLATION	REF. & REV. AUG. 2006	CITY OF FRESNO W-2

Fixed Network Radio – A fixed network radio system offers a truly fully automatic meter reading capability. The meter reading is "captured" through a system of collectors that transmits the meter reading back to the utility location. The RF devices are programmed to send the readings to the utility on at least a daily basis. These collectors could be located on the towers currently used for the City's Supervisory Control and Data Acquisition (SCADA) monitoring of the municipal well sites. If needed or desired, this system provides the capability for multiple reads within a specified time period. It also has the capability to provide "real-time" information to consumers. Figure 2-3 shows the fixed network schematic from the residential meters through to the utility billing department.

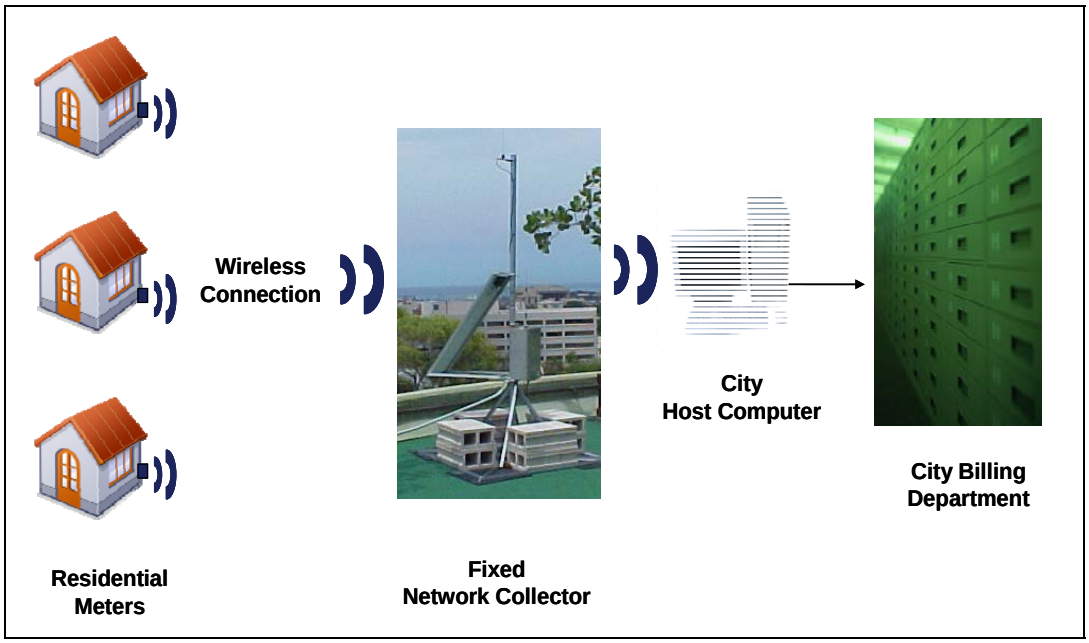


Figure 2-3 Fixed Network Schematic

The number of collection units required is mainly dependent upon the topography of the area. The typical range for a fixed network collector is one collector per square mile, with as little as one collector per four square miles in a flat terrain situation. Generally, collectors are placed upon public buildings, power poles, or water towers. A specialized system server for collecting the reading data and software for its operation is needed as well.

Both the drive-by and fixed network alternatives would work well for the City. However, the fixed network is far more powerful in its ability to provide multiple reads and be used as a communication tool with the City's customers. Once the City determines the actual costs and benefits for the two types of AMR systems, the City would select one of the alternatives.

Schedule

The water meters would be installed over a five-year period. During 2008, the City would bid and award the Project and purchase equipment. Meter installation and AMR deployment would begin in 2008. The 2008 installations would not include pit and box installations and assumes replacement of 30,465 meters (24,232 replacements plus 6,233 installations to meet the 29 percent of meters to be installed per the CVP contract). This takes into consideration the City's current backlog of 10,223 pit and boxes installed with no meters.

The installation of meters would increase annually starting in 2008 at 1.9 percent to include the estimated City growth over the 105,000 flat rate bills currently sent out. It is projected that 43 percent of the meters would be installed by the end of 2009, 62 percent by end of 2010, and 81 percent by the end of 2011. The installations of all meters would be completed by the end of 2012.

Installation

The placement of the water meter box and meter would be dictated by the location of the curb stops. Usually the curb stops are located just behind the curb in front of residences. However, due to the locations of the water mains, some of the water meters would be located in backyards, public utility easements, and alleys.

Presently 24,232 residences already have meters installed. Another 10,223 residences have no meters, but do have meter boxes installed and are meter ready. The biggest challenge of the Project would be to meter the remaining 70,595 residences that would require a complete meter installation. These residences have no existing meter boxes and would require meters to be cut and plumbed to the existing service lines. The water meters to be installed would range in size from 3/4 to 2 inches at the service connection. The size selected would depend on the size of the existing water service.

A simple water meter installation, where a spool or existing meter is removed, would take about 20 to 30 minutes to complete. The installation normally would require the meter box to be cleaned out prior to installing the meter.

A complete water meter installation, i.e., when no existing meter box is present, would need a pit approximately two feet wide by three feet long and deep enough to reach the house service line (water line). The excavation would accommodate the curb stop, water meter, meter box, and the connection to the house service line. In some circumstances it may be necessary to cut into concrete public works improvements, such as sidewalks or driveways, and homeowner improvements, such as pool decks, to accommodate the meter installation. All concrete repairs would be replaced in-kind. After backfilling, sod would be re-laid and the area returned it to its original condition. This type of installation would take approximately, 1.5 to 2.5 hours to complete.

The contractor would be required to turn off the house valve before turning off the water service to prevent water running back into the meter box from the house lead line when the spool is removed or when disconnecting the house lead line. After installation of the water meter and before turning the service on, the contractor would be required to open a hose bib and flush the house lead line until it is clear of debris. The Contractor would not turn off a water service for more than one hour to make the necessary connections.

Installation equipment would include a truck, shovel, jackhammer, and possibly a concrete saw.

Chapter 3 - Environmental Setting

This chapter describes the environmental setting for the Proposed Project. This environmental setting constitutes the baseline physical conditions by which the City will determine whether a potential environmental impact is significant in Chapter 4, CEQA Initial Study Checklist.

3.1 Land Use

The City of Fresno is located in Fresno County, California, along State Route 99 in the San Joaquin Valley. Land uses surrounding the City are primarily agricultural; however, the City has primarily residential, commercial, and industrial development.

In 2002, the City adopted its current 2025 General Plan, which charted land use and development through 2025. At the time of preparation, the General Plan projected a population gain of approximately 72,746 people between 2000 and 2007, representing an average annual increase of approximately 9,699 residents. By 2007, the population of the City was projected to be approximately 550,000 (City of Fresno, 2002).

3.2 Topography, Climate, and Air Quality

The San Joaquin Valley Air Basin (SJVAB) includes the counties of San Joaquin, Stanislaus, Merced, Madera, Fresno, Kings, Tulare, and the western portion of Kern County. Comprising nearly 25,000 square miles, it represents approximately 16 percent of the geographic area of California. The SJVAB contains 9 percent of the population of California and generates 12 percent of vehicle miles driven and 14 percent of the State's air pollution (CARB, 2008).

The topography of the San Joaquin Valley is flat, with elevations ranging from a few feet to few hundred feet above mean sea level. The SJVAB consists of a continuous relatively flat, inter-mountain valley approximately 300 miles long. The SJVAB is bounded on the west by the Coast Mountain range, on the east by the Sierra Nevada Range, and on the south by the Tehachapi Mountains. These surrounding mountain ranges are a barrier to transport, restricting air movement through and out of the air basin.

During summer periods airflow in the region is primarily influenced by marine air that enters through the Carquinez Strait. Winds usually originate out of the north end of the San Joaquin Valley and flow in a south-southeasterly direction through the Valley, through the Tehachapi Pass and into the neighboring Southeast Desert Air Basin. Summer transport of pollutants into the region from upwind sources sometimes contributes to ozone formation. Additionally, local emissions may impact downwind communities. Winter air quality is influenced by regional storms carrying moisture from the Pacific Ocean, with periods of calm winds between storms. During winter months, winds occasionally originate from the south end of the Valley and flow in a north-northwesterly direction. Also, during winter months, the Valley experiences light, variable winds, less than 10 miles per hour. Low wind speeds, combined with low inversion

heights, create a winter climate conducive to high concentrations of certain air pollutants (e.g., particulate matter and carbon monoxide).

The SJVAB has an inland Mediterranean climate that is typified by dry, very hot summers and wet, cool winters. Summer high temperatures often exceed 100ºF, averaging from the low 90s in the northern part of the valley to the high 90s in the south. The daily summer temperature variation can be as great as 30ºF. Generally, winters are mild. Average high temperatures during the winter are in the 50s, while the average daily low temperature is about 45ºF. The SJVAB averages over 260 sunny days per year. Annual rainfall varies from north to south, with the northern counties receiving as much as 11 inches of rainfall and the southern counties as little as 4 inches per year. Nearly 90 percent of the annual precipitation in the SJVAB falls November through April.

Chapter 4 - CEQA Initial Study Checklist

This section evaluates the potential for the Proposed Project to have a significant effect on the environment.

4.1 Approach to Analysis

This chapter evaluates the potential for the Proposed Project to have a significant effect on the environment through the use of a modified CEQA Environmental Checklist as presented in Appendix G of the CEQA Guidelines. According to Section 15382 of the CEQA Guidelines, a significant effect on the environment means "… a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project." For each category of physical condition evaluated in this Checklist, impact significance thresholds are defined for each environmental topic. Where appropriate, mitigation measures are identified to reduce the identified impact below a level of significance. For this checklist, the following designations are used to distinguish between levels of significance of potential impacts to each resource area:

- ***Potentially Significant Impact.*** Adverse environmental consequences that have the potential to be significant according to the threshold criteria identified for the resource, even after mitigation strategies are applied and/or an adverse effect that could be significant and for which no mitigation has been identified. If any potentially significant impacts are identified, an environmental impact report must be prepared to meet CEQA requirements.
- ***Less-than-Significant Impact with Mitigation Incorporated.*** Adverse environmental consequences that have the potential to be significant, but can be reduced to less-than-significant levels through the application of identified mitigation strategies that have not already been incorporated into the Proposed Project description.
- ***Less-than-Significant Impact.*** Potential adverse environmental consequences have been identified. However, they are not so adverse as to meet the significance threshold criteria for that resource. Therefore, no mitigation measures are required.
- ***No Impact.*** No adverse environmental consequences have been identified for the resource or the consequences are negligible or undetectable. Therefore, no mitigation measures are required.

4.2 Environmental Resources to Be Evaluated

The following discussion evaluates the potential for the Proposed Project to have a significant effect on the environment. This discussion is organized by the following resource areas:

- ☐ Aesthetics
- ☐ Agriculture Resources
- ☐ Air Quality
- ☐ Biological Resources
- ☐ Cultural Resources
- ☐ Geology/Soils
- ☐ Hazards/Hazardous Materials
- ☐ Hydrology/Water Quality
- ☐ Mandatory Findings of Significance
- ☐ Land Use/Planning
- ☐ Mineral Resources
- ☐ Noise
- ☐ Population/Housing
- ☐ Public Services
- ☐ Recreation
- ☐ Transportation/Traffic
- ☐ Utilities/Service Systems

Aesthetics

Issues (and Supporting Information Sources):	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less-Than-Significant Impact	No Impact
1. AESTHETICS — Would the project:				
a) Have a substantial adverse effect on a scenic vista?	☐	☐	☐	☒
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?	☐	☐	☐	☒
c) Substantially degrade the existing visual character or quality of the site and its surroundings?	☐	☐	☐	☒
d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?	☐	☐	☐	☒

Discussion

a) **No Impact.** The Proposed Project would be located near the San Joaquin river bluffs. However, the Proposed Project would not have a substantial adverse effect on the bluffs or any designated scenic vistas. As a result, no mitigation would be required.

b) **No Impact**. The Proposed Project is not located near or within a state scenic highway, and therefore, would not damage scenic resources, including but not limited to trees, outcroppings, and historic buildings within a state scenic highway. As a result, no impact would occur and no mitigation would be required.

c) **No Impact**. During installation, one vehicle, digging/installation equipment, and personnel would be visible to residential occupants. However, installation impacts would be temporary and short-term, anticipated to last from 20 minutes (simple installation) up to 2.5 hours (complete installation). Operation of the Proposed Project would not change existing conditions and would not degrade the visual character or quality of the site and its surroundings. If a fixed AMR system is used, the collectors could be located on the towers currently used for the City's SCADA monitoring of its municipal well sites; no additional antennas would be needed. Therefore, no impact would occur and no mitigation would be required.

d) **No Impact**. The Proposed Project would not create a new source of substantial light or glare that could adversely affect daytime or nighttime views in the area. Therefore, no impact would occur and no mitigation would be required.

Agricultural Resources

Issues (and Supporting Information Sources):	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less-Than-Significant Impact	No Impact
2. AGRICULTURE RESOURCES In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Department of Conservation as an optional model to use in assessing impacts on agriculture and farmland. Would the project:				
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance, as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	☐	☐	☐	☒
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?	☐	☐	☐	☒
c) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland of Statewide Importance, to non-agricultural use?	☐	☐	☐	☒

Discussion

a) **No Impact**. The Proposed Project would not convert to non-agricultural use any Prime Farmland, Unique Farmland, or Farmland of Statewide Importance. Installation associated with the Proposed Project would occur within existing residential properties that are completely developed. The Proposed Project would be an improvement to an existing utility system, and as a result, would not affect agricultural practices or convert any farmland to non-agricultural usage. Therefore, no impact would occur and no mitigation would be required.

b) **No Impact**. The Proposed Project would not conflict with zoning for agricultural use or a Williamson Act contract. As described in a) above, the Proposed Project would be constructed within existing residential properties that are completely developed. The Proposed Project would be an improvement to an existing utility system, and as a result, would not conflict with agricultural practices or a Williamson Act Contract. Therefore, no impact would occur and no mitigation would be required.

c) **No Impact.** The Proposed Project would not involve other changes in the existing environment which could result in conversion of Farmland of Statewide importance to non-agricultural use. As described in a) above, the Proposed Project would be constructed within existing residential properties that are completely developed. The Proposed Project would be an improvement to an existing utility system, and as a result, would not affect agricultural practices or convert any farmland to non-agricultural usage. Therefore, no impact would occur and no mitigation would be required.

Air Quality

Issues (and Supporting Information Sources):	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less-Than-Significant Impact	No Impact
3. AIR QUALITY Where available, the significance criteria established by the applicable air quality management or air pollution control district may be relied upon to make the following determinations. Would the project:				
a) Conflict with or obstruct implementation of the applicable air quality plan?	☐	☐	☐	☒
b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?	☐	☐	☐	☒
c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?	☐	☐	☐	☒
d) Expose sensitive receptors to substantial pollutant concentrations?	☐	☐	☐	☒
e) Create objectionable odors affecting a substantial number of people?	☐	☐	☐	☒

Discussion

a) **No Impact**. The Project site is located within the City of Fresno and is subject to the jurisdiction of the San Joaquin Valley Air Pollution Control District (SJVAPCD). If a project is proposed in a city or county with a General Plan that is consistent with the most recently adopted air quality plan, and if the project is consistent with that General Plan, then the project is considered to be consistent with applicable air quality plans and policies. The purpose of the Proposed Project is to equitably charge water customers for water consumed and meet the legal requirements of AB 514. The Proposed Project would remain consistent with current land use designations, and would be consistent with the City of Fresno's 2025 General Plan. The Proposed Project would not conflict with the region's air quality management plans. Therefore, no impact would occur and no mitigation would be required.

b) **No Impact.** As described in Chapter 2, Project Description, a complete water meter installation would involve digging a pit about two feet wide by three feet long, and installing the water meter, meter box, and reconnecting to the house service line. After installation, sod would be re-laid and the area returned to its original condition. Installation would take about 1.5 to 2.5 hours. A simple installation, where the residence is meter ready, would take about 20 to 30 minutes, and would not require any digging. Installation equipment would include a truck, shovel, jackhammer, and possibly a concrete saw.

Particulate emissions would be minor from these temporary and short-term installation activities. Installation of water meters would take place over an approximate four-year period. Because installation would extend over a four-year period, criteria pollutant concentrations, including greenhouse gases from installation vehicles, would only be added in very minor, incremental amounts to regional conditions.

If a drive-by AMR system is implemented, impacts from operation would consist of two vehicles periodically driving by the meters and collecting data. A meter reader could read approximately 6,000 meters per day; therefore; it would take two vehicles (meter readers) 8.75 days to read the entire City. Criteria pollutant concentrations, including greenhouse gases from the drive-by vehicles, would only be added in very minor, incremental amounts to regional conditions. If a fixed network AMR system is used, no vehicles (meter readers) would be needed to read the meters, and therefore, no additional air pollutants would be emitted.

Therefore, the Proposed Project would not violate any air quality standard or contribute substantially to an existing or projected air quality violation. No impact would occur and no mitigation would be required.

c) **No Impact.** As discussed in a) and b) above, the Proposed Project would involve improvements to an existing utility system. The Proposed Project would not result in a cumulatively considerable net increase of any criteria pollutant for which the Project region is non-attainment under an applicable federal or state ambient air quality standard. Therefore, no impact would occur and no mitigation would be required.

d) **No Impact**. As described in b) above, the Project would not generate substantial pollutant concentrations, and thus, would not expose sensitive receptors to substantial pollutant concentrations. Therefore, no impact would occur and no mitigation would be required.

e) **No Impact**. Construction and operation of the Proposed Project would not involve the use of any materials that would create objectionable odors. Therefore, no impact would occur and no mitigation would be required.

Biological Resources

Issues (and Supporting Information Sources):	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less-Than-Significant Impact	No Impact
4. BIOLOGICAL RESOURCES— Would the project:				
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?	☐	☐	☐	☒
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?	☐	☐	☐	☒
c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	☐	☐	☐	☒
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	☐	☐	☐	☒
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	☐	☐	☐	☒
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?	☐	☐	☐	☒

Discussion

a) **No Impact**. The Proposed Project is not expected to have a substantial adverse effect on any special-status species. Construction of the Proposed Project would occur within existing residential properties, which are completely developed and highly disturbed from their natural state. The Proposed Project would not impact any areas with native or relatively undisturbed vegetation. Due to the high level of existing disturbance and the lack of habitat for regionally-occurring special-status species at the existing residential properties, special-status species are not expected to occur. Therefore, no impact would occur and no mitigation would be required.

b) **No Impact.** The Proposed Project is not expected to have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations or by the California Department of Fish and

Game or U.S. Fish and Wildlife Service. Installation associated with the Proposed Project would occur within existing residential properties, which are completely developed and highly disturbed from their natural state. No riparian habitats or sensitive natural communities are known to be located on the Proposed Project sites. Therefore, no impact would occur and no mitigation would be required.

c) **No Impact.** Construction of the Proposed Project would occur within existing residential properties, which are completely developed and highly disturbed from their natural state. No wetlands or other aquatic habitats are known to be present on the Proposed Project sites. Therefore, there would be no impacts to wetlands or other aquatic habitats as defined by Section 404 of the Clean Water Act. Therefore, no impact would occur and no mitigation would be required.

d) **No Impact.** The Proposed Project sites do not serve as important wildlife movement corridors or sites. The Proposed Project would not remove, degrade, or otherwise interfere substantially with the structure or function of any migratory wildlife corridors. Therefore, no impact would occur and no mitigation would be required.

e) **No Impact.** Implementation of the Proposed Project would not conflict with any local policies or ordinances protecting biological resources. Therefore, no impact would occur and no mitigation would be required.

f) **No Impact.** Implementation of the Proposed Project would not conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan. Therefore, no impact on any habitat plans pertaining to biological resources would occur and no mitigation would be required.

Cultural Resources

Issues (and Supporting Information Sources):	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less-Than-Significant Impact	No Impact
5. CULTURAL RESOURCES— Would the project:				
a) Cause a substantial adverse change in the significance of a historical resource as defined in §15064.5?	☐	☐	☐	☒
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5?	☐	☐	☐	☒
c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	☐	☐	☐	☒
d) Disturb any human remains, including those interred outside of formal cemeteries?	☐	☐	☐	☒

Discussion

a) **No Impact.** Construction of the Proposed Project would occur within existing residential properties that are completely developed. No known historical resources are located within the Proposed Project sites, and it is unlikely that historical resources would be affected by the Proposed Project. Therefore, no impact would occur and no mitigation would be required.

b) **No Impact.** Construction of the Proposed Project would occur within existing residential properties which are completely developed. No known archaeological resources are located within the Proposed Project sites, and it is unlikely that archaeological resources would be affected by the Proposed Project. Therefore, no impact would occur and no mitigation would be required.

c) **No Impact.** Construction of the Proposed Project would occur within existing residential properties that are completely developed. No known paleontological resources are located within the Proposed Project sites, and it is unlikely that paleontological resources or sites or unique geologic features would be affected by the Proposed Project. Therefore, no impact would occur and no mitigation would be required.

d) **No Impact.** Construction of the Proposed Project would occur within existing residential properties which are completely developed. No known human remains are located within the Proposed Project sites, and it is unlikely that human remains would be affected by the Proposed Project. Therefore, no impact would occur and no mitigation would be required.

Geology, Soils, and Seismicity

Issues (and Supporting Information Sources):	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less-Than-Significant Impact	No Impact
6. GEOLOGY, SOILS, AND SEISMICITY—Would the project:				
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:				
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? (Refer to Division of Mines and Geology Special Publication 42.)	☐	☐	☐	☒
ii) Strong seismic ground shaking?	☐	☐	☐	☒
iii) Seismic-related ground failure, including liquefaction?	☐	☐	☐	☒
iv) Landslides?	☐	☐	☐	☒
b) Result in substantial soil erosion or the loss of topsoil?	☐	☐	☐	☒
c) Be located on geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse?	☐	☐	☐	☒
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?	☐	☐	☐	☒
e) Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of waste water?	☐	☐	☐	☒

Discussion

a) **No Impact.** Construction of the Proposed Project would occur within existing residential properties that are completely developed. The City's 2025 General Plan indicates that the City is located within an area with potential to be affected by earthquakes and related risks. However, installation activities would be temporary and short-term and would not expose people or structures to any increase in existing potential for substantial effects from earthquake, seismic ground shaking, seismic ground failure, or landslides. Therefore, no impact would occur and no mitigation would be required.

b) **No Impact.** Construction of the Proposed Project would occur within existing residential properties that are completely developed. During construction activities, areas of bare soil would be temporarily exposed to erosive forces for a maximum of 2.5

hours. Because installation activities would be temporary and short-term and are not likely to result in substantial soil erosion or loss of topsoil. Furthermore, the Proposed Project sites would be restored to their original condition immediately following completion of meter installation. Therefore, no impact would occur and no mitigation would be required.

c) **No Impact.** Construction of the Proposed Project would occur within existing residential properties, which are completely developed. During installation, areas of bare soil would be temporarily exposed. However, construction activities would be temporary (2.5 hours or less) and are not likely to be located on unstable geological units or soils and would not result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse. Furthermore, the Proposed Project sites would be restored to their original condition immediately following completion of meter installation. Therefore, no impact would occur and no mitigation would be required.

d) **No Impact.** Construction of the Proposed Project would occur within existing residential properties that are completely developed. During installation activities, areas of bare soil would be temporarily exposed. However, construction activities would be temporary and are not likely to result substantial risks to life or property associated with expansive soils. Furthermore, the Proposed Project sites would be returned to their original condition following completion of meter installation. Therefore, no impact would occur and no mitigation would be required.

e) **No Impact.** No additional septic tanks of alternative wastewater systems are necessary to support the Proposed Project. Therefore, no impact would occur and no mitigation would be required.

Hazards and Hazardous Materials

Issues (and Supporting Information Sources):	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less-Than-Significant Impact	No Impact
7. HAZARDS AND HAZARDOUS MATERIALS Would the project:				
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	☐	☐	☐	☒
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	☐	☐	☐	☒
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	☐	☐	☐	☒
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	☐	☐	☐	☒
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☐	☒
f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☐	☒
g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	☐	☐	☐	☒
h) Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?	☐	☐	☐	☒

Discussion

a) **No Impact.** Construction and operation activities of the Proposed Project would not require the use, storage, and handling of materials generally regarded as hazardous materials. Therefore, no impact would occur and no mitigation would be required.

b) **No Impact.** Construction and operation of the Proposed Project would not create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment. Therefore, no impact would occur and no mitigation would be required.

c) **No Impact.** Construction and operation of the Proposed Project would occur within existing residential properties within the City limits. Because the Proposed Project sites are located throughout the City, some sites may be located within one-quarter mile of an existing or proposed school. However, as described in a) above, only gasoline or diesel fuel for construction and operation vehicles would be present at the Proposed Project sites. Therefore, no impact would occur and no mitigation would be required.

d) **No Impact.** Construction and operation of the Proposed Project would occur within existing residential properties. The Proposed Project sites are not likely to be located on sites known to be included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and would not create a significant hazard to the public or the environment. Therefore, no impact would occur and no mitigation would be required.

e) **No Impact.** Construction and operation of the Proposed Project would occur within existing residential properties. No uses are proposed that could affect airport operations at the Fresno Yosemite International Airport, the Chandler Executive Airport, or other airports in the region. The Proposed Project would not result in a safety hazard for people residing or working in the Project area. Therefore, no impact would occur and no mitigation would be required.

f) **No Impact.** Construction and operation of the Proposed Project would occur within existing residential properties. No uses are proposed that could affect airport operations for a private airstrip. The Proposed Project would not result in a safety hazard for people residing or working in the Project area. Therefore, no impact would occur and no mitigation would be required.

g) **No Impact**. The Proposed Project would not impair the implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan. Therefore, no impact would occur and no mitigation would be required.

h) **No Impact.** Construction and operation of the Proposed Project would occur within existing residential properties, which are completely developed and highly disturbed from their natural state. The Proposed Project would not be constructed in an area at risk for wildland fire, and is not anticipated to have the potential to expose people or structures to a significant risk of loss, injury, or death involving wildland fires. Therefore, no impact would occur and no mitigation would be required

Hydrology and Water Quality

Issues (and Supporting Information Sources):	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less-Than-Significant Impact	No Impact
8. HYDROLOGY AND WATER QUALITY— Would the project:				
a) Violate any water quality standards or waste discharge requirements?	☐	☐	☐	☒
b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?	☐	☐	☐	☒
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion of siltation on- or off-site?	☐	☐	☐	☒
d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that would result in flooding on- or off-site?	☐	☐	☐	☒
e) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?	☐	☐	☐	☒
f) Otherwise substantially degrade water quality?	☐	☐	☐	☒
g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other authoritative flood hazard delineation map?	☐	☐	☐	☒
h) Place within a 100-year flood hazard area structures that would impede or redirect flood flows?	☐	☐	☐	☒
i) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?	☐	☐	☐	☒
j) Inundation by seiche, tsunami, or mudflow?	☐	☐	☐	☒

Discussion

a) **No Impact.** Construction of the Proposed Project is not anticipated to adversely affect water quality through the exceedance of applicable water quality standards. During construction activities, areas of bare soil would be temporarily exposed to erosive forces for up to 2.5 hours. However, construction activities are not likely to result in increased erosion and sedimentation to surface waters. Furthermore, the Proposed

Project sites would be restored to their original condition immediately following completion of meter installations. The federal Clean Water Act requires that construction sites greater than one acre be covered under the General Permit for Discharges of Storm Water Associated with Construction Activity. Construction activities for the Project would exceed one acre, and therefore, would be required to obtain coverage under this permit. Construction activities would comply with all other water quality standards and waste discharge requirements. Therefore, no impact would occur and no mitigation would be required.

b) **No Impact**. The Proposed Project would not deplete groundwater supplies or interfere with groundwater recharge. The purpose of the Proposed Project is to equitably charge water customers for water consumed. It is anticipated that water conservation would improve as a result of the Proposed Project. Furthermore, the Proposed Project would improve an existing utility system and would not expand capacity. The Proposed Project would have no additional impact on the regional groundwater table level nor would it cause an impact to groundwater resources. Therefore, no impact would occur and no mitigation would be required.

c) **No Impact**. The Proposed Project would not alter the existing drainage pattern or increase the rate or amount of surface runoff at the Project sites in a manner which could result in erosion or siltation either on- or off-site. Furthermore, the Proposed Project sites would be restored to their original condition immediately following completion of meter installations. Therefore, no impact would occur and no mitigation would be required.

d) **No Impact.** The Proposed Project would not alter the existing drainage pattern or increase the rate or amount of surface runoff at the Project sites in a manner that could result in flooding either on- or off-site. Furthermore, the Proposed Project sites would be restored to their original condition immediately following completion of meter installation. Therefore, no impact would occur and no mitigation would be required.

e) **No Impact**. The Proposed Project would not result in any new significant impervious surfaces and would not create new areas of low permeability. The Proposed Project is not expected to generate additional runoff, and would not exceed the capacity of current or planned stormwater drainage systems. Therefore, no impact would occur and no mitigation would be required.

f) **No Impact.** The Proposed Project would not substantially affect water quality. As discussed earlier, construction could result in minor, temporary, and highly localized soil erosion issues. However, the Proposed Project sites would be restored to their original condition immediately following completion of meter installations. Furthermore, it is not expected that groundwater would be encountered in excavations for meter installation. Therefore, no impact would occur and no mitigation would be required.

g) **No Impact.** The Proposed Project would not redirect flood flows or otherwise place housing within a 100-year flood hazard area. Therefore, no impact would occur and no mitigation would be required.

h) **No Impact.** The Proposed Project does not include new structures and would not place within a 100-year flood hazard area structures that would impede or redirect flood flows. Therefore, no impact would occur and no mitigation would be required.

i) **No Impact.** The Proposed Project would not expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding resulting from a levee or dam failure. Therefore, no impact would occur and no mitigation would be required.

j) **No Impact**. Risks associated with a seiche, tsunami, or mudflow at the Proposed Project sites are not anticipated. Therefore, no impact would occur and no mitigation would be required.

Land Use, Planning, and Policies

Issues (and Supporting Information Sources):	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less-Than-Significant Impact	No Impact
9. LAND USE AND LAND USE PLANNING—Would the project:				
a) Physically divide an established community?	☐	☐	☐	☒
b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	☐	☐	☐	☒
c) Conflict with any applicable habitat conservation plan or natural community conservation plan?	☐	☐	☐	☒

Discussion

a) **No Impact.** The Proposed Project would not physically divide an established community. Construction and operation of the Proposed Project would occur within existing residential properties. Therefore, the Proposed Project would not result in a disruption, physical division, or isolation of residential or open space areas. As a result, no impact would occur and no mitigation would be required.

b) **No Impact.** As described in a) above, the Proposed Project would be located within existing residential properties. The Proposed Project would not conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the Project area. Therefore, no impact would occur and no mitigation would be required.

c) **No Impact.** The Proposed Project would not conflict with the provisions of an adopted Habitat Conservation Plan, Natural Conservation Community Plan, or other approved local, regional, or state habitat conservation plan. Therefore, no impact would occur and no mitigation would be required.

Mineral Resources

Issues (and Supporting Information Sources):	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less-Than-Significant Impact	No Impact
10. MINERAL RESOURCES — Would the project:				
a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	☐	☐	☐	☒
b) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?	☐	☐	☐	☒

Discussion

a) **No Impact.** Construction of the Proposed Project would occur within existing residential properties, which are completely developed and highly disturbed from their natural state. The Proposed Project sites are not anticipated to provide a significant source of mineral resources. As a result, the Proposed Project would not result in the loss of availability of known mineral resources. Therefore, no impact would occur and no mitigation would be required.

b) **No Impact.** The City General Plan identifies locally important mineral resources within the region. However, as described in a) above, the Proposed Project sites are not anticipated to provide a significant source of mineral resources. The Proposed Project would be unlikely to result in the loss of availability of a locally-important mineral resource recovery site. Therefore, no impact would occur and no mitigation would be required.

Noise

Issues (and Supporting Information Sources):	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less-Than-Significant Impact	No Impact
11. NOISE — Would the project result in:				
a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	☐	☐	☐	☒
b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?	☐	☐	☐	☒
c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☐	☒
d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☐	☒
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the area to excessive noise levels?	☐	☐	☐	☒
f) For a project located in the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	☒

Discussion

a) **No Impact.** Construction of the Proposed Project would generate temporary and intermittent short-term noise, lasting at a maximum of 2.5 hours. Sensitive receptors nearest to the Proposed Project sites would be existing residences receiving the new water meters. Therefore, residential occupants may experience a temporary increase in ambient noise levels during construction. However, construction of the Proposed Project is not anticipated to generate noise at levels in excess of established standards. Rather, noise-generating activities associated with construction of the Proposed Project would comply with the Noise Element of the City General Plan. Therefore, no impact would occur and no mitigation would be required.

b) **No Impact.** The Proposed Project would not expose persons to excessive groundborne vibration or groundborne noise levels. Construction of the Proposed Project would be short-term and temporary, and in some cases, may require the use of a jackhammer for no more than 30 to 45 minutes during a 1.5 hour installation period. Operational noise levels would remain at existing levels, and therefore, would not create any additional impacts. Therefore, no impact would occur and no mitigation would be required.

c) **No Impact.** The Proposed Project would not result in a substantial permanent increase in ambient noise levels in the Project vicinity above levels existing without the Project.

Operational noise levels would remain at existing levels, and therefore, would not create any additional impacts. Therefore, no impact would occur and no mitigation would be required.

d) **No Impact.** Construction of the Proposed Project may lead to an increase in ambient noise levels in the Project vicinity above levels existing without the Project. However, increased noise levels would be temporary and short-term and are not expected to be substantial. Furthermore, noise-generating activities associated with construction of the Proposed Project would comply with the Noise Element of the City General Plan. Therefore, no impact would occur and no mitigation would be required.

e) **No Impact.** The Proposed Project would not affect any aircraft operations at the Fresno Yosemite International Airport, the Chandler Executive Airport, or other public airports in the region. The Proposed Project would not expose people residing or working in the Project area to excessive noise levels. Therefore, no impact would occur and no mitigation would be required.

f) **No Impact.** The Proposed Project would not affect any aircraft operations at a private airstrip. The Proposed Project would not expose people residing or working in the Project area to excessive noise levels. Therefore, no impact would occur and no mitigation would be required.

Population and Housing

Issues (and Supporting Information Sources):	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less-Than-Significant Impact	No Impact
12. POPULATION AND HOUSING—Would the project:				
a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	☐	☐	☐	☒
b) Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒
c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒

Discussion

a) **No Impact.** The Proposed Project would not generate population growth, and therefore, would not propose new homes or businesses or substantially change existing utility demands or uses. The Proposed Project would not affect population growth either directly or indirectly. Therefore, no impact would occur and no mitigation would be required.

b) **No Impact.** The Proposed Project would not displace substantial numbers of housing units, necessitating the construction of replacement housing elsewhere. Construction of the Proposed Project would not demolish any houses and would not affect any existing housing structures. As a result, the Proposed Project would not displace existing housing. Therefore, no impact would occur and no mitigation would be required.

c) **No Impact.** The Proposed Project would not displace substantial numbers of people, necessitating the construction of replacement housing elsewhere. Construction of the Proposed Project would not demolish any housing and other housing structures. As a result, the Proposed Project would not displace people from their homes. Therefore, no impact would occur and no mitigation would be required.

Public Services

Issues (and Supporting Information Sources):	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less-Than-Significant Impact	No Impact
13. PUBLIC SERVICES —				
a) Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered government facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for any of the following public services:				
i) Fire protection?	☐	☐	☐	☒
ii) Police protection?	☐	☐	☐	☒
iii) Schools?	☐	☐	☐	☒
iv) Parks?	☐	☐	☐	☒
v) Other public facilities?	☐	☐	☐	☒

Discussion

a) **No Impact.** The Proposed Project would not generate population growth, and therefore, would not increase the demand for public services (e.g., schools, parks, fire, police, or other public facilities). Furthermore, Proposed Project facilities would be confined to existing residential properties and would not substantially increase the demand for police and fire protection. If a fixed AMR system is used, the collectors could be located on the towers currently used for the City's SCADA monitoring of its municipal well sites. As a result, no impact would occur and no mitigation would be required.

Recreation

Issues (and Supporting Information Sources):	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less-Than-Significant Impact	No Impact
14. RECREATION —				
a) Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	☐	☐	☐	☒
b) Does the project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?	☐	☐	☐	☒

Discussion

a) **No Impact.** The Proposed Project would not generate population growth, and therefore, would not increase the use of neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated. As a result, no impact would occur and no mitigation would be required.

b) **No Impact.** The Proposed Project does not include or require construction or expansion of recreational facilities. Furthermore, as discussed in a) above, the Proposed Project would not increase the demand for recreational facilities. As a result, no impact would occur and no mitigation would be required.

Transportation and Traffic

Issues (and Supporting Information Sources):	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less-Than-Significant Impact	No Impact
15. TRANSPORTATION AND TRAFFIC—Would the project:				
a) Cause an increase in traffic which is substantial in relation to the existing traffic load and capacity of the street system (i.e., result in a substantial increase in either the number of vehicle trips, the volume-to-capacity ratio on roads, or congestion at intersections)?	☐	☐	☐	☒
b) Exceed, either individually or cumulatively, a level of service standard established by the county congestion management agency for designated roads or highways?	☐	☐	☐	☒
c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?	☐	☐	☐	☒
d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	☐	☐	☐	☒
e) Result in inadequate emergency access?	☐	☐	☐	☒
f) Result in inadequate parking capacity?	☐	☐	☐	☒
g) Conflict with adopted policies, plans, or programs supporting alternative transportation (e.g., bus turnouts, bicycle racks)?	☐	☐	☐	☒

Discussion

No Impact. The Proposed Project sites are located within residential neighborhoods throughout the City, and within the City limits (Figure 2-1). Construction would not disrupt transportation and circulation patterns in the vicinity of the Proposed Project sites. Construction-generated traffic would be temporary and short-term. Construction equipment and vehicles would remain at each site long enough to complete the proposed meter installation, anticipated to last up to 2.5 hours. If a drive-by AMR system is implemented, two vehicles would periodically drive by the meters and collect data. A meter reader would read approximately 6,000 meters per day; therefore; it would take two vehicles (meter readers) 8.75 days to read the entire City. If a fixed network AMR system is used, no vehicle (meter readers) would be needed to read the meters. Therefore, no substantial impact to traffic would occur and no mitigation would be required.

a) **No Impact.** The Proposed Project is not expected to generate a substantial increase in traffic during the peak traffic hours of the surrounding roadway network. The Proposed Project would not temporarily exceed, either individually or cumulatively, current level

of service standards. Therefore, no impact would occur and no mitigation would be required.

b) **No Impact.** No uses are proposed that could affect air safety at the Fresno Yosemite International Airport, the Chandler Executive Airport, or other airports in the region. Further, the Proposed Project would not involve use of air transit, nor is it expected to cause any change in air traffic patterns. Therefore, no impact would occur and no mitigation would be required.

c) **No Impact.** The Proposed Project does not propose to make changes to roadways that would create road hazards or alter design features developed to mitigate such hazards. Therefore, no impact would occur and no mitigation would be required.

d) **No Impact.** Construction of the Proposed Project would not affect traffic flow, resulting in delays for emergency vehicle access in the vicinity of the Project. Operation of the Proposed Project would not change current emergency access routes or cause an increase in the need for emergency services. Therefore, no impact would occur and no mitigation would be required.

e) **No Impact.** Project-related construction activities would require temporary parking for workers and equipment in residential areas where installations are occurring. However, these residential areas contain sufficient space to accommodate the temporary parking needs for construction workers and equipment. As a result, no impact would occur and no mitigation would be required.

f) **No Impact.** The Proposed Project would not create a demand for alternative transportation. In addition, the Proposed Project would have no impact on alternative transportation facilities. Therefore, no impact would occur and no mitigation would be required.

Utilities and Service Systems

Issues (and Supporting Information Sources):	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less-Than-Significant Impact	No Impact
16. UTILITIES AND SERVICE SYSTEMS—Would the project:				
a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?	☐	☐	☐	☒
b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☐	☒
c) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☐	☒
d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?	☐	☐	☐	☒
e) Result in a determination by the wastewater treatment provider which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?	☐	☐	☐	☒
f) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?	☐	☐	☐	☒
g) Comply with federal, state, and local statutes and regulations related to solid waste?	☐	☐	☐	☒

Discussion

a) **No Impact.** Implementation of the Proposed Project would not result in exceedance of wastewater treatment requirements of the Central Valley Regional Water Quality Control Board. Therefore, no impact would occur and no mitigation would be required.

b) **No Impact.** The Proposed Project would not require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities. Therefore, no impact would occur and no mitigation would be required.

c) **No Impact.** The Proposed Project would not require or result in the construction of new stormwater drainage facilities or expansion of existing facilities. Therefore, no impact would occur and no mitigation would be required.

d) **No Impact.** No new or expanded water supplies or entitlements would be required under or as a result of the Proposed Project. Therefore, no impact would occur and no mitigation would be required.

e) **No Impact.** The Proposed Project would not increase the demand for wastewater treatment. Therefore, no impact would occur and no mitigation would be required.

f) **No Impact.** Construction and operation of the Proposed Project would not generate a significant amount of solid wastes. Therefore, no impact would occur and no mitigation would be required.

g) **No Impact.** The Proposed Project would comply with all relevant federal, state, and local statutes and regulations related to solid waste. Therefore, no impact would occur and no mitigation would be required.

Mandatory Findings of Significance

Issues (and Supporting Information Sources):	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less-Than-Significant Impact	No Impact
17. MANDATORY FINDINGS OF SIGNIFICANCE—				
a) Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal, or eliminate important examples of the major periods of California history or prehistory?	☐	☐	☐	☒
b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects.)	☐	☐	☐	☒
c) Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	☐	☐	☐	☒

Discussion

a) **No Impact.** The Proposed Project is not anticipated to have the potential to degrade the quality of the environment. Implementation of the Proposed Project would not substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal, or eliminate important examples of the major periods of California history or prehistory. The particular impacts are described in the respective sections of this Initial Study checklist.

The Proposed Project is beneficial in that the addition of water meters is a conservation tool that would save water. Therefore, the Proposed Project would improve the overall environment.

b) **No Impact**. Implementation of the Proposed Project would not result in a significant contribution to any cumulative environmental impacts. The Proposed Project would add only minor amounts of pollutants to cumulative air quality impacts. If a drive-by AMR system is implemented, two vehicles would periodically drive by the meters and collect data. A meter reader would read approximately 6,000 meters per day; therefore; it would take two vehicles (meter readers) 8.75 days to read the entire City. Criteria pollutant concentrations, including greenhouse gases from the two drive-by vehicles, would only add very minor, incremental amounts to the cumulative impacts. If a fixed network AMR system is used, no vehicles (meter readers) would be needed to read the

meters, and therefore, no additional air pollutants would be emitted. The Proposed Project is not anticipated to have impacts that are individually limited, but cumulatively considerable.

c) **No Impact.** The Proposed Project would not directly or indirectly cause substantial adverse effects on human beings. The impact analysis included in this chapter indicates that for all resource areas, the Proposed Project would have no impacts.

Chapter 5 - Determination

On the basis of the Initial Study:

☒ I find that the Proposed Project WOULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.

☐ I find that although the Proposed Project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the project have been made by or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.

☐ I find that the Proposed Project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT will be prepared.

☐ I find that the Proposed Project may have a "potentially significant impact" or "potentially significant unless mitigated" impact on the environment, but at least one effect (1) has been adequately analyzed in an earlier document pursuant to applicable legal standards and (2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.

☐ I find that although the Proposed Project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier EIR pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier EIR, including revisions or mitigation measures that are imposed upon the Proposed Project/Action, nothing further is required.

Signature	April 28, 2008 Date
Robert N. Anderson Printed Name and Title	Asst. Director City of Fresno
Printed Name and Title	Affiliation

Chapter 6 - Bibliography

California Air Resources Board (CARB). 2008. Available at: http://www.arb.ca.gov.

City of Fresno. 2002. 2025 General Plan. November 2002.

HDR Engineering, Inc. (HDR). 2008. City of Fresno Residential Meter Implementation Plan.

Chapter 7 - List of Preparers

7.1 HDR Engineering

Project Manager	Michele Stern
Environmental Planner	Jeanette Winter
QA/QC	Laurie Warner Herson

CERTIFICATION

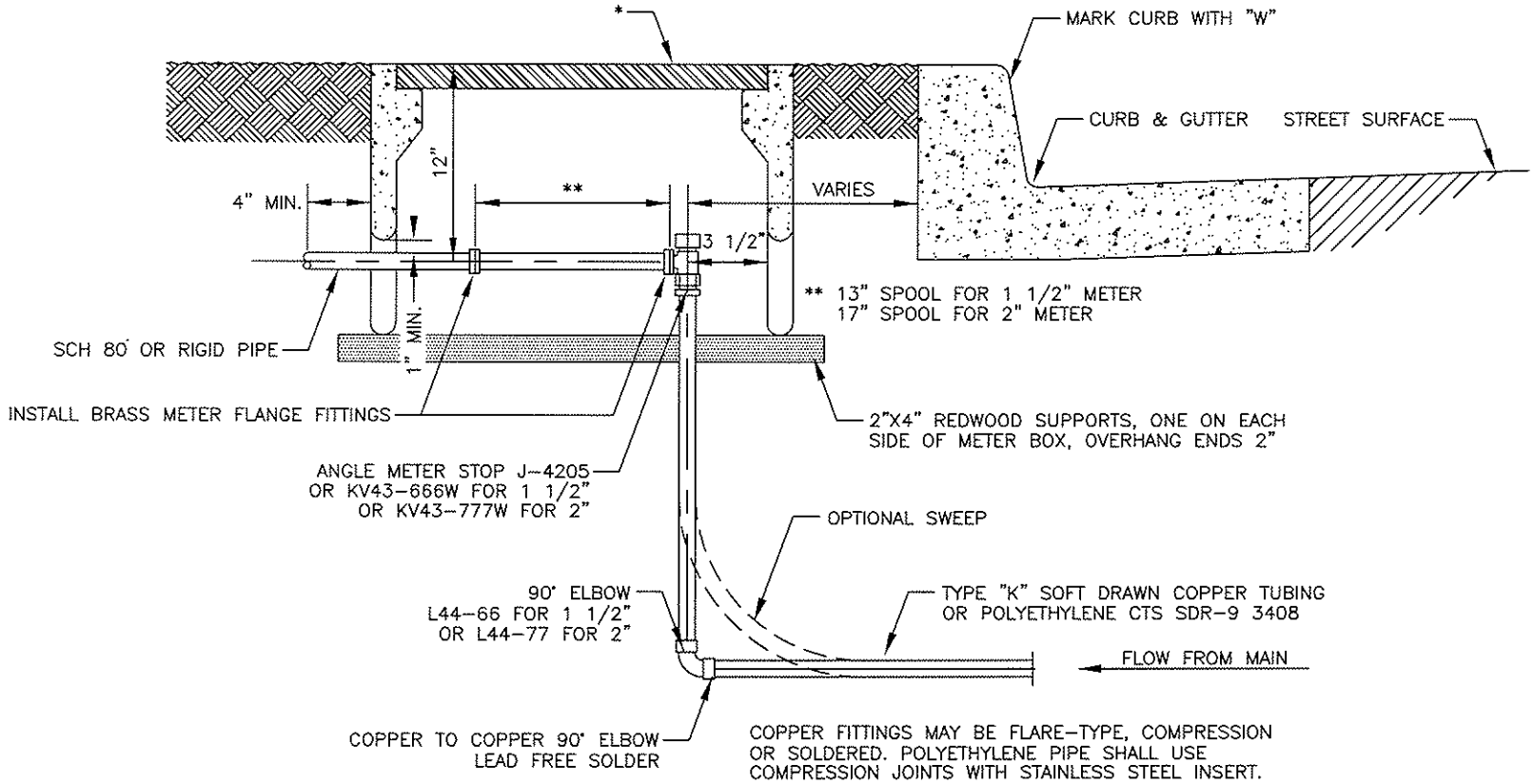
STANDARD SPECIFICATIONS
DEPARTMENT OF PUBLIC WORKS
2002 EDITION

These Standard Specifications were established by the Director of Public Works in August of 1969 and were adopted by the Council of the City of Fresno on the 4th day of March, 1970 by Resolution No. 70-36.
These Standard Specification were updated in August, 2002 and made effective this 1st day of September, 2002. Any plans submitted after this date for approval by the Director shall abide by these Specifications.

James W. Owens, Interim Director

8/1/02
Date

METER BOX INSTALLATION FOR 1 1/2" & 2" SERVICES



METER BOX SPECIFICATIONS		
CHRISTY		BROOKS
1 1/2" B30 BOX WITH READ RITE B-30WL LID	OR	1 1/2" NO. 38 BOX WITH READ RITE BB-30WL LID
2" B36 BOX WITH READ RITE B-36WL LID	OR	2" NO. 66 BOX WITH READ RITE BB-36WL LID

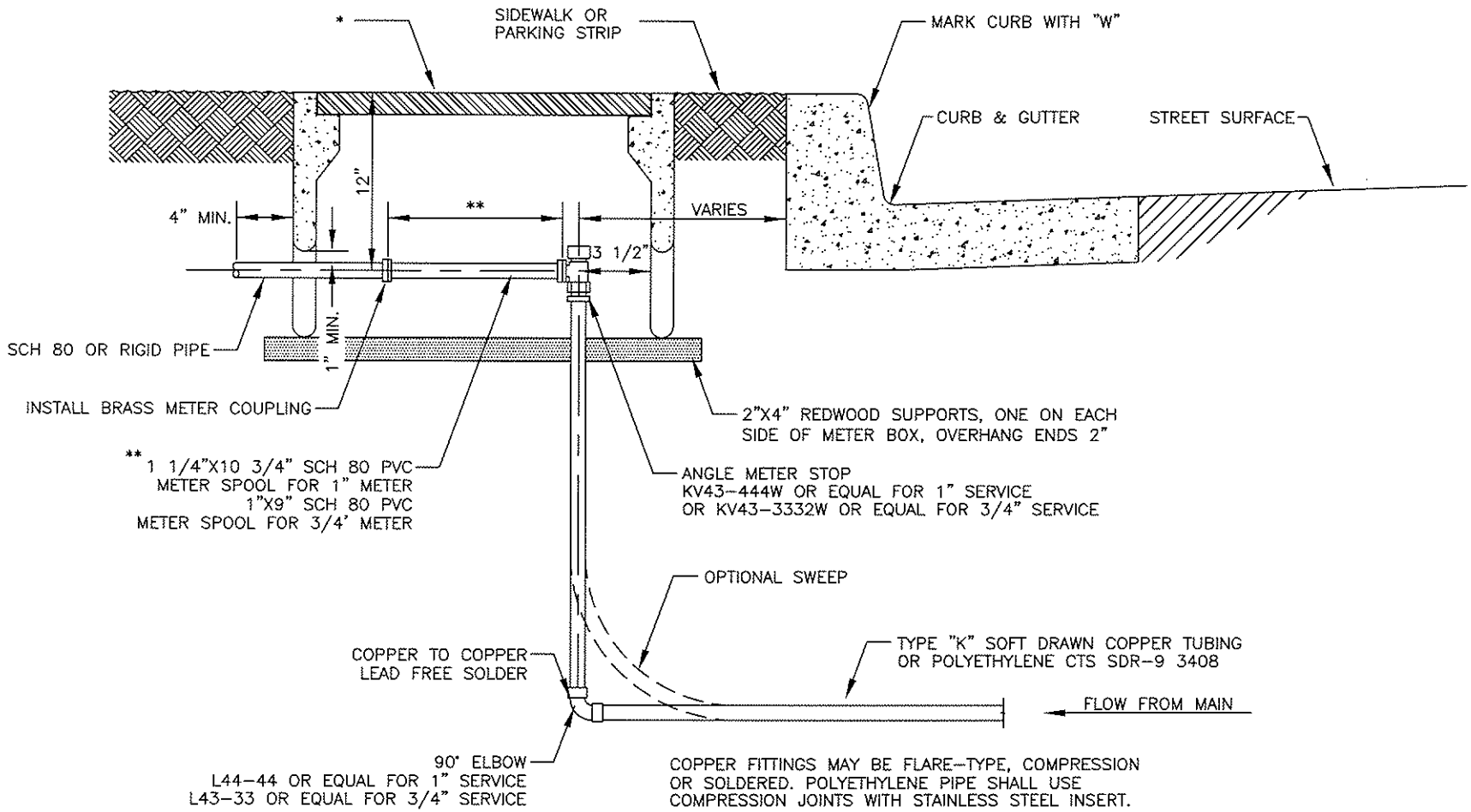
* TRAFFIC RATED LID TO BE USED WHEN METER IS LOCATED IN ALLEYS, DRIVEWAYS OR ROLLED CURB AREAS

REF. & REV.
OCTOBER 2008

CITY OF FRESNO

W-1A

METER BOX INSTALLATION FOR 3/4" & 1" SERVICES



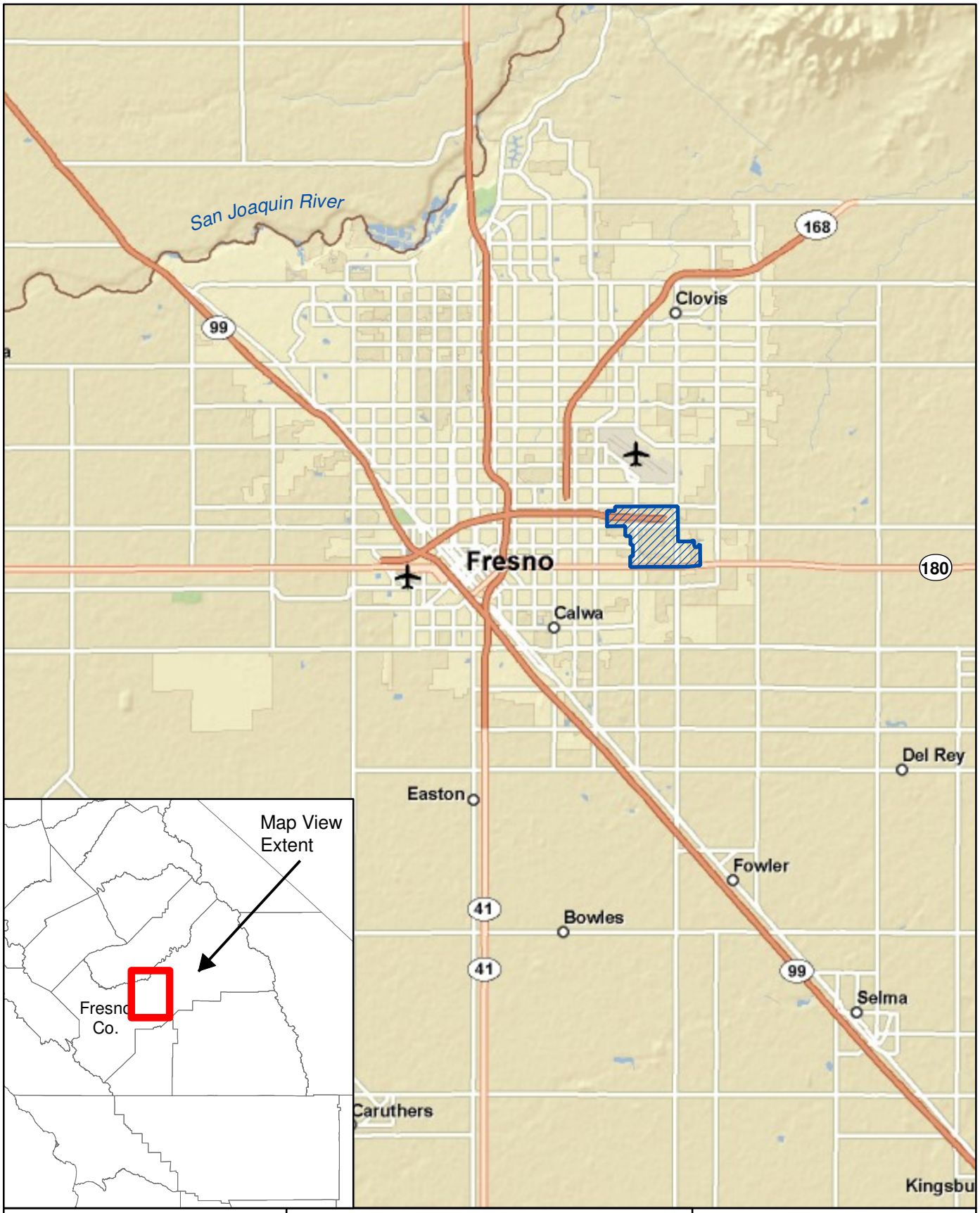
METER BOX SPECIFICATIONS		
CRISTY		BROOKS
B16 OR N16 BOX WITH READ RITE B-16WL LID	OR	NO. 37 BOX WITH READ RITE BB-16WL LID

* TRAFFIC RATED LID TO BE USED WHEN METER IS LOCATED IN ALLEYS, DRIVEWAYS, OR ROLLED CURB AREAS

REF. & REV.
OCTOBER 2008

CITY OF FRESNO

W-2A



0 1 2 3 4 Miles

EST. 1968
PROVOST & PRITCHARD
CONSULTING GROUP
An Employee Owned Company

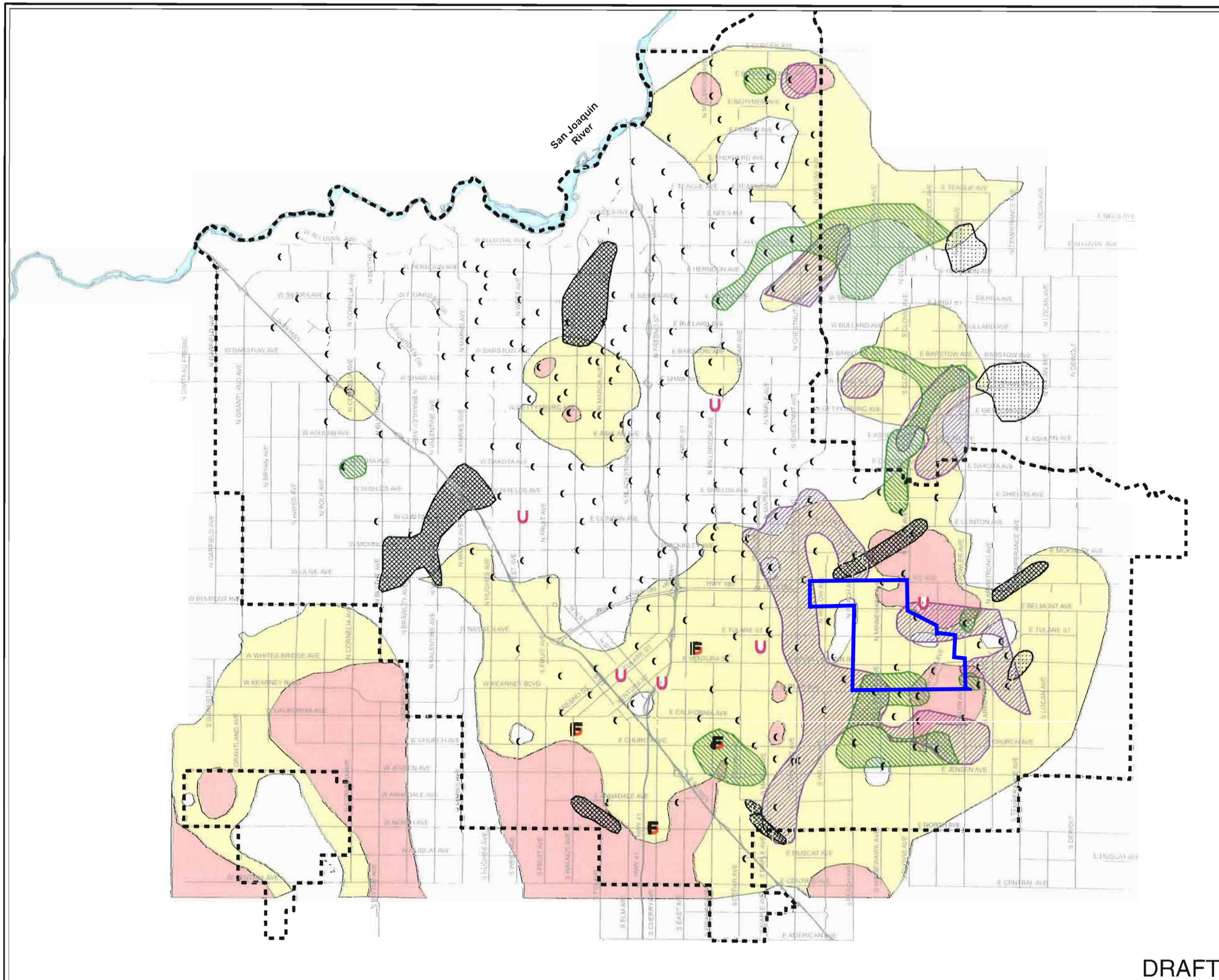
286 W. Cromwell Ave.
Fresno, CA 93711-6162
(559) 449-2700

Legend

BAKMAN W.C.

Location Map

Bakman Water Company



City of Fresno Metropolitan Water Resources Management Plan Update

REGIONAL GROUNDWATER CONTAMINATION

N

0 0.5 1 2
Scale in Miles

NOTES:

LEGEND:

- City of Fresno Sphere of Influence
- Active City Wells
- Superfund Site (Old)
- Gasoline Case (Old)
- EDB Plume (Old)
- Point Source Plume (Old)
- DBCP Plume (> 0.1 ppb)
- TCP Plume (> 0.01 ppb)

Nitrates

- Nitrate > 20 mg/L
- Nitrate > 40 mg/L

Fresno All-America City 2000

WEST YOST ASSOCIATES Consulting Engineers

O:\C1439\020501\GIS\Phase1\Ch05\439020501-FIG0506cn1.mxd