



R900® SYSTEM BID SPECIFICATIONS



This document is intended for utilities and consultants and provides specifications for a mobile AMR or hybrid AMI system.

1. SCOPE OF WORK

The utility issues this RFP to procure a meter reading system capable of meeting the current and future meter reading needs within our service area. The scope of work involves, but is not limited to, providing and installing a meter reading system which includes software, hardware, and all necessary training and installation support. The reading equipment shall be capable of receiving meter readings while utilizing a handheld reading device and/or a mobile reading unit and/or a fixed network.

The system must have the capability to be upgraded to radio frequency (RF) technology to improve meter reading efficiency, including addressing "hard-to-read" meters and increasing meter reader safety. The vendor shall describe the upgrade requirements to incorporate RF technology.

During upgrade to RF reading, the system shall still be able to probe water meters or allow manual entry within the same route without detaching the receptacle or RF meter interface unit (MIU).

The proposed system must be provided by the same company or an equity partner (specifics must be submitted with the proposal).

All system parts furnished (reading equipment, RF transmitters, meters with absolute encoders) shall be produced from an ISO 9001 manufacturing facility.

2. SYSTEM OVERVIEW

The meter reading system shall be adaptable to walk-by, mobile, or full fixed network methods of collecting data.

The transition from walk-by to mobile to fixed network shall be seamless and allow all methods to operate together in a hybrid system.

The meter reading system shall include a walk-by system providing a migration path from the walk-by to mobile to full fixed network applications. The difference between the three systems shall be the method of gathering the meter readings. The systems are not mutually exclusive – they can be used together seamlessly. The first shall use the handheld data collection device; the second shall use a mobile data collection device driven near the customer premises to collect reads; and the third shall use a fixed network data collector to continually receive, store, and communicate data from meters within range. Each method shall add its unique value to the utility and the choice shall be driven by the needs of the utility and its customers.

Host Software The software package installed on the host system at the utility site. Its main function shall be to make route assignments to send to the data collection device and to transfer collected information to the billing/CIS system via a transfer file. The utility will be responsible for the transfer file.

Data Collection Device The means of communication between the MIU installed at the meter site and the host software. In a walk-by system, it must be a handheld computer capable of reading meters using keyed-entry, probing, or RF communications with an attached receiver device. In the case of a mobile application, the data collection device must be a portable personal computer integrated with an RF receiver that can be installed in any vehicle. For the fixed network application, the data collection device must be an environmentally sealed control box able to adapt to various installation settings. It must also demonstrate the ability to receive, store, and communicate meter readings to the host software for further use and analysis.

Meters/Meter Interface Units (MIUs) Meters connected to electronic devices that shall collect meter usage from an encoder meter register and shall transmit the meter reading and a unique ID number to the data collection device.

3. HOST SOFTWARE

The host software must be meter reading software that will transfer files between the utility billing/CIS system and the data collection devices. The utility will provide the transfer file to the vendor's file format provided it is a standard ASCII format. The host software must be configurable for either a standalone installation or operate in a Windows Client/Server environment.

3.1 BASIC FUNCTIONS

The software must provide easy management of the meter reading data. After the readings are collected, they must be unloaded to the PC for review and reporting and exported to a file to be sent to the utility billing/CIS system. New meter reading routes must then be imported into the database and prepared for loading into the handheld.

The meter reading software shall manage the routes that are loaded into the data collection device and be able to split them into multiple routes if necessary.

The meter reading software must include the following:

- Must be able to load/unload from the handhelds by either serial communications at a minimum speed of 19,200 bps or by Ethernet communications at a minimum speed of 10 Mbps.
- Allow PC operator to review and edit any account in the meter reading database.
- Generate route and activity reports defined by the user.
- Provide integrated database backup/restore functions.
- Allow user to merge several separate files into one database.
- Enable the user to set up and save custom report formats.
- Enable the user to specify the data to be exported from the database for transferring to the billing system.
- Allow for database records to be automatically deleted during the export process.
- Enable the user to search the database for records matching specified information.
- Allow the user to define up to 100 notes.

3.1.1 TYPICAL READ CYCLE

In a typical read cycle, the meter reading system must allow the following operations:

- Merge routes into the existing database for loading onto a data collection device.
- Select routes to be read, split routes, and assign routes to a data collection device.
- Generate the route file and load it onto the data collection device or flash drive.
- Unload routes from the data collection device.
- Post readings from the data collection device onto appropriate accounts within the database.
- Make a backup copy of the routes within the database (including current system configuration files).
- Print preselected reports.
- Export routes out of the database to be sent back to the utility billing system.

3.1.2 REPORTS

Standard reports must include:

1. All Leak – Summarizes data relating to high resolution solid state absolute encoder-equipped meters that show a continuous or intermittent leak.
2. Coded Notes – Summarizes data relating to any predefined notes associated with a meter. The coded notes represent any issues found at a specific meter that a meter reader is required to report during the route reading and work order process. The note codes are customizable to meet the needs of the utility.
3. Continuous Leak – Prioritizes the number of days a continuous leak was detected within the last 35 days, reported by high resolution solid state absolute encoder-equipped meters.
4. High Resolution Solid State Absolute Encoder – Summarizes data relating to the high resolution solid state absolute encoder-equipped meters within the last 35 days. Displayed within the report are consecutive days of no consumption, reverse flow detected at the meter, number of days a leak was detected, and the current status of the leak.
5. Found Meters – Displays meters located by field technicians, but not displaying within the route.
6. Free-Form Notes – Displays personalized notes entered by the meter reader for a specific meter.
7. Hi/Lo Fail – Summarizes all meters that exceeded the preset limits allowed for the reading on a specific meter. The preset limits are defined within the CIS.
8. Invalid Readings or IDs – Lists readings that were taken but are incorrect or invalid. A non-numeric character or characters within the meter reading represents an invalid reading.
9. Major Reverse Flow Event – Lists the meter information relating to high resolution solid state absolute encoder-equipped meters that show a major reverse flow event occurring.
10. Meter ID Compare – Displays account information in which a meter reader forced a specific ID and reading to an account because it did not match information sent over from the CIS file.
11. Meters with No Readings – Summarizes data relating to meters in which readings or skip codes were not obtained.
12. Meters with Readings – Summarizes data relating to all meters for which readings were obtained.
13. Meters with Readings or Notes – Summarizes meters that have readings but also have a code present on a specific meter.
14. Non-Billable Reads – Lists the readings that were taken but are incorrect or invalid. A non-numeric character or characters within the meter reading represents an invalid read.
15. Walk Order and Productivity – Lists readings statistics for a particular reader. This report shows the route, date, and time the route was read, total number of readings collected, starting and ending times for each route, as well as the minimum, maximum, and average elapsed time.
16. Zero Consumption – Prioritizes by severity the number of consecutive days of no consumption detected by an MIU and register within the last 35 days.
17. Skip Codes – Summarizes data relating to meters for which readings were attempted but unable to be obtained. The skip codes that are available on the handheld are defined by the host system operator.
18. Trouble Codes – Summarizes data relating to any issues reported at the meter with a reading still received at the meter. The trouble codes available on the handheld are defined by the host system operator.
19. Productivity Report – Displays the information for the reader, along with the time elapsed between readings.

20. Route Assignments – Allows users to view which routes are currently assigned. This report also contains information on the scheduled date and sequence of the route.
21. Route Detail – Displays specific route information for all available routes. This report is an overview of all routes which shows detailed information on how the route was read, all readings received within the route, the date and time meters were read, and any codes received on specific meters.
22. Data Logger – Displays daily or hourly consumption in a bar or line format reported by a data logger attached to an MIU.
23. Handheld List – Lists the handheld IDs set up within the software.
24. General Log – Tool used primarily by support personnel to troubleshoot customer concerns and issues regarding the software.
25. Import Log – Displays all of the import activity generated within the database.
26. Review Reading Log – Displays all changes made within the Review Readings module of the software.
27. System Errors Log – Displays the date and time of any errors reported during any processes within the database. This report is considered a troubleshooting tool.

The software must also provide a powerful custom report generator, allowing the user to select and order specific fields from the database to be printed; in addition, it should allow the entire database to be sorted by criteria such as date, reader ID, or other specified fields.

3.1.3 SPECIAL REPORTS

Special reports must provide meter reader productivity information. The reporting module must also be a detailed productivity report that will list total number of readings for a specific meter reader and book as well as the time elapsed between each read entered. Also available must be a summary of start time, stop time, elapsed time, mean, maximum, and minimum read times.

3.1.4 SECURITY

- The system shall provide a method for multiple levels of user login access into the software application.
- The system shall support active directory login processes.
- The system shall provide a method of database encryption.

3.1.5 ADDITIONAL HOST FEATURES AND FUNCTIONALITY

- The system shall provide a method to provide a last recent read.
- The system shall support migration to fixed network without the need to implement a separate software package.
- The system shall provide a method to view collector status in the event of power failure or other catastrophic event.
- The system shall provide a method to work in unattended operations.
- The system shall provide a method to auto-update or notify the users of an update when available for installation.

4. DATA COLLECTION DEVICES

4.1 WALK-BY SYSTEM

In a walk-by system, the system must give the user the ability to collect metering data in several ways:

- Keyed entry.
- Inductive probing.
- RF communication: The meter must be attached to an RF MIU, and the handheld must connect via Bluetooth to a RF receiving device.

The proposed walk-by data collection system must include:

- Handheld data collector device which shall be a combination of a handheld unit and a separate Bluetooth-connected RF receiver.
- Communication cradles for charging and loading the handheld unit.
- Probes for interrogating Neptune and Sensus absolute encoders.

4.1.1 HANDHELD DATA COLLECTOR DEVICE

4.1.1.1 BASIC FUNCTIONS

The handheld data collection device shall have the capability to collect and store meter readings at any time of the meter reading route by any of the following methods:

- Manual use through an alphanumeric keypad.
- Probing of water meters equipped with supported absolute encoders.
- Via radio frequency through a Bluetooth-paired receiver.

The unit shall be able to obtain all types of readings on any particular route without requiring:

- Reprogramming of the handheld computer.
- Physical change of software contained within the unit while in the field.
- Access through special software menus contained within a given route/program.

The handheld data collection device must be able to multitask by collecting data while in keyed entry (manual) meter reading mode.

4.1.1.2 HARDWARE REQUIREMENTS

4.1.1.2.1 PROCESSOR AND PC COMPATIBILITY

The handheld data collection device must be PC compatible and run Windows Mobile 6.1. At minimum, the handheld must operate with a Marvell PXA320 Processor at 806 MHz.

4.1.1.2.2 CASE

- The unit must be able to withstand 26 drops at room temperature from four (4) feet onto plywood over concrete.
- The handheld must meet and exceed MIL-STD 810F standard, method 516.5, procedure IV for drop tests.
- The handheld shall be ergonomically designed to be comfortable for handheld meter reading.

4.1.1.2.3 DISPLAY

- The handheld screen must be Full VGA, sunlight-readable 16-bit color TFT with LED backlighting. The size of the display characters must be selectable, allowing the use of larger characters that are easier to read. The screen must have a minimum of 480 by 640 pixels (a total of 307,200 pixels).
- The manufacturer's specification on the contrast ratio on the LCD display must provide automatic contrast adjustment based on temperature, which will give clear readings in extreme temperature. There must also be a manual contrast adjustment feature which will allow the user to adjust the contrast to his or her satisfaction.
- The display must have no degradation when exposed to storage temperatures of -40°C to +70°C (-40°F to +158°F) and operating temperatures of -30°C to +60°C (-22°F to +140°F).

4.1.1.2.4 KEYBOARD

- The keyboard must have independent numerical keys with adequate separation for use with a gloved hand. Must have a full on-screen, customizable alphanumeric keyboard.
- There must be an auto-repeat function on keys and a rapid response between keying and seeing results on the screen.

4.1.1.2.5 BATTERY

- The battery capacity must be sufficient for a minimum of ten (10) hours of meter reading.
- The handheld must have a rechargeable 5200 mAh lithium-ion battery.
- The handheld must come with a power management system designed to conserve power.
- The handheld must come with an integrated intelligent, fast-charge capability that allows for full charge in four (4) hours.

4.1.1.2.6 MEMORY

- The handheld data collection device must include 128 MB of DDR SDRAM.
- The handheld must have 512 MB to 2 GB of onboard non-volatile flash storage.
- The handheld must come with a Secure Digital (SD/SDHC).

4.1.1.2.7 CARRYING METHOD

A hand strap must be provided with each unit and must provide ease of use for right- or left-handed operators.

4.1.1.2.8 SIZE

The handheld data collection device dimensions must not be larger than:

- Length: 6.92" (17.6 cm)
- Width: 3.92" (10 cm)
- Height: 1.96" (5.0 cm)

4.1.1.2.9 WEIGHT

The unit's weight must be less than 21 ounces (596 g) with the battery pack installed.

4.1.1.3 ENVIRONMENTAL CHARACTERISTICS

The handheld must include but not be limited to the following:

- The unit must operate in a temperature range of -30°C to +60°C (-22° F to +140° F).
- The device shall be water-resistant, capable of unlimited exposure to spray or splash (such as rain or snow).
- The handheld unit must be capable of being immersed in 3.3 feet (1 meter) of water for 30 minutes.
- The device must be protected against an 8 kV static discharge without loss of data.

The unit must be resistant to various chemical products and must be sealed to keep out dust, humidity, and water.

- The device must be shock-resistant exceeding IEC 68-2-32 method 1 (a one-meter drop on concrete).

4.1.1.4 SOFTWARE REQUIREMENTS

4.1.1.4.1 BASIC FUNCTIONS

The handheld software must be easy to use and give the meter reader control over the route in searching for accounts, tagging accounts for later action, entering related notes, and manually reading meters.

The handheld software must include entry of meter readings.

In addition, the handheld software shall include but shall not be limited to the following basic features:

- User-customizable key assignments.
- Allow manual or automatic entry of meter readings, ID numbers, and note codes.
- Perform high/low test on readings.
- Date and time stamped to each reading.
- Identify type of reading – manual keyed, probed, or RF MIU.
- Must be able to read Neptune ARB® I –VI, E-Coder®, and Sensus ECR® II and ECR III.*
*(*Denotes support for the ECR III encoder when programmed as an ECR II with 6 wheel-encoders via either wireless probed reading or via RF MIU.)*
- Perform unread meter search.
- Found meter processing for new accounts.
- Allow forward and reverse walk order.
- Data search capability (display, notes, and ID).
- Auto-search for automatic reading of encoded meters.
- Display the number of read and unread accounts on demand.
- Enable left-to-right, right-to-left, or calculator entry of manual meter readings.
- Capture multiple meter readings from a single ProRead™; i.e., two networked ProRead or E-Coder encoders.
- Collect the information from the host to generate reports on leak detection, tamper detection, and backflow conditions when used with Neptune R900® MIU and E-Coder register.

4.1.1.4.2 SOUNDS

Successful meter readings will be confirmed by an audible tone.

4.1.2 COMMUNICATIONS/CHARGING EQUIPMENT

4.1.2.1 COMMUNICATION

Communications between the handheld and the PC software must be established using a cradle connected via Ethernet or USB. In addition, the following basic features must be included:

- Extensive error checking is provided to ensure data integrity during communications between the handheld and the PC.

A typical route of 400-500 accounts can be loaded or unloaded in less than one minute with the ability to load more than 5,000 records into a single handheld unit.

- Routes/books can be split at the PC level.
- Once loaded, routes may be individually selected on the handheld.

4.1.2.2 COMMUNICATIONS/CHARGING CRADLES

- The communications/charging cradle will be housed in a suitable material that can be wall- or tabletop-mounted.
- It will have the capability of recharging the handheld unit within four (4) hours and also provide the communication port connection to the computer.
- The cradle will be capable of communicating with the host computer at 10 Mbps.
- The cradle must be capable of both USB and Ethernet communications with a PC.
- The charging units must carry the Underwriters Laboratory (UL) seal of approval.

4.1.3 PROBES

The handheld must be compatible with a wireless probe capable of reading Neptune ARB V, Neptune ProRead AutoDetect and Sensus ECRR II and ECR III.*

*(*Denotes support for the ECR III encoder when programmed as an ECR II with six (6) wheel-encoder water meters.)*

4.1.4 RADIO FREQUENCY CAPABILITY

The reading system must be capable of being upgraded to radio frequency communications. Utility plans to read water meters equipped with radio frequency meter interface units. Only absolute encoder registers using Neptune ProRead, E-Coder, or Sensus UI-1203 communication protocols shall be acceptable. In the radio read system, the encoder registers will be connected to an MIU that shall provide the radio link from the meter to the handheld interface unit. MIUs shall feature "auto detect" functionality and shall not require reprogramming in the field.

The handheld radio frequency receiver must be separate from the handheld unit itself.

4.1.4.1 RADIO FREQUENCY READING FUNCTION

The function of the handheld and external receiver in radio frequency mode is to provide the utility the capability of reading meters via radio signals. The external receiver must be capable of receiving RF readings and transferring those readings to the handheld via Bluetooth connection. All transmissions from supported MIUs will be collected. The reading of any MIU shall be automatically stored in the proper account record without the intervention of the meter reader.

Should any MIU not be able to be read during the route, the software shall support storage of a flag in the account record, indicating clearly that the MIU could not be read. When reading the meters in the RF mode, it should not require the meter reader to activate any wake-up tone.

The handheld with the external receiver reading equipment must provide a test mode to verify operation of the MIU. This test mode must be accessible from within the meter reading application as well as accessible from a handheld's main screen (no login required). The test application must be capable of reporting statistics for an individual MIU or displaying all MIUs within range.

4.1.4.2 WALK-BY RF RECEIVER

- The walk-by RF receiver must be a separate belt-clip wearable device which communicates via Bluetooth to the handheld. It must be compatible with Neptune R900 technology to allow radio frequency communications with water meters that have an RF MIU connected externally.
- The external RF receiver antenna shall be internally mounted.
- The external RF receiver must have FCC Class B certification.
- The external RF receiver must contain an SD card.
- The external RF receiver must utilize SDR (Software-Defined radio) technology.
- The external RF receiver must contain a mini-USB port for both battery charging and PC communications.
- The external RF receiver must contain a field-replaceable battery.
- The external RF receiver must have an available Android application so that the receiver can be paired via Bluetooth with an Android phone or tablet for RF test read functionality.
- The external RF receiver must have four (4) LEDs displaying the following:
 - Battery/power status
 - RF status
 - Bluetooth status
 - Mode status
- The external RF receiver must be capable of unattended operations where the receiver is not paired with any handheld device but hears and stores any received Neptune R900 reading packets to the SD card. This data must be able to be imported into the host software for use as billing reads.

The following specifications must be met:

Radio Characteristics

- Receiving Frequency: 910-920 MHz unlicensed RF.
- The receiver must have 50 channels.
- The receiver must support reading eight (8) channels simultaneously.
- The external RF receiver must be capable of processing 360 RF packets per second.

Size and Weight

Physical specifications of the external RF receiver must be within the following parameters:

- Length: 5.75" (14.6 cm)
- Width: 1.66" (4.22 cm)
- Height: 3.58" (9.1 cm)
- Weight
 - With battery: 1.3 lbs.
 - Without battery: 1.1 lbs.

Probe Compatibility

- Compatibility with Neptune Advantage II Probe or Neptune Pocket ProReader RF.

Environmental Operating Conditions

- Operating conditions: -4°F to +122°F (-20°C to +50°C)
- Storage temperature: -40°F to +185°F (-30°C to +70°C)
- Designed to and tested to MIL-STD-810F specifications
- Designed to withstand electrostatic discharges per EN61000-4-2

RF Walk-by Receiver Battery Life

- The data collection device battery must provide enough power to support RF meter reading for a minimum of eight (8) hours.

4.2 MOBILE DATA COLLECTION SYSTEM

The mobile data collection device must be a portable, compact electronic system mountable in any vehicle. It must collect the data broadcast by the MIUs and store it onto a USB flash drive to be downloaded to the host computer at the utility office.

The unit shall be easily transportable from vehicle to vehicle or from vehicle to office.

4.2.1 HARDWARE SPECIFICATIONS

The key components of the collection device must consist of a portable personal computer (PPC) and an integrated radio receiver unit.

The mobile data collection device must be easily installed in any vehicle that will drive to the field for meter reading. It must be mounted securely in the passenger seat with a standard seat belt. Through a 12V DC plug-in power cord, the unit must be powered from the vehicle's power supply (cigarette lighter).

The system must include a magnetic base antenna and the antenna chord as well as all necessary power and communication cables.

The mobile data collection device shall draw no more than one (1) AMP of power. The mobile data collection device dimensions must be no larger than the following parameters: 11.0" x 8.0" x 3.15". The weight shall not be more than five (5) lbs.

The mobile data collection device shall support the connection to any laptop that meets the following minimum system requirements:

- Operating System: Windows XP (32 bit), Windows Vista (32 bit), or Windows 7 (Professional 32 and Home Premium 64)
- Processor: Intel Pentium processor 1.7 GHz
- Memory: 1 GB
- Communication: Internal 802.11 b/g wireless LAN
- USB 2.0

The mobile data collection unit should also be capable of supporting Itron R300 and Itron electric bubble-up ERTs in the event the utility supports electric meters.

4.2.2 ENVIRONMENTAL CONDITIONS

The mobile data collection device must work in the following environmental conditions:

- Operating Temperatures: 32° to +122°F (0° to +50°C)

- Storage Temperature: -40°F to +185°F (-40°C to +85°C)
- Operating Humidity: 5 to 95% non-condensing relative humidity

4.2.3 SOFTWARE REQUIREMENTS

4.2.3.1 BASIC FUNCTIONS

The software must be a dialog-based, intuitive, easy-to-use meter reading application.

After the meter reader starts the reading process, the software must be fully automated to collect the meter reading data received from the radio receiver unit and store it in an export file which can be used by the host software to update the mainframe route data. The system must support import/export via a USB flash drive or WiFi.

Self-diagnostic tests must be run upon booting up the laptop or on request to ensure the proper functionality of the system, including the collection method.

The unit must be capable of optimizing the memory storage space by filtering out duplicate readings from the same MIU and keeping only the last reading received.

Each reading record must contain an MIU ID and a time stamp of the reading.

The software must have the option to provide found meter processing for new accounts.

The software must be capable of performing high/low tests on readings.

The software interface must allow the user to select a single route to view the route status.

The mobile data collection software unit must allow a manual reading to be entered into the account record.

The software must allow free-form notes to be entered to record conditions in the field that require noting and may require an additional work order created to address at a later date.

The software must be capable of displaying meter points, read success, and unread accounts via GIS mapping interface. The software must be capable of collecting the following information for the host to generate reports: leak detection, tamper detection, and backflow conditions (when used with an E-Coder register and Neptune R900 MIU).

The software must allow for GPS location tracking of the meter reading vehicle.

The mobile data collection unit must allow for wireless importing and exporting of route files.

4.2.4 PERFORMANCE REQUIREMENTS

The antenna must be omni-directional and support a gain of 5 dB minimum.

The receiver utilized must operate with a minimum sensitivity of greater than 110 dB.

The receiver module must process at minimum 72 discrete channels across a 10 MHz bandwidth utilizing a digital signal processor capable of capturing eight (8) meter readings simultaneously from these channels.

The receiver module must operate with a dynamic range of greater than or equal to 100 dB with a message success rate greater than 50%.

The mobile data collection device must be able to maintain a minimum sustained processing rate of 70 unique meter reading accounts per second.

The mobile data collection device must reject a minimum 45 dB of noise energy above the target message in adjacent channels.

The mobile data collection device must operate effectively at posted speed limits.

4.3 FIXED NETWORK SYSTEM

4.3.1 BASIC REQUIREMENTS

The system must be able to operate in parallel with other meter reading technologies such as walk-by handheld and mobile systems and utilize a common interface to the CIS/billing software system. The system must also support the migration of technologies.

The system is comprised of two major components: data collection software and fixed network data collection units.

The system must be capable of automatically retrieving consumption information from the same MIUs being read by walk-by and mobile data collection devices to manage customer account and meter reading information, to provide usage analysis information, and to provide a flexible host interface to the utility's CIS system.

The system must be capable of retrieving consumption information from MIUs via walk-by, mobile drive-by, and fixed network data collection without the need for mode changes or reprogramming.

The software must be capable of storing up to 96 readings per day per meter. The software must also provide meter reading management reports, usage analysis reports (flow profiling, leak detection, tamper detection, and reverse flow conditions), off-cycle reads, and system management diagnostics. The software must provide comprehensive coverage for all selected strategic commercial and industrial customers, including indoor, outside, and in pits/vaults, utilizing a single or hybrid technology solution.

The network architecture should provide scalability and adequate bandwidth to provide hourly reading requirements.

The WAN architecture must be flexible to allow communications via common public communication networks such as CDMA and GSM cellular systems.

The system must utilize an unlicensed radio frequency band for LAN communications.

Network management tools must be available to properly monitor the performance of the system to ensure reliable data delivery to the utility for all billing and/or other customer service applications.

Both the fixed network WAN and host software system shall remain the property of the utility. All costs associated with the ongoing operation of the system will be the responsibility of the utility.

The utility shall be responsible for the operation and maintenance of the fixed network system.

4.3.2 HARDWARE REQUIREMENTS

Must demonstrate ability to read Neptune ARB, ProRead, E-Coder, Sensus ECR II and ICE (ECR III)* water meters for commercial and industrial accounts.

*(*Denotes support for the ECR III encoder when programmed as an ECR II with six (6) wheel-encoder water meters.)*

Fixed network data collection must support flexible installation configurations for rooftop, pole, and wall installations.

The fixed network data collection units must utilize a 50-channel, software-defined radio (SDR) capable of processing up to 360 readings per second and eight (8) readings simultaneously.

The fixed network data collection units must provide USB flash drive data retrieval in the event of a backhaul outage.

The fixed network data collection units with AC power must have an uninterruptible power supply (UPS) capable of powering the data collector for eight (8) hours in the event of a power outage.

The fixed network data collection units must support the following backhaul options:

- EVDO Rev A (CDMA)
- 1xEVDO Rev 0 (CDMA)

- 1xRTT (CDMA)
- UMTS/HSPA (GSM)
- EDGE/GPRS (GSM)
- Ethernet

The data collection units shall consist of the following:

- NEMA 4X all-weather proof enclosure
- 100-140V power supply with UPS or solar cell with battery backup
- LAN: Receiver shall support unlicensed communication protocol from MIUs and comply with FCC part 15.247

WAN: Multi-carrier cellular modem or Ethernet

Must be able to provide a minimum daily meter reading resolution.

Must be able to store a minimum of seven (7) days of data in the fixed network data collector.

The data collection unit must meet the following environmental operating requirements:

- Temperature range: -30°C to +60°C
- Humidity: 0 to 95% non-condensing inside enclosure

4.3.3 SOFTWARE REQUIREMENTS

Host software and hardware shall provide all the control needed in the network and provide for the essential functions of network management, meter communications, reporting, database configuration, and alarm monitoring. It shall comply with prevailing industry standards and should run on a Windows compatible PC. Host software shall support walk-by, mobile, and fixed network applications utilizing a common interface to CIS/billing software.

The utility will interface its CIS system to the host application through a standard, flexible interface from a standard PC. All billing reads must be supported through this interface.

The meter reading data communicated to the CIS system shall be provided in a flat file format.

Communications to host software shall take place utilizing public communication networks and be capable of communicating data directly.

The host system shall be PC-based and interfaced to the WAN/LAN through the defined public communication networks.

The system shall remotely upgrade fixed network unit software without impacting system operation.

The software must support reading performance reports, usage analysis, and advanced usage analysis capabilities.

The software must be able to export data to MS Excel and Word applications.

The fixed network data collection system shall have the capability to provide the following data to the utility on a daily basis for monthly billing applications:

- Scheduled meter readings from all commercial and industrial water meters for monthly billing purposes.
- Last recent meter readings for resolution of customer billing disputes and improved customer service.
- Off-cycle reading capabilities for final reads.

4.3.4 TRAINING AND SUPPORT

An approved, detailed training plan must be developed by the vendor with approval by the utility based on results of pre-implementation meetings. The following are items to be determined during these meetings:

- Identify the training personnel and the employees to be trained.
- Identify training schedules for hardware, software, and total system products.
- Define acceptance criteria for system deployment.

The vendor shall be responsible for fully training utility personnel in the system mapping, deployment planning, and installation of the fixed network LAN and WAN components.

4.3.5 SUPPORT SERVICES

The vendor shall have a customer support department. The customer support department is required to maintain a telephone help desk and must have the capability of continuing the support through the use of a service agreement. A list of required services to be provided by the help desk includes but is not limited to the following:

- Answer and resolve hardware/operation/maintenance questions and problems.
- Answer and resolve software operation questions and problems.
- Evaluate information for updates or revisions.
- Evaluate personnel for training needs.
- Perform additional on-site training or evaluation as needed.

The help desk must be available weekdays between 8:00 a.m. and 7:00 p.m. EST with after-hours numbers available as needed.

5. METER INTERFACE UNITS (MIUs)

The MIUs must be compact electronic devices connected to the water meters. They shall interrogate the encoder register and transmit the meter reading and other information to a remote reading device. They shall be compatible with Neptune and Sensus-protocol (UI-1203) absolute encoder registers. MIUs shall feature "auto detect" functionality and shall not require reprogramming in the field. The same RF MIUs must be capable of being read by a walk-by handheld computer equipped with an RF receiver, a mobile system with an RF receiver mounted in a vehicle, and a fixed network data collection system. This shall allow an easy migration between the three meter reading systems without any change to the MIU devices or revisiting the site. The MIUs shall be attached to new meters, or they shall retrofit existing meters in the field. The MIUs shall be manufactured in both wall and pit models. The wall MIU shall have the ability to be mounted in a basement or on the outside of a house and the pit MIU shall have the ability to be mounted in a pit or an underground vault. The wall and pit MIUs shall have a fully-potted, submersible design.

MIUs shall also be available as integrated devices where the encoder register and RF transmitter module are integrated into a single module. These shall be compatible with all Neptune meters. The unit shall interrogate the solid state odometer of the integrated absolute encoder register and transmit the meter reading and other information to a data collection reading device. The unit shall be capable of being read by a walk-by handheld computer equipped with an RF interface unit, a mobile system with a unit mounted in a vehicle, and/or a fixed network data collection system. This shall allow an easy migration between the three systems without any change to devices or need to revisit the site. The absolute solid state encoder register with MIU shall be attached to new meters, or they shall retrofit existing meters in the field via a bayonet mount on top of the meter maincase. The absolute solid state encoder register with MIU shall be manufactured in both inside and pit models. The inside MIU will be mounted inside without degradation of performance and the pit MIU shall have the ability to be mounted in a pit or an underground vault. The inside MIU shall have a water-resistant enclosure and a permanent antenna, while the pit MIU enclosure shall be a roll-sealed copper can and glass lens designed to ensure a watertight seal, and offer a short whip antenna or an optional through-the-pit-lid antenna to address various applications. The MIU shall log 96 days of hourly consumption intervals.

Encoder Description – General

See Neptune Encoder Specifications

5.1 PHYSICAL/MECHANICAL REQUIREMENTS

5.1.1 WALL UNIT

- The MIU housing shall be constructed of a polycarbonate plastic compound and be capable of mounting both indoors and outdoors on wall or pole or attached directly to the meter. The device must be water-resistant and capable of exposure to spray and splash. The device must be able to withstand a 200-hour salt fog test as specified in NEMA 4 standard.
- The device shall provide a location for a tamper-deterrent seal. Tampering with the device functions or connections shall not be possible without causing visible damage to the device exterior or to the seal.
- The device shall be capable of operating at temperatures of -22°F to +149°F (-30°C to +65°C) with operating humidity of 0 to 100% condensing.
- The circuit board and the battery will be protected by a potting material.
- The unit must retrofit to existing installations.
- The MIU device must be protected against static discharge without loss of data per IEC 801-2, issue 2.

5.1.2 PIT UNIT

- For pit or vault applications, the MIU antenna shall be designed to be installed through the industry-standard 1¼" hole in the pit lid with no degradation of transmission range. The MIU antenna unit will be capable of mounting to various thicknesses of pit lids from ½" to 2½".
- The device shall be capable of operating at temperatures of -22°F to +149°F (-30°C to +65°C) and operating humidity of 0 to 100% condensing.
- The range will not be affected when the pit is flooded.
- The circuit board and the battery will be protected by a potting material.
- The antenna shall be made of a metallic and polymer material to withstand traffic and shall have a dual-seal connection to the MIU housing.
- The MIU device must be protected against static discharge without loss of data per IEC 801-2, issue 2.

5.1.3 INTEGRATED UNIT – INSIDE SET

- The integrated MIU housing shall be constructed of a polycarbonate plastic compound and be capable of mounting indoors. The device must be water-resistant and capable of exposure to spray and splash. The device must be able to withstand a 200-hour salt fog test as specified in NEMA 4 standard.
- The device shall provide a location for a tamper-deterrent seal. Tampering with the device functions or connections shall not be possible without causing visible damage to the device exterior or to the seal.
- The device shall be capable of operating at temperatures of -14°F to +149°F (-10°C to +65°C) with a humidity factor of 0 to 95%.
- The circuit board will be coated for moisture protection.
- The battery will be protected by encapsulation in a hard potting.
- The unit must retrofit to existing installations.
- The IMIU device must be protected against static discharge without loss of data per IEC 801-2, issue 2.

5.1.4 INTEGRATED UNIT – PIT SET

- The MIU shall be sealed in a roll-sealed copper can and glass lens to allow for submersion in a flooded pit environment.
- For pit or vault applications, the MIU shall be designed with a whip-type antenna for below-the-pit lid applications.

- The device shall provide a location for a tamper-deterrent seal. Tampering with the device functions or connections shall not be possible without causing visible damage to the device exterior or to the seal.
- The device shall be capable of operating at temperatures of -14°F to +149°F (-10°C to +65°C) and operating humidity factor of 0 to 100% condensing.
- The battery will be protected by a hard potting material.
- The device shall be designed for an optional remote antenna capable of being installed through the industry-standard 1¼" hole in the pit lid for maximum transmission range.
- The optional through-the-lid antenna will be capable of mounting to various thicknesses of pit lids from ½" to 2½" and various distances from meters.
- The optional through-the-pit-lid antenna shall be rigid in design to withstand traffic and shall have a dual-seal connection to the MIU housing.
- The MIU device must be protected against static discharge without loss of data per IEC 801-2, issue 2.

5.2 OPERATION SPECIFICATIONS

- The MIU shall operate within FCC Part 15.247 regulations for devices operating in the 902 MHz to 928 MHz unlicensed band. The output power of the devices will be governed by their conformance to these relevant FCC standards.
- To minimize the potential for RF interference from other devices, the MIU shall transmit using the frequency-hopping, spread-spectrum technique comprised of alternating pseudo-random frequencies within the 902 MHz to 928 MHz unlicensed band.
- For ease of implementation, the system shall not require any special licensing, including licenses from the FCC. The system must, therefore, operate in the 902 MHz to 928 MHz unlicensed band.
- The system must be expandable at any time without getting authorization from the FCC.
- No wake-up tone shall be necessary.
- No MIU programming shall be necessary for installation.
- Power shall be supplied to the MIU by a lithium battery with capacitor. The vendor shall warrant that any battery provided and installed in the MIUs by the vendor shall be free of manufacture and design defects for a period of twenty (20) years – the first ten (10) years from the date of shipment from factory without prorating, and the second ten (10) years with prorating, as long as the MIU is working under the environmental and meter reading conditions specified.
- The number of radio-based meter reads performed must not affect the battery life.
- The battery life shall not be affected by outside erroneous wake-up tones (e.g., other water, gas, or electric utilities reading and therefore sending out a wake-up tone).
- For reliability and meter reading integrity, the vendor shall be the sole manufacturer of the different components of the system (water meters, RF MIUs, meter reading equipment, and meter reading software) and provide a turnkey system offering to the utility.
- The MIU shall not send readings older than one hour. In the event of a cut wire, the MIU shall not send the last good read as this can lead to mis-billing. The MIU shall transmit a trouble code in lieu of the meter reading.
- Tamper – If wiring has been disconnected, a "non-reading" shall be provided indicating wire tamper; a reading that gives the last available reading is an incorrect reading.
- The MIU shall transmit the meter reading continuously at a predetermined transmission interval.
- Each device shall have unique preprogrammed identification numbers of ten (10) characters. ID numbers will be permanent and shall not be altered. Each device shall be labeled with the ID number in numeric and barcode form. The label shall also display FCC approval information, manufacturer's designation, and date of manufacture.

- The MIU shall transmit the encoder meter reading and a unique MIU ID number.
- The MIU shall interface to Neptune V, ProRead (ARB VI), E-Coder (ARB VII), or Sensus UI-1203 communication protocol absolute encoder registers via a 3-conductor wire without need for special configuration to the MIU.
- The MIU shall be mounted per the manufacturer's installation instructions.
- The handheld reading equipment shall provide a test mode to verify proper operation of the MIU by displaying the MIU ID number and meter reading.
- The MIU shall be capable of being received by either a handheld receiver, mobile receiver, or targeted fixed network receiver without special configuration or remanufacture.

6. INSTALLATION AND TRAINING

Complete installation and operating instructions will be included for all of the supplied hardware and software equipment. The training must be supplied by the system manufacturer or approved VAR. Proposal must include any additional costs for training and assistance to install and begin operation of the system. The vendor will also inform the customer of what pre-installation activities are to be completed and what support material will be needed for the initial installation.

7. PERFORMANCE WARRANTIES

In evaluating bid submittals, warranty coverage will be considered. The vendor shall be required to state its warranty and/or guarantee policy in writing with respect to each item of proposed equipment. The procedure for submitting warranty claims must also be provided.

As a minimum, the electronics shall be warranted for one (1) year from date of shipment for defects in material and workmanship.

8. SYSTEM MAINTENANCE SUPPORT

In addition to warranty periods, the vendor is required to supply information on required or optional maintenance programs beyond the warranty period for both hardware and software.

The vendor must offer multiple-year maintenance contracts so that the utility can take advantage of multi-year discounts.

The location of and procedures for obtaining such support shall be stated. A toll-free help desk number must be provided for system support.

9. VENDOR QUALIFICATIONS

The qualified vendor will have a minimum of thirty (30) years' experience with meter reading systems. The selected vendor shall be thoroughly versed in encoder meter and RF AMR/AMI technology and be a major supplier in the marketplace. The proposed system shall be manufactured and maintained by the selected vendor or an equity partner.

The vendor shall document which water meter manufacturers and models they are capable of interrogating with the proposed meter reading equipment. A customer reference list shall be enclosed with the proposal.

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