



## R450™ SYSTEM BID SPECIFICATIONS



This document is intended for utilities and consultants and provides specifications for a fixed network system.

### 1. SCOPE OF WORK

Utility issues this RFP to procure a fixed network system capable of meeting the current and future needs within our service area. The scope of work involves, but is not limited to, providing and installing a fixed network system which includes software, hardware, and all necessary training and installation support. The fixed network system shall be capable of receiving meter readings over fixed network system architecture.

All components of the proposed system must be manufactured and provided by the same company (specifics must be submitted with the proposal). All system parts furnished, including meters with absolute encoders, RF transmitter meter interface units (MIUs), data collectors/network infrastructure, and fixed network host software, shall be supplied by an ISO 9001 certified company.

### 2. SYSTEM OVERVIEW

The fixed network system must provide two-way communications from the fixed network host software/computer to the data collectors and to the MIUs to allow daily time synchronization of system components as well as MIU configuration over the air. The communication from the collectors to the MIUs must utilize an FCC-licensed, two-way frequency to assure clear channel communications between the MIU and the collector. The system shall be capable of operating in a hybrid mode to allow for the transition from mobile devices to fixed network devices.

The fixed network system must provide system-wide, time-synchronized readings from all MIUs (at midnight) – to support Non-Revenue Water and conservation initiatives and eliminate off-cycle readings for high water bill complaints and/or move-ins/move-outs. Following the activation of the MIU, the system shall provide auto-discovery of the MIU over the network to allow utility personnel or installation contractors to confirm proper MIU operation and register function before leaving an installation site.

The fixed network host software shall be designed to support key departments within the utility organization (customer service, billing, operations) by providing data in user-friendly, function-specific screens as well as reports to help utility personnel manage their day-to-day operations. The fixed network host software shall provide users with easy system monitoring and control, over-the-air system upgrades, auto-discovery over the network, time-synchronized midnight meter readings, monthly/daily/hourly customer usage graphs, enhanced reporting, priority alarms, and mapping functionality.

#### Definitions:

**Fixed Network System (the “system”):** The fixed network system is comprised of fixed network host software, wide area network (WAN), data collector (DC), and radio frequency meter interface unit (MIU) to enable the remote collection of metering data from absolute-encoder-equipped water meters or other compatible devices.

**Fixed Network Host Software:** The host software package is installed on a server at the utility site. The host software shall manage the communication with the data collectors and MIUs, issue configuration commands to the data collectors and MIUs, and transfer collected meter data to the billing/CIS system via a transfer file. The host software shall also provide an easy-to-use graphical user interface (GUI) allowing utility personnel to manage the system and analyze the resulting data. The utility will be responsible for the transfer file that links the host software with the utility's billing and customer information systems (CIS).

**Wide Area Network (WAN):** The WAN is the communications link between the host software and fixed network data collector(s). The standard WANs utilized in the fixed network data collector(s) are GPRS/CDMA modems and Ethernet.

**Data Collector (DC):** The hardware/software that enables communication between the MIU installed at the meter site and the host software. The data collector must have two-way communication capabilities to receive, store, and transmit meter data and commands, and must be housed in a NEMA-4X environmentally-rated enclosure. It must be AC-powered and be mountable on street lights, poles, rooftops, walls, towers, tanks, etc.

**Mini Collector (MC):** The hardware/software that enables communication between the MIU installed at the meter site and the host software. The mini collector must have two-way communication capabilities to receive, store, and transmit meter data and commands, and must be housed in a NEMA-4X environmentally-rated enclosure. It must have a solar power option and be mountable on street lights, poles, rooftops, and walls.

**Radio Frequency Meter Interface Unit (MIU):** The MIU must transmit on an FCC-licensed frequency. The MIU shall be a high-power, two-way communication device designed to transmit the meter reading data and a unique MIU ID number to the data collector. The standard mode of operation of the MIU is to transmit a daily time-synchronized meter reading at midnight and daily consumption data comprised of 24 hourly consumption intervals to host software. The MIU must be capable of being configured to transmit priority alarms for leak and reverse flow events.

### 3. FIXED NETWORK HOST SOFTWARE OVERVIEW

The fixed network host software is a thin-client application where the database resides on a server at the utility location.

The host software shall have the basic capability of supplying the following features to the end user:

- Employ thin-client (browser-based) architecture wherein the database is centralized and the host application requires no local install, but is accessed through an Internet browser.
- Host software should utilize their standard file layout format to interface with the utility's CIS for both on-cycle and off-cycle meter reading.
- Host software should interface with third-party applications such as work order systems via a standard interface (e.g., web services).
- A customizable reporting engine which provides key reports on advanced usage analysis included within the application: district metering, consumption reporting, troubleshooting, leak report, tamper report, reverse flow report, and non-billable report. A list of all reports and a brief description of each report included within the application are provided in section 3.4, Reporting.
- Customizable dashboard that provides key performance indicators (KPIs) to allow for proactive monitoring of system health and performance. Provides a wizard-driven priority alarm configuration capable of sending information directly to key utility personnel (via email or SMS) based on predefined triggers and thresholds.
- Must be able to export data to MS Excel and MS Word applications.
- Designed to hold two (2) years of history for direct access, with an option for secondary direct access storage and reporting of older consumption history.
- Provides an export of key data for third-party meter data management or customer web presentment.
- Provides specialized customer service screens for support of utility customers by customer service representatives.
- Provides an embedded mapping tool that enables visual interpretation and analysis of data within the fixed network system to reveal relationship patterns and usage trends. The map-based interface component provides viewing, selecting, managing, and reporting options on all assets that are managed by the system.

This mapping component is designed to integrate with Esri® GIS applications.

General mapping component features:

- Highly interactive (drag-and-drop) mapping interface.
- Auto-zoom to map display result set.
- Custom modifiable symbol library.

- Ability to display MIUs, collectors, and other system components on the same map interface.
- Ability to display other Esri base maps managed by the utility, such as pipe distribution networks, laterals, etc.
- Polygon selection capabilities for all entities displayed on the map.
- Ability to send selected items from the mapping component directly to the customer service screen for display.
- Ability to create groups from map queries and polygon selections.
- Ability to view all MIUs, collectors, and compatible leak monitoring devices contained within the fixed network software on a map.
- Ability to display endpoints based on unique device attributes such as continuous/intermittent leak, major/minor backflow, no consumption, inactive status, etc.
- Ability to query and display endpoints based on endpoint's conditions such as owned, data pending, last heard time, inactive with usage, etc.
- Ability to add date or value ranges and tolerances to specific queries, such as inactive usage, zero consumption, etc.
- Ability to generate queries based on specialized conditions such as soft or virtual disconnect.
- Ability to auto-generate (geocode) map coordinates for above assets (requires complete address information).
- Ability to display all relevant dashboard KPI items on a map.
- Ability to display groups of endpoints on a map, either from a specialized search or by predefined group indicators.
- Ability to generate result queries to display on a map from events and alert lists.
- Ability to create customized queries to display endpoints based on attributes and save them for future use.
- Ability to publish defined map queries for use by other map component uses (administrative rights required).
- Ability to layer multiple map queries onto a common base map.
- Ability to print maps, including any attributes and/or endpoints displayed.
- Ability to export any endpoints or attributes displayed on the map to MS Excel.

The host software shall have the basic capability of providing the following data to utility on a daily basis:

- A daily time-synchronized meter reading taken at midnight from all water meters for monthly billing purposes.
- 24 hourly usage/consumption readings delivered daily for resolution of customer billing disputes and improved customer service.

### **3.1 FIXED NETWORK HOST SOFTWARE REQUIREMENTS**

The host software must 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. The host software must be able to interface with handheld and mobile meter reading software to enable a hybrid meter reading approach.

The host software must interface to utility's CIS/billing software via the N\_SIGHT™ software suite. The meter reading data communicated to the CIS system shall be provided in an ASCII flat file format.

#### **Fixed Network Server Specifications**

For optimal performance, Neptune recommends the following server specifications. Limited support will be provided for performance issues if specifications are not met. Number of services is the number of services expected to be implemented after full deployment is complete.

### **General Requirements**

- Should not require third-party software and/or databases to function. All capabilities should be fully integrated and supported directly by the fixed network host provider.
- Must not require specialized technical resources such as a database administrator (DBA) or IT developers to support the system. System must be designed to self-manage its internal resources.
- Must run on standard off-the-shelf server hardware and not require any specialized storage attached networks (SANs), database replication or backup.

## **3.2 INFORMATION REQUIREMENTS**

In addition to obtaining the meter reading from an MIU, the data collector, and host software, the system must also support the following information requirements:

- Storing additional meter readings and status flag information from other monitoring devices (such as distribution line acoustic leak detectors).
- Must support single-and-dual register meters.
- Must support meter readings (4-8 digits) and MIU ID numbers up to 10 digits.
- Must support Neptune E-Coder®PLUS output information.
- Must support a hybrid approach to meter reading.
- Must support GPS-type data to identify locations of account graphically.
- Must have the capability to store all meter data information obtained from the data collectors for a minimum of two (2) years.
- Must be able to retain the past three (3) rolling days of collected meter data in the case of a power outage or interruption of the communication link with the software.
- Must be able to monitor the status of the WAN and alert the user in the event of a problem impacting communication between the data collector and host software (server receiving alarm information about signal strength, etc.).
- Must have the capability to monitor MIUs that have transmitted for the first time to identify successful installation and operation.
- The supplier must provide remote monitoring of the system and have controls in place to ensure optimized system operation.
- Must have the capability to monitor status/performance of the data collector units in the network.
- Must generate a report of data collectors that have not downloaded information by day or date range. The report must list data collector ID numbers.
- Diagnostics must be available such that operators can evaluate performance and send instructions over the air to optimize performance of the data collectors and the network.

## **3.3 NETWORK MANAGEMENT**

The system must allow for MIU message success rate and data collector performance to be monitored daily with system diagnostic information readily available on a "system health" or dashboard-type screen. The host software must produce a data collector download report for all data collector units in the network. The report must list each data collector unit by ID number, name and summary of the download statistics. The system must allow utility personnel to configure key system critical alarms such as reverse flow, 24-hour continuous leak, and distribution main leak. The software must be able to forward these alarms via email or text message to maintenance personnel assigned by the utility.

### 3.4 REPORTING

The host software must provide normal reporting and exception reporting capabilities that must address basic operational requirements:

- The host software must have the ability to identify three (3) types of reading information to include; numeric reads (successful reads that can be used for billing), non-numeric reads (reads that cannot be used for billing but may indicate a problem with the meter register or MIU or tamper condition), and no readings (no transmitted reading was received).
- The host software must allow the user to review total number and percentage of successful reads, unsuccessful reads, and no reads.
- Network Level Reports – must identify by day or date range, a summary of the total number and percentage of successful reads, unsuccessful reads, and no readings.
- Data Collector Level Report – must provide a summary of the total number and percentage of successful reads, unsuccessful reads, and no readings.

Standard reporting to include the following information:

#### **Premise Level Reports**

- Account List – lists all premises that have account records within the database.
- Account Reads – lists all readings received for a selected MIU.
- Billing List – lists the latest readings for MIUs in the system that will be sent if a billing file is created (has a premise record).
- Last Read – lists the last read received for all MIUs within the system (premise and not-premise reads).
- Past Due – lists all premises that have not received a reading in a selected date range.
- Soft Disconnect – lists all MIUs that have been flagged within the system for soft disconnect.
- Soft Disconnect w/Usage – lists all MIUs that have been flagged for soft disconnect in which usage has been reported on.

#### **Endpoint Level Reports**

- All Readings – lists all MIUs that have received readings within the system for a selected date range.
- Found Meters – lists all MIUs that have not been associated with a premise within the system.
- Hourly Reads – lists the hourly readings for a selected MIU for a specified reading date.
- Missed Reads – lists all MIUs that have not received a reading for a specified read date.
- MIU Reads – lists all readings for selected MIU within a specified timeframe.
- New Endpoints – lists all MIUs from which the system has received a read for the first time within a specified date range.
- Non Billable – lists all MIUs with non-numeric characters within the reading.
- Not Active – lists all accounts within the system that are flagged as inactive.
- Usage Profile – lists all MIUs within the system that are in 24-hour usage profile mode.

#### **Event Level Reports**

- Leak – lists all leak events that have occurred within the system (continuous and intermittent).
- No Flow – lists all MIUs that have reported zero consumption within a selected timeframe.

- Acoustic Leak – lists confidence factors for a selected unit within a specified timeframe.
- Reverse Flow – lists all reverse flow events that have occurred within the system (major and minor).
- Tamper – lists all accounts from which specific tamper events have been configured within a specified timeframe (reverse flow, no flow, disconnect with flow, and cut wire).

#### **System Level Reports**

- District Metering Daily – daily consumption comparison of billed versus pumped water.
- District Metering Hourly – hourly consumption comparison of billed versus pumped water.
- Consumption – total consumption for accounts within a specified group.

#### **System Status Reports**

- Audit – lists user modification to the system where data updates have been made for a selected MIU for a specific date range.
- Priority Alert Log – lists all accounts that have reported a priority alarm within a specified date range.
- Status Log – displays the overall status (in percentage) of all MIUs within the system.

The host software must allow the user to select specific fields from the database to be exported to a third-party report generator for custom reports.

### **3.5 DATA REPOSITORY & CONSUMER WEB PORTAL**

The fixed network software suite includes a data repository and consumer web portal option, which is a cloud-based data management and analytics package that provides long-term data storage, web presentation for utilities and consumers, and advanced consumption analysis and reporting.

The application shall have the basic capability of supplying the following features to the end user:

#### **Utility Customer Web Presentation**

- The system must provide at a minimum hourly time-synchronized data to both utility users and utility customers.
- The system shall provide a method for utility’s customers to view their own consumption information through a customer web portal.
- The system must provide the ability for utility’s customers to view and manage multiple meters and/or multiple accounts.
- The system shall provide a method to ensure complete integration into utility’s existing website to establish a consistent look and feel (header, footer, color, etc.).
- The system must provide a method for utility’s customers to set water budgets and a method to alert them in the event they exceed their budget.
- The system must be able to provide 15-minute interval leak and reverse flow monitoring and alerts via email to utility’s customers. These alerts can be generated by the endpoints themselves, or, if an endpoint option is not available, by the data repository system.
- Utility’s customers shall be able to configure their system to receive alerts and configure the timeframe at which alerts are sent.
- The system shall provide a method of displaying and utilizing temperature and precipitation data synchronized with the consumption data in the system for data analysis purposes. This information shall also be made available to utility’s customers.
- The system shall be able to display synthesized data to the customer.

- The system shall enable users to display consumption information in both graphical and tabular formats.
- The system shall provide a method to allow utility's customers to compare their consumption against utility-created, predefined groups.
- The system shall allow utility's customers to set multi-level communications for leak, reverse flow, and consumption alerts.
- The system shall provide a method to export data in Adobe PDF and MS Excel formats.
- The application shall provide daily water budget analysis.
- The vendor must be able to promptly demonstrate all required and offered features of the utility customer web presentment via live onsite or remote use of the actual system if requested.

**Utility Data Repository**

- The system must be able to store up to ten (10) years of AMI data for immediate real-time access and must provide this data within the data repository, reporting, and customer web presentment environments.
- The system shall be able to display data graphically and in tabular form to both utility's users and customers.
- The system must be able to export data in Adobe PDF and MS Excel formats.
- The data repository and web presentment application should not impact the performance of the operational AMI data collection system.
- The data repository shall have a facility to provide custom reporting and data analysis.
- The system must provide a method for the utility to load customized reports without vendor assistance.
- The system shall provide a method of performing District Metered Area (DMA) analysis.
- The system shall be able to support network meters, deduct meters, and compound meters.
- The system shall be able to store additional forms of data other than consumption data for long-term reporting and analysis purposes.
- The vendor must be able to promptly demonstrate all required and offered features of the utility data repository via live onsite or remote use of the actual system if requested.
- The application shall provide consumption analysis of daily, monthly, and yearly data.
- The application shall track weather data such as precipitation and temperature as it corresponds to the consumption data.
- The application shall provide alarm notification for events such as leaks and reverse flow events for water utility customers.
- The system shall provide a consumer web portal for utility customers to view consumption data and configure leak and/or reverse flow alerts.
- The application's web portal shall contain a customer self-enrollment process.
- The application shall be able to allow the customer the ability to configure consumption thresholds based on daily water budget values and receive alerts when that consumption has been exceeded.
- The application shall be able to deliver alerts via email.
- The application shall provide a list of standard reports.
- To address final reads, the system must support the ability to capture a midnight read from the database without the need to manually capture an on-demand reading of the MIU. This preserves battery life and reduces special handling.

## **4. FIXED NETWORK DATA COLLECTORS – DATA COLLECTOR (DC) AND MINI COLLECTOR (MC)**

### **4.1 BASIC REQUIREMENTS**

The fixed network data collector should be available in two (2) configurations: a full-size, full-function data collector (DC) that is designed for installation on towers and a smaller, full-function mini collector (MC) that is designed to be installed on pole-tops.

The data collector (DC) must demonstrate the capability to read the MIU in the system and communicate back to the host software:

- The DC must support two-way communications over an FCC Part 90-licensed frequency with the MIU and provide such functionality as priority alarms and over-the-air updates.
- The DC must have an available uninterrupted power supply (UPS) that can provide at least four (4) hours of battery backup.
- The DC must store a minimum of three (3) days of meter reading data.
- The DC receiver must utilize the 450 – 470 MHz FCC Part 90-licensed frequency.
- The DC must utilize a Linux operating system.
- The DC must be able to process up to 50,000 data packets per day.

The mini collector (MC) must demonstrate the capability to read the MIU in the system and communicate back to the host software:

- The MC must support two-way communications over an FCC Part 90-licensed frequency with the MIU and provide such functionality as priority alarms and over-the-air updates.
- The MC must provide flexible mounting options such as pole-mounts, stand-alone configuration, and wall mounts.
- The MC must provide a solar panel power option.
- The MC must provide an AC-power option.
- The MC must have an available UPS that can provide at least eight (8) hours of battery backup.
- The MC must provide three (3) days of memory backup.
- The MC receiver must utilize the 450 – 470 MHz FCC Part 90-licensed frequency.
- The MC must utilize a Windows CE operating system.
- The MC must be able to process up to 25,000 data packets per day.

### **4.2 WIDE AREA NETWORK (WAN) BACKHAUL REQUIREMENTS**

The DC and MC must be capable of using the following as WAN backhauls for data:

- GPRS
- Ethernet
- CDMA

### **4.3 POWER REQUIREMENTS**

- The DC must be powered via 110V AC.
- Upon start-up after power failure, the DC must restore databases, tables, and logs to the previous operational state.



- Upon power failure, the DC shall retain the past three (3) days of meter data in non-volatile memory.
- The MC must be powered via 110-220V AC.
- The MC must have a solar panel power option.
- Upon start-up after power failure, the MC must restore databases, tables, and logs to the previous operational state.
- Upon power failure, the MC shall retain the past three (3) days of meter data in non-volatile memory.

#### **4.4 COMMUNICATION REQUIREMENTS**

##### **Data Collector (DC)**

- The DC must have a transmitter capable of sending out 10 Watt transmissions.
- The DC must log all events mentioned below and communicate to the host computer.
- Link failures:
  - The DC link failure time and date to the host must be logged and all data must be saved for three (3) days.
  - The DC must try continuously to reestablish a link to the host software.
- Reset:
  - The DC must be able to be reset by the host software computer.
  - Manual reset functionality must be available.
- The DC shall transfer the past three (3) days of data stored in non-volatile memory to the host software upon power-up reset.
- Other alarms and status changes.
- The DC will communicate to the host software if any of these events are detected:
  - New MIUs are discovered and resynchronized.
  - Power-up reset.

##### **Mini Collector (MC)**

- The MC must have a transmitter capable of sending out 5 Watt transmissions.
- The MC must log all events mentioned below and communicate to the host computer.
- Link failures:
  - The MC link failure time and date to the host must be logged and all data must be saved (3 days).
  - The MC must try continuously to reestablish a link to the host software.
- Reset:
  - The MC must be able to be reset by the host software computer.
  - Manual reset functionality must be available.
- The MC shall transfer the past three (3) days of data stored in non-volatile memory to the host software upon power-up reset.
- Other alarms and status changes.

#### 4.5 INSTALLATION/MOUNTING REQUIREMENTS

The data collector antenna should be capable of being mounted on the top of utility water towers. If water towers are not available, cell towers, tall buildings, billboards, and/or utility poles may be acceptable. The data collector must be powered by 110V AC.

The mini collector antenna should be capable of being mounted on poles, walls, towers, tall buildings, and cell towers. The mini collector should be powered by 110-220V AC or solar panel.

#### 4.6 ENVIRONMENTAL CHARACTERISTICS

- The DC/MC must have an operating temperature of -22°F to +140°F (-30°C to +60°C).
- The DC/MC must have a storage temperature of -40°F to +185°F (-40°C to +85°C).
- The DC/MC must have an operating humidity of 0 to 95% non-condensing.
- The DC/MC must have a NEMA 4X enclosure and pass the UL50 (Underwriter's Laboratory) rain test.
- The DC/MC must meet the vibration requirement of MIL-810F.

#### 4.7 APPROVALS

- The DC must be UL approved.
- The MC AC-power transformer must be UL approved.
- The DC/MC must be CSA approved.
- The DC/MC must meet FCC Part 90.

### 5. METER INTERFACE UNIT (MIU)

The meter interface unit (MIU) must be a compact, electronic, two-way communication device connected to an absolute encoder register of a water meter. The MIU shall interrogate the encoder register and transmit the meter reading and other information via a 450-470 MHz FCC Part 90 licensed frequency to a data collector. The MIU shall be compatible with Neptune and Sensus protocol (UI-1203) absolute encoder registers featuring 8-digit high resolution readings. The MIUs shall be attached to new meters with encoder registers, or they shall easily retrofit to existing meters with encoder registers in the field. The MIUs shall be manufactured in both wall and pit models. The pit MIU shall have the ability to be mounted in a pit or an underground vault and include a through-the-lid antenna. The wall and pit MIUs shall be of a fully-potted waterproof design. The MIU shall support two-way communications with the data collector and host software. The standard mode of operation of the MIU is to transmit a daily time-synchronized midnight meter reading and daily consumption data comprised of 24 hourly consumption intervals transmitted to host software. The MIU must be capable of being configured to transmit priority alarms for leak and reverse flow events.

MIUs shall also be available as integrated devices where the encoder register and RF transmitter module are integrated into a single register module. These shall be compatible with all Neptune meters. The absolute solid state encoder register with integrated MIU shall be attached to new meters, or 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 as a pit MIU with an enclosure that has a roll-sealed copper can and glass lens designed to ensure a watertight seal. The MIU shall be furnished with a through-the-lid pit antenna to provide for optimum RF link to the data collector. The integrated unit shall operate the same as the stand-alone MIU.

#### Encoder Description – General

The self-contained solid state absolute encoder register metering system shall be designed to obtain remote simultaneous water meter registration guaranteed to match exactly the registration on the register odometer. The solid state absolute encoder meter register shall be a direct-mounted, electromagnetically encoded measuring element with an

electronic solid state odometer. The encoder shall provide value-added flow data including leak, tamper, and reverse flow detection. Batteries and digital counters using volatile memory are not allowed. The encoder register shall display flow rate information at register.

*See Neptune Encoder Specifications.*

## **5.1 PHYSICAL/MECHANICAL REQUIREMENTS**

### **Wall MIU**

- 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.

### **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.

### **Integrated Pit Set Unit**

- 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 through-the-pit-lid antenna option 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

For reliability and meter reading integrity, the vendor shall be the sole manufacturer of the different components of the system (MIUs, data collectors, host software, and meters), and provide a turnkey system offering to the utility.

The system shall operate on an FCC-licensed frequency within the 450 MHz to 470 MHz licensed band and operate within FCC Part 90 regulations for this band. The output power of the devices will be governed by their conformance to these relevant FCC standards.

The MIU shall utilize two-way communications with the data collector to allow for over-the-air communications between the two devices for reprogramming and time synchronization.

The MIU shall be configurable via over-the-air communications.

Power shall be supplied to the MIU by at least a C-cell 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 will be warranted for full replacement cost, and the second ten (10) years will be warranted on a prorated basis, as long as the MIU is working under the environmental and meter reading conditions specified.

No programming of the MIU shall be necessary for installation.

The MIUs must be capable of reading two networked Neptune encoder registers at one time.

The MIU shall interface to Neptune ARB® V, ProRead™ (ARB VI), E-Coder (ARB VII), or Sensus ECR® II & ICE (six-and eight-digit format) absolute encoder registers via a three-conductor wire without need for special configuration/programming of the MIU.

The MIU shall support self-configuration of the system by automatically determining the strongest signal from a data collector and selecting that data collector for two-way communications. The MIU shall update its system configuration when a loss of two-way connectivity occurs and also monthly to maintain the system performance at optimum levels.

The MIU shall send in its configuration and status properties during installation by means of a magnet swipe and automatically transmit updates of its configuration on a monthly basis.

The MIU shall send a daily meter reading that is time-synchronized at midnight. The MIU shall provide a daily meter reading data packet with hourly consumption data for the previous 24 hours.

The MIU shall send time-synchronized, 24-hour consumption profile information as part of its standard configuration.

The MIU shall be designed to transmit the meter reading daily (up to four times a day – one transmission plus three retries if confirmation was not received to ensure maximum system message success rate).

Each MIU shall have two (2) unique preprogrammed identification numbers of nine (9) characters (meter (1) = HI side and meter (2) = LOW side). ID numbers will be permanent and shall not be altered. Each MIU shall be labeled with the ID number in both 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 9-digit MIU ID number.

Tamper – If wiring between the MIU and encoder register has been disconnected/cut, a "non-reading" shall be transmitted indicating wire tamper. Alternative approaches that provide the last available reading are not acceptable because these systems provide an incorrect indication of the meter reading.

The system should have the ability to test the installation to verify proper operation of the MIU prior to leaving the work site. The installation tool shall display the MIU ID number, valid meter reading, and the signal strength (RSSI = Received Signal Strength Indication) of the communication between the MIU and data collector.

The MIU shall have the capability to send **priority alarms** for leak, tamper, and reverse flow when connected to a Neptune E-Coder solid state absolute encoder register.

## **6.0 TRAINING AND SUPPORT**

A proven, 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.

### **6.1 SUPPORT SERVICES**

The vendor shall have an in-house 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.

The customer support department of the vendor must provide metrics demonstrating that it routinely meets or exceeds the following minimum support performance metrics:

- 95% Same Call Resolution
- 95% Same Day Resolution

### **6.2 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 distributor. 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 any pre-installation activities that are to be completed and the support material that will be needed for the initial installation.

## 7.0 WARRANTIES

In evaluating bid submittals, warranty coverage will be considered. The vendor shall be required to state its warranty and/or guarantee policy with respect to each item of proposed equipment. The procedure for submitting warranty claims must also be provided. At a minimum, the MIU must have a 20-year warranty and the data collector shall be warranted for one (1) year from date of shipment for defects in material and workmanship.

## 8.0 SYSTEM MAINTENANCE AND SUPPORT

In addition to warranty periods, vendors are required to supply information on required or optional maintenance programs beyond the warranty period for both hardware and software. Vendor must offer multiple-year maintenance contracts so 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.

## 9.0 VENDOR QUALIFICATIONS

The qualified vendor will have a minimum of thirty (30) years of 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 equity partner.

All vendors 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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