Chicago Smart Lighting Technology Requirements
Form 7: Functional, Logical, and Technical Requirements
Instructions: For each requirement, please insert an "YES" if the requirement will be met with no customization. Insert a "CU" if customization will be necessary to meet the requirement. Insert a "TP" if third party software will be needed to meet the requirement. Insert an "NA" if the functionality is not part of this Proposal.

	Lighting Management System	Optional	Response	Comments
1.1	*The Lighting Management System is a software as a service solution or hosted solution.*			
1.2	*Authentication and authorization*			
1.2.1	Users must securely authenticate into the system to gain access.			
1.2.2	The system supports integration with Active Directory.	Optional		
1.2.3	System access levels are role-based, limiting access to change schedules or other settings within the system.			
1.2.4	A login page will identify the application and provide a means for the user to access the system.			
1.2.5	If authentication is not successful, the Login page is re-displayed with appropriate messaging.			
1.2.6	The system supports session timeout at a configurable frequency.			
1.2.7	Users are able to log out of the system.			
1.3	*The Lighting Management System shall be capable storing asset, component, schedules, manual overrides, alarm triggers, burning hours, voltages, failures, maintenance, energy consumption data.*			
1.4	*The System will allow users to search, view, and edit lighting system data via a map-based interface.*			
1.4.1	The system provides both street and satellite image basemaps.			
1.4.2	The system allows users to toggle between different basemaps.			
1.4.3	The system integrates with Google Street View.	Optional		
1.4.4	Users can adjust zoom level.			
1.4.5	Users can pan in any direction.			
1.4.6	Users may zoom to a point or a group.			
1.4.7	The system allows users to view different point-based or boundary-based geographies.			

	Lighting Management System	Optional	Response	Comments
1.4.8	The system allows users to view Control Point locations.			
1.4.9	The system allows users to view attributes of each Control Point, including, luminaire type and/or sensor type.			
1.4.10	The system allows users to view the status of each controller (i.e., online, online reporting error, offline)			
1.4.11	If applicable, the system allows users to view Gateway status (i.e., online, online reporting error, offline) if applicable			
1.4.12	The system allows users to view Luminaire status (On, Off, Dimmed State, Boosted State, etc.)			
1.4.13	The system allows users to view power quality requirements (current requirement, peak requirement).			
1.4.14	The system enables users to view the peak requirement in a prescribed time period (e.g., last 24 hours).			
1.4.15	The system allows users to view lighting system energy consumption (Daily over last prescribed time period – e.g., Daily for last 7 days).			
1.4.16	Users may search around a radius from a point in either miles or feet. Users should be able to set distance.			
1.4.17	Users may search within a predefined boundary.			
1.4.18	Users may draw/define their own boundaries and search around or within that custom boundary or point: Around a single point, In a rectangle, Within a free-form polygon, Around and along a route.	Optional		
1.4.19	Users may search within more than one polygon simultaneously.	Optional		
1.4.20	Users may query multiple data types at one time.	Optional		
1.4.21	Users may add one or more query filters per data type based on the schema for each data type, and using standard operators (e.g., show me all lights that are out in a particular district)			
1.4.22	Users may select and run a saved query.			
1.4.23	Users may name and save queries that are run regularly.	Optional		
1.4.24	Controller or sensor data elements display an information window with data elements on hover over or on click for each point.			

	Lighting Management System	Optional	Response	Comments
1.4.25	Users may generate a PDF of the map and all data points with a dynamic legend.			
1.5	*The System shall enable users to configure the followlwing via the Graphical User Interface:*			
1.5.2	Users may configure the reporting frequency of online Control Point parameters for A SINGLE Control Point or groups of Control Points.			
1.5.3	The Lighting Management System shall be capable of defining Luminaire groups, including "Atlas" boundaries designations provided by the city.			
1.5.4	Users may modify the ON/OFF, DIMMED, or BOOSTED state of a single Luminaire or group of Luminaires.			
1.5.5	Users may configure and modify a predefined schedule for the ON/OFF and DIMMED or BOOSTED state of a single Luminaire or a group of Luminaires.			
1.5.6	The Lighting Management System does not limit the number of times/events per day that may be scheduled.			
1.5.7	Schedules may be either time-based, whereby Controllers modify Luminaire operation when a specific time in the schedule occurs, or event-based, whereby Controllers modify Luminaire operation when the next event in the schedule occurs.			
1.5.8	The Lighting Management System shall be capable of creating programs for time-based Scheduled Control that are defined: On a daily recurring basis, by specific day types, for special events, and the scheduling should allow exception days, for instance holidays.			
1.5.9	Event-based Scheduled Controls are defined according to inputs from sensors or commands from the Lighting Management System.			
1.5.10	The Lighting Management System is capable of Dynamic Control, whereby the ON/OFF, DIMMED, or BOOSTED state of a single Luminaire or a group of Luminaires is modified in response to dynamic inputs from sensors or commands from the Lighting Management System.			

	Lighting Management System	Optional	Response	Comments
1.5.11	The Lighting Management System is capable of Prioritized Control, whereby the Scheduled Control of individual Luminaires or groups of Luminaires is modified according to input from sensors or commands from the Lighting Management System.			
1.5.12	The Lighting Management System is capable of True Input Power Control, whereby the Luminaire DIMMED or BOOSTED state is actuated to achieve to a desired true input power (percent relative watts). Please describe any Luminaire features that are required to meet this, and whether this would be done via manual or automated processes.			
1.5.13	The Lighting Management System is capable of Light Output Control, whereby the Luminaire DIMMED or BOOSTED state is actuated to achieve a desired light output (percent relative lumens). Please describe any Luminaire features that are required to meet this, and whether this would be done via manual or automated processes.			
1.5.14	The Lighting Management System is capable of Constant Light Output Control, whereby the Luminaire DIMMED or BOOSTED state is automatically actuated to achieve a maintained constant light output (lumens) over time by compensating for Luminaire lumen depreciation. Please describe any Luminaire features that are required to meet this.			
1.5.15	The Lighting Management System can ensure that a maximum Luminaire true input power (watts) is never exceeded.			
1.6	*User Administration*			
1.6.1	Allows administrators to add users to the system.			
1.6.2	Allows administrators to assign roles to users within the system.			
1.7	*Notifications and Alerts*			
1.7.1	The Lighting Management System shall be capable generating outage or alert Notifications related to system components, which are specified (pre-defined and/or customized). Notifications should be automatically sent to assigned users and/or user groups via email or SMS.			

	Lighting Management System	Optional	Response	Comments
1.7.2	The Lighting Management System shall be capable of detecting and reporting wire or cable theft through use of an algorithm that identifies when the following conditions exist: 1. A user-defined number of Controllers report a loss of electrical service 2. The loss of electrical service occurs within a user-defined time window 3. The Controllers are physically located consecutively along a roadway			
1.7.3	The Lighting Management System shall be capable of comparing all reported Control Point parameters with optional pre-defined maximum and minimum thresholds, and generating error messages in real-time (based on reported data availability) for any condition that violates a specified threshold a specified number (1 or more) of times.			
1.8	*Work Order & Asset Management*			
1.8	*The CLMS should interface with 311/the City's primary work order system to enable users to conduct common work order and dispatch activities from the Lighting Management System application/GUI. The CLMS should not be the work order management system of record, but should provide the primary application for field staff to receive assignments and make updates. The CLMS will be the primary asset management system for streetlight components.*			
1.8.1	The LMS shall be capabale of integrating with the City's primary work order system to manage service outages, route and dispatch crews for surveying and maintenance.			
1.8.2	The LMS shall shall be capabale of integrating with the City's primary work order system and allows a dispatcher to assign maintenance work to crews or contractors.			
1.8.3	The LMS shall be mobile-friendly, allowing field personnel to receive and manage their work via GPS-enabled mobile devices that include to make edits to the inventory via form and/or map interfaces.			

	Lighting Management System	Optional	Response	Comments
1.8.4	Any changes to the work order status based on the updates made in the field shall be transmitted to the City's 311/primary work order management system via integration to ensure transparency to residents and call takers.			
1.8.5	The LMS shall contain an asset management system that maintains information about each lighting structure and its associated features, including type, model, and wattages; installation, maintenance, removal and disposal dates, and warranty information.			
1.8.6	The LMS shall contain an asset management system that maintains information about each light and its associated circuitry, controller, and power feed.			
1.8.7	The LMS shall enable notification to ComEd, through established FTP data exchange processes, of changes to the city's lighting infrastructure that affect energy usage for billing purposes.			
1.9	*Reporting*			
1.9.1	The Lighting Management System shall be capable of creating Remote Monitoring reports based on the generation of an error message or on a schedule.			
1.9.2	The Lighting Management System shall be capable of creating pre-defined Remote Monitoring reports containing:			
1.9.3	Instances of communication loss between Field Devices and the Lighting Management System			
1.9.4	Control Points with error conditions, sorted by error type and/or Electrical Service Point location			
1.9.5	Energy Consumption Data for individual Luminaires and/or groups of Luminaires			
1.9.6	Logs of work assigned, dispatched and completion from the work order dispatch system			
1.9.7	The Lighting Management System shall be capable of creating customized Remote Monitoring reports.			
1.9.7.1	The Lighting Management System shall be capable of creating pre-defined asset reports.			

	Lighting Management System	Optional	Response	Comments
1.9.7.2	The Lighting Management System shall be capable of creating customized asset reports.			
1.9.8	Administrators or Network Operations Staff may configure the reporting frequency of online Control Point parameters for all Control Points.			
1.9.9	Administrators or Network Operations Staff Network Operations Staff may configure the reporting frequency of online Control Point parameters for a single control point or groups of control points.			
1.10	*Application Programming Interfaces*			
1.10.1	The Lighting Management System shall have an API capable of supporting integration through web services (e.g. SOAP, Restful).			
1.10.2	The Lighting Management System's Scheduled Control interface should provide an interface protocol (e.g., REST, SOAP, XML) to allow third party systems to create programs for alternative schedules to be automated into the LMS Schedule Control.			
1.10.3	The API supports programmatically modifying or overriding the ON/OFF, DIMMED, or BOOSTED state of a single Luminaire or group of Luminaires (i.e., when a traffic incident is reported via 911, the light levels of the lights in the surrounding area will be raised automatically).			
1.10.4	The API supports getting/retrieving information about individual controllers/luminaires that may then be imported into another system or used in a program to kick-off an event in a third-party system (i.e., if a light is out, a ticket is opened in 311 via the Open311 API).			
1.11	*System Documentation*			
1.11.1	The System shall provide users with searchable end user help documentation that provides step-by-step instructions for common tasks.			
1.11.2	The System help information should be accessible from the GUI.			
1.12	*Interoperability and Interchangeability*			
1.12.1	The Lighting Management System shall be certified as compliant with the TALQ v1.0.1 standard, and Interoperable with TALQ certified Field Devices or Field Device networks.			

	Lighting Management System	Optional	Response	Comments
1.12.2	The Lighting Management System shall be Interoperable with the Backhaul Communication Network(s).			
1.12.3	The Lighting Management System shall be Interoperable with the Field Devices.			
1.12.4	The Lighting Management System shall be Interoperable with the Sensor(s).			
1.13	*Availability- As the system supports emergency response, the system must be available 24 by 7, 365 days a year with a 99.9% uptime to accommodate scheduled maintenance activities.*			
1.14	*Capacity- The system must support 500 simultaneous users.*			
1.15	*Compliance with City IT and IS Policies and Standards- The system must comply with City of Chicago Information Technology and Security Policies.*			
1.16	*Logging/Audit - All administrator and user operations are logged in the system and may be accessed via report.*			
1.17	*Mobility - The application shall be usable on small glass/mobile devices.*			
1.18	*Web Browsers Minimum Requirements* - Apple Safari latest version - Google Chrome latest version - Internet Explorer latest version - Mozilla Firefox latest version			

	Lighting Management System	Optional	Response	Comments

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Form 7: Functional, Logical, and Technical Requirements

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Ref #	Network	Response	Comments
2.1	The Backhaul Communication Network shall be capable of accommodating the following backhaul models. Please specifiy which model(s) your solution employs: 1) Node to Lighting Management Server, 2) Node to Access Point to Lighting Management Server, or 3) Hybrid Model (e.g., combination of both). **If the respondent is interested in utilizing any City-owned Fiber for backhaul, City Fiber Maps – denoting the existing location of all City-owned Fiber – can be obtained through the City's secure SFTP site.		
2.2	Backhaul Communication Network components shall be capable of normal operation over an ambient temperature range of -50 degrees C to 70 degrees C (full commercial environment).		
2.3	Backhaul Communication Network components installed external or remote to luminaires shall be rated IEC 60529 IP67 or NEMA Type 4X.		
2.4	Backhaul Communication Network components shall operate from the following (nominal ±10%) input: Universal AC input (RMS Volts) 120-277.		
2.5	The Backhaul Communication Network shall "use an open, standard-based physical layer for communication such as IEEE 802.15.4.g for wireless mesh networks or 4G LTE Standards for Cellular Networks (i.e., GSM or CDMA Technologies)."		
2.6	The Backhaul Communication Network shall be capable of connecting to Lighting Management Systems using open, standard-based networking technologies such as HTTPS, SMTP, SNMP, COAP, TCP, UDP or FTP.		
2.7	All data communications over the Backhaul Communication Network (i.e., between Field Devices and the Lighting Management System) shall be secured using a standard-based security protocol (e.g., TLS, DTLS, IPsec).		
2.8	The Backhaul Communication Network shall be capable of communicating using Internet Protocol version 6 (IPv6). Every device must be addressable via an assigned IPv6 address.		

Ref #	Network	Response	Comments
2.8	The Backhaul Communication Network shall allow only authenticated and authorized access to network services by a Lighting Management System or Field Device (or Field Device Network connected through a Gateway). For example, an unauthenticated Field Device (or Field Device Network connected through a Gateway) shall not be able to use the Backhaul Communication Network to report usage or accept commands from a Lighting Management System application.		
2.9	The Backhaul Communication Network and any connected device or system shall be able to authenticate each other by a standard-based mechanism (e.g., X.509 certificates or pre-shared keys).		
2.1	The Backhaul Communication Network and any connected device or system shall be able to authorize each other by a standard-based mechanism (e.g., X.509 certificates).		
2.11	The data exchange between the Backhaul Communication Network and any connected device or system shall be kept confidential using a standard-based algorithm (e.g., AES-128 or AES-256).		
2.12	The data exchange between the Backhaul Communication Network and any connected device or system shall be checked for integrity using a standard-based algorithm (e.g. keyed HMAC with SHA-256).		
2.13	The Backhaul Communication Network shall be capable of maintaining time either on its own or by synchronizing with a remote service.		
2.14	The Backhaul Communication Network shall provide a detailed view of the network and its topology, including all connected Field Devices (or Field Device networks connected through a Gateway if applicable), links, and ports.		
2.15	The Backhaul Communication Network shall provide a detailed view of network performance, including available bandwidth, Field Device (or Field Device network connected through a Gateway if applicable) reachability, round-trip times, path costs, and packet delivery success/failure.		
2.16	The Backhaul Communication Network shall provide a configuration management tool that provides the ability to view and remotely apply changes, updates, and patches to operating systems and applications on any single or a group of Backhaul Communication Network components.		
2.17	Backhaul Communication Network components shall be capable of logging time-stamped activity. The logging level shall be configurable. Any write and execute operations completed by the device shall be recorded together with the source IP address.		

Ref #	Network	Response	Comments
2.18	The Backhaul Communication Network shall provide basic firewall capabilities, including filtering by port, protocol, source IP address, and destination IP address.		
2.19	The Backhaul Communication Network shall be capable of two-way communication.		
2.2	The Backhaul Communication Network shall support failover to alternate routes.		
2.21	The Backhaul Communication Network shall be capable of automatic retries during message/packet delivery attempts.		
2.22	The Backhaul Communication Network shall be capable of generating asynchronous alerts and routing both its own alerts and other devices' alerts to the Lighting Management System.		
2.23	The Backhaul Communication Network shall be able to prioritize the delivery of specified traffic types (e.g., high priority) over others (e.g., low priority).		
2.24	The Backhaul Communication Network shall be capable of addressing of groups of Field Devices (or Field Device networks connected through a Gateway) for bulk messages including remote firmware upgrades and configuration changes.		
2.25	The Backhaul Communication Network shall be capable of maintaining Network Availability of 98% of active and functional Field Devices (or Field Device networks connected through a Gateway) in 24 hours, 99.8% of active and functional Field Devices (or Field Device networks connected through a Gateway) in 48 hours		
2.26	The Backhaul Communication Network shall be capable of maintaining a round trip message time (excluding low priority traffic) of 95% within 5 seconds, 99% within 10 seconds		
2.27	The Backhaul Communication Network shall be capable of maintaining latency for individual on-demand (high priority traffic) messages of average size (up to 400 bytes) within 2 seconds or less		
2.28	The Backhaul Communication Network shall be capable of performing bulk firmware upgrades (as lower priority traffic) 95% in 24 hours, 100% in 4 days		
2.29	*Interchangeability and Interoperability*		
2.29.1	The Backhaul Communication Network shall be Interoperable with the Lighting Management System.		

Ref #	Network	Response	Comments
2.29.7	The Backhaul Communication Network shall be Interoperable with the Field Devices.		
2.29.10	The Backhaul Communication Network shall be Interoperable with the Sensor(s).		
2.30	*Rated Life and Reliability*		
2.30.1	The rated life of all Backhaul Communication Network components at an ambient temperature of 25 degrees Celsius shall be 10 years or more		
2.30.2	The Vendor shall report the reliability of the following Backhaul Communication Network components, as measured by Mean Time between Failures (MTBF) Gateway, Routers.		
2.30.3	The reported MTBF shall be calculated according to Telcordia SR-332.		

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Ref #	Controllers		Response	Significant Budgetary Impact?	Comments
3.1	Field Devices shall be capable of normal operation over an ambient temperature range of -40 degrees C to 50 degrees C (full commercial environment).				
3.2	Field Devices installed external or remote to luminaires shall be housed in enclosures rated shall be rated IEC 60529 IP67 or NEMA Type 4X.				
3.3	Field Devices shall operate from the following (nominal ±10%) input: Universal AC input (RMS Volts) 120-277.				
3.4	Provide an estimate of the peak and average power requirement of all Field Devices, and describe the methodology and assumptions used to create this estimate.				
3.5	Controllers shall be integrated (mechanically and electrically connected) at Control Points External to Luminaires, using a ANSI/NEMA C136.41 standard 7-terminal polarized twist-lock receptacle for both electrical and dimming control signal connectivity.				
3.6	Controllers shall be capable of actuating the status (ON state, OFF state) of Luminaires.				
3.7	Controllers shall be capable of actuating a Luminaire DIMMED or BOOSTED state by creating a control signal that complies with a specified DALI standard (e.g., IEC 62386).				
3.8	Controller dimming control signal interoperability shall be verified with all Luminaires specified.				
3.9	Actuated changes to Luminaire DIMMED or BOOSTED states by Controllers shall occur at the following rate Instantaneously, or as dictated by the Luminaire.				
3.1	Actuated changes to Luminaire DIMMED or BOOSTED states by Controllers shall occur at the following rate over a user programmable range (% change per minute) disclosed by the Vendor.				
3.11	Controllers shall be capable of measuring and monitoring over time the following power quality parameters: 1. RMS input voltage (Volts) 2. RMS input current (Amps) 3. Apparent power (VA) 4. True input power (Watts) 5. Power factor				
3.12	Controllers shall measure power quality parameters at each Control Point for The Luminaire AND the Controller.				
3.13	Controllers shall measure energy consumption with utility grade accuracy and precision ±2%.				
3.14	Controller energy consumption accuracy shall be verified with all Luminaires specified.				

Ref #	Controllers		Response	Significant Budgetary Impact?	Comments
3.15	Controllers shall be capable of integrally sensing (or otherwise determining) and monitoring over time the following environmental parameters at minimum ambient light level (e.g., via a Photoelectric Sensor). Optionally, indicate if the following may be provided 1. Expected sunrise and sunset times (e.g., via an Astronomical Clock) 2. GPS Location 3. Temperature				
3.16	Field Devices shall be capable of logging				
3.16.1	Cumulative hours in the Luminaire ON state for each Control Point				
3.16.2	Cumulative energy consumption of each Control Point				
3.17	Field Devices shall log cumulative energy consumption file and send an xml file daily to an SFTP site with data fields specified by ComEd.				
3.18	During Offline Operation, Field Devices shall be capable of STORING the following offline TIME-STAMPED Control Point parameters:				
3.18.1	Controller status (Online, Offline, Warning or Error codes)				
3.18.2	Luminaire status (ON, OFF, Dimmed State, Boosted State, Warning or Error codes)				
3.18.3	Cumulative ON state time (minutes)				
3.18.4	Cumulative energy consumption (kWh)				
3.19	During Offline Operation Field Devices shall be capable of STORING measurements of all offline parameters at a STORING frequency of less than once every 60 minutes.				
3.20	During Offline Operation Field Devices shall be capable of STORING measurements of all offline parameters at the specified STORING frequency for a STORING period of greater than 2 days.				
3.21	During Online Operation, Field Devices shall be capable of REPORTING the following online Control Point parameters:				
3.21.1	Controller status (Online time, Offline time, Warning or Error codes)				
3.21.2	Luminaire status (ON, OFF, Dimmed State, Boosted State, Warning or Error codes)				
3.21.3	Average RMS input voltage (Volts) in the ON state				
3.21.4	Average RMS input current (Amps) in the ON state				
3.21.5	Average true input power (Watts) in the ON state				
3.21.6	Average input power factor in the ON state				
3.21.7	Cumulative ON state time (minutes)				