WATER | ENERGY | LIFE

CITY OF RIVERSIDE PUBLIC UTILITIES

RIVERSIDE PUBLIC UTILITIES

Board Memorandum

BOARD OF PUBLIC UTILITIES **DATE: SEPTEMBER 25, 2023**

SUBJECT: MULTI-SUBSTATION PROTECTION AND AUTOMATION UPGRADE PROJECTS; WORK ORDER NO. 2403007 IN THE AMOUNT OF $193,000; WORK ORDER NO. 2323918 IN THE AMOUNT OF $260,000; AND WORK ORDER NO. 2402369 IN THE AMOUNT OF $979,000

ISSUES:

Consider approval of the capital expenditure for Work Order No. 2403007 in the amount of $193,000 for Springs Substation Bus Differential Relay Upgrade Project, Work Order No. 2323918 in the amount of $260,000 for Harvey Lynn Substation Switchgear 5 Protection and Upgrade Project, and Work Order No. 2402369 in the amount of $979,000 for Orangecrest Substation Switchgear 1 and 2 Protection and Automation Upgrade Project.

RECOMMENDATIONS:

That the Board of Public Utilities:

1. Approve the capital expenditure for Work Order No. 2403007 in the amount of $193,000 for Springs Substation Bus Differential Relay Upgrade Project;

2. Approve the capital expenditure for Work Order No. 2323918 in the amount of $260,000 for Harvey Lynn Substation Switchgear 5 Protection and Upgrade Project; and

3. Approve the capital expenditure for Work Order No. 2402369 in the amount of $979,000 for Orangecrest Switchgear 1 and 2 Protection and Automation Upgrade Project.

BACKGROUND:

Riverside Public Utilities (RPU) owns, maintains, and operates 17 substations, including three generating substations, 10 distribution substations, three customer substations and one interconnection collector substation. Substations play a crucial role in power delivery systems, ensuring the safe and reliable distribution of electricity from generation facilities to end-users. They serve as vital nodes in the energy infrastructure, facilitating the efficient transmission and distribution of electrical power. Substations provide several key functions that contribute to maintaining the stability and integrity of the power grid such as voltage regulation and transformation, operational switching, monitoring and control, fault isolation, and equipment protection.

The electrical grid is a complex network responsible for the transmission and distribution of electricity to City of Riverside customers within its service territory. The grid's reliability, stability, and safety are vital and primarily maintained by protective relays and automation systems. Protective relays play a critical role in preserving the integrity of the grid by monitoring the system for abnormal conditions such as overloads, faults (short circuit), and other disturbances. Once the abnormal conditions are detected, the relays quickly isolate the affected sections of the grid, preserving the system's stability, preventing large-scale blackouts and potentially significant damage to infrastructure.

The automation system in the electric grid provides centralized control, data visualization, and the necessary tools to support system operators. By collecting data from sensors across the grid, these systems allow operators to quickly diagnose and address issues, implement changes, and plan for future needs. They also enhance efficiency by automating routine tasks and providing advanced analytics to optimize grid performance.

For decades, the electrical industry operated primarily using electromechanical relays and control systems, the benchmark for managing and protecting the power grid. It wasn't until the late 1990s that we witnessed a significant shift in the industry, marking the transition from electromechanical to digital technologies. This change was driven by advancements in electronics and computing, providing enhanced capabilities in speed, accuracy, and versatility.

While electromechanical relays have served us well, they are now dated technologies, struggling to meet the demands of our increasingly interconnected and high-demand grid. These older relay models are less precise, slower to respond, and lack the advanced functionality of contemporary digital relays. Moreover, they are becoming increasingly challenging to maintain and repair due to obsolete parts.

Modern digital relays, on the other hand, provide a significant upgrade. They are capable of monitoring and analyzing multiple parameters simultaneously, offer faster and more accurate fault detection and isolation, and can adapt to changing grid conditions. In addition, they support advanced communication protocols for better integration with our automation systems. This improved coordination between protective relays and automation systems enhances our grid's security and efficiency.

To transition from electromechanical relays, RPU established a relay replacement program that identifies and proactively replaces substation protective relays, automation, and control equipment. The program is driven by several factors, including the relay's age, relay obsolescence, level of effort to maintain a complex and unique relay model, and system criticality. This ongoing modernization program represents a strategic investment in our grid's future, ensuring it continues to deliver reliable and secure power to all our consumers.

Typical 1st Generation Digital Relays

Typical New Digital Relays

DISCUSSION:

As part of the relay program replacement, we are initiating these projects to upgrade the protective relays and automation systems at several substations.

Springs Substation Bus Differential Relay Upgrade Project

Through several protection and automation upgrade projects, RPU has upgraded all of the electromechanical relays at the Springs substation except for two relays that protect two 66kV bus segments. RPU is initiating this project to replace the last two electromechanical relays at Springs Substation.

The scope of work includes replacing two 66kV electromechanical bus differential relays with two digital relays. In addition, the scope of work includes installing auxiliary devices to support the new digital relays. The engineering design contemplated for this project will be performed by RPU staff. RPU field forces will complete the construction work, testing, and commissioning.

Total Project Cost

The project and fiscal breakdown is proposed as follows:

Project and Fiscal Breakdown (Springs Bus Differential Relay Upgrade Project)		
Work Type	Performed By:	Amount ($)
Project Management and Engineering	RPU Engineering Staff	$40,000
Construction	RPU Substation Electricians	$60,000
Testing and Commissioning	RPU Test and SCADA	$30,000
Equipment and Material		$45,000
Project Contingency (10%)		$18,000

Work Order Total:	**$193,000**
Anticipated Start Date:	**October 2023**
Anticipated Duration:	**5 Months**

Harvey Lynn Substation Switchgear 5 Protection and Upgrade Project
Harvey Lynn Switchgear has old electromechanical relays that protect transformer T5. Also, it has old electromechanical control relays that control the auto transfer schemes between switchgear 5 and other switchgears at Harvey Lynn Substation. RPU is initiating this project to replace these old electromechanical protection and control relays.

The scope of work includes replacing three transformer protection electromechanical relays with one digital relay and replacing electromechanical control relays with a new automation system for the auto transfer schemes of the potential transformer, control power, and main bus tie breakers. In addition, the scope will include installing new auxiliary devices to support the latest digital relays. The engineering design intended for this project will be performed by RPU staff. RPU field forces will complete the construction work, testing, and commissioning.

Total Project Cost
The project and fiscal breakdown is proposed as follows:

Project and Fiscal Breakdown (Harvey Lynn Switchgear 5 Protection and Upgrade Project)		
Work Type	Performed By:	Amount ($)
Project Management and Engineering	RPU Engineering Staff	$50,000
Construction	RPU Substation Electricians	$96,000
Testing and Commissioning	RPU Test and SCADA	$40,000
Equipment and Material		$50,000
Project Contingency (10%)		$24,000
Work Order Total:		**$260,000**
Anticipated Start Date:		**October 2023**
Anticipated Duration:		**6 Months**

Orangecrest Substation Switchgear 1 and 2 Protection and Automation Upgrade Project
The Orangecrest Switchgear 1 and 2 are equipped with 32 protective relays that were installed between the late 1980s and early 1990s. The current relays encompass a mix of electromechanical and early-generation digital systems. Also, the control and automation infrastructure at these units are considerably antiquated.

The scope of work includes replacing 32 electromechanical and first-generation digital relays with 17 modern digital relays, upgrading the automation to integrate the new relays, replacing the control relays to improve the auto transfer schemes, and installing auxiliary devices to support the integration of the new relays into RPU's system.

Total Project Cost
The project and fiscal breakdown is proposed as follows:

Project and Fiscal Breakdown (Orangecrest Switchgear 1 & 2 Protection and Automation Upgrade Project)		
Work Type	Performed By:	Amount ($)
Project Management and Engineering	RPU Engineering Staff	$190,000

Construction	RPU Substation Electricians	$360,000
Testing and Commissioning	RPU Test and SCADA	$120,000
Equipment and Material		$220,000
Project Contingency (10%)		$89,000
Work Order Total:		**$979,000**
Anticipated Start Date:		**October 2023**
Anticipated Duration:		**10 Months**

STRATEGIC PLAN ALIGNMENT:

This item contributes to **Strategic Priority 6 - Infrastructure, Mobility and Connectivity** and **Goal 6.2** – Maintain, protect, and improve assets and infrastructure within the City's built environment to ensure and enhance reliability, resiliency, sustainability, and facilitate connectivity.

This item aligns with each of the five Cross-Cutting Threads as follows:

1. **Community Trust** – Planned replacement of deteriorating infrastructure with equipment that complies with current standards will improve safety and reliability of the electric system is a prudent and responsible action that helps build community trust and results in the greater public good.

2. **Equity** – The replacement of the protective relays and automation systems has been established based on engineering planning and operational criteria, with equitable distribution of services to ensure every member of the community has equal access to share the benefits of community progress.

3. **Fiscal Responsibility** – This item represents fiscal responsibility by identifying and replacing aging infrastructure, providing optimal electrical system reliability, safety, and efficiency, and reducing potential equipment and system failures and overall operational costs. The lowest price for the replacement units and thereby the best value for RPU' s customers was ensured through a competitive bidding process.

4. **Innovation** – RPU is committed to identifying creative solutions to meet the needs of our community members, effectively and efficiently by providing innovative infrastructure improvements. A collaborative and efficient approach has been used to replace the aging electric infrastructure to minimize potential disruptions to our customers in the future.

5. **Sustainability & Resiliency** – This project ensures that new substation protective relays and automation related system upgrades provide grid modernization and reliability that is expected to last well into the future.

FISCAL IMPACT:

The total fiscal impact is $1,432,000. Sufficient funds are available in Public Utilities Substation Bus Upgrade Account No. 6130100-470616.

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Certified as to availability of funds:	Kristie Thomas, Finance Director/Assistant Chief Financial Officer
Approved by:	Rafael Guzman, Assistant City Manager
Approved as to form:	Phaedra A. Norton, City Attorney

Attachments:

1. Project Site Map
2. Presentation