VILLAGE OF SHOREWOOD

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Village of Shorewood Lighting Replacement

Preliminary Design Study

MILWAUKEE COUNTY, WISCONSIN

DATE: 10/22/2024

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1.0 Executive Summary

The Village of Shorewood is undertaking a comprehensive overhaul of its aging street lighting system. This ambitious project aims to enhance public safety, improve system reliability, and reduce energy consumption by replacing outdated infrastructure with modern, energy-efficient LED lighting. This project is focused on residential street lighting systems, as the commercial corridors are being upgraded separately, with the reconstruction of Lake Drive taking place in 2025.

The existing lighting systems, dating back to the 1970s, are nearing the end of their lifespans and suffer from frequent failures. Outdated panels, deteriorating cables, and inadequate protective measures pose safety risks to maintenance personnel. Additionally, the current lighting units are outdated and consume excessive energy, leading to higher operating costs.

To address these critical issues, the project will completely upgrade the residential systems, including the replacement of most existing lighting panels, cables, junction boxes, and lighting units. New conduit and wire will be installed to improve reliability and safety. All lighting units will be converted to LED technology, offering significant energy savings and improved lighting quality.

This study evaluated three (3) alternatives for residential street lighting base infrastructure, including 240V single-phase, 480V single-phase, and 277V three-phase operations. 480V single-phase lighting systems are the recommended alternative due to lower capital and maintenance costs, convenience of matching infrastructure with current operations, and reduced impacts to residents.

The project will be implemented in five (5) phases to navigate concurrent construction, minimize disruptions to residents, manage costs effectively, and optimize resources. This phased approach will allow for a gradual rollout of the upgrades while ensuring minimal impact on the community.

Construction and design costs were analyzed for the two (2) feasible infrastructure alternatives. Anticipated panel, or electrical control enclosures, were also quantified for each alternative.

Alternative	A: 480V	B: 240V	C: 277V
Construction Cost per Light (Year 1)	$13,753.91	$14,713.22	--
Total Project Cost	$14,699,697.90	$15,572,766.45	--
Panel Quantity	4	14	--

Finally, this study evaluated potential grant funding opportunities for project compatibility and feasibility. It is recommended that the Village apply for Focus on Energy rebates upon completion of each construction stage, as well as apply for CRP funding once the next cycle is announced.

The proposed street lighting system upgrade is a critical investment in the Village of Shorewood's infrastructure. By addressing the existing system's deficiencies and adopting modern technologies, the project will provide numerous benefits to the community for years to come. Benefits include:

- **Enhanced public safety:** Improved lighting deters crime and reduces the risk of accidents.
- **Improved system reliability:** The new infrastructure will be more resilient to failures, reducing outages and maintenance costs.
- **Reduced energy consumption and operating costs:** LED lighting is significantly more energy-efficient than traditional lighting, resulting in lower utility bills.
- **Modernized infrastructure:** The upgraded system will align with current industry standards and provide a platform for future technological advancements.
- **Improved aesthetics:** The new LED lighting will create a more modern and uniform illumination in the community.

These direct benefits will make a significant contribution to any sustainability goals that the Village of Shorewood may have. By investing in energy-efficient lighting, the Village is taking a proactive step towards a more sustainable future.

2.0 Introduction

The Village of Shorewood's street lighting system is comprised of a mix of 120/240V and 240/480V lighting circuits with control cabinets that are wired to a mix of direct burial concrete light poles and metal light poles mounted to concrete bases using a combination of wire in conduit and direct bury wire. Portions of the existing lighting system infrastructure have been replaced since its original installation, but the majority of the system remains from the early 1970's and included various street lighting control cabinets powered by medium voltage services stepped down to 480V for power distribution. The reliability of the existing lighting system suffers due to frequent faults leading to outages and requiring significant maintenance.

With a focus on enhancing community safety and efficiency, the Village initiated a thorough infrastructure review in 2019 to identify key areas for improvement. Through this study, the Village identified a network of 35-40 lighting circuits supporting approximately 1,200 streetlights. The existing system's age, surpassing its typical life expectancy of 30-40 years, necessitated a formal review of lighting system operations, performance, efficiency, and safety.

Welcome The Village of Shorewood

In 2022 the Village of Shorewood developed a street lighting replacement plan. The plan included a high-level investigation of the existing lighting systems and infrastructure that supports it. The report concluded that the Village of Shorewood needs a complete electrical lighting overhaul. This overhaul would aim to not only replace aging infrastructure, but also to bring the system up to current standards.

Existing 240V Lighting Panel and Meter

Beyond addressing safety and reliability concerns, the system overhaul also aims to capitalize on energy savings by converting to LED lighting. This transition not only aligns with modern energy efficiency standards, but also promises long-term cost savings and environmental benefits. Recent endeavors to replace 325 lights, including the integration of 60 LED conversions, reflect the Village's proactive stance toward creating a more robust, reliable, and energy-efficient lighting system for the community.

Lake Bluff Elementary Baseball Field

In August 2023, the Village initiated the Street Lighting Replacement Program Request for Proposal (RFP), inviting proposals from firms for project management, engineering design, construction management, and inspection services. The program's strategic execution is structured across 5 phases, commencing with design in 2024 and culminating in the final phase's construction by 2029. KL Engineering was selected to oversee this project, to support the realization of the Village's vision for a modern, sustainable lighting infrastructure.

3.0 Existing Lighting System Evaluation

A thorough evaluation of existing lighting infrastructure has been completed and brought to light significant concerns, particularly surrounding panels, cables, splices, and junction boxes. Outdated panels, some dating back to 1971, lack essential safety features, posing hazards that require attention. Field reviews conducted by KL Engineering has highlighted deficiencies in protective measures, clearances, and equipment integrity, underscoring the imperative for urgent modernization efforts. Concurrently, the utilization of direct buried cables, coupled with aging splices and junction boxes, further accentuates the need for comprehensive upgrades to ensure reliability and safety.

3.1. Underground Infrastructure

The current state of the Village of Shorewood's electrical infrastructure highlights several concerning deficiencies, which can largely be attributed to the age of the system. The reliance on direct buried cables, a common practice at the time of installation, coupled with splices and handholes that are in poor condition, underscores the need for modernization. It's crucial to address these issues to safeguard the reliability, safety, and longevity of the Village's electrical network.

Degraded Handhole for conductor splicing and pulling

Existing splice. Submersible Terminal Blocks are recommended for all handhole splices

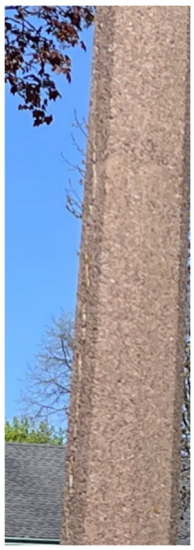
Installing conduit and wire offers multiple benefits that enhance both functionality and longevity. Firstly, conduit provides a protective casing for wires, shielding them from external elements such as moisture and physical damage, thereby reducing the risk of electrical faults and prolonging the lifespan of the wiring system. Moreover, conduit facilitates easier maintenance and troubleshooting, as wires can be easily accessed and replaced without the need for extensive excavation. Additionally, conduit installations offer greater flexibility for future expansions or modifications, allowing for the seamless integration of new wiring or technology. This approach not only ensures safer and more reliable electrical connections, but also offers peace of mind for the Village and property owners.

In addition to a wire in conduit system, underground infrastructure upgrades would relocate all conductor splicing to occur in the bases of light poles. The current system includes conductor splicing in pull boxes, which regularly fill up with water and ultimately provide a failure point if any splice blocks or fuses are not completely waterproof. Though splicing the conductors in pole handholes will result in additional conductor quantities, it removes the requirement for submersible splice blocks, and offers savings in the form of future maintenance.

3.2. Lighting Units

In addition to the challenges posed by the aging electrical infrastructure, the Village of Shorewood also faces issues with outdated lighting units and deteriorating light poles. Many of the lighting units installed in the Village are outdated, fail to meet modern energy efficiency standards, and require frequent maintenance. Furthermore, the harsh weather conditions in Wisconsin have taken a toll on the integrity of the light poles, leading to visible signs of deterioration and crumbling infrastructure. Addressing these issues is essential not only to improve the aesthetics of the Village, but also to enhance lighting performance and public safety by ensuring adequate illumination of roads and public spaces.

Existing Light Pole



Cracked Pole

Degraded Light Pole Base

The residential areas of the Village of Shorewood are currently illuminated by lighting units constructed of precast concrete. Many of these units are now showing their age from the elements of time and are ready for retirement. The Village of Shorewood has selected to replace the existing fixtures with Valiant, Full Cutoff LED – Series AVPCL2 fixtures (Appendix A, Exhibit 1). The selected luminaire for residential areas was approved for use by the Village Board in 2023 to provide aesthetic preference and performance in accordance with dark sky principles. This improvement will modernize the Village of Shorewood and enhance safety by replacing outdated high-pressure sodium (HPS) luminaires with energy-efficient LED luminaires. By upgrading to LED luminaires and replacing compromised poles, the Village will benefit from reduced maintenance needs. The Village can also expect to see an approximate 33% decrease with their monthly utility costs by converting to LED. LED technology can also be leveraged by integrating

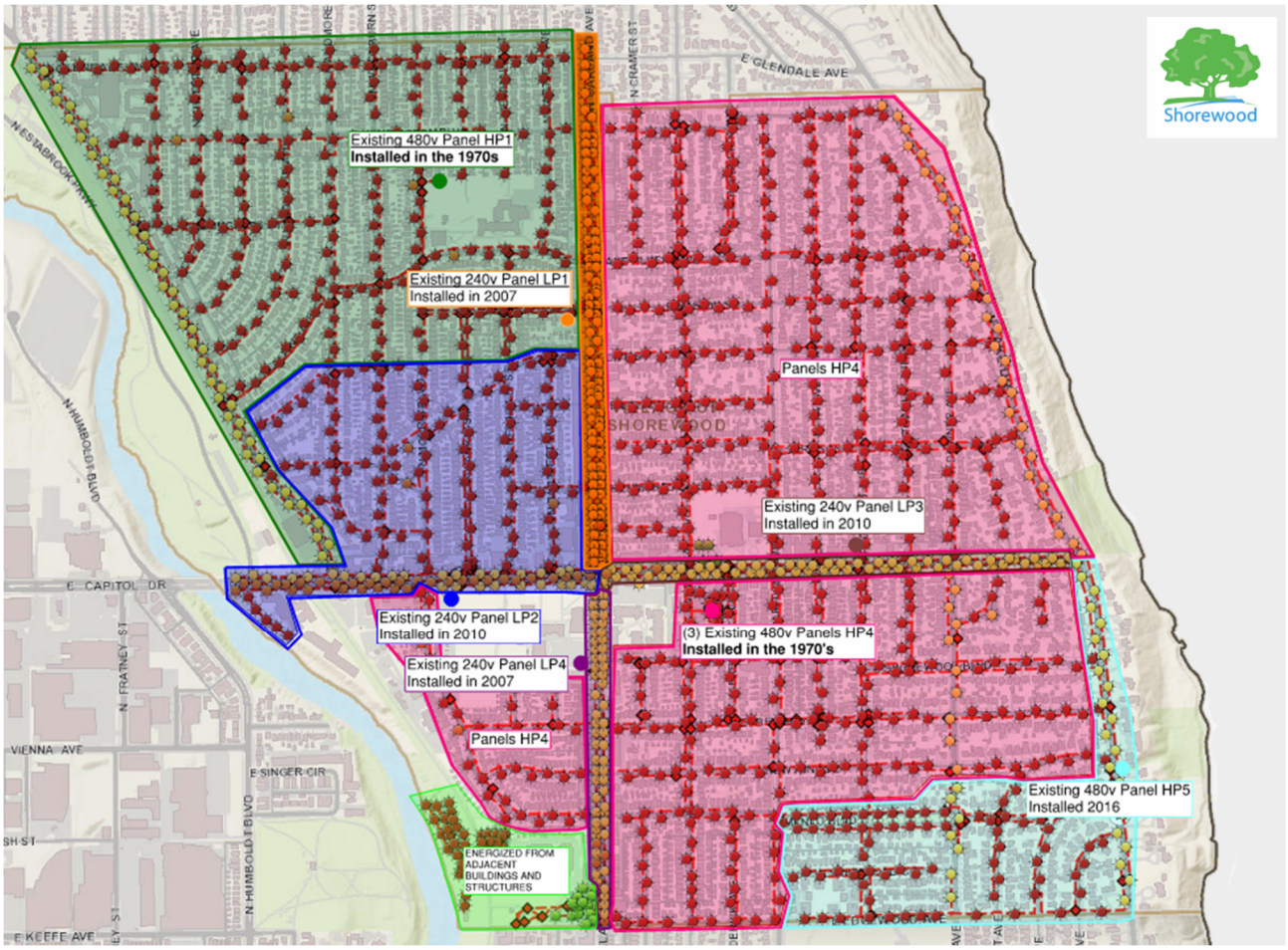
modern wireless controls that allows for remote monitoring and dimming of individual lighting units.

Capitol Drive and Oakland Avenue makeup the commercial district of the Village lighting systems and utilize an overhead pendant style lighting unit. These systems received upgraded luminaires and light poles as part of a previous upgrade project (2007-08). Although newer, the lamps for the luminaries are still predominantly high-pressure sodium (HPS). The Village has already converted these units from HPS lamps to LED and therefore they are not included with the scope of this project.

Recent Capitol Drive Fixture Installations

3.3. Electrical Services and Controls

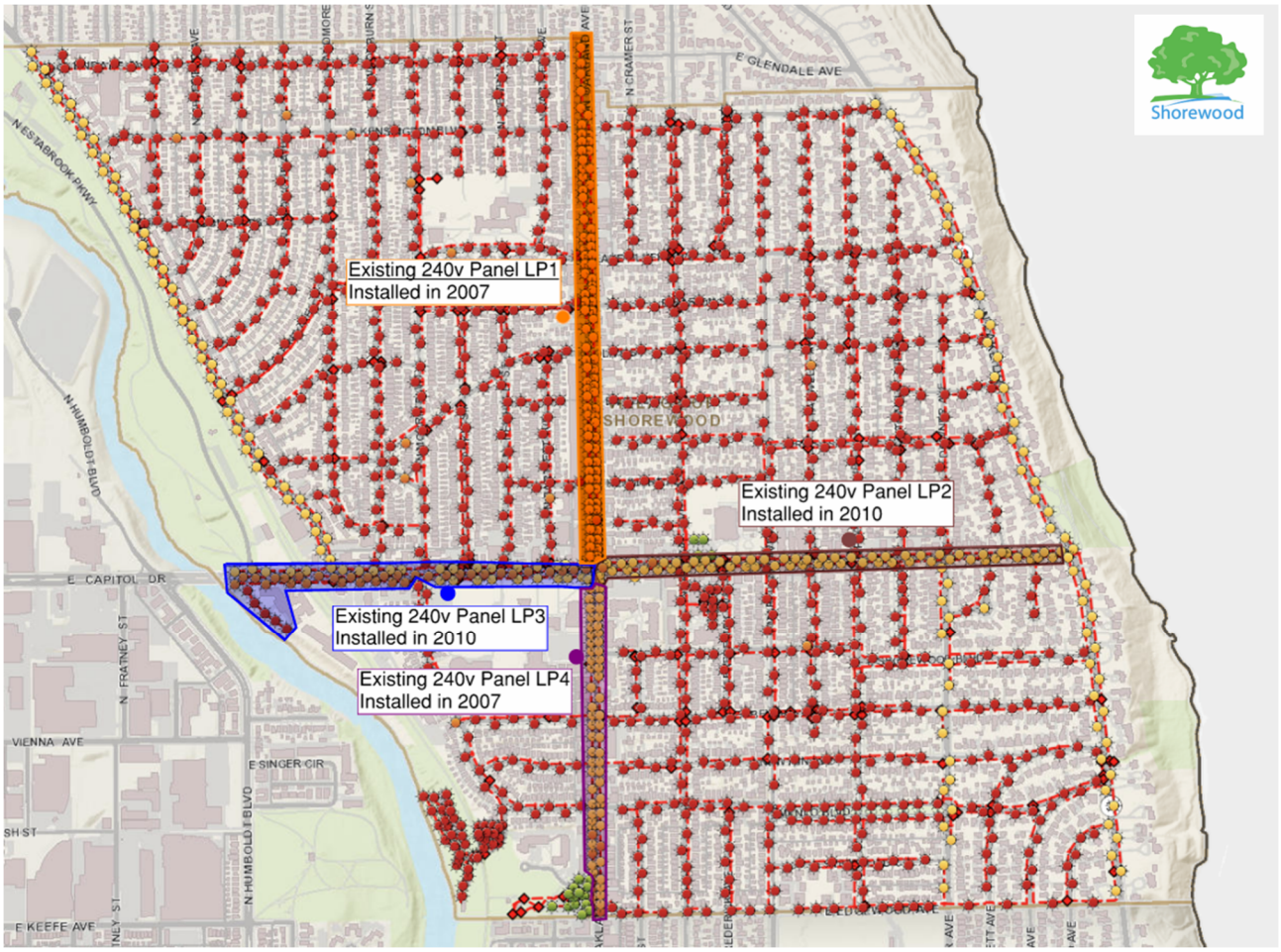
The Village of Shorewood has a lighting infrastructure that is outdated and in need of replacement. The existing infrastructure includes seven (7) strategically positioned lighting panel locations, each serving separate portions of the Village.



The Village of Shorewood Existing Lighting Infrastructure

3.3.1. Existing Electrical Services - Commercial Corridors

The main corridors of the Village of Shorewood, Capitol Drive, and Oakland Avenue are serviced by four (4) panels that are currently in good condition. Panels LP1 (NW quadrant, west of Capitol Drive), LP2 (SW quadrant, south of Capitol Drive), LP3 (NE quadrant, north of Capitol Drive) and LP4 (SW quadrant, west of Oakland Avenue) supply 240Vcircuits to power the commercial corridor light poles, while also offering 120V circuits for light pole receptacles. These services are labeled as “LP” in reference to the low-voltage panel operations and are not proposed for replacement with the project. The intention is for these systems to maintain current operations, with extents as shown in the graphic
below.



Village of Shorewood Main Corridor Lighting Extents

Panel LP1 is a 200A, 240V panel that serves Oakland Avenue north of Capitol Drive, it was installed in 2007 and is still in good condition. This panel's only limitation is the enclosure that it is housed in, there is not physical space to add contactors for additional lighting circuits. All lighting circuits are controlled by a timeclock or photocell that open and close contactors to actuate the streetlights.

Panel LP1 - 4480 E. Kensington Boulevard

Panel LP2 is a 200A, 240V panel that serves Capitol Drive east of Oakland Avenue. Panel LP2 was installed in 2010 and is still in good condtion. This panel is also limited with physical space for additional lighting contactors.

Panel LP2 - 4001 N. Prospect Ave.

Panel LP3 was installed in 2010, is a 400A, 240V panel that supplies power to Capitol Drive west of Oakland Avenue and to a portion of the residential area north of Capitol Drive and west of Oakland Avenue. Panel LP3 incorporates a remote, single phase 240/480V transformer that will be removed as part of this project and is discussed in a later chapter. Panel LP3 is in good overall

physical condition without any need for replacement. Panel LP3 is limited to its enclosures physical space, which would not allow for the addition of any new lighting contactors.

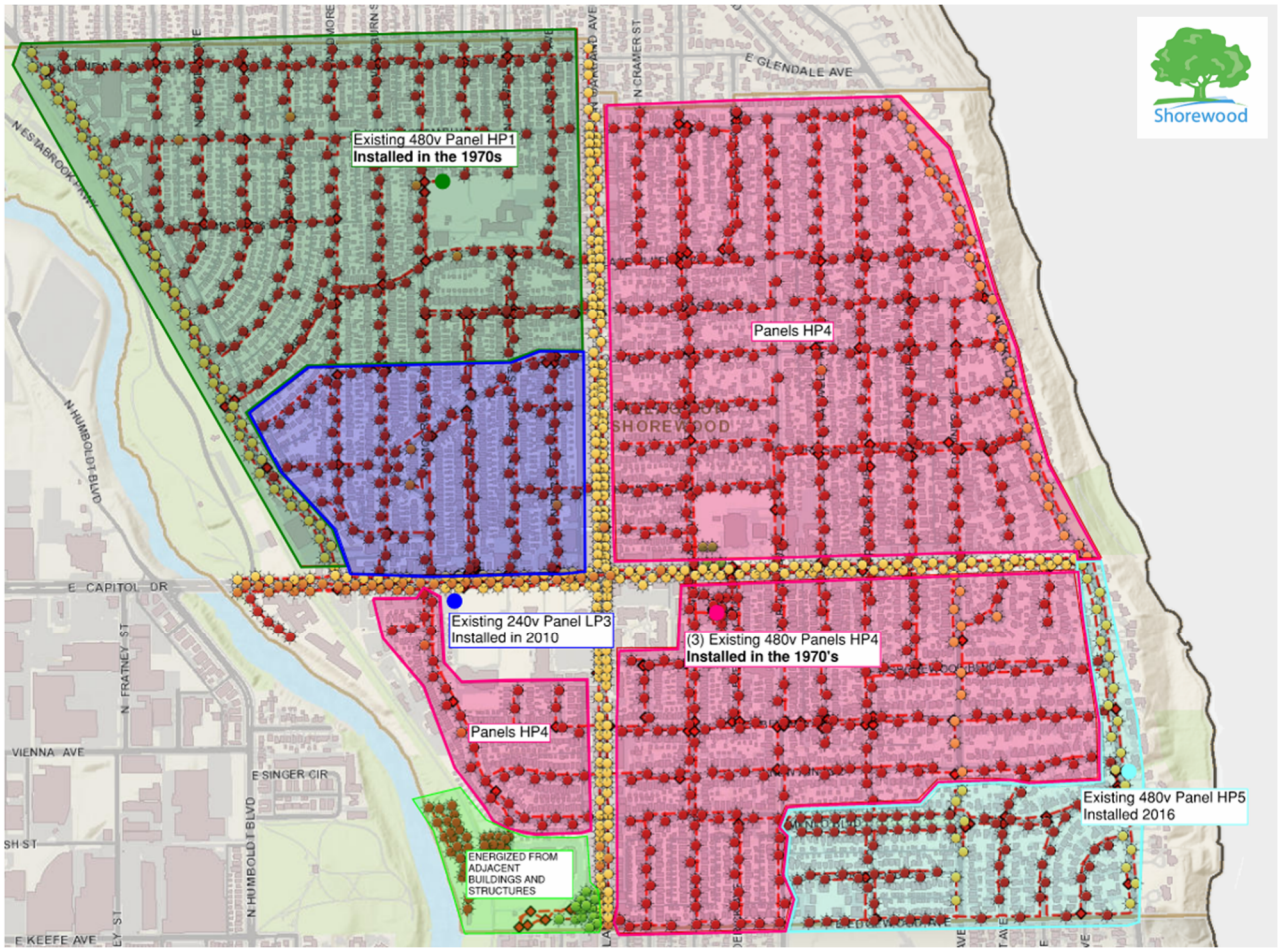
Panel LP3 - Capitol Drive, North of Football Field

Panel LP4 is a 200A, 240V panel that serves Oakland Avene south of Capitol Drive. Similar to LP1, LP4 was installed in 2007 and is in good condition with the same limiting factors.

Panel LP4 - 1701 E. Capitol Drive

3.3.2. Existing Electrical Services – Residential Areas

In the residential areas, however, the lighting panels, dating back to 1971, tell a different story. While these panels dutifully supply 480V circuits to the majority of residential zones, their age has left them lacking critical safety features, necessitating urgent updates. These services are labeled as HP in reference to the higher-voltage panel operations, as shown in the graphic below.



Village of Shorewood Existing Residential Panel Extents

Panel HP1 is located near Lake Bluff Elementary School just north of the foul line of a baseball field. HP1 is lacking a protective barrier that separates the primary and secondary sides of the equipment, putting maintenance personnel at risk of exposure to live voltage. Nearly all the electrical components that make up HP1 are outdated and show signs of rust and overall degradation. HP1 is not a risk to the general public, as long as it remains locked when not being serviced by qualified electricians.

Panel HP1
Lake Bluff Elem. School Baseball Field

LP3 incorporates a remote, single phase 240/480V transformer. The remote transformer is fed with a 240V circuit from LP3. The 240V circuit is transformed into a 480V circuit where it enters back into LP3, terminates onto a lighting contactor, and then is sent into a portion of the residential area north of Capitol Drive. The transformer that is part of LP3's lighting system is in very poor condition and will be phased out as part of this project in Phase 5.

Panel LP3 – Capitol Drive, North of Football Field

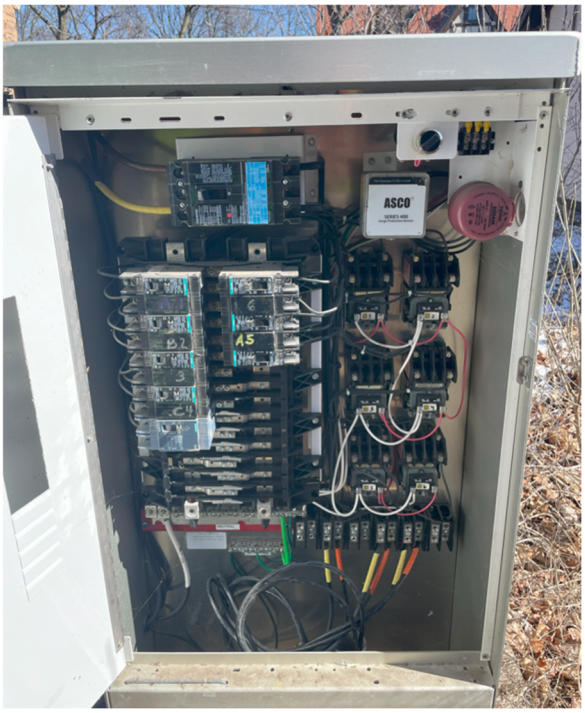
Panel HP4 is situated adjacent to North Shore Fire/Rescue Station 83. Similar to HP1, HP4 is also missing protective barriers that separate the primary and secondary sides of the equipment. Nearly all of the electrical components that are part of HP4 are showing signs of rust and overall degradation. HP4 also sits next to a downspout for roof water discharge, which encourages further deterioration and rust infiltration. HP4 does not maintain proper working clearances required by the National Fire Protection Agency's National Electrical Code (NEC Table 110.26 (A) (1) Working Spaces).

Panel HP4 - Behind North Shore Fire/Rescue Station 83

Panel HP5 was installed in 2016 and is located at the entrance of the Shorewood Nature Preserve. HP5 energizes the lights along Lake Drive and a limited portion of the southeast residential area. HP5 is in excellent physical condition overall. However, there are a few issues to navigate. This panel operates past its allowable full load ampacity of 160 amps (80% of main circuit breaker rating). WisDOT has a project that begins in 2025 that includes adding circuits and additional load to the panel, while simultaneously reducing loads by converting the luminaires to LED.

There have also been many issues associated with the circuiting and controls of HP5 since its installation. The cabinet re-established power to old, outdated underground infrastructure in the residential areas of its footprint. This old infrastructure has proven to be a major source of continued failures for the HP5 system.

Panel HP5 - Located at the Shorewood Nature Preserve

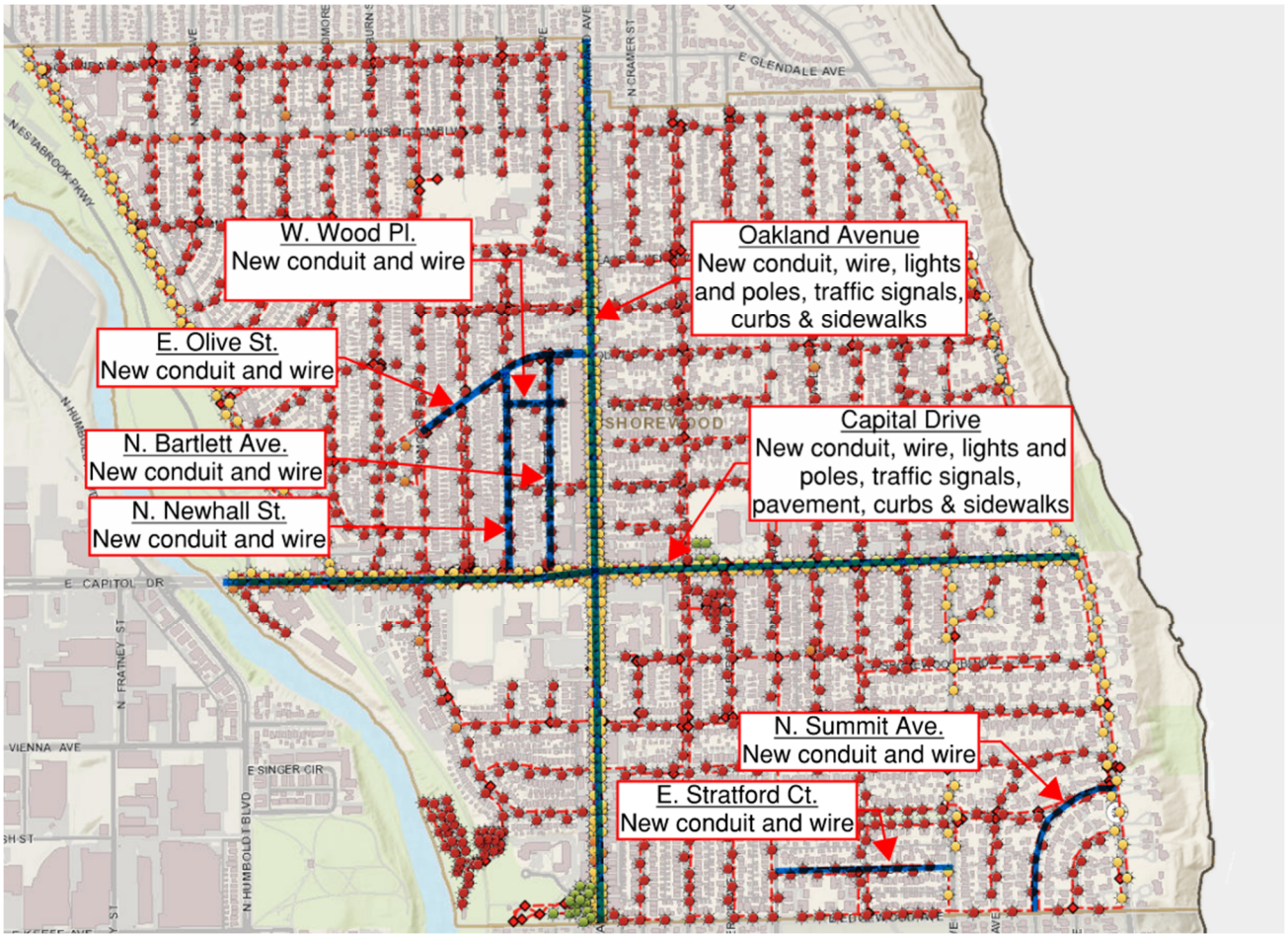


4.0 Previously Completed & Concurrent Construction

4.1. Recent Electrical Infrastructure Upgrades

In recent years, the Village of Shorewood has undertaken significant strides to enhance its infrastructure across various streets and neighborhoods. Notable efforts include the installation of new conduit and wiring in select areas of the Northwest and Southeast quadrants. Moreover, a comprehensive infrastructure revitalization was executed along Capitol Drive (2010) and Oakland Avenue (2007-08), encompassing upgraded conduit, conductors, installation of new lights and poles, as well as the renewal of curb, gutter, pavement, and traffic signals.

Recent Infrastructure Upgrades

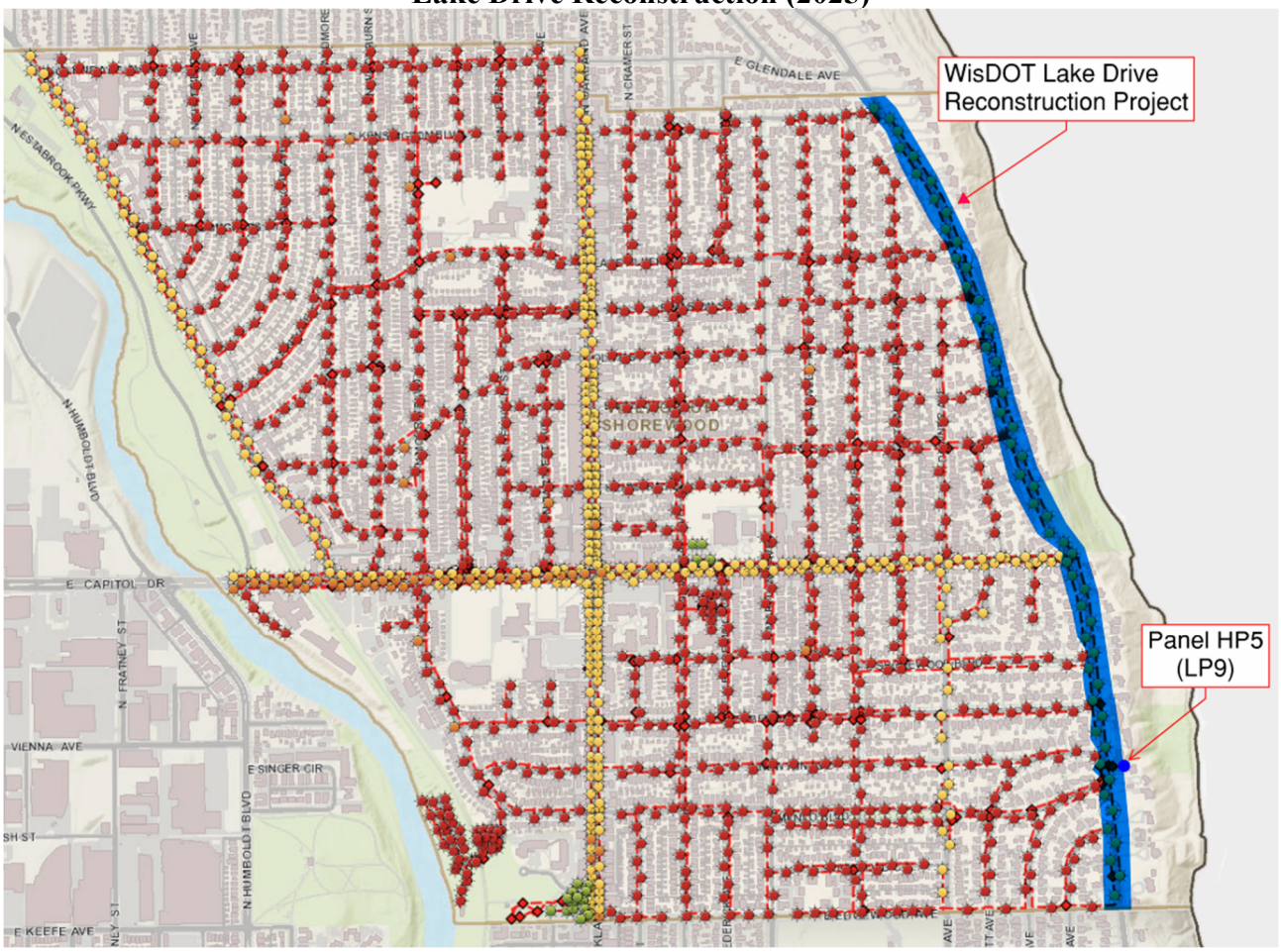


Looking ahead, KL Engineering is actively considering several forthcoming projects as integral components of our phased planning process. Recently installed, code compliant infrastructure in the residential areas will be salvaged in-place and re-used.

4.2. Lake Drive Reconstruction

WisDOT will be reconstructing STH 32/N Lake Dr. in 2025. This project will include new conduit, wire and LED lighting units. This reconstruction project will stretch from East Kensington Boulevard to E. Edgewood Avenue. New lighting circuits will derive power from existing Panel HP5 located at the entrance of the Shorewood Nature Preserve. Upgrades to the electric panel and controls are not included as part of the Village of Shorewood Lighting Replacement Project.

Lake Drive Reconstruction (2025)

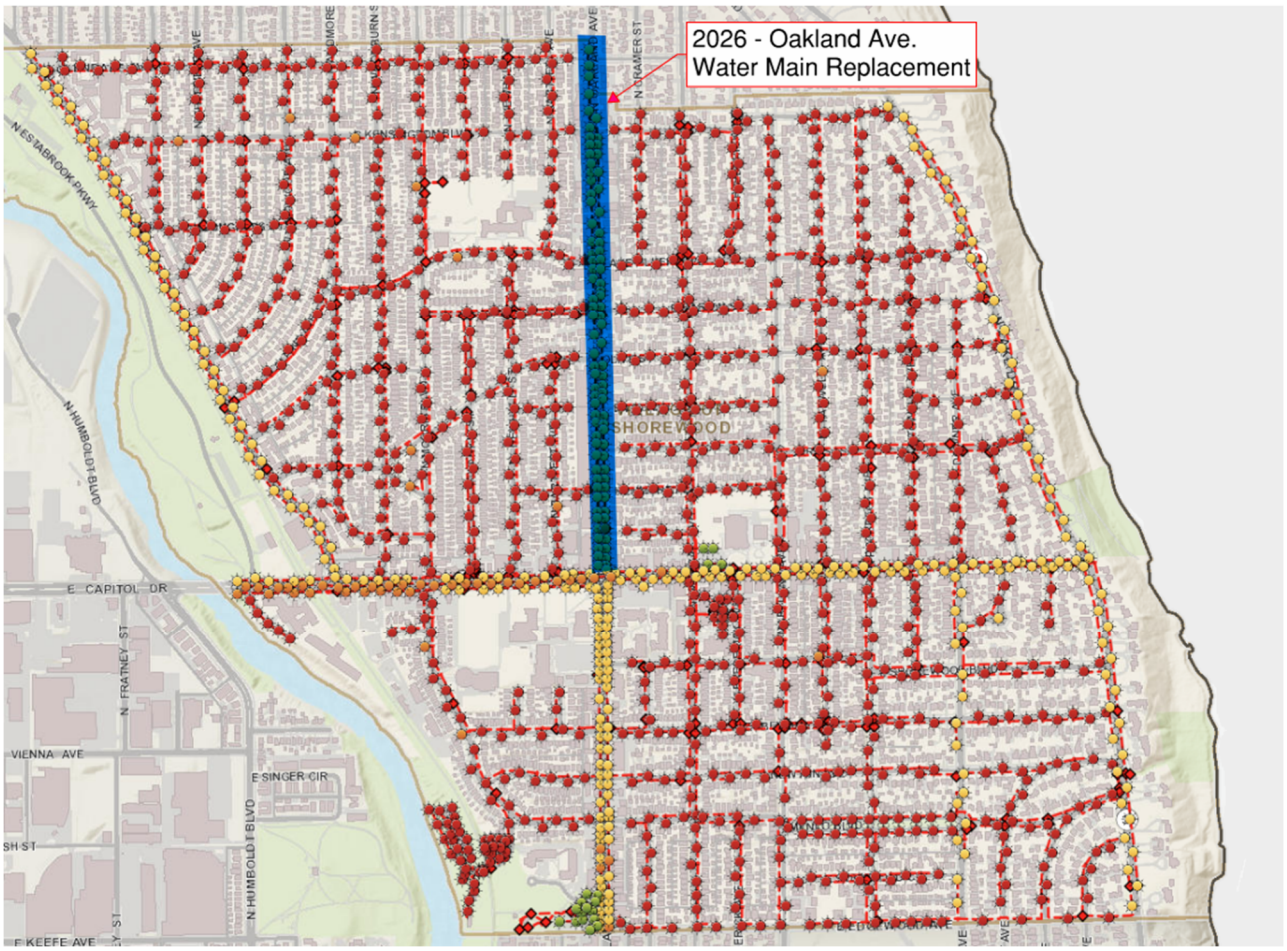


4.3. Water Main Replacements

In response to lead service line replacement required under the Federal Lead and Copper Rule Improvements, the Village of Shorewood is expected to undertake a comprehensive and intensive schedule of public and private water service replacements in the next 10-15 years. It is anticipated that the early phases of this work will coincide with the planned streetlight system replacement. The design and schedule of these watermain and lead service line replacement projects is in progress and not yet final. The proposed construction phasing of the lighting upgrades provided in this report were developed based upon the best information available to avoid project overlap and construction congestion.

Oakland Avenue (north of Capitol Drive) is scheduled for reconstruction and watermain replacement in 2026.

North Oakland Avenue Water Main Replacement (2026)



5.0 Lighting System Upgrade Alternatives

The determination to overhaul the Village of Shorewood lighting system comes with the challenge of how to accomplish the upgrades most efficiently and economically. As mentioned previously, the current lighting systems are comprised of a mix of 120/240V and 240/480V lighting control cabinets. Each type of system has its advantages and disadvantages, which has been compiled and compared to determine the best solution for the Village.

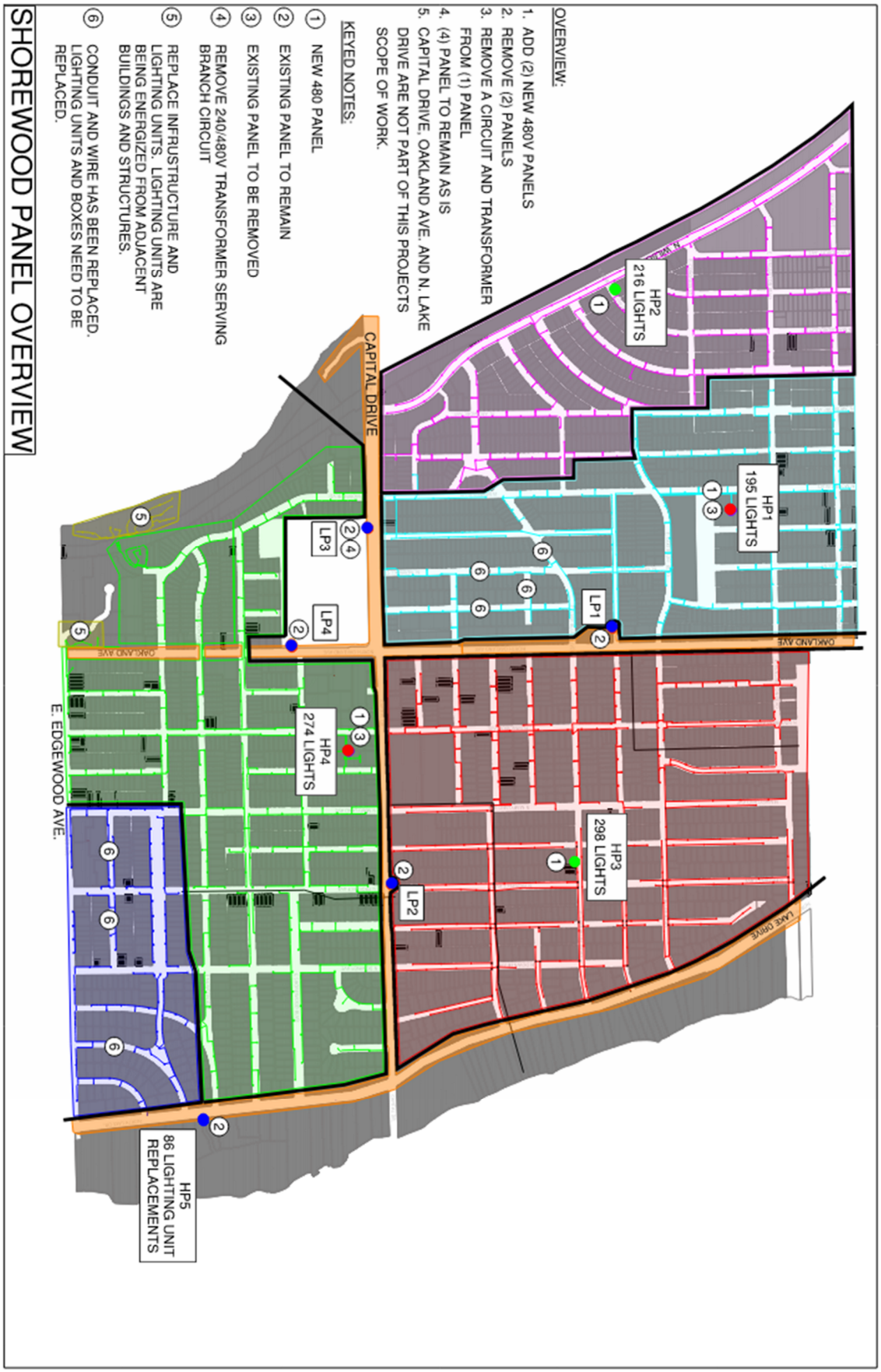
The Village has recently upgraded the underground electrical infrastructure for the commercial corridors and is currently working on retrofitting these luminaires to LED. Additionally, the reconstruction project on STH 32/N Lake Drive in 2025, will include upgrades to all associated electrical infrastructure. Therefore, the focus of this project and subsequent alternatives evaluation are centered on the residential lighting systems. Included in this evaluation is replacement of the residential lighting with 480V single phase, 240V single phase, and 277V three phase lighting systems.

5.1. Alternative A: Single Phase, 480-Volt System

The first alternative evaluated with this study included a complete replacement of the existing 240/480V residential lighting systems, with a modernized, code compliant 240/480V system, utilizing 480V for lighting operations. One of the primary advantages to a 480V system is the ability to handle power distribution over greater distances. This results in the deployment of fewer panels and circuits, streamlining the overall infrastructure and reducing installation complexity.

The deployment of fewer panels ultimately means fewer properties and residents will be impacted with a control cabinet in their terrace or having to maintain their lawns around it. This alternative would result in the replacement of two (2) cabinets to their current locations, with the addition of two (2) new cabinets where none previously existed. These new cabinets will be located best as possible to mitigate impacts to residents, targeting terraces on lot lines, near alleys or partially hidden by vegetation. Additionally, fewer control cabinet locations will reduce the number of electrical services from WE Energies and monthly charges paid by the Village. The graphic below illustrates the tentative locations of all panels under this alternative.

Village of Shorewood 480V System Panel Layout



The ability of a 480V system to efficiently handle power distribution over longer distances, while utilizing smaller wire gauges is due to ohms law, where an increase in voltage is directly proportional to a decrease in current. In turn, a decrease in current means a smaller sized wire is adequate to carry the same load. This not only reduces material costs, but the reduction in current also minimizes voltage drop, ensuring consistent and reliable power delivery throughout the system.

By evaluating 480V system capacities and calculating approximate wire sizing, a comprehensive construction cost estimation was developed for the alternative. Estimates were initially developed on a smaller scale, looking at a conversion for a single lighting panel and translating that to a cost per lighting unit **($13,754)**. That cost was then extrapolated across the entire quantity of lighting units included with the project scope, while factoring an inflation rate of 3% annually. The total cost for construction for Alternative A is estimated at **$14.7M**.

Safety and maintenance considerations were also paramount in the evaluation process, with the 480V system offering inherent safety benefits. The lower current requirements for the circuiting results in a reduced risk of electrical hazards for maintenance officials, while the reduced number of electrical panels results in less maintenance and subsequently fewer opportunities for hazards to occur. From a maintenance perspective, these systems utilize very similar components to all other alternatives and a higher operating voltage does not equate to additional wear and tear on the equipment. Furthermore, the Village already maintains 480V lighting circuits for the residential areas, so this alternative would not create a need for additional education or training of Village staff.

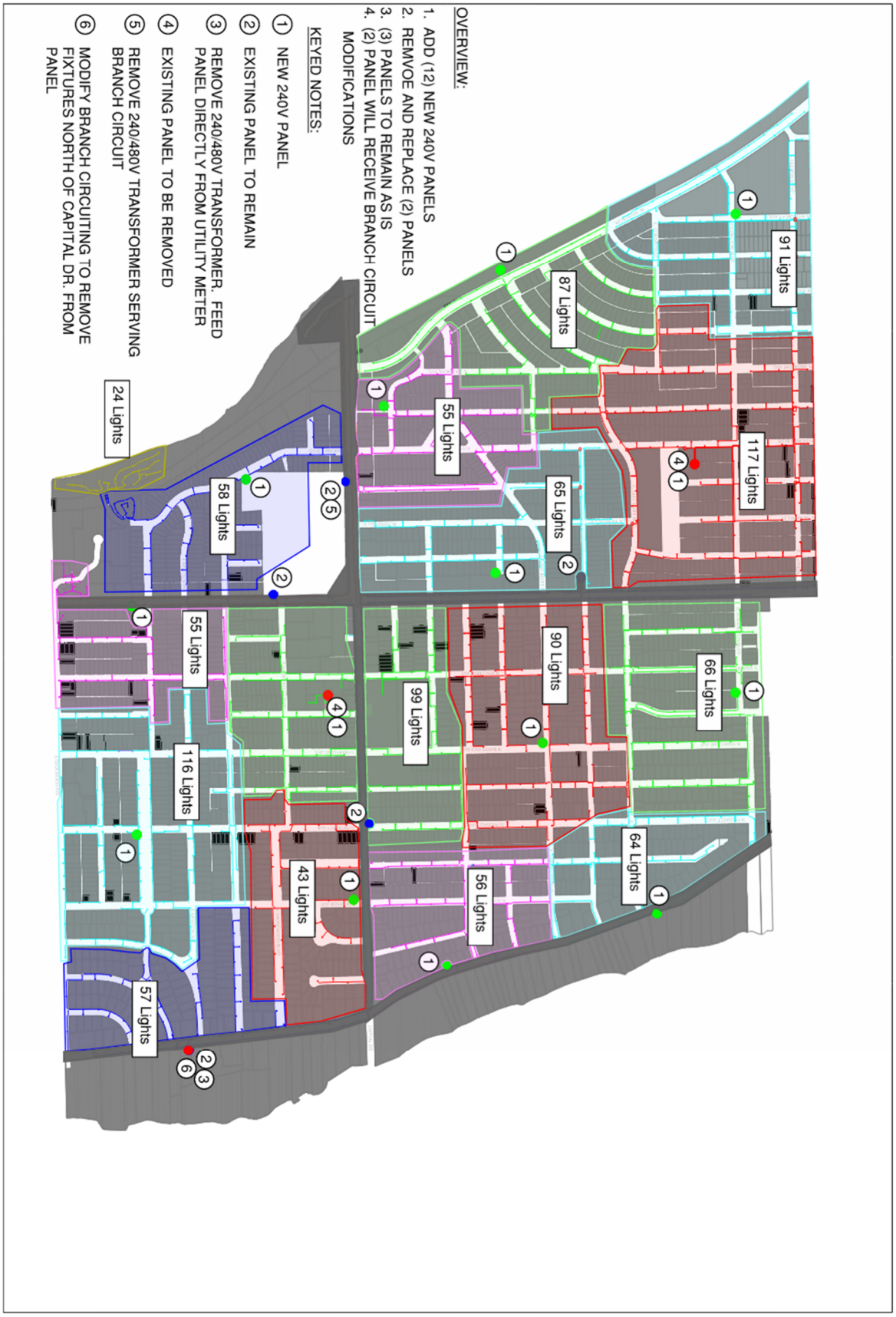
The biggest disadvantage to a 480V system is the incompatibility with the existing 120/240V lighting systems to remain on the commercial corridors. Simply put, the Village would not have the option to include outlet receptacles with the light poles for holiday decorations or maintenance use without the addition of stepdown transformers.

5.2. Alternative B: Single Phase, 240V System

The second alternative evaluated with this study included a complete replacement of the existing 480V residential lighting systems, with a modernized, code compliant 120/240V system, utilizing 240V for lighting operations. One of the primary advantages to a 240V system is compatibility with the existing 120/240V lighting system to remain on the commercial corridors. This means the Village would only be responsible for maintaining and purchasing components for systems with the same operating voltage.

Opting for a system that solely operates at 240V does have its drawbacks. Alternative B necessitates the installation of (12) additional panels across the Village to counteract voltage drop. Unlike their 480-volt counterparts, 240V circuits cannot provide coverage anywhere near as extensive. This increased number of panels directly correlates to an increased number of impacts to properties and residents, potentially deeming them undesirable additions to their terrace. The graphic below illustrates the tentative locations of all panels under this alternative.

Village of Shorewood 240-Volt System Panel Layout



Despite being a commonly utilized voltage standard, it falls short in several key areas relative to the needs of this overall project. Primarily, its limitations become apparent with the need for larger wire gauges to transmit the lower voltage power and mitigate voltage drop. Larger wire sizes lead to increased material costs and constructability concerns. Higher current requirements necessitate the deployment of more panels and circuits, further contributing to higher infrastructure expenses. Additionally, electrical providers charge a monthly fee for each meter, every panel requires a meter.

The same cost estimation method was applied to Alternative B as was used for Alternative A. Alternative B resulted in a cost per lighting unit of **$14,713** and a total construction cost of roughly **$15.6M**.

Safety considerations also weigh against the 240V system. While the operating voltage provides similar risk of electrical hazards for maintenance officials, the increased number of panels results in more opportunities for these hazards to occur. The Village already maintains 240V lighting circuits for the commercial areas, so this alternative would not require unique components be kept on-hand and would not require additional education or training of Village staff.

5.3. Alternative C: Three Phase, 277V System

A 277V three phase system was eliminated early in this evaluation due to several factors. A 277V system would provide for greater capacity of the panels themselves to power more circuits, however they would not allow a circuit to be extended much further than a 240V system due to voltage drop. This factor alone means we would need the same number of panels as the 240V alternative, as well as the same size wire gauge.

Additionally, converting to a 277V three phase system for the residential areas would require a complete overhaul of the electrical service infrastructure from the utility, as well as the street lighting infrastructure. The utility would be required to provide either new or make alterations to their transformers, as well as bring new service laterals to our cabinet locations. The work associated with the utility company would drive the cost well beyond the previous alternatives, while providing little to no operational benefit.

6.0 Grant and Funding Opportunities

An evaluation of potential funding opportunities has been completed and identified multiple sources that may not have previously been considered. The evaluation looked at all sectors for opportunities, including private foundations and public entities at both the state and federal levels.

6.1. Focus on Energy

Focus on Energy provides prescriptive rebates for replacing existing lighting with energy-efficient light-emitting diode (LED) fixtures. The luminaires supplied for the project are listed on the DLC SSL QPL and approved by Focus on Energy (FOE), meeting those rebate requirements. Rebates are applied for after construction is completed and require meter statements form the electric utility be provided. The luminaires selected for this project are classified as low output and will be eligible for incentives of $20 each, for an estimated project total of $21K.

6.2. Public Service Commission

The Public Service Commission's Energy Innovation Grant Program (EIGP) supports a wide variety of energy projects, including those related to energy efficiency, renewable energy, energy storage, and energy planning. Each year, the Commission selects projects for eligible activities based on its energy priorities, emerging trends, and public input. The previous round (5th) was opened on 11/30/23 and closed on 3/1/24. Therefore, the next round is anticipated to open in late November of 2024. This is a competitive program; in the most recent round, 28 projects were selected with a total value of $7.8 Million out of 86 applications. The projects are selected under three categories:

1) Renewable Energy and Energy Storage
2) Energy Efficiency and Demand Response
3) Comprehensive Energy Planning and Feasibility Studies for Microgrids.

In reviewing past awards, one LED conversion project was selected, which funded all remaining lighting owned by the Madison Metropolitan School District. If Shorewood is interested in applying for funding under the upcoming round, it is recommended to discuss the potential success of the application with the PSC.

6.3. WisDOT/Carbon Reduction Program

The Bipartisan Infrastructure Law of 2021 (BIL) established a Carbon Reduction Program (CRP) at the national level. This new federal program provides funding for projects that reduce transportation emissions and requires states to develop comprehensive carbon reduction strategies.The Wisconsin Department of Transportation Local Program is administering the states portion of the funds. Future application cycles have not yet been announced but are anticipated. Signalization and LED lighting projects are eligible under this program.

6.4. Energy Efficiency and Conservation Block Grant Program

The Energy Efficiency and Conservation Block Grant (EECBG) Program is a $550 million grant program funded through the Bipartisan Infrastructure Law. It is designed to assist states, local governments, and Tribes in implementing strategies to reduce energy use, to reduce fossil fuel emissions, and to improve energy efficiency. Fourteen categories of eligible uses of EECBG Program funds have been identified. There are direct grants to the largest cities and counties in each state (the Village of Shorewood is not included on the list of communities covered). Additionally, in Wisconsin the Office of Energy Innovation is using those EECBG funds to finance rural energy planning efforts, which would not be applicable to the Village of Shorewood. Therefore, this Program would not be applicable the Village's LED conversion project.

6.5. Recommendation

Based on the findings described in this report, it is recommended that the Village of Shorewood apply for Focus on Energy rebates upon completion of each construction stage. Additionally, it is recommended that the Village apply for WisDOT CRP funding once the next funding cycle is announced.

The Public Service Commission Grant appears to be established for more complex energy savings projects; however, an application could be justified depending on availability of Village staff. The Energy Efficiency and Conservation Block Grant is not recommended for application by the Village.

7.0 Conclusion

7.1. Recommendation

KL Engineering recommends **Alternative A: Single Phase, 480V system** for the residential areas of the Village of Shorewood. The panels serving Capitol Drive, Oakland Avenue. & Lake Drive would remain intact. There were many factors taken into consideration for this recommendation, including safety, cost, convenience, maintenance, and impacts to residents. With a lower cost, less anticipated maintenance and a minimal impact to residential properties, Alternative A is the clear choice.

Table 6.1

Alternative	A: 480V	B: 240V	C: 277V
Construction Cost per Light (Year 1)	$13,753.91	$14,713.22	--
Total Project Cost	$14,699,697.90	$15,572,766.45	--
Panel Quantity	4	14	--

7.2. Construction Phasing

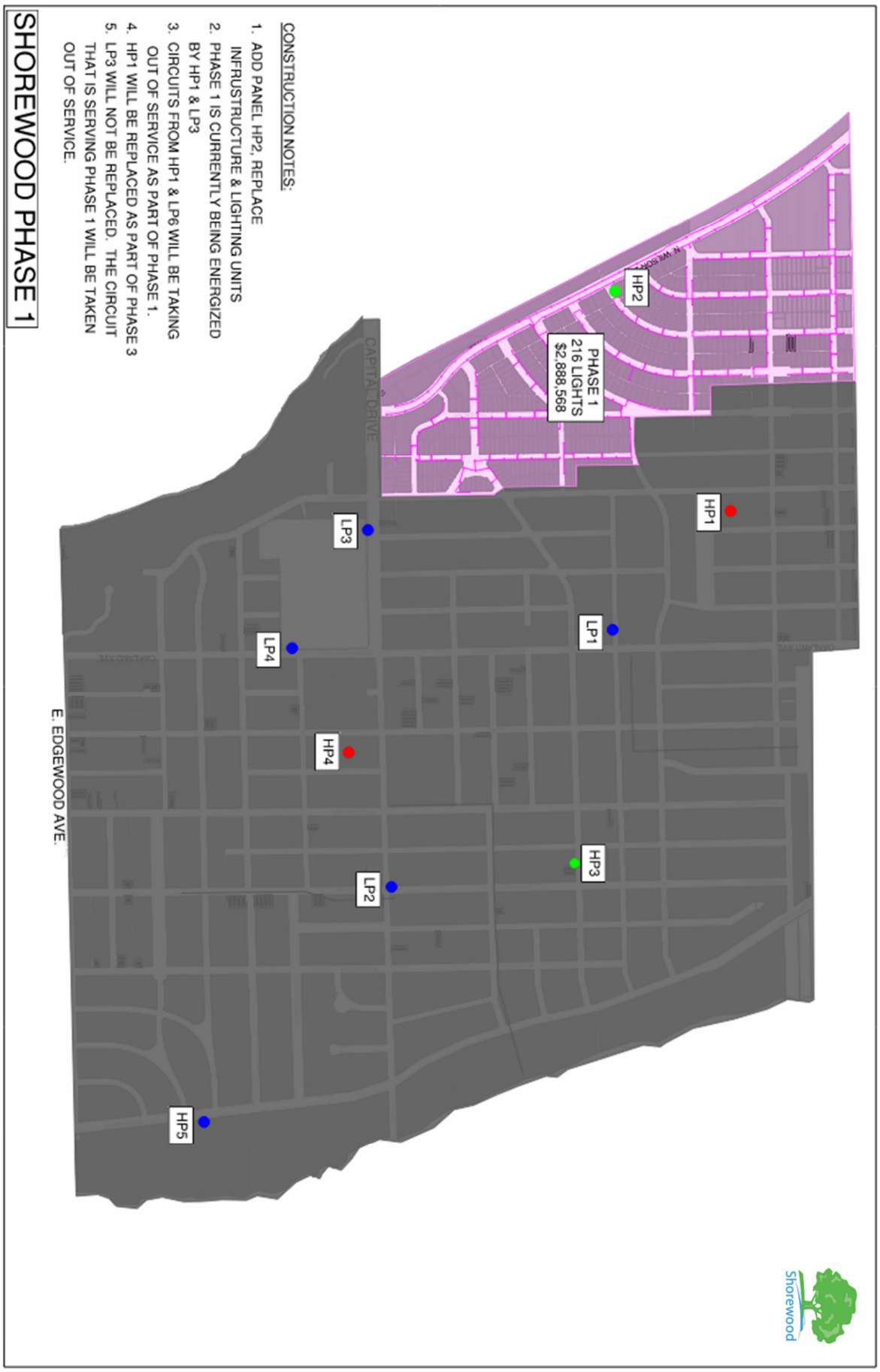
7.2.1. Phase Development Overview

Phasing was analyzed to determine the optimal approach for dividing the Village into five (5) phases. This careful planning was necessary due to the multiple construction projects scheduled concurrently with the lighting project. KL Engineering's proposed phasing schedule considered the need to balance costs across phases and to work inward toward existing panels, aiming to minimize lighting outages.

In addition to balancing costs and limiting disruptions, the phasing plan was designed to ensure efficient and coordinated progress across all construction activities. By integrating the lighting project with the Village's broader construction timeline, the plan seeks to optimize resources. This approach helps maintain the quality and continuity of services while managing the complexities of simultaneous infrastructure improvements.

7.2.2. Phase 1 Northwest Quadrant of Village - 2025

In Phase 1 of the project, HP2 will be installed, accompanied by the replacement of 216 lighting units, with an estimated cost totaling $2,888,568. This phase also involves the removal of lights from HP1 and LP3. No existing panels undergo removal or replacement as part of Phase 1. Construction for Phase 1 is proposed for 2025.

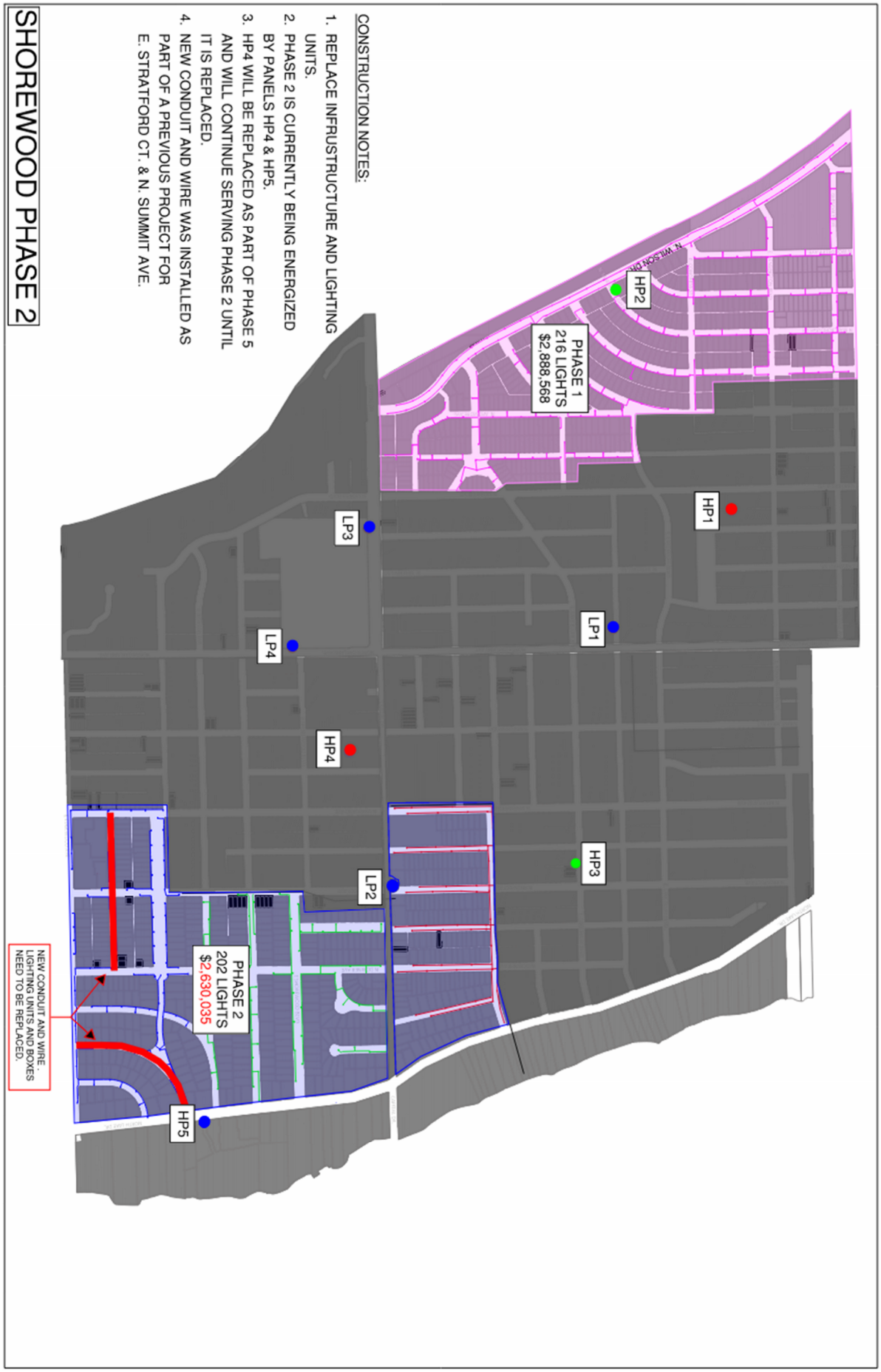

SHOREWOOD PHASE 1
CONSTRUCTION NOTES:
1. ADD PANEL HP2, REPLACE INFRUSTRUCTURE & LIGHTING UNITS
2. PHASE 1 IS CURRENTLY BEING ENERGIZED BY HP1 & LP3
3. CIRCUITS FROM HP1 & LP6 WILL BE TAKING OUT OF SERVICE AS PART OF PHASE 1.
4. HP1 WILL BE REPLACED AS PART OF PHASE 3
5. LP3 WILL NOT BE REPLACED. THE CIRCUIT THAT IS SERVING PHASE 1 WILL BE TAKEN OUT OF SERVICE.
PHASE 1
216 LIGHTS
$2,888,568
HP1
HP2
HP3
HP4
HP5
LP1
LP2
LP3
LP4
CAPITAL DRIVE
E. EDGEWOOD AVE.
Shorewood

HP2 is tentatively proposed for installation near the intersection of N Wilson Drive and Marlborough Drive as depicted below. The location was identified primarily because of its centrality to the proposed circuit extents. Other factors that helped identify this location include accessibility for maintenance crews, proximity from accident prone locations, and minimal potential for property owner concerns.

Proposed Location for Panel HP2

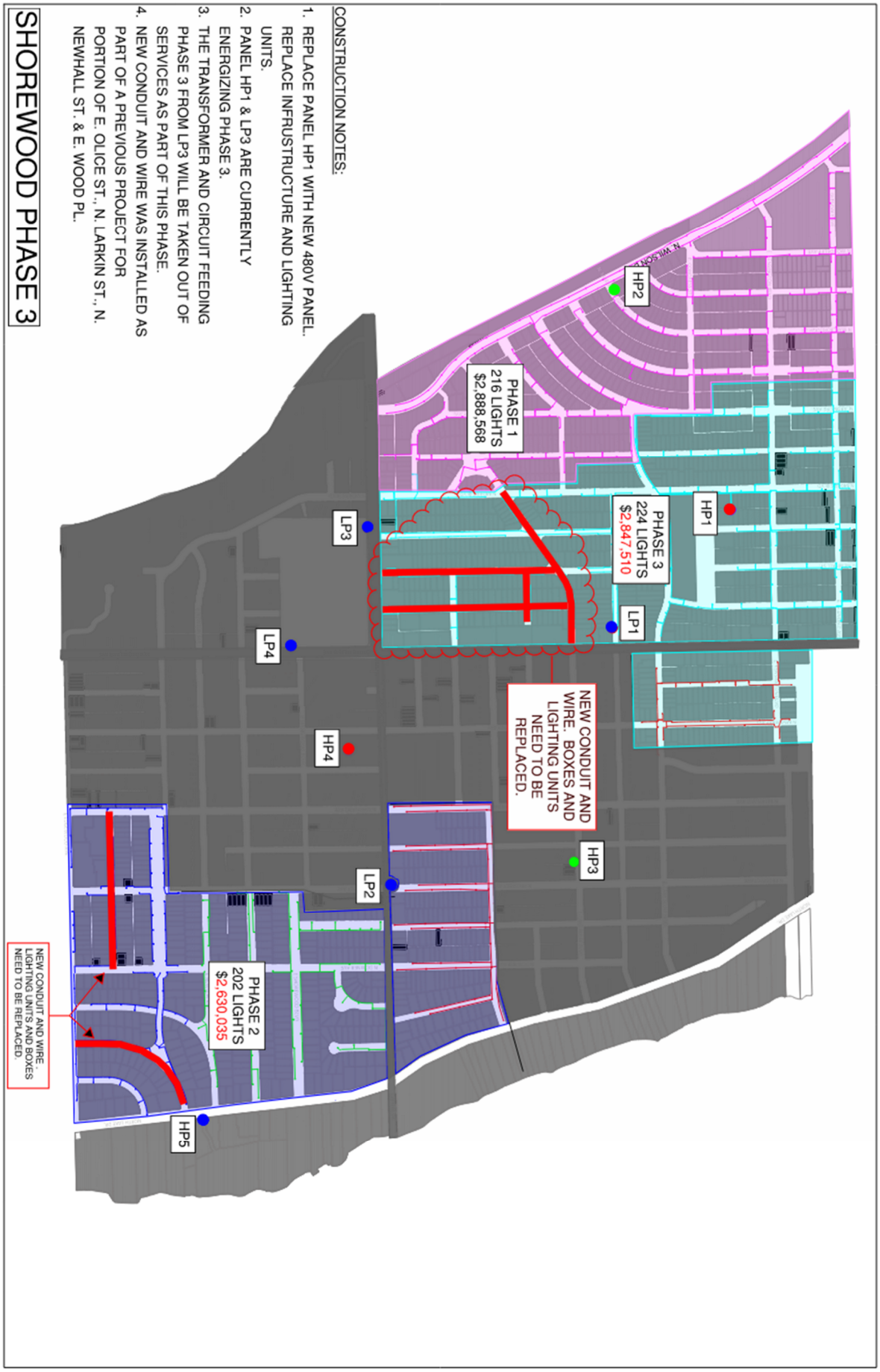
7.2.3. Phase 2 Southeast, slightly into Northeast Quadrant of Village - 2026

Phase 2 does not require any panel removals, replacements, or installations. Instead, the focus is on the removal and replacement of 202 existing fixtures, with an estimated cost of $2,630,035. The fixtures in this phase are currently being powered by a combination of existing panels HP4 and HP5 and will ultimately be served by three different panels once upgrades to the rest of the Village are complete. Panel HP3 (Installed as part of Phase 4) will power the fixtures north of Capitol Drive, while those south of Capitol Drive will receive power from both HP4 and HP5. Recent infrastructure upgrades, including new conduit and wire, were part of a previous project on N. Summit Avenue and E. Stratford Court, and these upgrades have been factored into the cost estimate of this phase. Construction for Phase 2 is scheduled for 2026.


SHOREWOOD PHASE 2
CONSTRUCTION NOTES:
1. REPLACE INFRUSTRUCTURE AND LIGHTING UNITS.
2. PHASE 2 IS CURRENTLY BEING ENERGIZED BY PANELS HP4 & HP5.
3. HP4 WILL BE REPLACED AS PART OF PHASE 5 AND WILL CONTINUE SERVING PHASE 2 UNTIL IT IS REPLACED.
4. NEW CONDUIT AND WIRE WAS INSTALLED AS PART OF A PREVIOUS PROJECT FOR E. STRATFORD CT. & N. SUMMIT AVE.
PHASE 1
216 LIGHTS
$2,888,568
PHASE 2
202 LIGHTS
$2,630,035
NEW CONDUIT AND WIRE. LIGHTING UNITS AND BOXES NEED TO BE REPLACED.
HP1
HP2
HP3
HP4
HP5
LP1
LP2
LP3
LP4

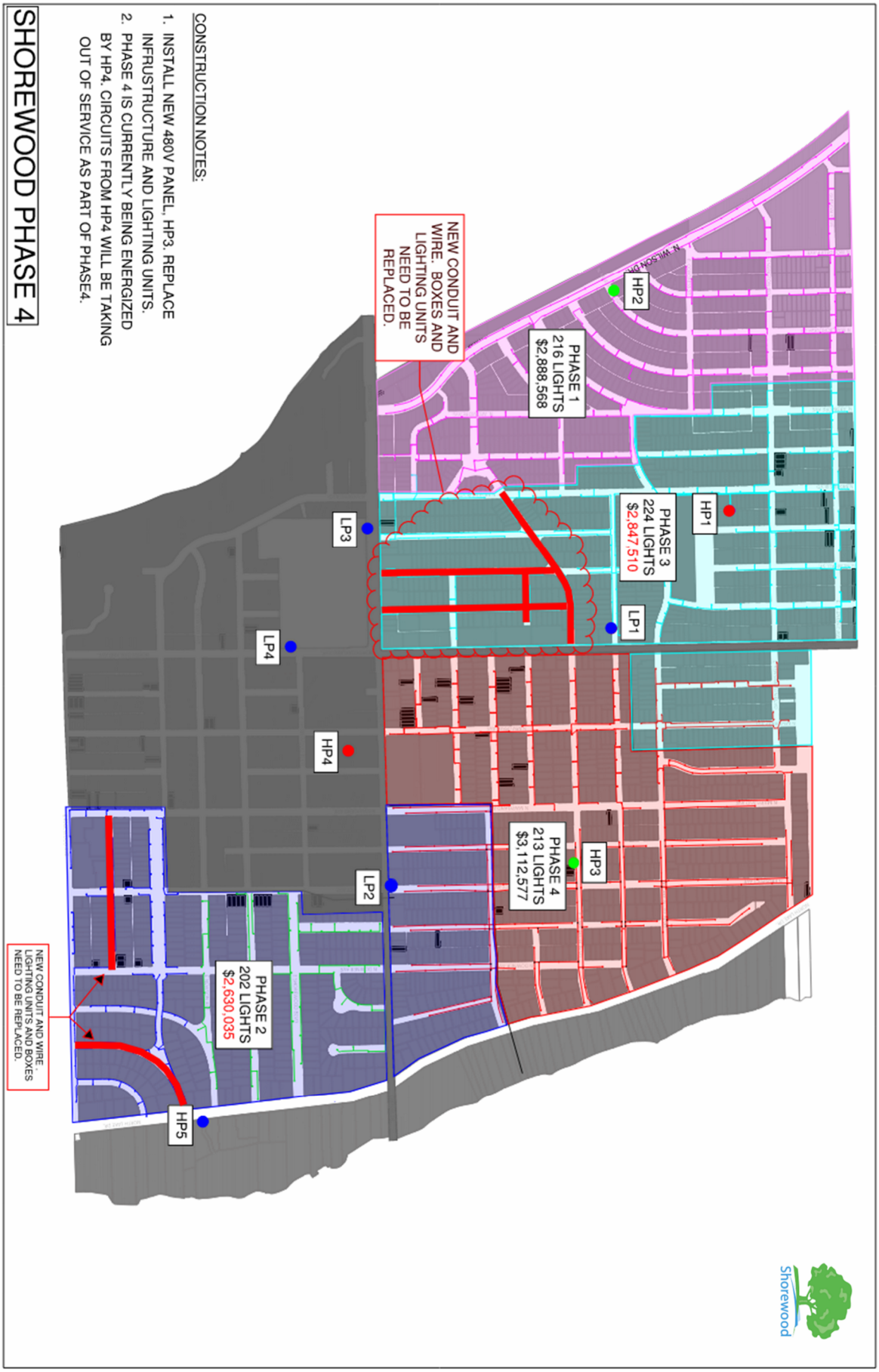
7.2.4. Phase 3 Northwest Quadrant - 2027

Phase 3, with an estimated cost of $2,847,510, marks a significant milestone in the project. Currently, Panel HP1 and LP3 supply power to the remaining lighting units in need of replacement in the Northwest Quadrant. Existing HP1 will be retired and replaced, marking the first panel replacement of the project. Following Phase 3, LP3 will cease to provide power to any residential fixtures and the transformer at this panel will be removed. Moreover, previous infrastructure upgrades, including conduit and wire installations on sections of E. Olive Street, N. Newhall Street, N. Bartlett Avenue, and E. Wood Place, have been factored into the cost estimate for this phase, ensuring comprehensive project planning and budgeting. Construction for Phase 3 would be scheduled for 2027.


SHOREWOOD PHASE 3
CONSTRUCTION NOTES:
1. REPLACE PANEL HP1 WITH NEW 480V PANEL. REPLACE INFRUSTRUCTURE AND LIGHTING UNITS.
2. PANEL HP1 & LP3 ARE CURRENTLY ENERGIZING PHASE 3.
3. THE TRANSFORMER AND CIRCUIT FEEDING PHASE 3 FROM LP3 WILL BE TAKEN OUT OF SERVICES AS PART OF THIS PHASE.
4. NEW CONDUIT AND WIRE WAS INSTALLED AS PART OF A PREVIOUS PROJECT FOR PORTION OF E. OLICE ST., N. LARKIN ST., N. NEWHALL ST. & E. WOOD PL.
PHASE 1
216 LIGHTS
$2,888,568
PHASE 3
224 LIGHTS
$2,847,510
PHASE 2
202 LIGHTS
$2,630,035
NEW CONDUIT AND WIRE. BOXES AND LIGHTING UNITS NEED TO BE REPLACED.
NEW CONDUIT AND WIRE LIGHTING UNITS AND BOXES NEED TO BE REPLACED.
HP1
HP2
HP3
HP4
HP5
LP1
LP2
LP3
LP4

7.2.5. Phase 4 Northeast Quadrant - 2028

Phase 4 entails an estimated cost of $3,112,577 and involves the replacement of 213 light units and the installation of HP3. Notably, Phase 4 includes the installation of a new electrical panel HP3, which will control some of the fixtures that were replaced during Phases 2 and 3, that overlap with the final panel extents, east of Oakland Avenue and North of Capitol Drive. The final extents for the HP3 circuiting will include the entire northeast quadrant of the Village, except for STH 32/N Lake Dr. Construction for Phase 4 is proposed for 2028.

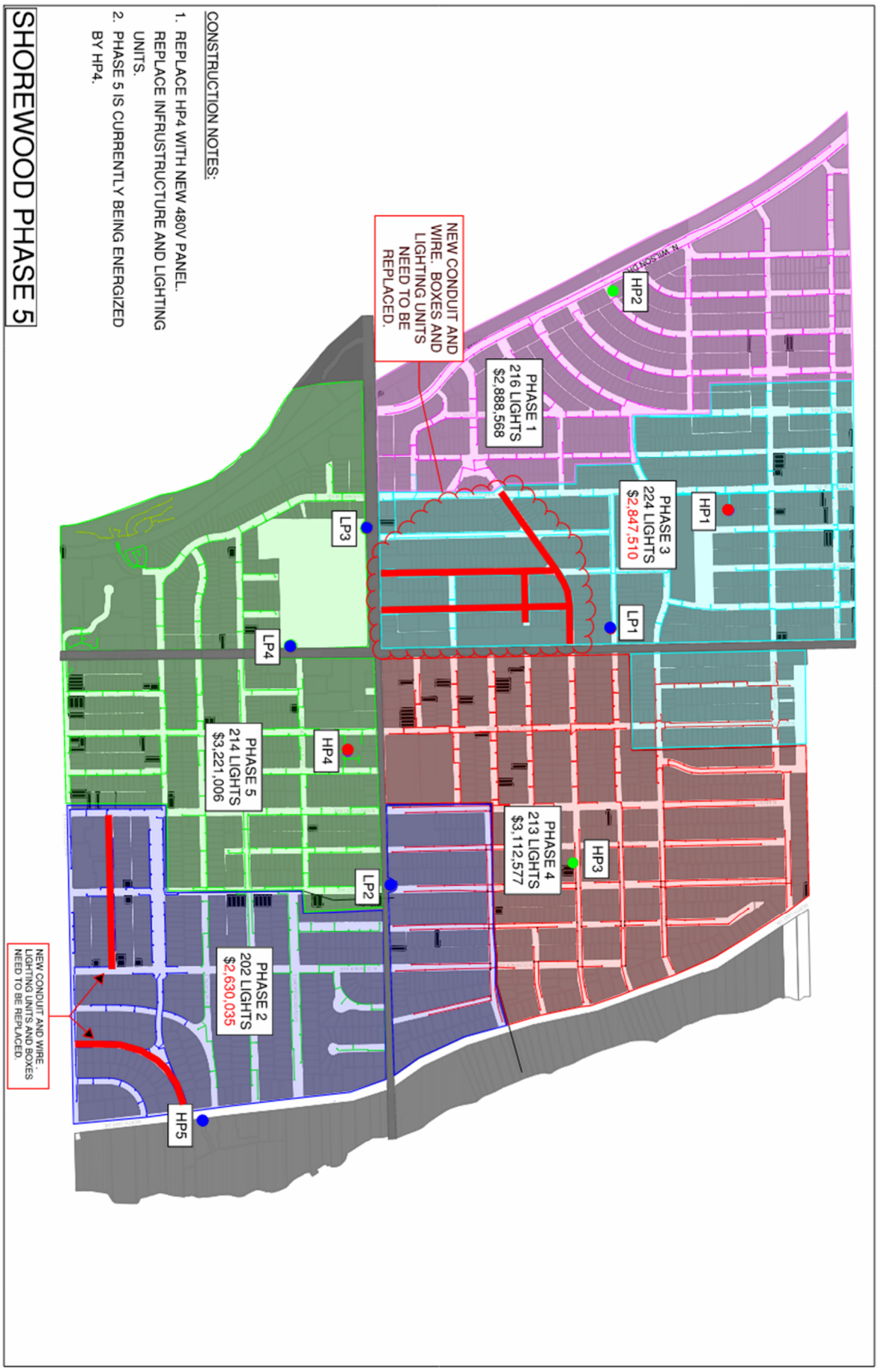

SHOREWOOD PHASE 4
CONSTRUCTION NOTES:
1. INSTALL NEW 480V PANEL, HP3. REPLACE INFRUSTRUCTURE AND LIGHTING UNITS.
2. PHASE 4 IS CURRENTLY BEING ENERGIZED BY HP4. CIRCUITS FROM HP4 WILL BE TAKING OUT OF SERVICE AS PART OF PHASE4.
NEW CONDUIT AND WIRE. BOXES AND LIGHTING UNITS NEED TO BE REPLACED.
PHASE 1
216 LIGHTS
$2,888,568
PHASE 3
224 LIGHTS
$2,847,510
PHASE 4
213 LIGHTS
$3,112,577
PHASE 2
202 LIGHTS
$2,630,035
HP1
HP2
HP3
HP4
HP5
LP1
LP2
LP3
LP4
NEW CONDUIT AND WIRE. LIGHTING UNITS AND BOXES NEED TO BE REPLACED.
Shorewood

HP3 is proposed as a new electric panel where one did not previously exist. The panel is tentatively proposed to be in the northeast quadrant of the Village, positioned between N. Farwell Avenue and N. Prospect Avenue on E. Olive Street as shown below. This centralized location enables HP3 to efficiently serve the entirety of the northeast quadrant, while maintaining acceptable proximity to the electric utility and from potential conflict areas. This location would impact a local resident who would be responsible for maintaining their lawn around the cabinet.

Proposed Location for Panel HP3

7.2.6. Phase 5 Southeast & Southwest Quadrant - 2029

As the concluding phase of the project, Phase 5 carries an estimated cost of $3,221,006 and involves the replacement of 214 lighting units. A significant aspect of this phase is the replacement of Panel HP4, representing a crucial upgrade in safety and efficiency. HP4 will assume responsibility for providing lighting circuits to most of the southeast quadrant and the entirety of the southwest quadrant. Construction for Phase 5 is scheduled for 2029.

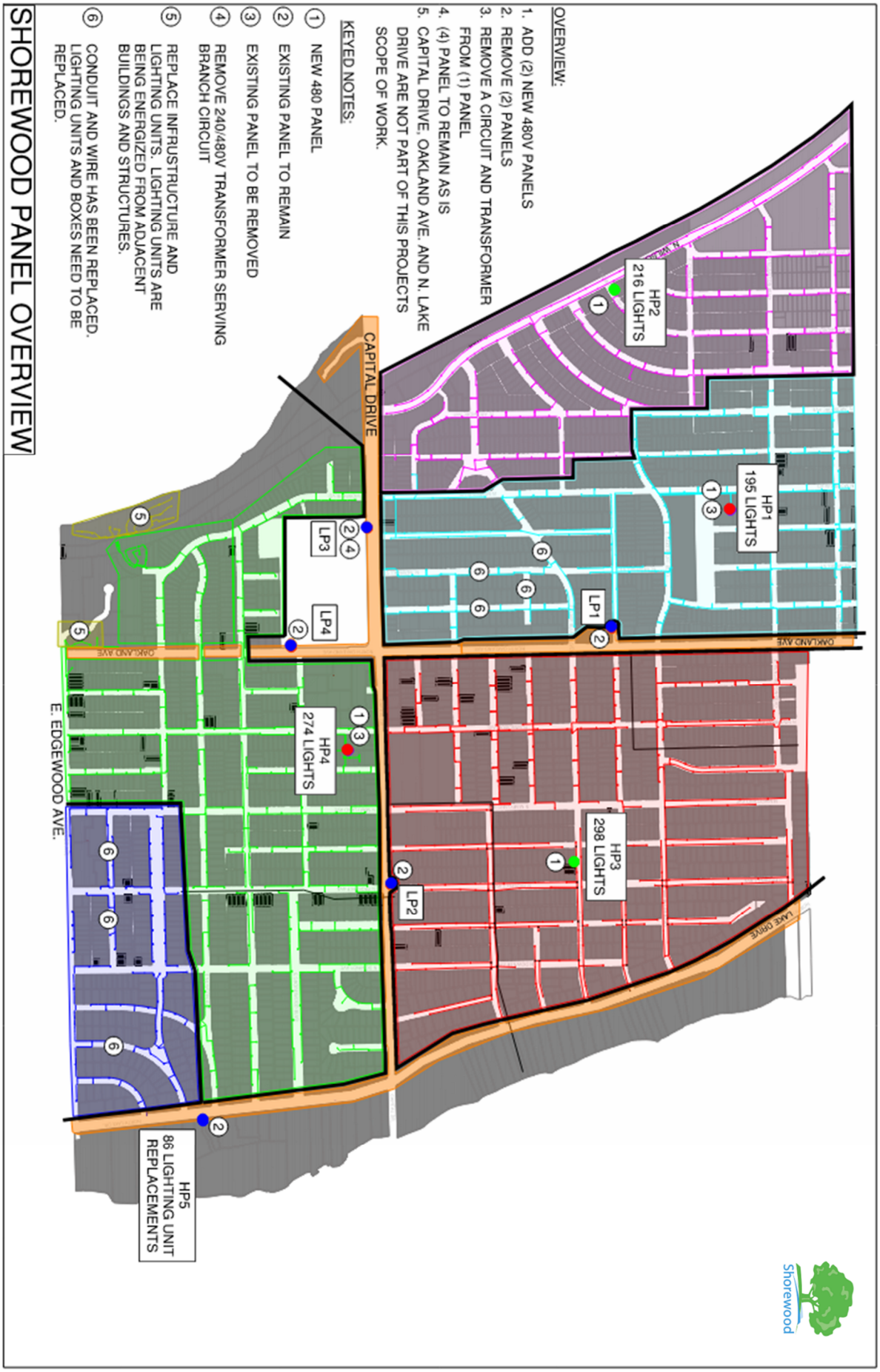

SHOREWOOD PHASE 5
CONSTRUCTION NOTES:
1. REPLACE HP4 WITH NEW 480V PANEL. REPLACE INFRUSTRUCTURE AND LIGHTING UNITS.
2. PHASE 5 IS CURRENTLY BEING ENERGIZED BY HP4.
NEW CONDUIT AND WIRE. BOXES AND LIGHTING UNITS NEED TO BE REPLACED.
PHASE 1
216 LIGHTS
$2,888,568
PHASE 3
224 LIGHTS
$2,847,510
PHASE 4
213 LIGHTS
$3,112,577
PHASE 5
214 LIGHTS
$3,221,006
PHASE 2
202 LIGHTS
$2,630,035
HP1
HP2
HP3
HP4
HP5
LP1
LP2
LP3
LP4
NEW CONDUIT AND WIRE - LIGHTING UNITS AND BOXES NEED TO BE REPLACED.

7.2.7. Project Close-Out

Total construction costs of all phases of the recommended alternative are described in the table below, with the final circuit extents of each upgraded panel depicted in the graphic below. Upon completion of Phase 5, the electrical infrastructure for all Village owned street lighting will be modernized with optimal photometric performance, and savings from energy consumption and maintenance will be realized.

Table 6.2

480v System Cost Per Phase			
Phase	Lighting Units	Lighting Unit Cost	Cost Per Phase
1	216	$ 13,373.00	$ 2,888,568.00
2	202	$ 13,019.98	$ 2,630,035.96
3	224	$ 12,712.10	$ 2,847,510.40
4	213	$ 14,613.04	$ 3,112,577.52
5	214	$ 15,051.43	$ 3,221,006.02


SHOREWOOD PANEL OVERVIEW
OVERVIEW:
1. ADD (2) NEW 480V PANELS
2. REMOVE (2) PANELS
3. REMOVE A CIRCUIT AND TRANSFORMER FROM (1) PANEL
4. (4) PANEL TO REMAIN AS IS
5. CAPITAL DRIVE, OAKLAND AVE. AND N. LAKE DRIVE ARE NOT PART OF THIS PROJECTS SCOPE OF WORK.
KEYED NOTES:
1 NEW 480 PANEL
2 EXISTING PANEL TO REMAIN
3 EXISTING PANEL TO BE REMOVED
4 REMOVE 240/480V TRANSFORMER SERVING BRANCH CIRCUIT
5 REPLACE INFRUSTRUCTURE AND LIGHTING UNITS. LIGHTING UNITS ARE BEING ENERGIZED FROM ADJACENT BUILDINGS AND STRUCTURES.
6 CONDUIT AND WIRE HAS BEEN REPLACED. LIGHTING UNITS AND BOXES NEED TO BE REPLACED.
HP1 195 LIGHTS
HP2 216 LIGHTS
HP3 298 LIGHTS
HP4 274 LIGHTS
HP5 86 LIGHTING UNIT REPLACEMENTS
LP1
LP2
LP3
LP4
CAPITAL DRIVE
OAKLAND AVE
LAKE DRIVE
E. EDGEWOOD AVE.
Shorewood

Appendix A

Cost Estimates

Appendix B

Meeting Minutes

Minutes
March 21, 2024

Village of Shorewood – Street Lighting Implementation Plan
Plan Review Meeting

Information: 10:00a – 12:00p
3801 N. Morris (DPW Office)

Attendees: KL Engineering: Jake Joyal, Chris Halverson
Shorewood: Leeann Butschlick, Dan Heyen

1. Existing Lighting Systems

a. (4) 240V panels on Capitol Dr & Oakland Ave to remain operational
   1. *Lighting @ 240V, Receptacles at 120V*
   2. *City will be performing LED retrofits – No work included with this project*
   3. *West Capitol panel has one circuit being transformed to 480V to service the neighborhood to the north – Plan is to design this out of the system*

b. (1) 480V panel in the NW quad (behind the school) to be removed and replaced

c. (3) 480V panels in the SE quad (at the fire station) to be removed and replaced

d. (1) 480V panel in the SE quad (Lake Dr.) to be remain operational

e. SW quadrant miscellaneous systems
   1. *One group served from the nearby pavilion*
   2. *One group served from nearby building*
   3. *Plan is to design these out of the system*

f. Underground infrastructure (conduit installed) has been upgraded at the following locations
   1. *SE Quad*
      a) *N Summit Ave*
      b) *E Stratford Ct*
   2. *NW Quad*
      a) *N Newhall St (Capitol – Olive)*
      b) *N Bartlett Ave (Capitol – Olive)*
      c) *E Wood Place*
      d) *E Olive St (Morris – Oakland)*

g. Notable Problem Areas
   1. *#1 problem area – SE quad neighborhood being powered from the Lake Dr cabinet*
      a) *Issues when existing lighting was tied in to the new cabinet*
   2. *#2 Problem Area – NW quadrant system from the panel behind the school*

2. Concurrent Construction

a. Lake Dr Project
   1. *WisDOT will be reconstructing all of Lake Dr – Kapur is designing the lighting*
      a) *Sept 2024 LET*
      b) *2025 construction – Try to avoid this area*
   2. *Street lighting power and controls will be derived from the Lake Dr 480 panel*
      a) *No upgrades to the panel are anticipated*

b. Oakland Ave Reconstruction
   1. *2026 construction – Try to avoid this area*
   2. *Retrofit existing street lights*

c. Water Main Replacement - SW Quadrant
   1. *Trench and Restore*
   2. *2027 Construction – Try to avoid this area*

d. Water Main Replacement – SE Quadrant
   1. *Reconstruction*
   2. *2028 Construction – Try to avoid this area*

e. Water Main Replacement – NE Quadrant
   1. *Trench and Restore*

2. *2029 Construction – Try to avoid this area*

3. Proposed Lighting

a. Alternative 1 – 480V (Recommended)

1. *Estimated Construction Cost = $15.2M*
2. *Pros*
   a) *Most cost effective*
   b) *Cover more area with smaller wire (5 panels with #6 wire)*
   c) *Materials are not unique or hard to find*
   d) *Matches current operating conditions – Including Lake Dr and subsequent STH 32 project*
3. *Cons*
   a) *Cannot install receptacles on any of the 480V lighting systems*
   b) *2 different types of systems throughout the village (240V & 480V)*
4. *Phase 1 Lighting Panel 2 (LP2)*
   a) *NW Quadrant*
   b) *Construction in 2025*
   c) *New Panel Located on Marlborough Dr. adjacent to Wilson Dr.*
      a. *Located to avoid high pressure gas on the west side of the road (park side)*
   d) *Can maintain operations from existing 240V panel with the 480V transformer for neighborhood north of Capitol*
5. *Phase 2 Lighting panel 9 (LP9)*
   a) *SE Quadrant*
   b) *Construction in (2026)*
   c) *Existing panel to remain – replace infrastructure in neighborhood*
   d) *Avoid work in 2025 & 2028*
6. *Phase 3 (2027) Lighting Panel 1 (LP1)*
   a) *NW Quadrant*
   b) *Replace the existing 480V cabinet behind the school*
   c) *Avoid construction in 2026*
7. *Phase 4 Lighting Panel 4 (LP4)*
   a) *NE Quadrant*
   b) *Construction in (2028)*
   c) *New panel centrally located on Olive – Near alley between Prospect and Farwell ave.*
   d) *Avoid construction in 2029*
8. *Phase 5 Lighting Panel 8 (LP8)*
   a) *SE Quadrant*
   b) *Construction in (2029)*
   c) *Replace the (3) existing panels at the fire station*
   d) *Work must happen in the final phase (2029)*

b. Alternative 2 – 240V

1. *Estimated Construction Cost = $16M*
2. *Pros*
   a) *Can install receptacles on any/all lighting systems*
   b) *Consistent operating voltage throughout the village*
   c) *Materials are not unique or hard to find*
3. *Cons*
   a) *Least cost effective*
   b) *Covers less area with larger wire (12 panels and #4/#6 wire)*
   c) *Does not match current operating conditions in the neighborhoods*

c. Phase 1

1. *NW Quadrant*
2. *Can maintain operations from existing 240V panel with the 480V transformer for neighborhood north of Capitol*

4. Funding

a. Carbon Reduction Program
b. Project Readiness for Federal Fiscal Year (FFY) 2024 Federal Redistribution

https://wisconsindot.gov/Pages/doing-bus/redistribution.aspx

c. Focus on Energy Rebates

5. Survey

a. Survey crew needs to get started asap before the leaves come in
   1. *Leeann to request survey datum information*
      a) *Completed*
   2. *Jake to provide language to facilitate request*
      a) *Completed*

6. Public Information Meeting #1

a. Gather input regarding optical performance preferences and concerns
   1. *Color Temperature*
   2. *Output Levels*
   3. *Dark Sky Compliance*
   4. *Lighting Priorities (security, pedestrians, etc)*
   5. *Layout preferences (single sided, staggered)*
   6. *Outages during construction*
   7. *Interest in technology applications*
   8. *Construction Impacts*

b. See if the Holophane rep can bring samples for a demonstration
   1. *Jake to call Steve Cotey – Response Pending*

c. KL can be prepared as early as mid-April
   1. *Tentatively thinking early June*

7. Board of Trustees Meeting

a. Present the Implementation to the board of Trustees for approval
   1. *Final report will need to be prepared and approved by Public Works before we take anything to the board.*

b. KL can be prepared as early as mid-May
   1. *Tentatively scheduled for May 20th*

8. Going Forward

a. Task 1
   1. *March 21, 2024: Implementation Review Meeting*
   2. *May 3rd, 2024: Implementation Report Completed*
   3. *May 20th, 2024: Board of Trustees*
   4. *June 2024: PIM #1*
   5. *Late Summer 2024: PIM #2*

b. Task 2
   1. *July 2024: Phase I Design – Preliminary Design Review Meeting*
   2. *October 2024: Phase I Design – Final Design Review Meeting*
   3. *November 2024: Phase I Design – Advertisement for Bids*
   4. *Spring 2025: Phase I Construction – Start*
   5. *July 2025: Phase II Design – Preliminary Design Review Meeting*
   6. *October 2025: Phase II Design – Final Design Review Meeting*
   7. *October 31, 2025: Phase II Construction – End*
   8. *November 2025: Phase II Design – Advertisement for Bids*

Existing 480v Panel (A)
No photo
Installed in the 1970s; replace with new panel.

Existing 240v Panel (B)
Installed in 2007

Existing 240v Panel (D)
Installed in 2010

Existing 240v Panel (F)
Installed in 2007

Panels (G)

Panels (G)

Existing 240v Panel (C)
Installed in 2010

(3) Existing 480v Panels (G)
Installed in the 1970's
Replacement and relocation(?)

Existing 480v Panel (H)
Installed 2016

ENERGIZED FROM ADJACENT BUILDINGS AND STRUCTURES

E GLENDALE AVE
N ESTABROOK PKWY
N HUMBOLDT BLVD
E CAPITOL DR
N FRATNEY ST
VIENNA AVE
E SINGER CIR
E KEEFE AVE
N CRAMER ST
N OAKLAND AVE
SHOREWOOD

<u>OVERVIEW:</u>

1. ADD (2) NEW 480V PANELS
2. REMOVE (2) PANELS
3. REMOVE A CIRCUIT AND TRANSFORMER FROM (1) PANEL
4. (4) PANEL TO REMAIN AS IS
5. CAPITAL DRIVE, OAKLAND AVE. AND N. LAKE DRIVE ARE NOT PART OF THIS PROJECTS SCOPE OF WORK.

<u>KEYED NOTES:</u>

(1) NEW 480 PANEL

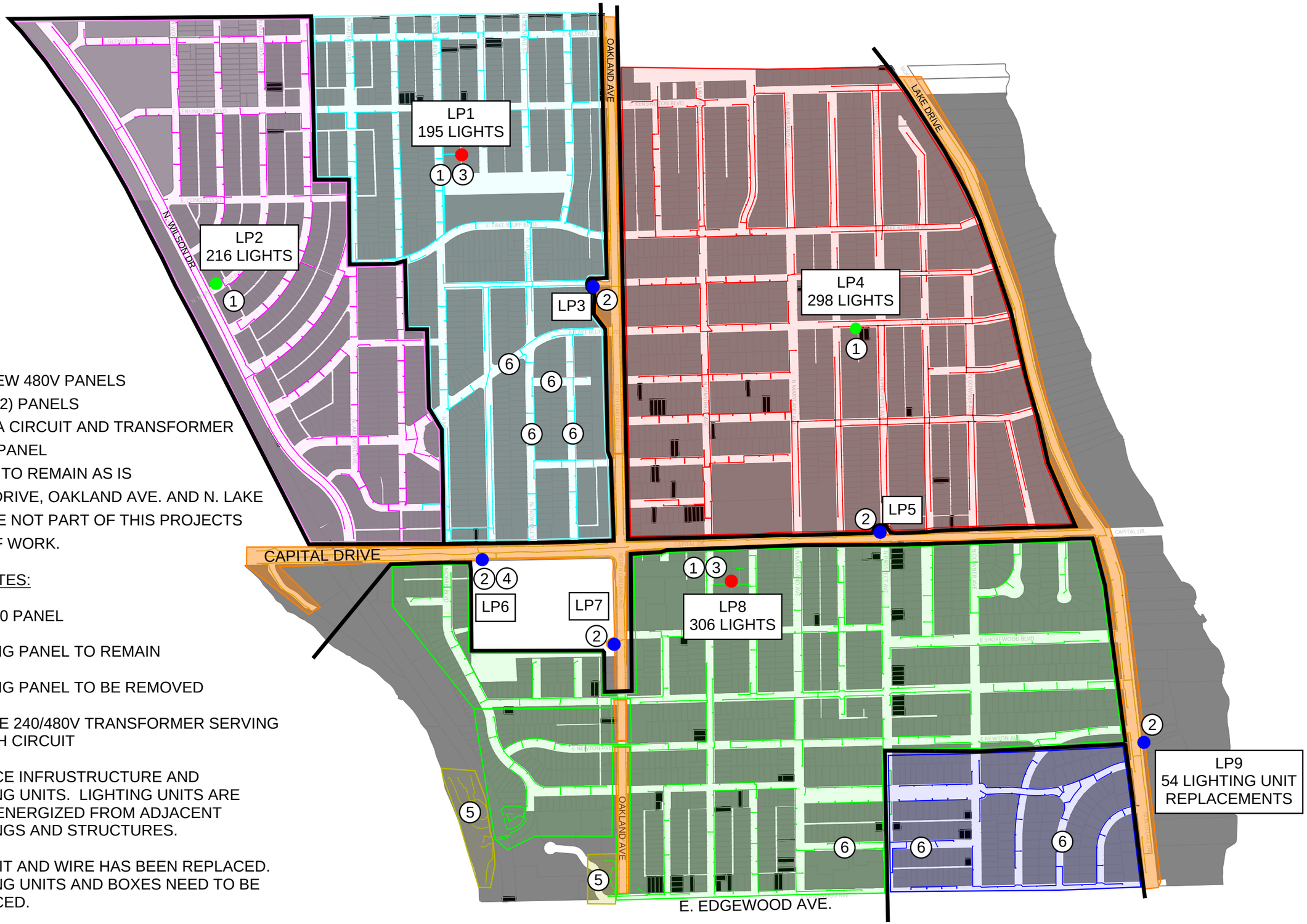
(2) EXISTING PANEL TO REMAIN

(3) EXISTING PANEL TO BE REMOVED

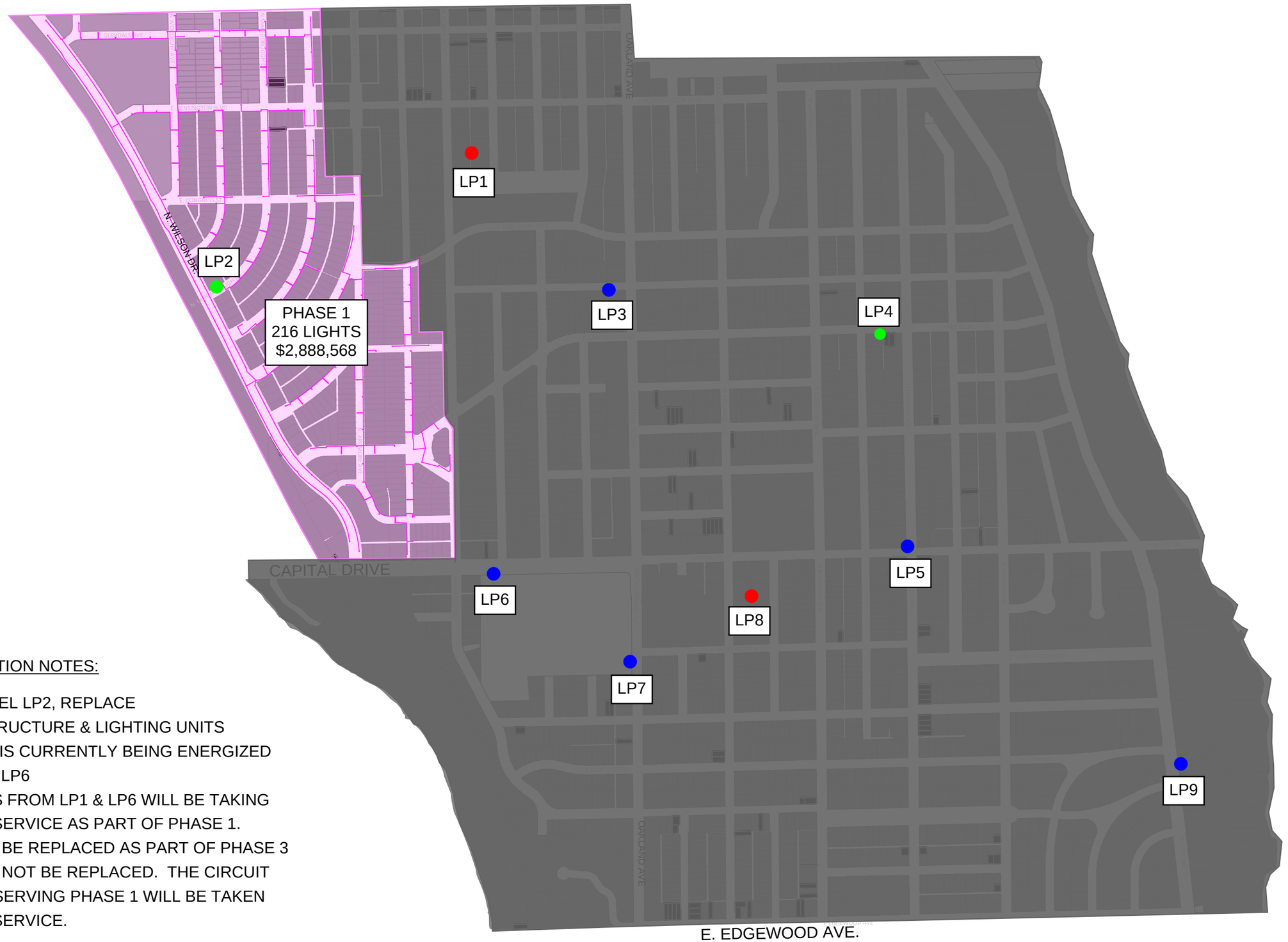
(4) REMOVE 240/480V TRANSFORMER SERVING BRANCH CIRCUIT

(5) REPLACE INFRUSTRUCTURE AND LIGHTING UNITS. LIGHTING UNITS ARE BEING ENERGIZED FROM ADJACENT BUILDINGS AND STRUCTURES.

(6) CONDUIT AND WIRE HAS BEEN REPLACED. LIGHTING UNITS AND BOXES NEED TO BE REPLACED.



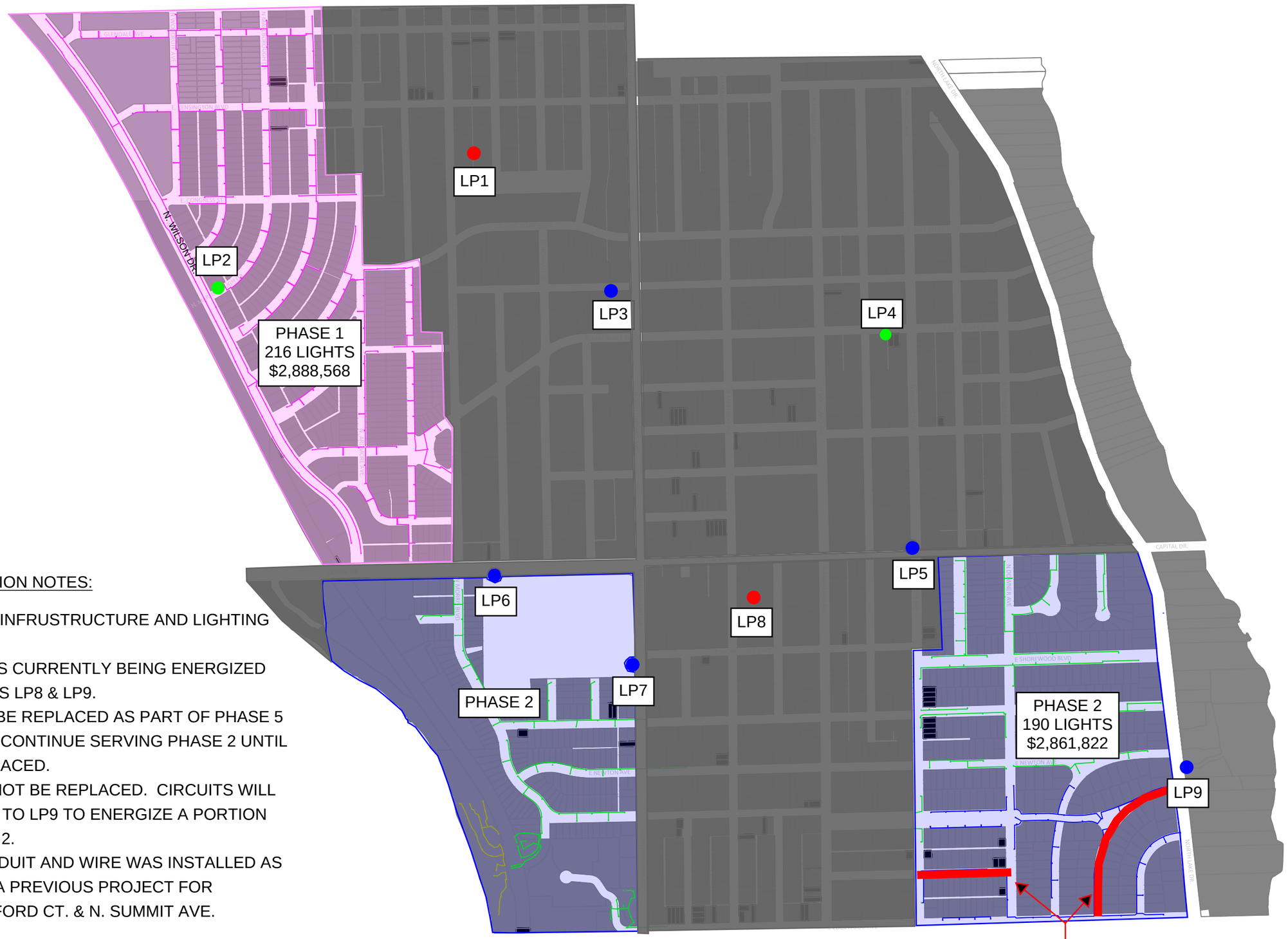
SHOREWOOD PANEL OVERVIEW



CONSTRUCTION NOTES:

1. ADD PANEL LP2, REPLACE INFRUSTRUCTURE & LIGHTING UNITS
2. PHASE 1 IS CURRENTLY BEING ENERGIZED BY LP1 & LP6
3. CIRCUITS FROM LP1 & LP6 WILL BE TAKING OUT OF SERVICE AS PART OF PHASE 1.
4. LP1 WILL BE REPLACED AS PART OF PHASE 3
5. LP6 WILL NOT BE REPLACED. THE CIRCUIT THAT IS SERVING PHASE 1 WILL BE TAKEN OUT OF SERVICE.

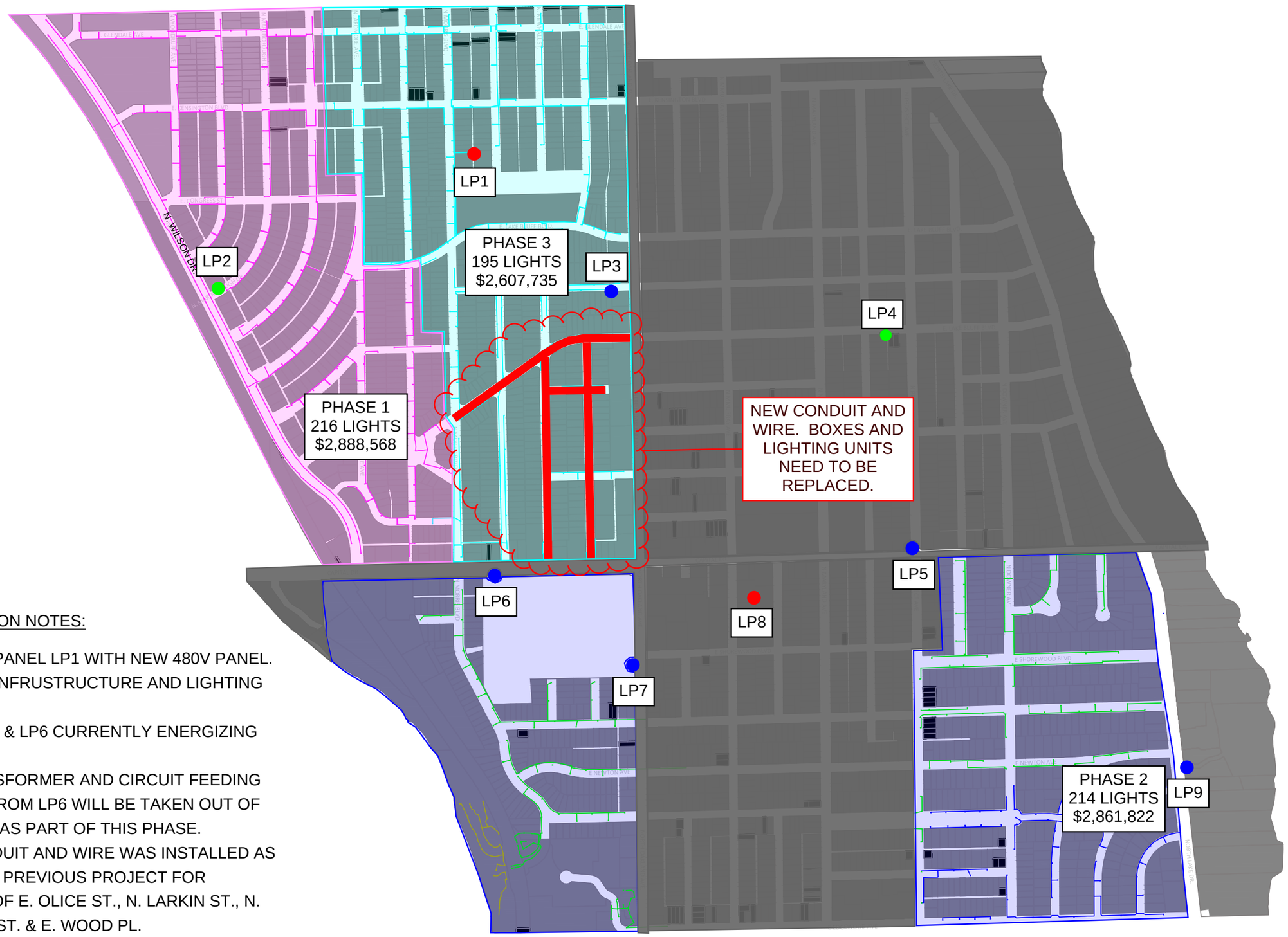
SHOREWOOD PHASE 1



CONSTRUCTION NOTES:

1. REPLACE INFRUSTRUCTURE AND LIGHTING UNITS.
2. PHASE 2 IS CURRENTLY BEING ENERGIZED BY PANELS LP8 & LP9.
3. LP8 WILL BE REPLACED AS PART OF PHASE 5 AND WILL CONTINUE SERVING PHASE 2 UNTIL IT IS REPLACED.
4. LP9 WILL NOT BE REPLACED. CIRCUITS WILL BE ADDED TO LP9 TO ENERGIZE A PORTION OF PHASE 2.
5. NEW CONDUIT AND WIRE WAS INSTALLED AS PART OF A PREVIOUS PROJECT FOR E. STRATFORD CT. & N. SUMMIT AVE.

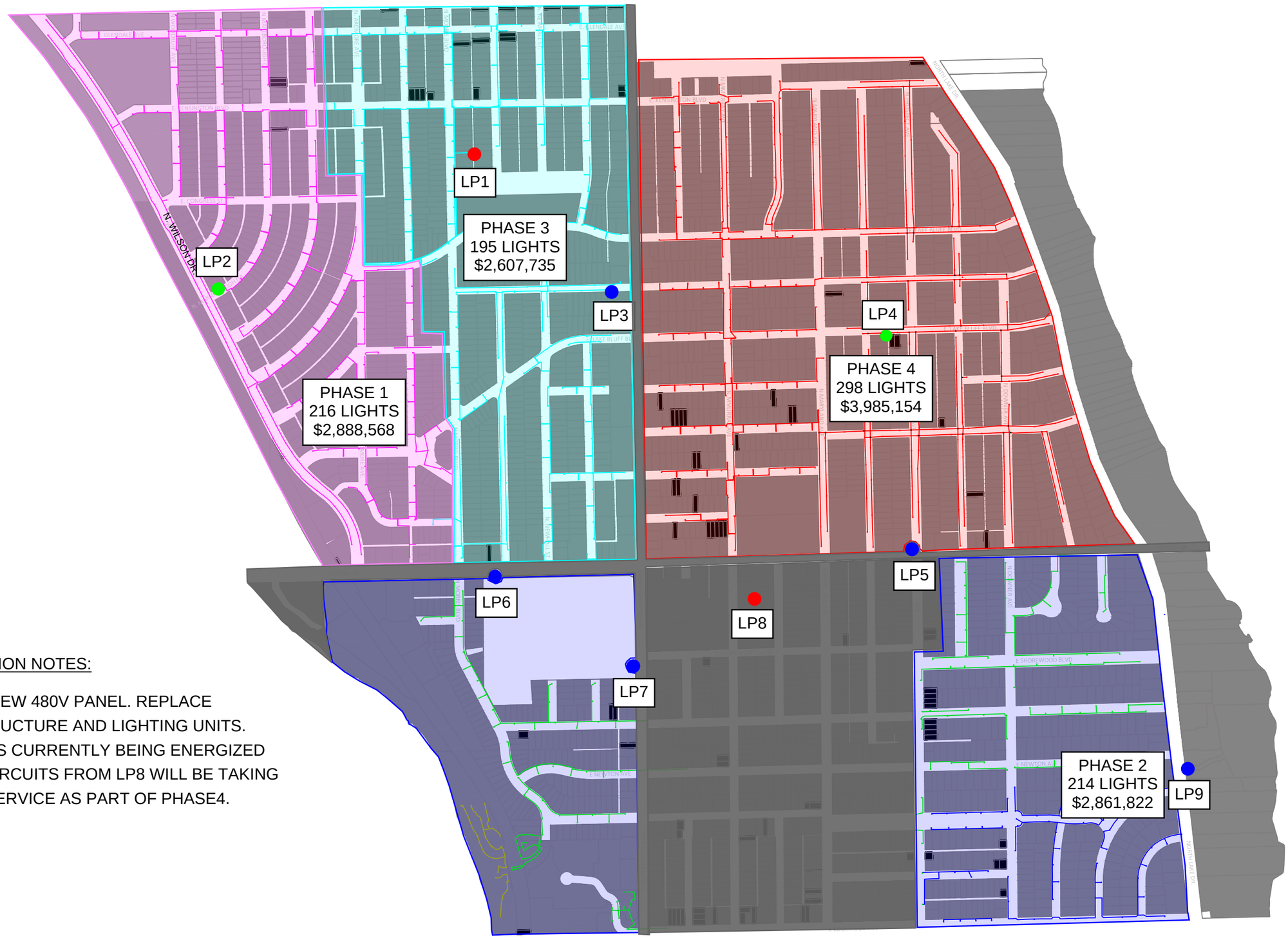
SHOREWOOD PHASE 2



CONSTRUCTION NOTES:

1. REPLACE PANEL LP1 WITH NEW 480V PANEL. REPLACE INFRUSTRUCTURE AND LIGHTING UNITS.
2. PANEL LP1 & LP6 CURRENTLY ENERGIZING PHASE 3.
3. THE TRANSFORMER AND CIRCUIT FEEDING PHASE 3 FROM LP6 WILL BE TAKEN OUT OF SERVICES AS PART OF THIS PHASE.
4. NEW CONDUIT AND WIRE WAS INSTALLED AS PART OF A PREVIOUS PROJECT FOR PORTION OF E. OLICE ST., N. LARKIN ST., N. NEWHALL ST. & E. WOOD PL.

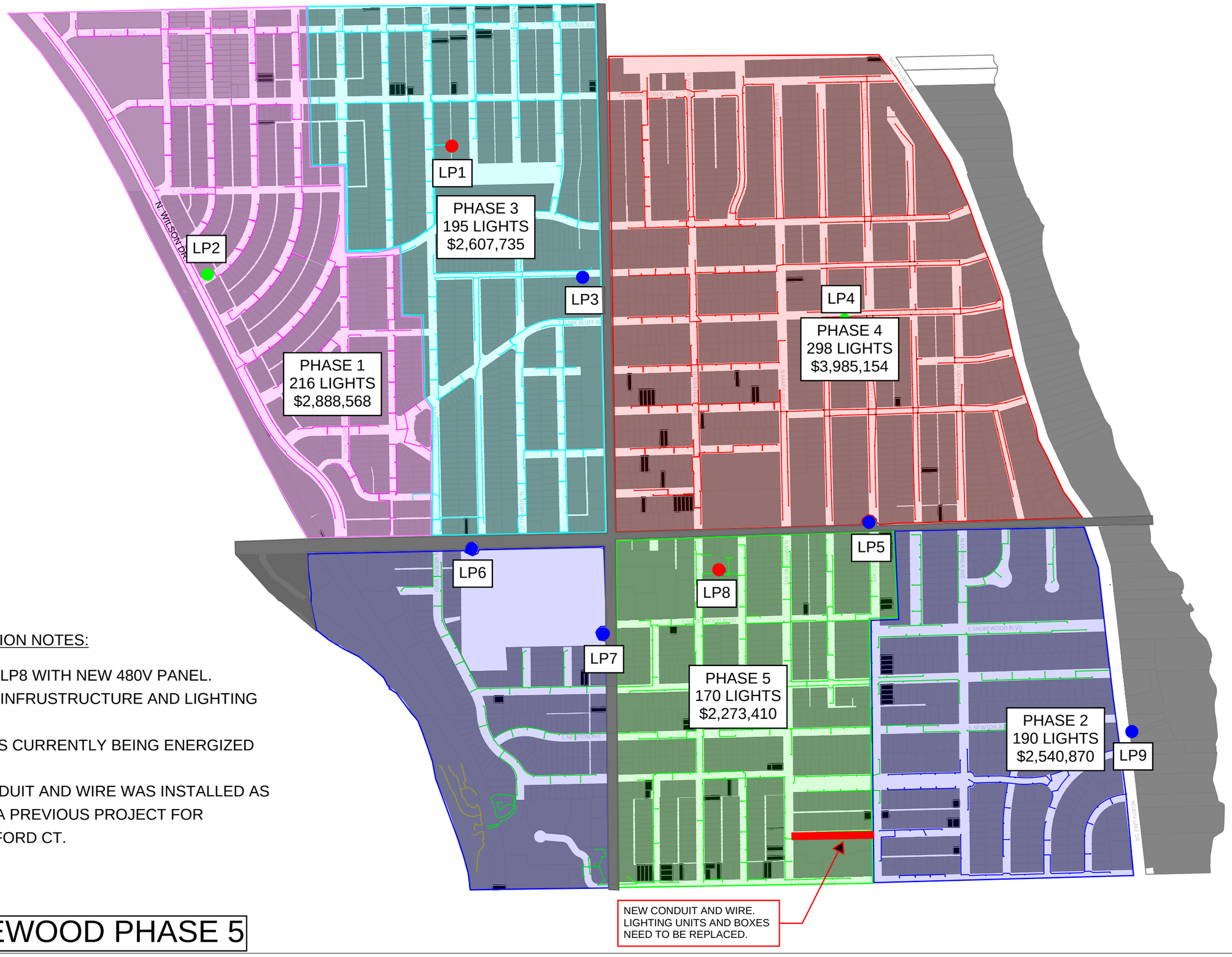
SHOREWOOD PHASE 3



CONSTRUCTION NOTES:

1. INSTALL NEW 480V PANEL. REPLACE INFRUSTRUCTURE AND LIGHTING UNITS.
2. PHASE 4 IS CURRENTLY BEING ENERGIZED BY LP8. CIRCUITS FROM LP8 WILL BE TAKING OUT OF SERVICE AS PART OF PHASE4.

SHOREWOOD PHASE 4



CONSTRUCTION NOTES:

1. REPLACE LP8 WITH NEW 480V PANEL. REPLACE INFRUSTRUCTURE AND LIGHTING UNITS.
2. PHASE 5 IS CURRENTLY BEING ENERGIZED BY LP8.
3. NEW CONDUIT AND WIRE WAS INSTALLED AS PART OF A PREVIOUS PROJECT FOR E. STRATFORD CT.

SHOREWOOD PHASE 5

Appendix C

Luminaire Cut Sheets

Valiant™ Full Cutoff LED
Series AVPCL2

PRODUCT OVERVIEW

Features:

- Colonial LED lantern, replaces up to 250W HID models for street and area lighting applications
- Sixteen (16) LED performance packages deliver just the right amount of light for any given application up to 13,000 lumens
- Available in color temperature choices of 2700K, 3000K and 4000K
- Designed for up-light restrictive applications, AVPCL2 has zero up-light
- Four (4) distinct light distribution options provide design flexibility, available in Type II, Type III, Type IV, and Type V
- Die-cast aluminum housing, engineered for sturdy life-long performance
- Die-cast aluminum hood features a trigger latch (TL) option and captive thumb screws for fast, easy electrical and optical chamber access
- Standard black finish is matte texture. All other finishes are smooth gloss.
- Housing is tenon pole-mounted and designed for use with a 3" tall by 2-3/8" to 3" diameter tenon, and secured by three set screws.
- Rated LED and driver life greater than 100,000 hours at 25°C
- Surge protection device (standard) exceeds ANSI/IEEE C62.41-2002 Category C High (10kV/10kA) and ANSI C136.2-2015 Enhanced (10kV/5kA). 20KV Option exceeds ANSI/IEEE C62.41-2002 Category C High (10kV/10kA) and ANSI C136.2-2015 Extreme (20kV/10kA)
- Equipped with LED electronic 0-10V dimmable driver

Applications:

Streetscapes
Walkways
Pathways
Parks

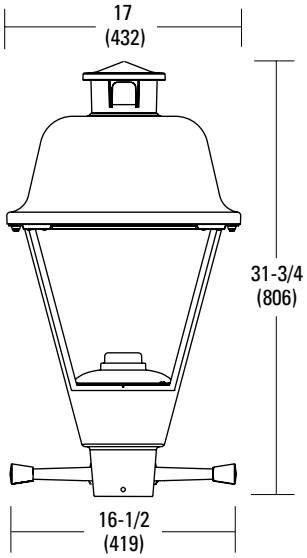
IP66 Optics

Standards:

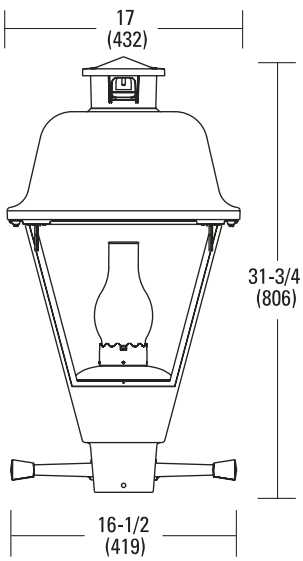
- Complies with ANSI: C136.2, C136.10, C136.15
- CSA listed and suitable for up to 40°C ambient
- DesignLights Consortium® (DLC) qualified product. Not all versions of this product may be DLC qualified. Please check the DLC Qualified Products List at www.designlights.org/QPL to confirm which versions are qualified.

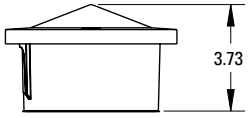
DIMENSIONS

Full Cutoff

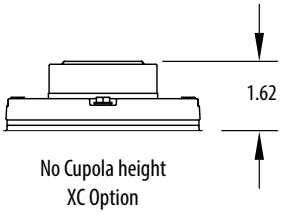


Vieux Option

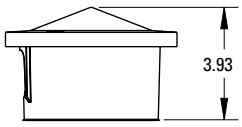




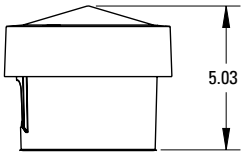
Cupola height
PR3 with SCC option
Shown in line diagram



No Cupola height
XC Option



Cupola height
PR7 with SCC option



Cupola height
PR7 with SNC option

**See Cupola Control Node Compatibility chart to ensure compatibility with smart controls*

Effective Projected Area (EPA)
The EPA for the AVPCL2 is 1.4 sq. ft.
The EPA for the AVPCL2 Vieux is 2.4 sq. ft.
Fixture weight = 38 lbs.

All dimensions are inches (millimeters) unless otherwise noted.

Valiant™ Full Cutoff LED
Series AVPCL2

ORDERING INFORMATION

Example: AVPCL2 P301 MVOLT 30K R3 BK SCC PR7

Series

AVPCL2	Valiant Full Cutoff LED

Performance Package

Package	Input Watts	Lumens (nominal)
P101	30	3,200
P102	40	4,100
P103	50	4,900
P151	50	5,300
P152	60	6,300
P153	70	7,100
P201	70	7,400
P202	80	8,200
P203	90	8,900
P300	61	7,100
P301	70	7,900
P302	80	8,900
P303	90	9,800
P304	100	10,600
P451	100	11,600
P452	110	12,600

Voltage

MVOLT	120-277V
HVOLT	347-480V
XVOLT	277-480V with enhanced power quality protection

Color Temperature (CCT)

27K	2700K
30K	3000K
40K	4000K

Distribution

R2	Type II
R3	Type III
R4	Type IV
R5	Type V

Finish

BK	Black matte texture
GY	Gray, smooth gloss
DDB	Dark Bronze, smooth gloss
WH	White, smooth gloss
BZ	Bronze, smooth gloss

Cupola

SCC	Standard cupola
SNC	Smart node cupola
XC	No cupola

Photocontrol Receptacle

NR	No photocontrol receptacle
PR3	3 pin NEMA photocontrol
PR7	7 pin NEMA photocontrol

Options

Controls

PCLL	Solid state long life photocontrol 120-277V (fail off)
P34	Solid state long life photocontrol, 347 Volt only (fail off)
P48	Solid state long life photocontrol, 480 Volt only (fail off)
PCSS	Solid state photocontrol, 120-277V (not CSA Listed) (fail on)
SH	Shorting cap
AO	Field adjustable output module
DALI	DALI driver (RFD required)

Miscellaneous

SS	Stainless steel hardware
TL	Tool-less trigger latch entry
NL1X1	1″ x 1″ NEMA label
NL2X2	2″ x 2″ NEMA label
XL	Not CSA Listed
LDR	Ladder Rest
CR	Epoxy Pre-Coat Finish
20kV	20kV/10kA surge protection device
VX	Vieux Option
VXCA	VX option with Clear Acrylic lens

House-Side Shields

HSS	House Side Shield

Prewired leads

L1H	1.5 ft. prewired leads
L03	3 ft. prewired leads
L10	10 ft. prewired leads
L20	20 ft. prewired leads
L25	25 ft. prewired leads
L30	30 ft. prewired leads

Accessory

House Side Shield shipped separately and installed in the field

FHSSLEM10-15R2/R5	P10x or P15x package, R2 or R5 optic
FHSSLEM10-15R3	P10x or P15x package, R3 optic
FHSSLEM20-30R2/R5	P20x or P30x package, R2 or R5 optic
FHSSLEM20-30R3	P20x or P30x package, R3 optic
FHSSLEM45R2/R5	P45x package, R2 or R5 optic
FHSSLEM45R3	P45x package, R3 optic

Note: Check the OPTIONS MATRIX on Page 3 for compatibility & restrictions

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Valiant™ Full Cutoff LED
Series AVPCL2

OPTIONS MATRIX

		Voltage			Distribution				Cupola			Receptacle			Photocontrol					Other		
		MVOLT	HVOLT	XVOLT	R2	R3	R4	R5	SCC	SNC	XC	PR3	PR7	NR	PCLL	PCSS	P34	P48	SH	AO	DALI	20KV
Lumen Package	P101	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	RFD	Y
	P102	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	RFD	Y
	P103	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	RFD	Y
	P151	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	RFD	Y
	P152	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	RFD	Y
	P153	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	RFD	Y
	P201	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	RFD	Y
	P202	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	RFD	Y
	P203	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	RFD	Y
	P300	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	RFD	Y
	P301	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	RFD	Y
	P302	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	RFD	Y
	P303	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	RFD	Y
	P304	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	RFD	Y
	P451	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	RFD	Y
	P452	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	RFD	Y
Voltage	MVOLT				Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	Y	RFD	Y
	HVOLT				Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	N	Y
	XVOLT				Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
Cupola	SCC	Y	Y	Y	Y	Y	Y	Y				Y	Y	Y	Y	Y	Y	Y	Y	Y	RFD	Y
	SNC	Y	Y	Y	Y	Y	Y	Y				N	Y	N	Y	Y	Y	Y	Y	Y	RFD	Y
	XC	Y	Y	Y	Y	Y	Y	Y				Y	Y	N	Y	Y	Y	Y	Y	Y	RFD	Y
Receptacle	PR3	Y	Y	Y	Y	Y	Y	Y	Y	N	Y				Y	Y	Y	Y	Y	Y	RFD	Y
	PR7	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y				Y	Y	Y	Y	Y	Y	RFD	Y
	NR	Y	Y	Y	Y	Y	Y	Y	Y	N	N				N	N	N	N	N	Y	RFD	Y
Photocontrol	PCLL	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N						Y	RFD	Y
	PCSS	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N						Y	RFD	Y
	P34	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N						Y	RFD	Y
	P48	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N						Y	RFD	Y
	SH	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N						Y	RFD	Y
Other	AO	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		N	Y
	DALI	RFD	N	N	RFD	RFD	RFD	RFD	RFD	RFD	RFD	RFD	RFD	RFD	RFD	RFD	RFD	RFD	RFD	N		RFD
	20KV	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	RFD	

MATRIX KEY

Y = Option combination is available

N = Option combination is not available

RFD = Option combination is available but additional information required. Consult factory.

Cupola Control Node Compatibility		
Cupola Option	Acuity Brands Control	
	nLight rTLN	DTL DIN
XC	Yes	Yes
SCC	No	No
SNC	No	Yes

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 AVPCL2 Rev. 07/19/23

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OPERATING CHARACTERISTICS

			AVPCL2							
			R2		R3		R4		R5	
Performance Package	Wattage	CCT	Lumens	LPW	Lumens	LPW	Lumens	LPW	Lumens	LPW
P101	30	2700K	3,118	104	3,094	103	3,241	108	3,221	107
		3000K	3,254	108	3,229	108	3,383	113	3,362	112
		4000K	3,396	113	3,370	112	3,530	118	3,508	117
P102	40	2700K	3,939	98	3,909	98	4,095	102	4,069	102
		3000K	4,111	103	4,080	102	4,274	107	4,247	106
		4000K	4,290	107	4,257	106	4,460	111	4,432	111
P103	50	2700K	4,770	95	4,734	95	4,959	99	4,928	99
		3000K	4,979	100	4,941	99	5,177	103	5,144	103
		4000K	5,196	104	5,156	103	5,402	108	5,367	107
P151	50	2700K	5,098	102	5,059	101	--	--	5,266	105
		3000K	5,321	106	5,280	106	--	--	5,497	110
		4000K	5,552	111	5,510	110	--	--	5,735	115
P152	60	2700K	6,101	102	6,054	101	--	--	6,302	105
		3000K	6,368	106	6,319	105	--	--	6,578	110
		4000K	6,645	111	6,594	110	--	--	6,864	114
P153	70	2700K	6,837	98	6,785	97	--	--	7,062	101
		3000K	7,136	102	7,081	101	--	--	7,372	105
		4000K	7,446	106	7,389	106	--	--	7,692	110
P201	70	2700K	7,180	103	7,125	102	7,464	107	7,417	106
		3000K	7,494	107	7,437	106	7,791	111	7,741	111
		4000K	7,820	112	7,760	111	8,129	116	8,078	115
P202	80	2700K	7,925	99	7,864	98	8,239	103	8,186	102
		3000K	8,271	103	8,209	103	8,599	107	8,545	107
		4000K	8,631	108	8,565	107	8,973	112	8,916	111
P203	90	2700K	8,619	96	8,554	95	8,961	100	8,904	99
		3000K	8,997	100	8,928	99	9,353	104	9,294	103
		4000K	9,388	104	9,317	103	9,760	108	9,698	108
P300	61	2700K	6,826	112	6,774	111	7,096	116	7,051	116
		3000K	7,124	117	7,070	116	7,407	121	7,360	121
		4000K	7,434	122	7,378	121	7,729	127	7,680	126
P301	70	2700K	7,657	109	7,599	109	7,960	114	7,910	113
		3000K	7,992	114	7,931	113	8,309	119	8,256	118
		4000K	8,339	119	8,276	118	8,670	124	8,615	123
P302	80	2700K	8,631	108	8,566	107	8,973	112	8,917	111
		3000K	9,009	113	8,941	112	9,366	117	9,307	116
		4000K	9,401	118	9,329	117	9,773	122	9,711	121
P303	90	2700K	9,468	105	9,396	104	9,843	109	9,781	109
		3000K	9,882	110	9,807	109	10,274	114	10,209	113
		4000K	10,312	115	10,234	114	10,721	119	10,653	118
P304	100	2700K	10,207	102	10,129	101	10,611	106	10,544	105
		3000K	10,653	107	10,572	106	11,076	111	11,005	110
		4000K	11,116	111	11,032	110	11,557	116	11,484	115
P451	100	2700K	11,216	112	11,131	111	--	--	11,587	116
		3000K	11,707	117	11,618	116	--	--	12,094	121
		4000K	12,216	122	12,123	121	--	--	12,620	126
P452	110	2700K	12,182	111	12,090	110	--	--	12,585	114
		3000K	12,715	116	12,619	115	--	--	13,135	119
		4000K	13,268	121	13,167	120	--	--	13,706	125

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PROJECTED LED LUMEN MAINTENANCE

Data references the extrapolated performance projections for the platforms noted in a 25°C ambient, based on 6,000 hours of LED testing (tested per IESNA LM-80-08 and projected per IESNA TM-21-11). To calculate LLF, use the lumen maintenance factor that corresponds to the desired number of operating hours below. For other lumen maintenance values, contact factory.

Lumen Maintenance (LLD)							
Performance Package	**Initial**	**25k hours**	**36k hours**	**50k hours**	**60k hours**	**75k hours**	**100k hours**
P101	1.00	0.96	0.94	0.92	0.90	0.88	0.85
P102, P300	1.00	0.95	0.93	0.91	0.90	0.87	0.84
P151, P201, P301	1.00	0.95	0.93	0.91	0.89	0.87	0.83
P103, P152, P202, P302, P303, P451	1.00	0.95	0.93	0.90	0.89	0.86	0.82
P304, P452	1.00	0.94	0.92	0.90	0.88	0.85	0.81
P155, P202	1.00	0.94	0.92	0.89	0.88	0.85	0.80

LUMEN AMBIENT TEMPERATURE (LAT) MULTIPLIERS

Use these factors to determine relative lumen output for average ambient temperatures from 0-40°C (32-104°F).

Ambient Temperature Lumen Multipliers								
0°C	**5°C**	**10°C**	**15°C**	**20°C**	**25°C**	**30°C**	**35°C**	**40°C**
1.04	1.03	1.02	1.02	1.01	1.00	0.99	0.98	0.97

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Appendix D

Street Lighting Replacement Planning Study

STRAND ASSOCIATES®
Excellence in Engineering
Since 1946

Strand Associates, Inc.®
126 North Jefferson Street, Suite 350
Milwaukee, WI 53202
(P) 414.271.0771
www.strand.com

Task Order No. 22-05
Village of Shorewood, Wisconsin (OWNER)
and Strand Associates, Inc.® (ENGINEER)
Pursuant to Agreement for Technical Services dated March 11, 2019

Project Information

Service Name: Street Lighting System Replacement Plan

Services Description: Develop a street lighting replacement plan that includes phased annual costs for systematic replacement of the street lighting control panels east of the fire station, replacement of all direct buried street lighting wiring with a three-wire grounded system, and replacement of existing lighting fixtures with light-emitting diode (LED) lighting fixtures.

Scope of Services

ENGINEER will provide the following services to OWNER.

Project Administration

Provide project management and participate in up to two meetings with OWNER.

System Infrastructure Review

1. Generate existing light circuit cable lengths and light fixture quantities based on street lighting system record information and geographic information system mapping information provided by OWNER.

2. Review whether existing pole layout/configuration is compatible with LED conversion. Provide up to four photometric comparisons between existing light fixture types and new OWNER-selected light fixture types showing light levels for each along a typical roadway segment spanning three light poles.

Estimation of Costs

1. Develop opinion of probable construction costs (OPCC) to replace existing street lighting control panels and street lighting wiring.

2. Develop annual energy usage cost comparison of the existing lighting system versus the OWNER-selected LED replacement alternative using OWNER's current electrical rates.

3. Develop an LED replacement OPCC comparison between the following alternatives for LED lighting throughout the village.
   a. Replacement of all street light fixtures in-kind with OWNER-specified fixtures.
   b. Replacement of bulbs only within existing fixtures.

Third-Party Lease Evaluation

1. Provide up to 12 hours to assist with evaluation of a proposal prepared and obtained by OWNER from a third-party company to replace all street light fixture bulbs within the village with LED light bulbs as part of a lease program.

2. Compare the costs obtained in "Estimation of Costs" Tasks 2 and 3b to the third-party company lease program costs.

3. Evaluate partial replacement of the street light fixture bulbs within the village with LED bulbs as part of a lease program for areas of the village where fixture replacement is not planned for at least five years.

Development of Implementation Plan

1. Develop an annual lighting system replacement phasing plan based on the OWNER-selected LED replacement alternative, a map showing the annual lighting system replacement phasing plan, and an OPCC for each phase. Submit a draft report to OWNER for review and incorporate OWNER's comments, as appropriate. Submit the final report to OWNER.

2. Provide a timeline comparison reviewing when light fixtures are anticipated to be replaced as a part of the annual lighting system replacement phasing plan versus the third-party company lease program period.

Compensation

OWNER shall compensate ENGINEER for Services under this Task Order on an hourly rate basis plus expenses an estimated fee of $29,850.

Schedule

Services will begin upon execution of this Task Order, which is anticipated the week of December 12, 2022. Services are scheduled for completion on April 28, 2023.

TASK ORDER AUTHORIZATION AND ACCEPTANCE:

ENGINEER:	OWNER:
STRAND ASSOCIATES, INC.®	VILLAGE OF SHOREWOOD
DocuSigned by: Joe Bunker 80EAD785BE9D427... 12/13/2022	DocuSigned by: Leeann Butschlick B68DEF5245AE49A... 12/12/2022
Joseph M. Bunker, Corporate Secretary — Date	Leeann Butschlick, Director of Public Works — Date

Village of Shorewood
Street Lighting Replacement Plan Update

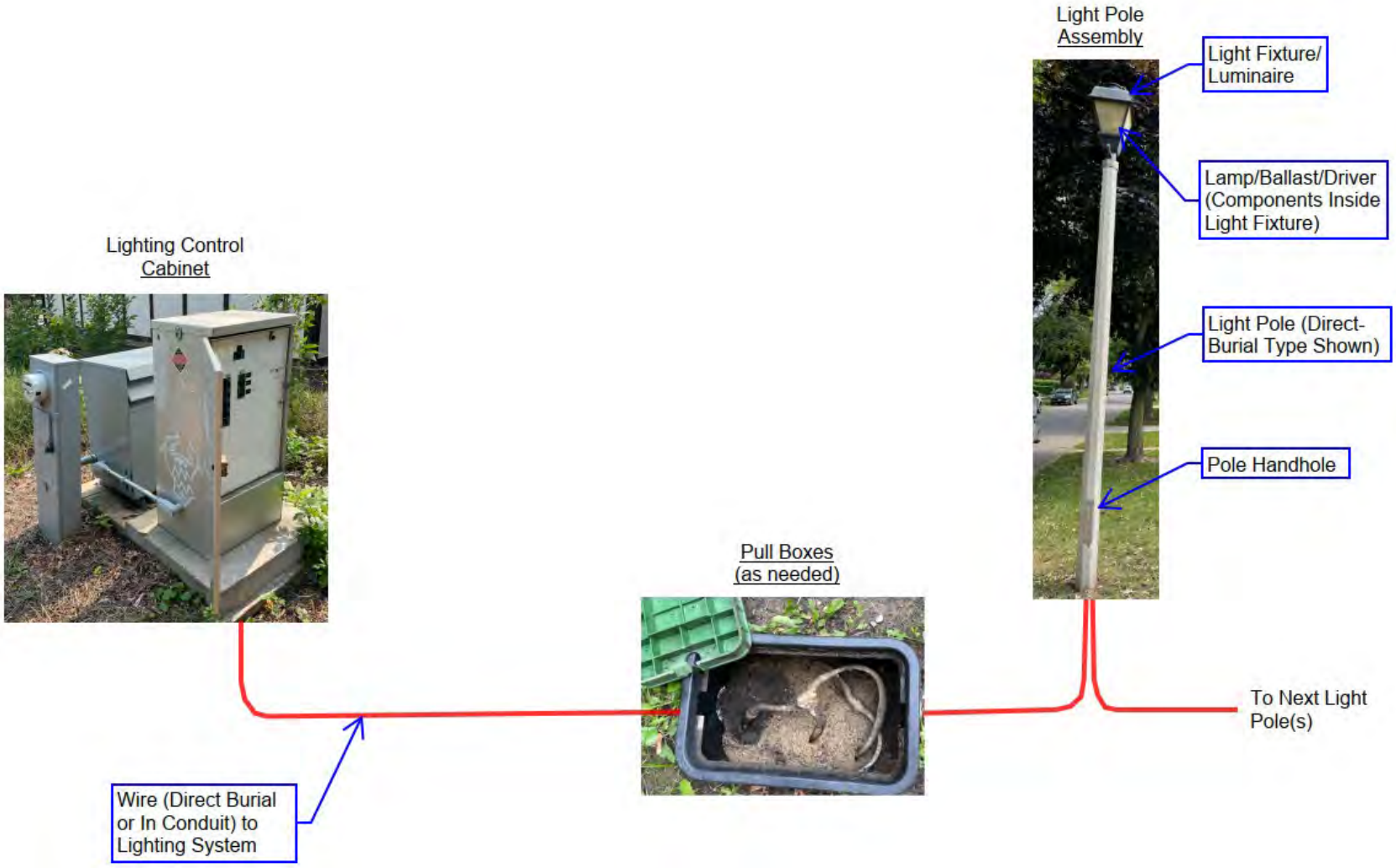
Village Board Meeting

March 6, 2023

Presentation Outline

- Lighting Infrastructure Overview
- Project Background/Drivers
- Existing System
- Expected Improvements
- Project Scope
- Next Steps

Lighting Infrastructure Overview



Project Background/Drivers

- 2015 – Lake Drive Lighting Controller Replaced; Led to Significant Cable Failures
- 2019/2020 Lighting System Analysis Report and Subsequent Infrastructure Review Identified Systemwide Issues
- Project Drivers - Replace Aging Infrastructure
  - Existing System Approximately 50-years Old in Most Areas
  - More Recent Installations on Capital, Oakland, and Wilson Drive; Lake Drive Expected 2024/2025.
  - Typical Life Expectancy: 30-40 years
  - Convert Outdated System Voltage to Current Standard Configuration
  - System Routinely Has Faults Causing Outages/Poor Reliability/Significant Maintenance

Project Background/Drivers

- Project Drivers - Correct Existing Infrastructure Code-Related Issues
  - System is ungrounded with outdated voltage configuration
    - Can lead to undetected cable faults.
  - Insufficient working space around fire station lighting controllers
  - Existing pull boxes in some areas can be opened without tools
  - Many light poles not 22 feet minimum required for existing voltage
- Project Drivers - Convert to LED for Energy Savings

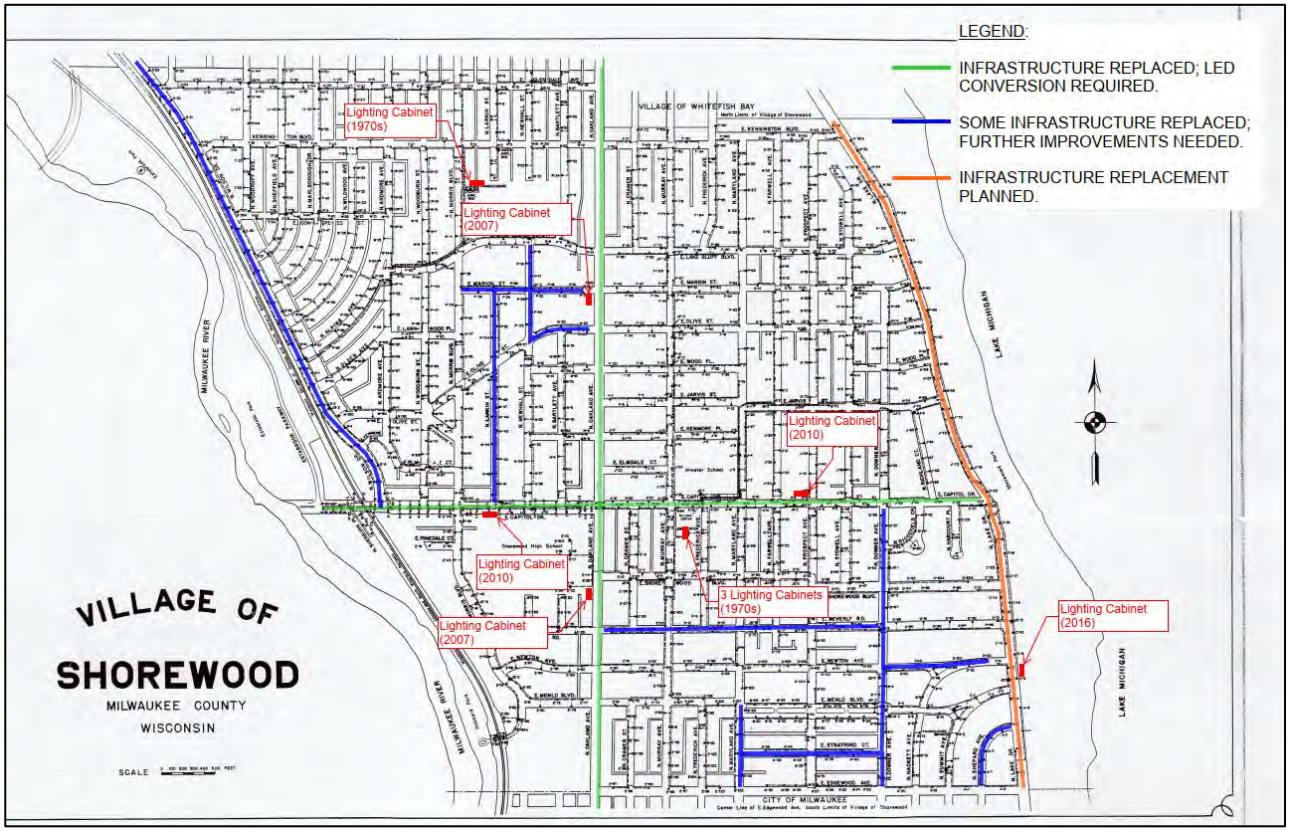
Fire Station Lighting Controller

Existing Pull Box

Proposed Pull Box Type

Existing System

- Approximately 450,000 Feet of Cable
- Approximately 1,200 Street Lights
  - ~325 have been replaced
  - ~60 LED
- 9 Control Panels
  - 5 Replaced
- 35-40 Circuits



Expected Improvements

- Replace Remaining Original Lighting Control Cabinets
  - Exact Locations/Quantities To Be Determined Later
- Install LED Retrofit Lamps Along Capitol Drive and Oakland Avenue
- Completely Replace All Other Non-LED Light Fixtures
  - Appears LED Retrofit Lamps Not Option Due to Voltage, Wattage, Code Issues
  - Age of Light Fixtures Also Merits Full Replacement

Existing Lighting Control Cabinet

Existing Street Light on Capital Drive

Expected Improvements

- Replace All Original Light Poles and Internal Pole Wiring
- Replace All Original and Non-Compliant Pull Boxes
- Replace All Direct-Burial Wire with Wire in Directional-Drilled Conduit
- Install Ground Wire in Upgraded Circuit Conduits (if Possible) Where Missing

Existing Light Pole with No Handhole to Pull Wires

Project Preliminary Phase Scope

- Develop Quantities for Existing Circuit Cable Lengths and Light Fixtures
- Review Existing Infrastructure for Potential LED Conversion
- Review Photometrics for up to Four LED Light Fixture Types
- Develop Costs to Replace Existing Street Lighting System
- Develop Energy Usage Cost Comparison of Existing System Versus System with LED
- Assist in Reviewing Third Party LED Lease Agreement – If Provided

VILLAGE OF SHOREWOOD

VENDOR: WE ENERGIES

ADDRESS: WE ENERGIES VILLAGE HALL -
2/8/22 - 3/8/22 WeEnergies billing

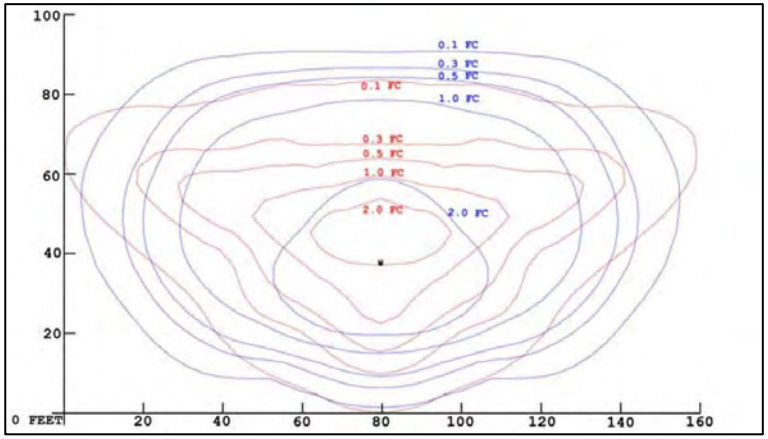
PREPAID ☐ Enter amounts below A/P ☐

	Acct #	KW / Therm	Description	Amount
1	100-1900-52200.55-00	6,120	VIL HALL ELECTRIC	$ 885.24
2	100-3300-52200	1,531	DPW GARAGE	$ 236.52
3	100-3300-52200	-	INCINERATOR / COMPACTOR	$ -
4	100-3620-52200	1,050	HUBBARD PARK	$ 162.11
5	100-3620-52200	80	HUMBOLDT PARK	$ 26.74
6	100-3620-52200	2,108	ATWATER BEACH	$ 319.93
7	100-2100-52200	14,232	WILSON DR POLICE BLDG ELEC	$ 1,924.99
8	100-3620-52200		GHOST TRAIN PARK	$ 235.36
9	100-3430-52200.01-00	63,010	STREET LIGHTING	$ 7,405.08
10	100-3430-52200.01-00	2,547	ALLEY LIGHTING	$ 1,212.78
11	100-3430-52200.02-00	8,317	TRAFFIC LIGHTS	$ 1,319.99
12	100-3430-52200.02-00		FLASHERS	$ 6.69
13				-
14	100-3300-52210	2,183	DPW GARAGE GAS	$ 1,896.46
15	100-1900-52210.55-00	1,519	VIL HALL GAS	$ 1,310.15
16	100-2100-52210	2,898	WILSON DR POLICE BLDG GAS	$ 2,478.03
17	100-3620-52210		RIVER CLUB GAS	$ 21.04
18	200-5110-52200	22,976	LIBRARY (75%) electric	2,076.68
18	100-1900-52200.77-00		VIL CENTER (25%) electric	692.23
19	200-5110-52210	2,198	LIBRARY (75%) gas	1,413.71
19	100-1900-52210.77-00		VIL CENTER (25%) gas	471.24
	TOTAL		ACH DEBIT	$ 24,094.96

4/4/2022

Req. Authorization: Dept Head

Authorization: Village Manager Date



Photometrics Example

Project Final Phase Scope/Next Steps

- Develop Implementation Plan
- Generate Memorandum
  - Summarize Findings and Develop Replacement Costs
  - Provide Implementation Timeline Options for Lighting Replacement
  - Draft Memo – Mid April
  - Final Memo – Beginning of May
- Begin Replacement Program Design and Construction

STRAND ASSOCIATES®