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4/19/2022

COUNCIL FILE 22-0156: REPORT ON THE ISSUE OF LIGHTING OUTAGES DUE TO THEFT & VANDALISM AND A STRATEGY FOR INCREASED INFRASTRUCTURE RESILIENCE

Over the past four years, Los Angeles has seen a dramatic four-fold increase in the number of theft and vandalism incidents that has significantly impacted its street lighting network. And while these types of incidents are endemic to electrical and lighting systems due to the value of metals and electricity, the cumulative damage and its profound effect has required the Bureau of Street Lighting (BSL) to both triple its resource requests to keep pace with outages, and reassess its strategic approach to the issue. This report analyzes BSL data and information to identify trends and hot spots and proposes a comprehensive strategy for the Mayor and Council's consideration.

BACKGROUND

BSL designs, constructs, and maintains approximately 220,000 streetlights that illuminate two-thirds of the City. The system has over 400 different styles of lights, ranging from modern to historic and ornate, with some assets in the field nearly a century old. In metal and concrete poles alone, the Bureau has invested over half a billion dollars throughout the course of its existence. The streetlights above are supported by a vast underground network of approximately 9,000 miles of conduit filled with 27,000 miles of copper wire that connects to 12,000 DWP service points. The system continues to evolve as new developments and grant projects continue to add new streetlights to its numbers.

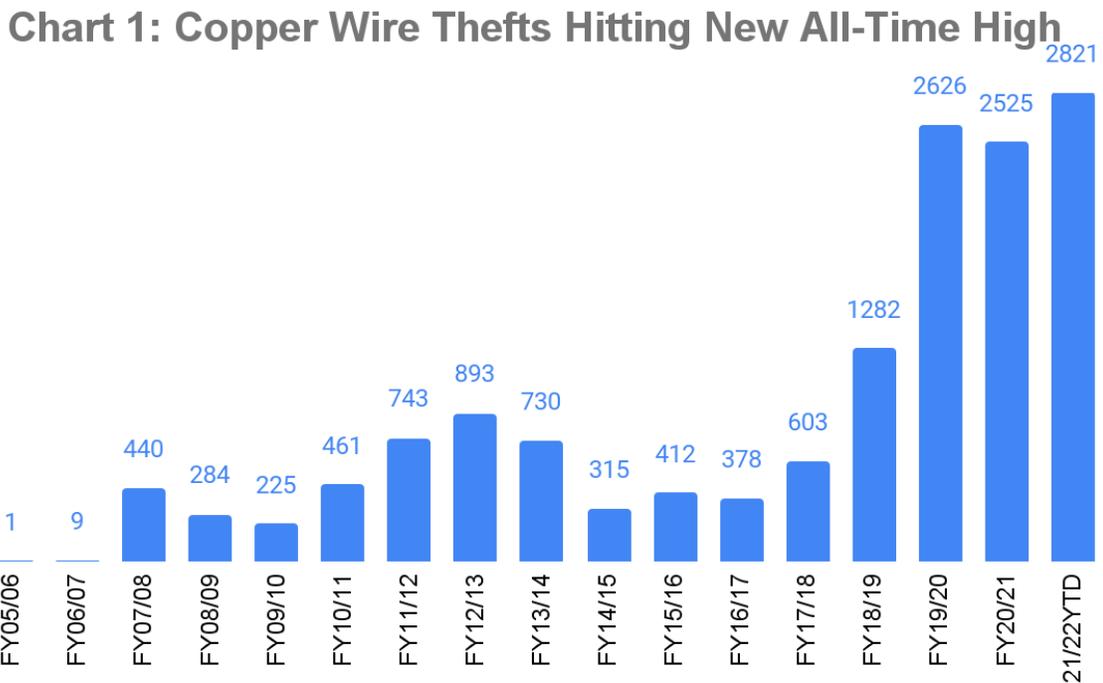
BSL undertook one of the first efforts in the world to replace its High Intensity Discharge fixtures with new LED technology in 2009 and as a result of the conversion to LEDs, have saved nearly \$10M annually in energy costs, reduced maintenance, lowered the City's carbon footprint, and freed up much-needed electrical capacity in order to pursue new services, such as Electric Vehicle Charging Stations, and Smart City technologies, such as sensors and cameras.

Finally, much of the streetlighting system grew similarly to how Los Angeles itself had grown as past developments accelerated the addition of new lights. The oldest tend to be downtown and on major streets and neighborhoods moving westerly towards the Pacific coast. Street lighting in the valley mostly developed during 1940's and 1950's, and in south, central and west L.A. during the 1960's and 1970's. The entirety of the system is a varied collection of engineering standards and aesthetics, and up until recently, had a common unifying trait: designing in a way

to minimize maintenance issues. This is why the system additionally has around 300,000 pull boxes housing electrical wiring near streetlights and access points at the base of the poles. This design, though useful in the past, now means that there are around half a million points of entry, and vulnerabilities that can lead to theft and vandalism.

Thefts and Vandalism Trends - Citywide

While the issue of thefts and vandalism in electrical systems have always been present, the City first saw a sharp uptick in thefts damaging the lighting system between FY06/07 (9 incidents) to FY07/08 (443 incidents) – well over a 40-fold increase. Levels remained fairly consistent with an average of 500 incidents per year until FY17/18. Within two years the number of incidents grew 4-fold and has consistently been above 2,500 incidents since FY19/20. To date, there are over 2,800 theft and vandalism incidents putting this fiscal year on a course to be the all-time high. Though we do not yet have enough data to show a consistent trend, it is my assessment that there is, at best, a new plateau for copper wire theft and vandalism in the City.



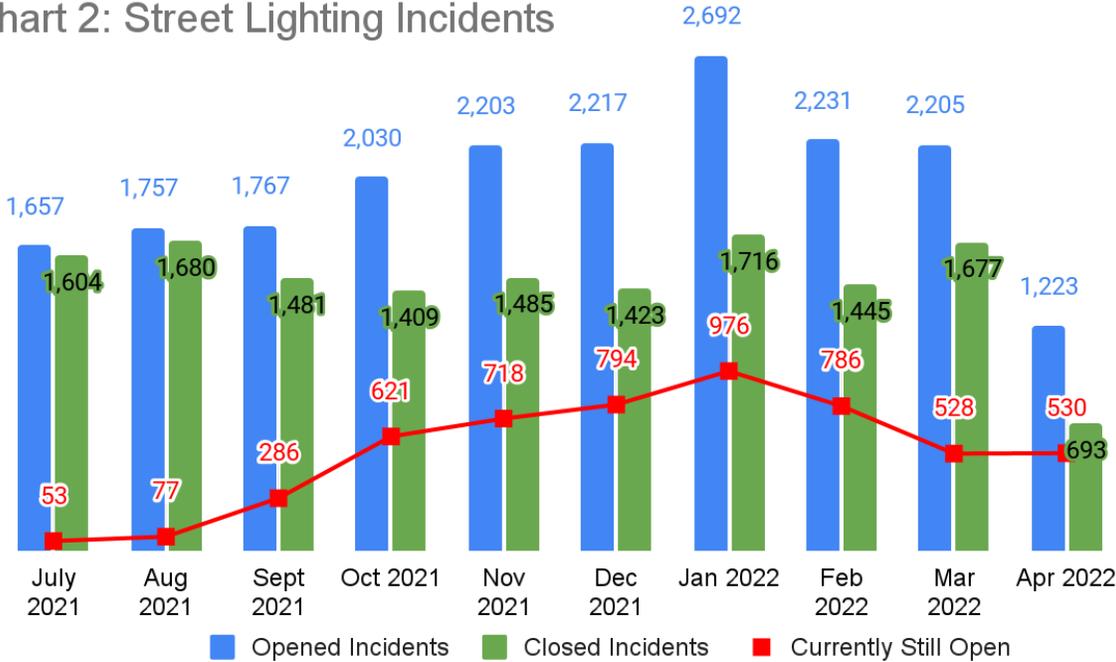
This current fiscal year marks the first time there were considerable new resources added to BSL. The Adopted City Budget saw the following additions to the Bureau’s office and field staff roster based off our previous theft and vandalism report in Council File 19-0600-S154:

Table 1: FY 21-22 Increased Services	Amount
6-Months Funding and Resolution Authority for 16 Positions One (1) Street Lighting Engineer One (1) Management Analyst Four (4) Street Lighting Electricians Four (4) Electrical Craft Helpers Two (2) Cement Finisher Workers One (1) SL Engineer Associate II One (1) Assistant SL Electrician Two (2) Welders	\$ 673,255

Hiring Hall Salaries	\$ 326,994
Benefits Hiring Hall	\$ 223,006
Overtime General	\$ 400,000
Street Lighting Supplies	\$ 450,000
Total	\$ 2,073,255

Though given only 6 months funding and position authorization, BSL redeployed staff to theft and vandalism crews in order to prioritize these types of major repairs since the start of the fiscal year. Unfortunately, the redeployment, in addition to a variety of other factors (e.g.: natural attrition; the hiring process; increased material costs) that have kept the vacancy rate relatively high at 23% in Field Operations (See **Issues and Constraints** Section), have impacted our ability to respond to all requests. This is most clearly seen in the graph below between July 2021 and January 2022 which shows the cumulative number of incidents currently open for all types of incidents (including theft and vandalism) – essentially, we have a growing backlog for all work.

Chart 2: Street Lighting Incidents



One highlight on the graph is February 2022 to date. In comparison to the rest of the year where the number of currently open incidents continued to grow, this is the first time we see a slight dip and leveling, which is predominantly due to the increased use of weekday and weekend overtime provided through council motions. Regarding resources, it is my assessment that both additional full time staff and a significant use of overtime will be required to both eliminate the backlog and meet the current rate of damage happening to street lighting infrastructure.

Table 2: Average Response Time to Complete Incident - Days						
Incident Type	FY 16/17	FY 17/18	FY 18/19	FY 19/20	FY 20/21	FY 21/22 YTD
SLO	3.3	4.9	6.6	14.1	20.8	27.8
Multiple Lights Out	14.1	19.4	27	29.5	42.5	26.1
Copper Wire Theft	19.1	27.5	42.7	62.3	57	57.9
Power Theft *	N/A	N/A	N/A	N/A	60.4	23.22
Post Hit **	131.3	143.5	128.6	62.2	51.7	27.3
Conduit Hit	38.3	22.2	19.3	24.4	13.1	6.9

*Power Theft started being tracked in 2020.

**Post Hits take longer repair times due to material out of stock, lead time on poles. Many post hit incidents are still open.

The table above (Table 2) is the average response time for different types of incident repairs. Copper wire theft incidents are some of the most labor intensive repairs in addition to being an increasing share of all incidents, growing to becoming the cause of one in eight incidents (from 2% of all incidents to 12.5% of all incidents). The redeployment of resources have caused other metrics to suffer.

Thefts and Vandalism Trends - Geographic Analysis

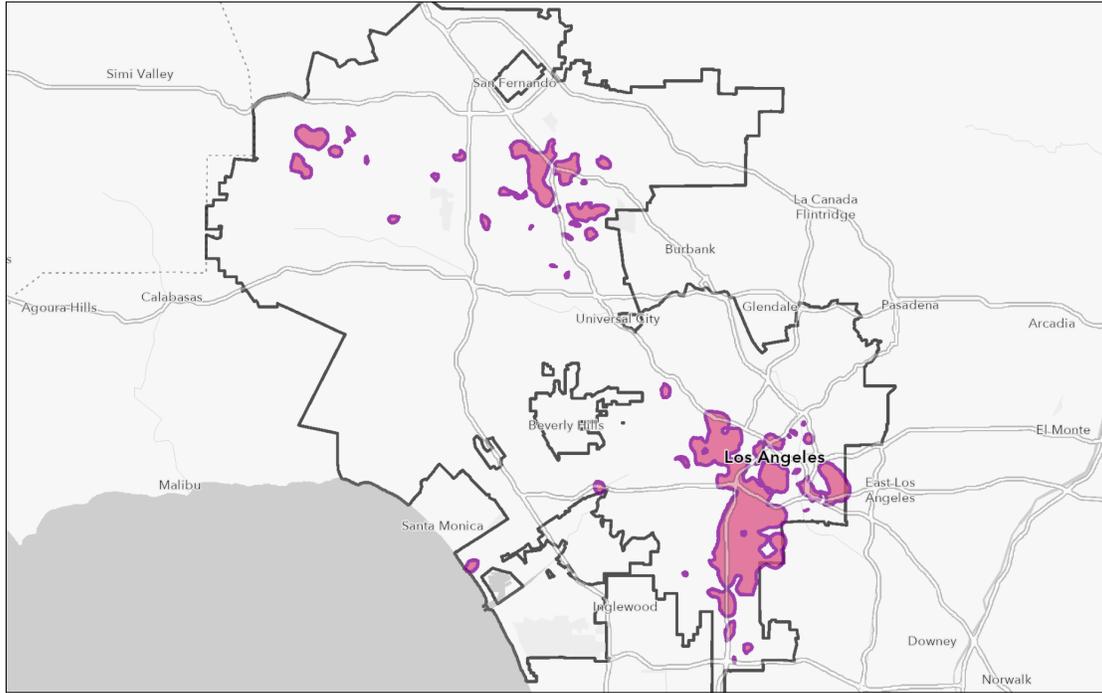
Incidents of theft and vandalism have occurred throughout the entirety of the City with trends of repetition in certain areas. In extreme cases, there have been instances where constituents have complained about outages that have been going on for months; it is also possible that field staff had already repaired the lights that were then immediately damaged by another theft.

To identify geographic areas with recurrent issues, BSL has developed the following map (MAP 1) that portrays the areas of the city that saw a high density of CWPT incidents (defined as 10 or more incidents per square mile) in each of the calendar years 2019, 2020, and 2021 (the calendar years that saw the greatest total number of incident increases). This illustrates communities that have been repeatedly impacted by copper wire and power theft incidents. This map shows that recurrent copper wire and power theft incidents have been concentrated in communities such as Southeast Los Angeles, Downtown Los Angeles, Boyle Heights, Westlake, Wilshire Center, Sun Valley and Chatsworth. In many cases, these areas of recurrent incidents are clustered around industrial districts, with incidents impacting the adjacent residential communities.

The map after (MAP 2) takes the analysis further, looking at the total density of incidents over the three years from 2019 to 2021 within the areas identified above and indicates areas such as the 110 corridor and Skid Row. It is my assessment that the areas identified are prime candidates for complete circuit fortification and warrant additional considerations for increased investigation / surveillance coupled with enforcement actions (See **Mitigation Strategies** Section).

MAP 1

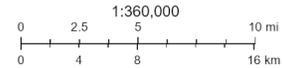
Recurrent CWPT Areas 2019 to 2021



4/18/2022

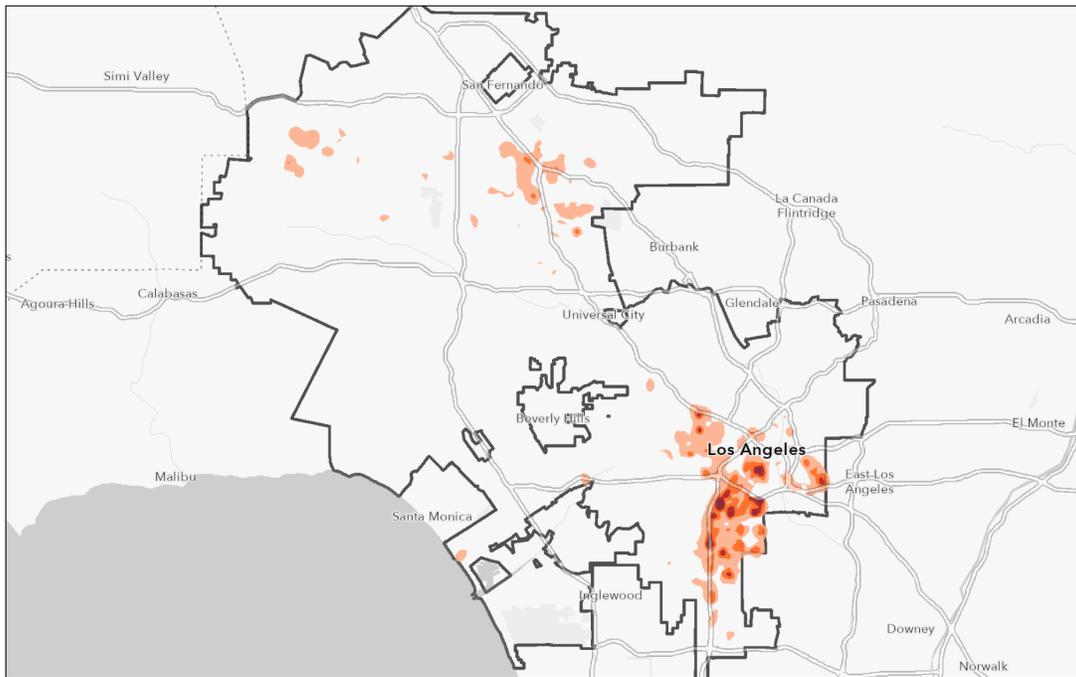
10 or More CWPT Incidents Per Square Mile in CY 2019, 2020, AND 2021

Los Angeles City Boundary



Sources: Esri, HERE, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community. Sources: Esri, HERE, Garmin,

MAP2 Density of Total CWPT Incidents Within Recurrent Areas (2019 to 2021)



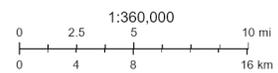
4/18/2022

CWPT Incidents Per Square Mile > 6 - 12 > 19 - 32

1 - 6

> 12 - 19

Los Angeles City Boundary



Sources: Esri, HERE, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community. Sources: Esri, HERE, Garmin,

Issues and Constraints

Assessment Revenue Does Not Meet Operational Needs

BSL is predominantly funded by an Assessment of benefit to property owners and collects this revenue through the County's property tax roll. Over 90% of the Assessment, however, has been frozen since 1996 due to Prop 218 and stunts revenue growth. A 2019 Matrix Consulting report analyzed the revenue and expenditures of the Bureau and surmised that in the same year BSL collected around \$84 on average (per year) from parcels but actually needed to collect around \$122 to meet an expenditure plan in pace with 2019 expected levels of maintenance. It should be noted that this recommended 46% increase was contemplated *BEFORE* the levels of theft and vandalism seen today.

Table 3

FISCAL YEAR	ASSESSMENT REVENUE (in Millions)	CWPT EXPENDITURES	CWPT INCIDENTS
FY 16-17	\$45.0	\$1,104,926	378
FY 17-18	\$45.4	\$1,218,017	603
FY 18-19	\$45.5	\$1,666,883	1,282
FY 19-20	\$45.9	\$3,910,478	2,626
FY 20-21	\$43.8	\$4,180,755	2,525

Simply put, BSL as structured cannot meet the regular maintenance demands and escalated response to theft and vandalism with the resources it currently has. I thank the Mayor and Council for their increased support, and the CAO and CLA for their continued assistance, as it has helped stem the tide of broken infrastructure. In the near future, greater investments will be required until longer term fixes (likely include an Assessment Ballot) around revenues can be put into place.

Infrastructure Originally Designed For Service And Maintenance Ease

As mentioned in the **BACKGROUND** above, the entire streetlighting network was aggregated over the course of 100 years with the considerations of maintenance driving how the system should work and be accessed, leading to around half a million access points for staff. This was necessary as lights before the adoption of LED technology were re-lamped once every two years, rather than the 10+ year lifespan that LEDs have. Absent theft and vandalism, these access points were useful to not only maintain lights, but also change the infrastructure for new purposes (i.e.: Low-voltage Conversion). Now they have become more of a vulnerability.

Attrition And Vacancies Limit The Overall Capacity Of Field Operations

In total there are 24 authorized positions (8 carried over from past fiscal years; 16 new this fiscal year) dedicated to theft and vandalism. Additionally, the Field Operations also deploys staff from other sections as needed and as available from Maintenance Districts and at times has gone up to nearly 40 staff assigned. Redeployment from all Field Operations is complicated by the fact that there are services that the Bureau provides (such as the 4G/5G Co-Location program

employing around 50 staff) that are revenue-generating, or are part of projects or regular maintenance. Redeployment from these assignments can cause a considerable loss of revenue, delays of projects, or increasing response times for other types of repairs. Given the “new plateau” for incidents, additional staff will be needed to properly respond to thefts and vandalism.

Related is the Bureau’s current vacancy rate of 23% made up of 42 vacancies in the 180 authorized positions of our Field Operations. A variety of factors have contributed to the current vacancy, including the previous fiscal year’s hiring freeze, 6 months authority and funding for new positions, and higher than usual transfers to other entities like the Department of Water and Power (12 to date to DWP alone this FY with usually 3-5 in previous years). So while increased staffing levels will be needed, we will be required to use other means of augmenting our workforce, such as hiring hall and overtime, as a short term surge strategy. The Bureau will use every means of hiring available to us: we have subscribed to the greatest extent possible to the Targeted Local Hire Program, and are now working with the Personnel Department and our Union partners for additional Bridge to Jobs classifications and possible apprenticeships.

Field Operations Yard Space Is Constricting Material, Vehicle, And Staffing Availability

Until recently, BSL has not grown in terms of real-estate and yard space since the City purchased an additional parcel adjacent to the Santa Monica Yard in the 90’s. In fact, the last significant expansion was in the 70’s with an added satellite location at the shared Raymer Yard located in Van Nuys. Thanks to a partnership with BSS and GM Mozee, we have been able to expand for the first time in 50 years to a new satellite location, again in a shared yard, in West LA near the Los Angeles World Airports staffed by a maintenance district. By adding the location, we are able to reduce drive time by 5% to 10% (10% is equivalent to adding an additional full time staffer to the district) and maintain higher levels of supplies.

Despite the recent addition BSL remains constrained in its ability to deploy staff efficiently throughout the City and effectively store required project materials for timely service delivery. The satellite yards only hold a total of 31 staff (20 in the Valley; 11 in the West) with materials and vehicles. The bulk remains at our Santa Monica Yard located in the middle of the City. To accommodate more staff and increase efficiencies, the Bureau will need to expand operations to other locations, especially for the hotspots in Downtown Los Angeles, South East Los Angeles, and the Valley.

The Use of Technology Has Yet To Reach Critical Mass And Results In Information Gaps

Approximately 20% of LA’s streetlights have communication nodes that enable additional smart city services, such as voltage drop tracking (which can help identify outages like ones due to theft), sensor technologies, or video feeds (with additional camera attachments). Because less than 1-in-5 lights have communication capabilities, it limits holistic solutions designed to combat theft issues or more positive outcomes such as real-time air quality monitoring. The gaps in our smarter, technology-enabled network has an additional ramification – the Bureau is reliant on service requests, sister bureau and department reports, and resident or business observations to have an understanding of the state of its infrastructure. While the Bureau is dedicated to being a responsive, customer driven agency, insights from the Bureau of Sanitation’s CleanStat program and the Bureau of Street Services Pavement Quality Index suggests that BSL undertake similar efforts to have a comparable “Streetlight Census” in order to ensure equity and apply limited capital dollars towards high-value returns.

Possible Mitigation Strategies

BSL has identified the following strategies most likely to have a positive impact on the network. Each strategy can be undertaken independently, but it is my assessment that all strategies will be used together with varying ratios of investment to balance the immediate need to turn lights on, and the longer term goal of infrastructure protection, sustainability, and resilience. The **RECOMMENDATIONS** section will contain additional details to the Bureau’s proposal.

Table 4: Per Light Cost Comparison of New Lights, Solar Lights, and Lighting Repairs

	New Ornamental Streetlight*	New Modern Streetlight*	Battery-Enabled Solar Fixture **	Repair Circuit and Fortify Vandalized Entrypoint	Fortify Circuit and Fortify All Lighting Infrastructure
Equipment and Materials	\$ 10,000	\$ 5,000	\$2800	\$300	\$900
Labor	\$ 5,000	\$ 5,000	\$400	\$600	\$1100
Total	\$ 15,000	\$ 10,000	\$3200	\$900	\$2000

*In-house costs. Contracted costs are 1.5X

** Solar lights for pilot program only

Circuit Restoration Crews (fortifying only damaged assets)

This reactive crew is predominantly how Field Ops have approached repairs to date. This crew fortifies only the accessed / damaged poles and pull boxes and restores as many lights along the affected circuit as possible. The crew consists of (1) Electrician Supervisor, (1) Electrician, (2) Electrical Craft Helpers with a Derrick Truck, Portable Compressor, and a Dump Truck. The repairs are made to get the lights back on. This option will be necessary to speed up “lights on” and is cheaper than all other options, but the areas remain vulnerable to repeated theft and vandalism until all surrounding assets are fortified or the additional strategies, such as bimetallic wire, are proven effective deterrents.

Circuit Fortification Crews (NEW - fortifying damaged assets and whole circuits)

This proactive crew is the newest hardening approach employed by Field Ops. This crew fortifies the entire circuit from the DWP service point, not just accessed or damaged poles or pull boxes. Fortifying the entire circuit involves: lowering and pouring concrete over pull boxes; replacing and/or splicing wire; welding handholds; and, relocating the fuse to the top of each luminaire along the vandalized circuit. To establish the crew, the Bureau would need eleven (11) new resolution authority positions and funding for overtime, equipment and materials. Though less costly than Solar Fixtures or new streetlights, this proactive approach nevertheless is a considerable investment in time and effort – to fortify all Streetlights would have an estimated cost of \$400M. If the Bureau were to continue at the current expenditure rate it would take over 80 years to touch all Streetlights. Unless/Until a funding strategy is identified, it is my assessment that this strategy be focused on the areas identified on the “Recurrent CWPT Areas” map found in the **Thefts and Vandalism Trends - Geographic Analysis** section.

MAP 3



As an example, the above diagram shows an entire circuit (CKT A) starting from its DWP service point (blue plus). From the red stars on the diagram, one can see the impact of theft to the system. If we approached with a mindset to “Restore” we would be able to fix 5 lights, but there are 12 lights on the circuit, leaving 7 vulnerable. If another incident were to occur on the same circuit, BSL would be spending nearly the same amount as the “fortify” approach, which would have hardened all 12 lights in the first response.

Below is the breakdown of positions and funding needed to establish a fortification crew:

Request 11 New Resolution Authority Positions Total \$ 930,000

- One (1) Street Lighting Electrician Supervisor
- Two (2) Street Lighting Electricians
- Two (2) Assistant Street Lighting Electricians
- One (1) Cement Finisher
- One (1) Cement Finisher Worker
- One (1) Welder
- Two (2) Electrical Craft Helpers
- One (1) Mechanical Helper

Overtime General \$ 1,000,000

Street Lighting Improvements and Supplies \$ 2,000,000

Equipment Rental Total \$ 514,000

Total Funding \$ 4,440,000

Usage of Bimetallic Wire

The Infrastructure Protection Division and Field Operations Division will pilot the use of aluminum wiring, or copper-aluminum bimetallic wiring, in our street lighting circuit in areas where Copper Wire and Power Theft is excessive. The pros to using Aluminum Wiring is that it costs half of Copper Wiring and will be less valuable to vandals should they steal it and take it to the recycling centers, though aluminum itself is less conductive than copper and will require other engineering consideration, such as expanded conduits, should other services (e.g.: EV

charging stations) expand. This strategy can be adapted through purchasing changes and should it prove effective, will be incorporated into larger response strategies.

Street Lighting Census

Field Operations Crews will immediately begin a proactive assessment of the entire city street light network at least once a year to identify unreported items, such as lights out and wire theft. This “streetlight census” will be used to create a database and baseline which BSL will use to deploy resources more strategically. Additional inspection factors, such as pole degradation or illegal attachments or signs, and additional observation instruments, such as smart nodes and sensors, can be added in the future. The data can also be used for identifying areas of repeat theft, and for better coordination of crews and resources across the city. BSL will report the results and associated metrics from its streetlight census, and will be able to use the results to assess the effectiveness of repair and hardening efforts over the years. We intend to produce a “State of the Streetlights” in tandem with Strategic Plan updates.

Fully Connected Smart Lighting Network

When applied network wide, Smart City technologies will have the potential to supply real-time outages and issues well before a service request is submitted and can help management and operations deploy resources more efficiently and effectively. With additional investments the network can be set up to support other connected services, such as sensors and video cameras, that can provide other valuable information. In my assessment, the streetlighting network is poised to become a vital set of “eyes and ears”, providing greater insights to both on-the-ground realities and city operations as a whole well beyond our lights. To capitalize on this potential, the BSL is exploring “Streetlights-as-a-Service”, a suite of smart city technologies hosted on streetlights to which other departments or entities can subscribe, and have begun testing such technologies in the field now.

The Bureau estimates \$40M will be required to connect every street light at the most basic level, with other services (e.g.: cameras, etc.) increasing costs. In my assessment, aligning the Smart Network with LED retrofits is likely the most cost effective solution, as both assets have similar lifespans and can likely be bought together, but will extend the time to 10 years before the Bureau has a complete network. Should other funding be available, the best candidates for these types of technologies are also the areas identified on the “Recurrent CWPT Areas” map found in the **Thefts and Vandalism Trends - Geographic Analysis** section. These areas also coincide with areas that are prone to illegal dumping and can be a way to mutually support Sanitation’s report dated March 31, 2022 regarding illegal dumping in response to Council Files 22-0116, 22-0118, 22-0121, and 22-0122.

Enforcement

The Infrastructure Protection Division is exploring the possibility of GPS trackers and other technologies, such as the above Fully Connected Smart Lighting Network Strategy, in often-stolen street light assets with the intent to share information with law enforcement to help with enforcement. The Bureau sees that technology is critical in supporting enforcement efforts as the past few years have unfortunately seen little with regards to successful cases. This is partially due to the pandemic and stretched resources and partially due to the speed and zeal of these crimes. As directed, the Bureau will work with LAPD on enforcement strategies and will report on those efforts and their success in the future.

Solar-Powered Battery-Enabled Streetlights

With an Innovation Fund Grant from the Innovation and Performance Commission, the Bureau is looking to invest in an All-in-One Solar Lighting fixture to be piloted in highly vandalized areas citywide. Investing in Solar Lights will eliminate the need for copper wiring, therefore reducing material and labor expenses, and most importantly providing continuous light in heavily vandalized areas where repairs do not hold up – Essentially, Copper Wire Theft can not occur without the wires. Solar Lighting fixtures will also contribute to achieving a low carbon, green energy future that aligns with the Mayor’s (E.D. No. 25) New Green Deal and will increase the resilience of the streetlighting network as natural disasters, such as earthquakes, will have less of an impact as any solar light can be power grid independent.

RECOMMENDATIONS

As directed by Council, this report identifies problem areas and outlines possible strategies to ameliorate the rash of thefts affecting the streetlighting network. BSL understands these recommendations should be considered in the context of the City Budget and available resources. With that in mind, I recommend that the City Council:

1. Instruct the CAO to verify BSL’s estimations for the strategies outlined in the **Possible Mitigation Strategies** Section.
2. Authorize 33 positions and resources as requested by BSL in their FY22/23 proposed departmental budget (listed below for convenience). These resources are intended to begin eliminating the backlog of repairs.
 - One (1) Street Lighting Engineer
 - One (1) Street Lighting Engineering Associate II
 - One (1) Management Analyst
 - Two (2) Street Lighting Electrician Supervisors I
 - Eight (8) Street Lighting Electrician
 - Four (4) Assistant Street Lighting Electricians
 - Seven (7) Electrical Craft Helpers
 - Three (3) Cement Finisher Worker
 - Four (4) Welder
 - Two (2) Mechanical Helper

Total Salaries of 33 Positions \$2,891,958

Hiring Hall Salaries \$326,994

Benefits Hiring Hall \$223,006

Overtime \$1,200,000

Contractual Security Services \$172,000

Equipment Rental \$ 369,700

Street Lighting Supplies \$1,250,000

Total Funding Requested: \$6,433,658

3. Authorize 11 positions and resources as requested by BSL to establish a *Circuit Fortification Crew* as described in the **Possible Mitigation Strategies** Section. This crew is intended to address issue areas as identified in the **Thefts and Vandalism Trends - Geographic Analysis** Section. (11 positions and funding of \$4,400,000)
4. Authorize an additional \$1,600,000 in Street Lighting Supplies to procure 500 Solar-Powered Battery-Enabled Streetlights.
5. Authorize an additional \$1,500,000 in Street Lighting Supplies to pilot additional Smart Cities Technology, such as sensors and camera installations, to curb copper wire theft and assist in other issue areas such as illegal dumping.
6. Instruct GSD, with assistance from BSL and CAO, to propose within 45 days to the Municipal Facilities Committee a list of possible properties that can be used to expand BSL yard space for Field Operations. This report shall include existing City properties and properties that can be purchased or leased and should take into consideration strategic deployment of resources, especially in the Valley, DTLA and Southeast LA.

A handwritten signature in black ink, reading "Miguel Sangalang" with a stylized flourish at the end.

Miguel Sangalang
Executive Director
Bureau of Street Lighting