Public Works Commission
Disaster & Fire Safety Commission
Transportation Commission

INFORMATION CALENDAR
January 26, 2021

To: Honorable Mayor and Members of the City Council

From: Public Works Commission, Disaster & Fire Safety Commission, Transportation Commission

Submitted by: Shane Krpata, Chairperson, Utility Undergrounding Subcommittee
Matthew Freiberg, Chairperson, Public Works Commission
Gradiva Couzin, Chairperson, Disaster & Fire Safety Commission
Barnali Ghosh, Chairperson, Transportation Commission

Subject: Report for Phase 3 Study to Underground Utility Wires in Berkeley

INTRODUCTION

Climate changes continue to threaten Berkeley with risks of wildland urban interface fires. Undergrounding overhead utility wires is an important tool to reduce the risks.

CURRENT SITUATION AND ITS EFFECTS

The attached document is the Phase 3 Study of the City Council referral. This work was completed at the end of 2019, and the report was approved by the Public Works Commission on November 7, 2019, Transportation Commission on January 16, 2020, and Disaster and Fire Safety Commission on February 26, 2020. It was scheduled to be presented to Council in March 2020 and has been delayed because of the Covid-19 pandemic emergency. The Commissions are providing it now as an informational item and are making the following recommendations.

1. The participating commissions encourage the continuation of studying undergrounding as an option to save lives. Our climate is in a crisis and the devastation caused by wildfires is increasing each year.

2. Further studying of undergrounding shall be conducted within the work scope of the Vision 2050 initiative. The initiative was approved by Council in September 2020 and is being implemented.

3. This transmittal closes out the Council referral from December 2014.

Public Works Commission discussed the recommendations at its November 7th, 2019 meeting and a motion was made to approve the report pending the inclusion of the items in the meeting minutes of this conversation.

> **Action:** It was Moved/Seconded (Erbe/Constantine) to "Approve the Utilities Undergrounding Subcommittee Report pending the inclusion of the items in the meeting minutes of this conversation."
> **Vote:** Aye - 9; Nay - 0; Abstain - 0; Absent - 0
> **Outcome:** Unanimous Agreement

Transportation Commission discussed the recommendations at its January 16th, 2020 meeting and a motion was made to approve forwarding the Utilities Undergrounding Subcommittee Report to City Council.

> **Action:** It was Moved/Seconded (Parolek/Zander) to "Approve forwarding the Utilities Undergrounding Subcommittee Report to City Council."
> **Vote:** Aye - 7; Nay - 0; Abstain - 0; Absent - 2
> **Outcome:** Unanimous Agreement

Disaster & Fire Safety Commission discussed the recommendations at its February 26th, 2020 meeting and a motion was made to approve forwarding the Report for Phase 3 Study to Underground Utility Wires in Berkeley to the City Council.

> **Action:** It was Moved/Seconded (Degenkolb/Grimes) to "Approve forwarding the Report for Phase 3 Study to Underground Utility Wires in Berkeley to the City Council."
> **Vote:** Aye - 9; Nay - 0; Abstain - 0; Absent - 0
> **Outcome:** Unanimous Agreement

The Public Works Commission, Transportation Commission, and Disaster & Fire Safety Commission each voted and unanimously agreed to forward the Phase 3 Study to Council.

BACKGROUND

The City Council, at its meeting December 16, 2014, referred to the Public Works, Disaster and Fire Safety and Transportation Commissions to develop a comprehensive plan for the funding of the undergrounding of utility wires on all major and collector streets in Berkeley. The arterial and collector streets were identified as a priority for the movement of emergency vehicles and the evacuation of residents in the event of a major disaster. The commissions organized a four-phase work plan consisting of: 1) baseline study to summarize Berkeley's status on undergrounding, 2) conceptual study to determine the feasibility of undergrounding, 3) financial and implementation plan to underground the recommended streets, and 4) implementation of an approved program.

The commissions presented the Phase 2 report to Council on February 27, 2018. It was well received and Council authorized proceeding with the Phase 3 study.

ENVIRONMENTAL SUSTAINABILITY

Undergrounding utility wires is environmentally sustainable by providing space for large trees and green infrastructure while improving public safety and energy reliability by substantially reducing the likelihood of downed wires and network disruptions along emergency evacuation corridors.

POSSIBLE FUTURE ACTION

It is important to recognize that undergrounding utility wires on evacuation routes must be only one component of a suite of actions to ensure that our community can safely escape advancing fire and first responders can access areas to fight fires. Undergrounding should be considered in combination with other actions, including but not be limited to educating the public of the risks, reducing vegetation that fuels fires, parking restrictions to provide more roadway clearance, improved road markings and signage, and more.

FISCAL IMPACTS OF POSSIBLE FUTURE ACTION

The estimated cost of the undergrounding program recommended in the Phase 3 Study is $90M in 2019 dollars. The Subcommittee has identified multiple funding strategies, described in the Section 2 Chapter C “Funding Strategies” (p.12) of the Phase 3 Study.

CONTACT PERSON

Andrew Brozyna, Deputy Director of Public Works, 510-981-6496
Joe Enke, Commission Secretary, Supervising Civil Engineer, 510-981-6411

Attachment:
1: Study to Underground Utility Wires in Berkeley Phase 3 Report

STUDY TO UNDERGROUND UTILITY WIRES IN BERKELEY

PHASE 3 REPORT

PREPARED BY MEMBERS OF BERKELEY'S

PUBLIC WORKS COMMISSION
DISASTER AND FIRE SAFETY COMMISSION
TRANSPORTATION COMMISSION
PUBLIC WORKS DEPARTMENT

Downed power poles and lines in 2017 Tubbs Fire
Photo by LA Times

February 2020

ACKNOWLEDGEMENTS

Participating Commissions

The following Commissioners participated in the preparation of this report:

Public Works Commission
Shane Krpata, Sachu Constantine and former commissioners Nic Dominguez, Larry Henry and Ray Yep

Disaster and Fire Safety Commission
Paul Degenkolb, Bob Flasher and former commissioner Victoria Legg

Transportation Commission
Tony Bruzzone

City of Berkeley

Phil Harrington, Public Works Director

Andrew Brozyna, Deputy Public Works Director

Keith May, Berkeley Fire Department

Hamid Mostowfi, Transportation Department

Ray Yep, Public Works Department program specialist

Other Participants

Charles Scawthorn, Earthquake and Fire Risk mitigation specialist

Marvin Snow, Berkeley Citizens for Utility Undergrounding

Gordon Wozniak, Former City Councilmember

Bellecci & Associates

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EXECUTIVE SUMMARY

In 2014, Berkeley's City Council issued a referral to "develop a comprehensive plan for the funding of the undergrounding of utility wires on all major arterial and collector streets in Berkeley" to the Public Works, Transportation and Disaster and Fire Safety Commissions. Results of the Phase 1 and 2 studies were presented to Council in February 2018.

The history of undergrounding in Berkeley dates back to the 1970's. Currently, 49% of arterial streets, 31% of collector streets and 7% of residential streets are undergrounded. The major streets undergrounded include San Pablo Avenue, University Avenue, MLK Way (part), Shattuck Avenue, Solano Avenue and Telegraph Avenue.

This report represents the results of our Phase 3 study. It is important to note that throughout this effort, the group was guided by the goals of **safety, equity, resilience and future technologies.**

Phase 3 Study Findings

The Phase 3 study identified the arterial and collector streets for undergrounding, updated the estimated costs and further studied the funding options. The basis for our understanding of the hazards facing the City and the mitigation strategies are stated in the 2019 Local Hazard Mitigation Plan.

The major arterial and collector streets to underground utilities were identified through discussions with Berkeley's Fire Department and a review of Berkeley's evacuation plan. The main purpose of undergrounding is to support public safety through ingress of first responders and egress of community members in the event of a major disaster. The routes selected for this study are mostly east/west plus two north/south routes. These routes are:

- Alcatraz/Claremont Avenues
- Ashby/Tunnel Road
- Cedar Street
- Gilman/Hopkins Streets
- Marin Avenue
- Grizzly Peak Blvd.
- Spruce/Oxford/Rose Streets

Bellecci & Associates was retained to update the cost estimate for the selected streets for undergrounding. The estimated cost is $90 million for the 15.1 miles of undergrounding. The cost is in 2019 dollars and the average cost is $6.0 million per mile. The cost estimate is inclusive of trenching, conduits, wiring, service conversions, street lighting and engineering.

Framework for Berkeley's Future Infrastructure Development

Understanding the big picture of Berkeley's current infrastructure condition and the framework for its future development is important and useful. As the Subcommittee has worked over the past five years in carrying out the Council referral, many initiatives are in development:

- Resilience Strategy
- Vision 2050
- We are in a time of transition in electric power delivery

- CPUC re-evaluation of Rule 20

The recent publication of the CPUC's report "Staff Proposal for Rule 20 Program Reform and Enhancements" in February 2020 include the following recommendations:

- Refine and expand the Rule 20 public interest criteria
- Modify Rule 20B to incorporate tiered ratepayer contributions commensurate with public benefit
- Sunset the Rule 20A and 20D programs as currently designed
- Incentivize municipal utility surcharge undergrounding programs
- Eliminate work credit trading with limited exceptions
- Modify the Rule 20A annual completion and allocation reports
- Adopt an updated Rule 20 guidebook
- Improve communications with the communities and publish relevant Rule 20 program information, documents and reports online
- Implement incentives to reduce project completion timelines and costs

What does this broader context mean to this study on undergrounding? The Resilience Strategy and Vision 2050 initiative is leading us to *"move beyond business-as-usual and accelerate the building of climate-smart, technologically-advanced, integrated, and efficient infrastructure in Berkeley".* The use of wooden poles dates back to the 1840's when the telegraph system was developed. New cities and developments have their utilities underground. Continuing the use of an overhead system is continuing to use old technology. Converting to undergrounded systems supports Berkeley to do the following:

- Meet our climate action goals with reliable electrical distribution
- Add to our quality of life, including public safety
- Support broadband expansion and other integrated needs in our public right of way
- Use new technology

Recommended Undergrounding Program

We propose the following long-term vision for undergrounding in Berkeley.

Undergrounding Development Phase	Timeframe, year	Description
Previous work	1970's – present	49% of arterial streets and 31% of collector streets are already undergrounded.
Near term	2020 - 2040	Underground key evacuation routes as described in this report. The work will be done in about 15 years.
Near term	2020 – continuing	Create and implement a Rule 20B program that includes a revolving fund to provide for upfront costs of proposed projects. Once a 20B project is approved by a vote of the parcel owners, the advanced upfront funds will be returned to the revolving fund.
Long term	2040 - 2070	Underground Berkeley citywide.

The Subcommittee proposes a 15-year program to underground the key evacuation routes, as follows.

Year	Street	Section	Council districts
1	Dwight Way	Fernwald Rd. to Shattuck Ave.	3, 4, 7, 8
2	Dwight Way	Shattuck Ave. to San Pablo Ave.	2, 3, 4
3	Marin Avenue	Tulare Ave. to Grizzly Peak Blvd.	5, 6
4	Grizzly Peak Blvd.	Spruce St. to Marin Ave.	6
5	Grizzly Peak Blvd.	Marin Ave. to Arcade Ave.	6
6	Ashby Ave., Tunnel Road	Vicente Rd to Telegraph Ave.	7, 8
7	Ashby Ave.	Telegraph Ave. to San Pablo Ave.	2, 3, 7
8	Cedar Street	La Loma Ave. to MLK Way	4, 5 6
9	Cedar Street	MLK Way to San Pablo Ave.	1, 5
10	Hopkins Street	Sutter St. to Gilman St.	5
11	Gilman Street	Gilman St. to San Pablo Ave.	1, 5
12	Spruce Street	Grizzly Peak Blvd. to Rose St.	5, 6
13	Rose Street, Oxford Street	Rose from Spruce to Oxford and Oxford from Rose to Cedar	5
14	Claremont Ave., Alcatraz Ave.	Ashby Ave. to Telegraph Ave.	8
15	Alcatraz Avenue	Telegraph Ave. to San Pablo Ave.	2, 3

This preliminary list has the following assumptions:

- The Fire Department has stated that Dwight Way is a high priority due to the risks in the Panoramic Hills area.
- Undergrounding is planned east of San Pablo Avenue because the areas west of San Pablo Avenue are subject to high groundwater levels and have ground liquefaction concerns.
- The percentage of streets in the hills is 37% and in the flat lands is 63%.

If we assume that the program will start in 2023, the estimated cost will be $105 million in FY2023 dollars. The project team recommends the following ranking of the four financing options studied.

1. Place a parcel tax with an inflator, similar to the Library and Parks taxes, on the ballot to fund undergrounding. A parcel tax of ~10 cents/ft2 will generate ~$7.0 - 12 million/yr. over the life of the project.
2. Create an Assessment District for Utility Undergrounding, similar to the City's recent Prop 218 Street Lighting & Storm Sewer. Although the approval threshold is lower for a Prop. 2018 fee, there are legal questions on the required nexus with the service provided.
3. Place a General Obligation bond on the ballot to authorize $140 million to fund the total project cost over 15 years.
4. Increase the Utility User Tax from 7.5% to 12.0% (increase of 4.5%). This will produce additional revenue of ~$9 million per year to fund the total project cost of $140 million.

Recommended Next Steps

The Subcommittee recommends the following next steps for Council consideration.

1. Review this report and provide direction on whether to proceed with the 15-year undergrounding program of the key evacuation routes.
2. Work with the Council's Facilities, Infrastructure, Transportation, Environment, and Sustainability Policy Committee on further development of the undergrounding program.
3. Work with the Finance Department, the Council's Budget committee, and consultant support, to refine costs and select the final funding option.
4. Implement a public engagement process in 2020.
5. Staff to prepare a Program Plan for the recommended undergrounding program.
6. Close out the original Council referral to the participating commissions. We recommend forming an Undergrounding Task Force to ensure public input in the future planning of utility undergrounding.

Section 1
INTRODUCTION AND BACKGROUND

City Council Referral

The Berkeley City Council (Council) referred a request to "develop a comprehensive plan for the funding of the undergrounding of utility wires on all major arterial and collector streets in Berkeley" to the Public Works Commission, Disaster and Fire Safety Commission and the Transportation Commission on December 16, 2014.

The three commissions organized an Undergrounding Subcommittee to respond to the referral. The Subcommittee structured the study into four phases, as follows.

Phase 1: Conduct a baseline study to summarize Berkeley's current status of undergrounding utilities, cost to complete the undergrounding of arterial and collector streets, and examples of where undergrounding programs have been implemented.

Phase 2: Conduct a conceptual study to determine the feasibility of utility undergrounding. The work included literature review, supporting studies by two Goldman School Masters candidates' thesis projects, meetings with utility and communications service providers, and meetings with municipalities having robust undergrounding programs.

Phase 3: Prepare a financial and implementation plan for the recommended streets to be undergrounded.

Phase 4: Implement the financing, design and construction of the approved program.

The Subcommittee presented progress reports to the Council on September 29, 2015 and March 28, 2017. The 2017 report included an updated work plan, the Harris & Associates baseline study, a proposal for studies by U.C. Berkeley's Goldman School of Public Policy graduate students, and notes from meetings held with utility and communications service providers. The Harris & Associates baseline study provides useful background information and included in Appendix A. The Council authorized the Subcommittee to complete the work through Phase 2 and to report back to them.

The Subcommittee presented the Phase 2 report to the Council on February 27, 2018. The comprehensive report was well received and Council authorized the Subcommittee to proceed with the Phase 3 study.

Phase 3 Study Work Scope

A recommended work scope for the Phase 3 study was included in the Phase 2 report. This work was planned as a shared responsibility between the participating commissions and Public Works Department (PWD) staff. PWD did not have staff available for the work and a funding request was made to hire temporary staff. That request was approved by Council in November 2018. The PWD made attempts to retain a temporary staff person, but it was not successful due to a shortage of

qualified technical candidates. Consequently, staff procured support services from one of the City of Berkeley's (City) on-call design firms in lieu of a temporary hire.

The Phase 3 study began at the beginning of 2019 with staffing from the PWD, Fire Department, participating commissions, and with technical expertise from Bellecci & Associates, the City's on-call consultant. The following is a summary of the work tasks and the progress.

Phase 3 Work Tasks	Work Progress
Task 1 – Define the Phase 3 projects	
A. Major and Collector Streets – The original work scope was to identify the major east/west routes to be undergrounded that would facilitate the travel of first responders and evacuation of residents.	This work was done with input from Berkeley's fire department and transportation department Also, we conducted a review of other fire mitigation measures underway in the Berkeley area.
B. Coordinate with Microgrid Development – The original work scope was to evaluate microgrids as a way to increase power reliability after a major disaster	This work will be changed to a separate study by the PWD.
C. Review code standards – The original work scope was to evaluate codes that would limit the loads carried by utility poles.	This work will be changed to a separate study by the PWD.
Task 2 – Develop the financing plan	
A. Refine cost estimate for undergrounding. The original work scope was to refine the cost estimates previously prepared by Harris & Associates.	This work has been done with a consultant from the City's pre-approved consultant list and from other references.
B. Participate in CPUC Rule 20 review – The original work scope was to monitor activities with the CPUC regarding Rule 20 modifications.	This work will be done by the PWD and the recommended task force.
C. Evaluate funding options. The original work scope was to evaluate funding options for Phase 3 projects in Berkeley.	This work has been done.
Task 3 – Conduct community input The original work scope was to conduct community outreach and workshops.	This work will be done following Council input on this report.
Task 4 – Coordinate with utilities The original work scope was to meet with PG&E and telecom companies regarding the phase 3 projects.	This work will be done at the appropriate time.
Task 5 – Prepare an implementation plan The original work scope was to prepare an implementation plan.	This work will be done following Council approval to proceed to implementation.

Section 2
PHASE 3 STUDY FINDINGS

The Phase 3 study is guided by the goals of safety, equity, resilience and future technologies. This study focused on identifying the streets for undergrounding, updating the estimated costs and further studying the funding options. The findings are described in this section.

Undergrounding Along Key Evacuation Routes

Berkeley's understanding of the hazards facing the city and the mitigation strategies to minimize the impacts to our buildings, infrastructure, community and the environment are stated in the **2019 Local Hazard Mitigation Plan, December 2019 (LHMP)**. The hazards of greatest concern include the following:

Earthquake

We do not know when the next major earthquake will strike Berkeley. The United States Geological Survey states that there is a 72% probability of one or more M 6.7 or greater earthquakes from 2014 to 2043 in the San Francisco Bay Region.4 There is a 33% chance that a 6.7 or greater will occur on the Hayward fault system between 2014 and 2043. This means that many Berkeley residents are likely to experience a severe earthquake in their lifetime.

In a 6.9 magnitude earthquake on the Hayward Fault, the City estimates that over 600 buildings in Berkeley will be completely destroyed and over 20,000 more will be damaged. One thousand to 4,000 families may need temporary shelter. Depending on the disaster scenario, one hundred people could be killed in Berkeley alone, and many more would be injured. Commercial buildings, utilities, and public roads will be disabled or destroyed. This plan estimates that building damage in Berkeley alone could exceed $2 billion, out of a multi-billion dollar regional loss, with losses to business activities and infrastructure adding to this figure.

Wildland-Urban Interface Fire

Berkeley is vulnerable to a wind-driven fire starting along the city's eastern border. The fire risk facing the people and properties in the eastern hills is compounded by the area's mountainous topography, limited water supply, minimal access and egress routes, and location, overlaid upon the Hayward Fault. Berkeley's flatlands are also exposed to a fire that spreads west from the hills. The flatlands are densely-covered with old wooden buildings housing low-income and vulnerable populations, including isolated seniors, people with disabilities, and students.

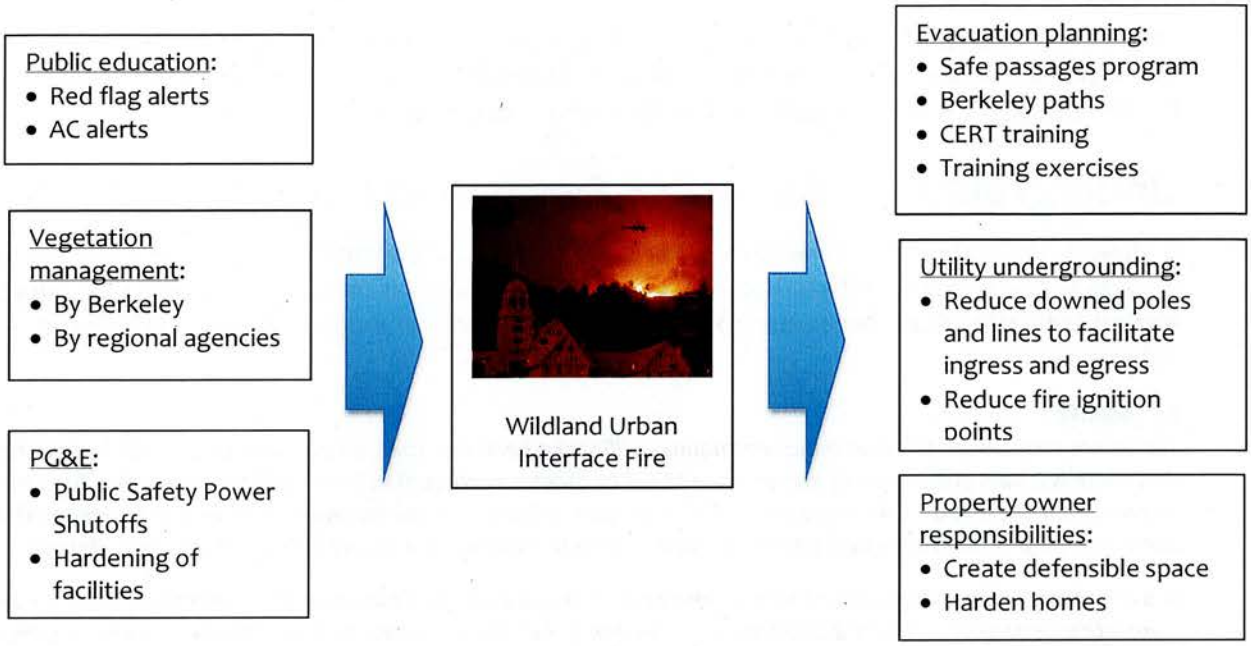
The high risk of wildland-urban interface (WUI) fire in Berkeley was clearly demonstrated in the 1991 Tunnel Fire, which destroyed 62 homes in Berkeley and more than 3,000 in Oakland. Accounts of major wildfires in Berkeley date back to at least 1905 when a fire burned through Strawberry Canyon and threatened the University campus and the small Panoramic Hill subdivision. Other major fires occurred in the 1970s and 1980s.

In 1923, an even more devastating fire burned through Berkeley. It began in the open lands of Wildcat Canyon to the northeast and, swept by a hot September wind, penetrated residential north Berkeley and destroyed nearly 600 structures, including homes, apartments, fraternities and sororities, a church, a fire station.

If a fire occurred today that burned the same area, the loss to structures would be in the billions of dollars. Destruction of contents in all of the homes and businesses burned would add hundreds of millions of dollars to fire losses. Efforts to stabilize hillsides after the fire to prevent massive landslides would also add costs. Depending on the speed of the fire spread, lives of Berkeley residents could also be lost. Many established small businesses, homes, and multifamily apartment buildings, particularly student housing, would be completely destroyed, changing the character of Berkeley forever.

Mitigation measures are described in the LHMP and are further describe in Appendix B of this report. The LHMP also describes Berkeley's three tiers of hazardous fire zones.

The pathways for reducing the hazard of a wildland urban interface fire are shown below.



There are multiple cases of downed powerlines blocking critical escape routes. Images of persons trapped because of downed power lines in the 1991 Tunnel Fire are etched in our memory. One common cause of tragic death by wildfire is the inability to outrun fire because of downed power lines and poles blocking roadways. Supporting an undergrounding program for emergency routes is one tool we have to reduce loss of life in wildfires by creating safer egress for community members and ingress for first responders to protect our community.

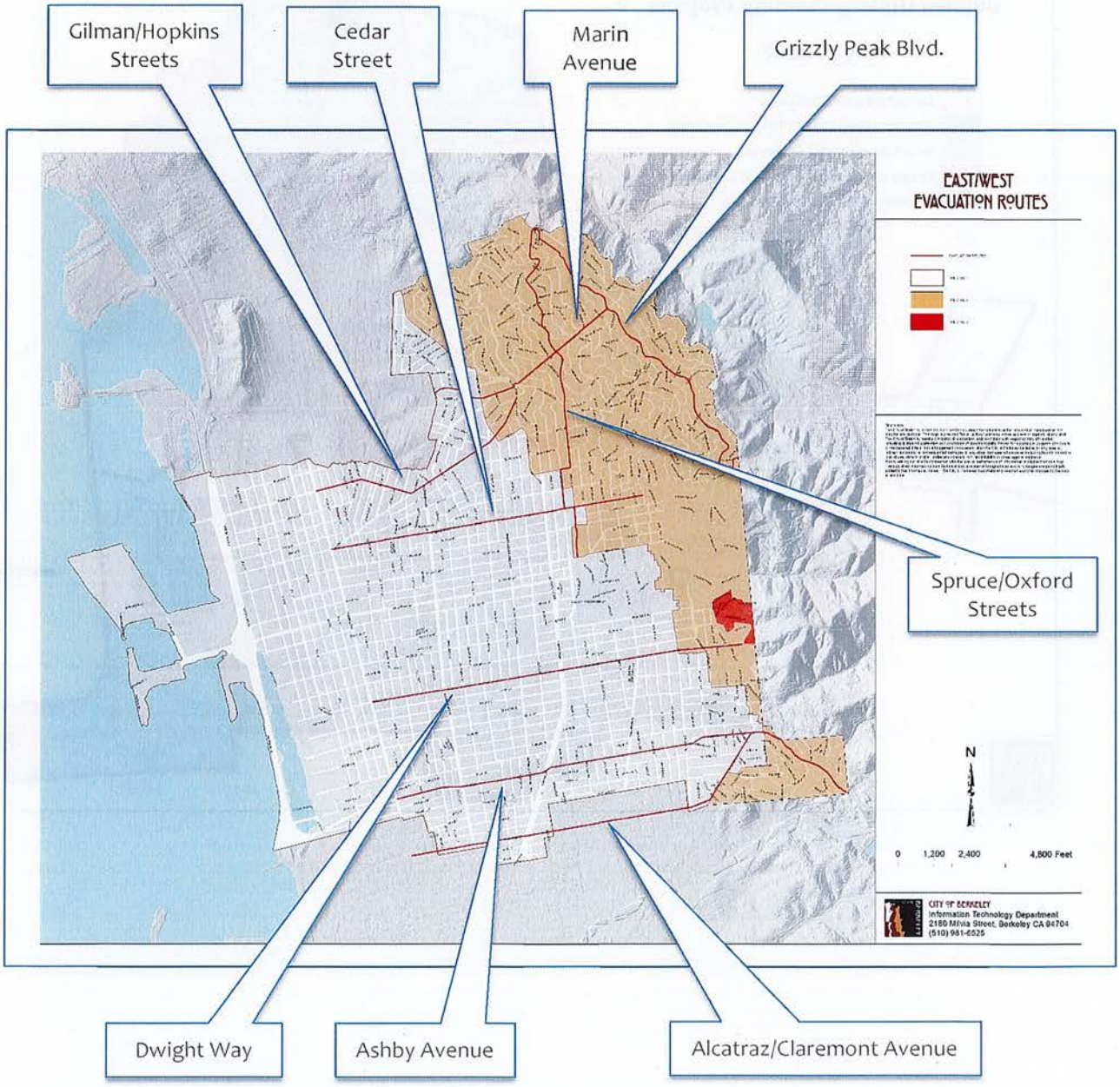
Representatives from Berkeley's Fire Department, Public Works Transportation Department and participating commissions met to review the critical evacuation routes in the City (see Figure 3). The evaluation included the following factors:

- Realize that a major wildland fire can affect all of Berkeley, just as the Tubbs Fire did in Santa Rosa.
- Consider the criticality of the routes for ingress and egress, including movement of people north/south and east/west.
- Review any barriers to the use of these routes, including width of street, capacity or blockages.
- Review the presence of overhead utility wires and the potential to underground them.

The routes selected for this study are shown on Figure 1. Other arterial and collector streets in Berkeley, such as University Avenue, Telegraph Avenue, Shattuck Avenue, Martin Luther King Jr Way

(part) and San Pablo Avenue are already undergrounded. The history of undergrounding in Berkeley goes back at least to the 1970's. Of the 25.6 miles of arterial streets, 12.5 miles have been undergrounded (49%). Of the 36.1 miles of collector streets, 11.3 miles have been undergrounded (31%). A map showing the undergrounding completed or scheduled to be completed in Berkeley is on Figure 2 and is in Appendix D.

Figure 1 – Undergrounding Along Major Evacuation Routes



The development of these undergrounding routes assumed that those avoiding a major fire are leaving by vehicle to get to I-80. This assumption depends on the severity and spread of the fire.

Other factors include people walking to get to shelter areas, vehicles driving to shelter areas instead of I-80 and leaving the area by travelling north or south.

Figure 2 – Undergrounded Streets in Berkeley

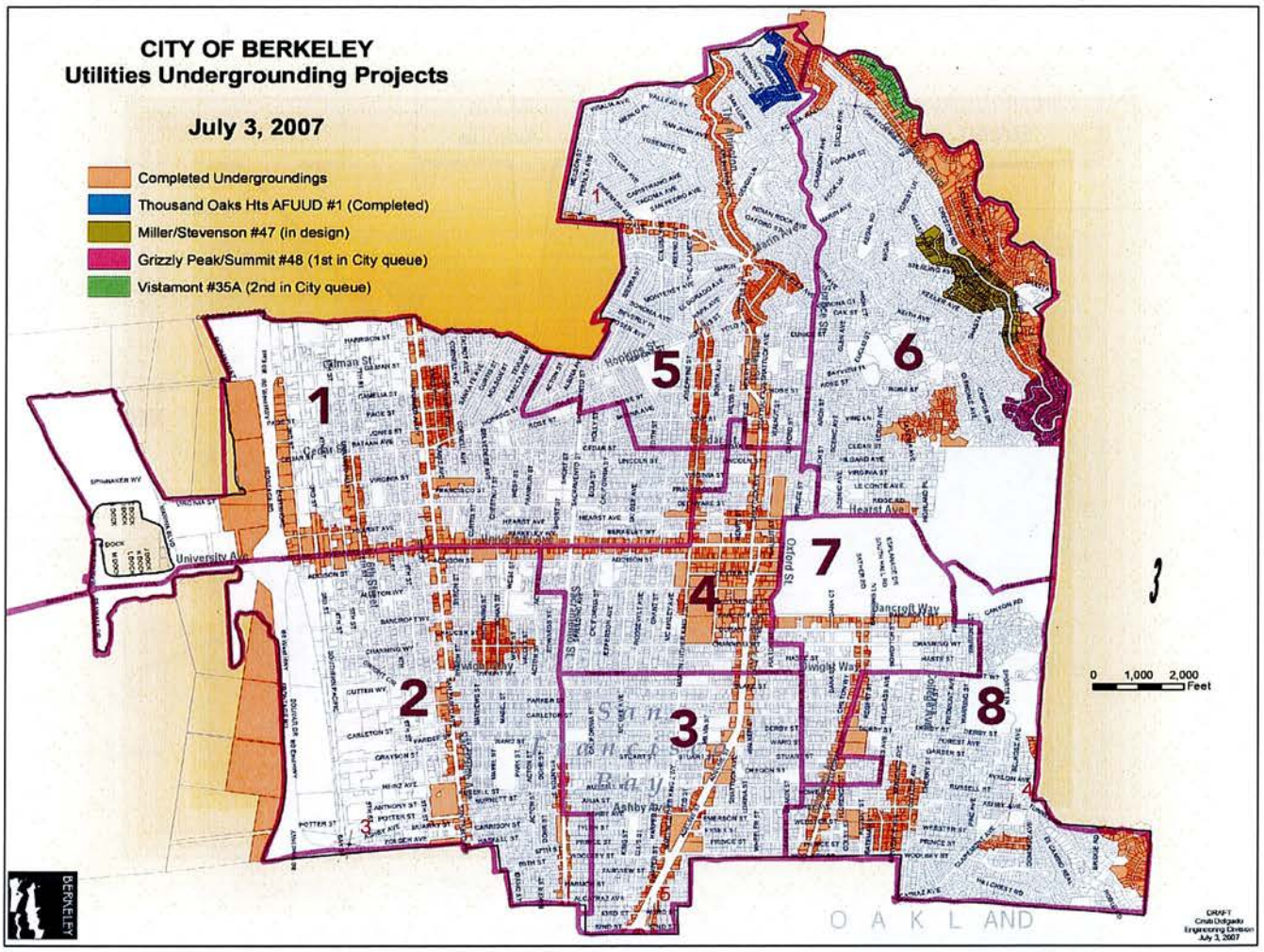
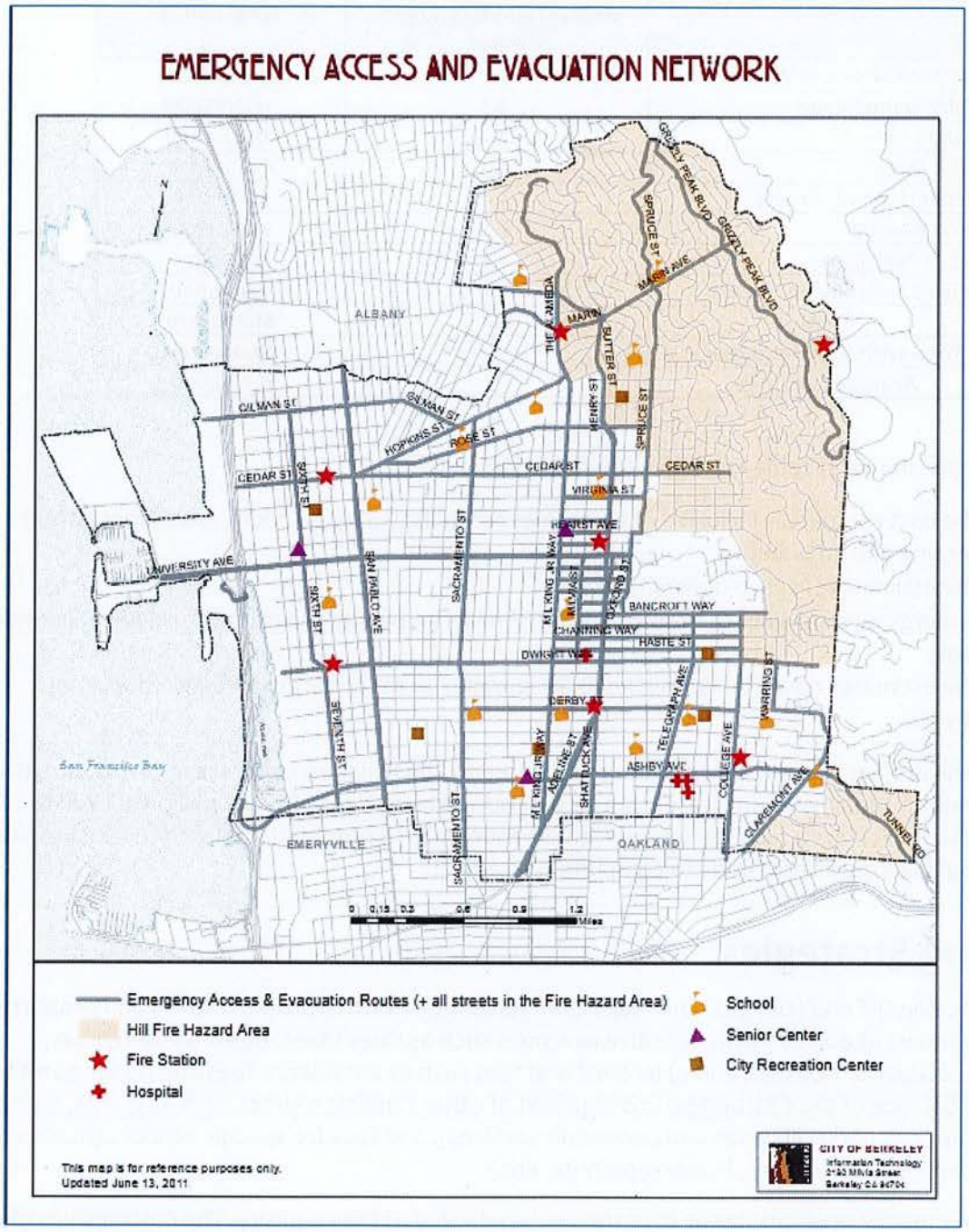


Figure 3 – Berkeley's emergency access and evacuation network



Estimated Cost of Undergrounding

The project team researched the cost of undergrounding from many sources. During Phase 1 of this study, an estimate was prepared by Harris and Associates. This was supplemented with the actual costs from Palo Alto, San Diego and published sources. The work scope of the Phase 3 study was to refine the cost estimates and the engineering firm Bellecci & Associates was retained to do the work. Their analysis is summarized on Table 1 and their report is included in Appendix E.

Table 1 – Estimated cost to underground overhead wires, in 2019 dollars

Street	Undergrounding length, miles	Total cost, $
Alcatraz/Claremont Avenues	2.3	9,400,000
Ashby/Tunnel Road	2.2	14,200,000
Dwight Way	2.7	16,400,000
Cedar Street	1.9	10,200,000
Gilman/Hopkins Streets	1.4	7,700,000
Marin Avenue	1.2	7,600,000
Grizzly Peak Blvd.	1.3	6,400,000
Spruce/Oxford/Rose Streets	2.1	9,900,000
Total	**15.1**	**81,800,000**
Total with 10% contingency		**90,000,000**
Average cost/mile		**6,000,000**

The estimate shown in Table 1 includes the following factors:

- The cost estimate is inclusive of trenching, conduits, wiring, service conversions, street lighting and engineering.
- The estimate is in 2019 dollars.
- Undergrounding all of the routes will be done as an overall program to achieve economies of scale.
- The estimates have considered levels of complexity for undergrounding in the various streets.

Because the project will take place over 15 years, due to construction cost escalation (4%/yr.), the cost of undergrounding will increase from $6.0 million/mile in FY2019 to ~$12 million in FY2038. Thus, it is important to select a funding source with revenue growth potential similar to the cost escalation to avoid having insufficient funds to complete the project.

Funding Strategies

The City's General Fund (GF) gets the majority of its money from: a) property taxes and property-based revenues; b) economically sensitive revenues such as sales taxes, business license tax, transient occupancy tax, etc.; and c) interest and fees such as ambulance fees and parking and traffic fines. The balance of the City budget is comprised of other funding sources such as grants, special tax revenue (e.g. parks, libraries and paramedic services), and fees for specific services (marina berth fees, garbage and sewer fees, building permits, etc.).

California property taxes are set at 1% of the assessed value of the property. The City receives about a third of every property tax dollar collected in Berkeley and schools get 43% of every property tax dollar. Sales tax is 9.25 cents of every dollar and the City gets 1.00 cent. Other potential sources of revenue are General Obligation (GO) Bonds and Revenue bonds. In June of 2019, Moody's Rating Agency upgraded the City's GO bonds from Aa2 to Aa1, which is the 2nd highest for long-term debt. In its credit analysis report, Moody's stated that "*The City of Berkeley, CA (AA1) has a robust tax base and economy benefiting from its central Bay Area location. The city's assessed valuation (AV) is large and growing, supported by strong resident wealth indicators. The city has a very strong fiscal position, with growing revenues, high available fund balances and strong financial management policies and practices.*

The city's debt level is moderately low, but the unfunded pension liability is high, which the city is proactively addressing through establishing and funding an irrevocable pension trust."

In summary, Berkeley has an exceptionally strong tax base and its economy benefits from its central Bay Area location. The City has a very strong financial profile, and in the last six years has significantly improved its reserve levels and liquidity.

Financing Options for Undergrounding

Rule 20 Funding

The California Public Utilities Commission (CPUC)'s Tariff Rule 20 is the vehicle for the implementation of underground programs. Rule 20 provides three levels, A, B, and C, of progressively diminishing ratepayer funding for the projects. There is also rule 20D adopted in 2014, which currently applies only to San Diego for undergrounding and other fire hardening techniques in their designated Very High Hazard Fire Zone. Under Rule 20, the CPUC requires the utility to allocate a certain amount of money each year for conversion projects. Upon completion of an undergrounding project, the utility records its cost in its electric plant account for inclusion in its rate base. Then the CPUC authorizes the utility to recover the cost from ratepayers until the project is fully depreciated. Rule 20 requires the utility to reallocate funds to communities having active undergrounding programs in amounts initially allocated to other municipalities but not spent. Cities may also commit to future 20A allocations for five years. The following table is a summary of the Rule 20 categories.

Table 2 -- Summary of Rule 20 Categories and Ratepayer Contribution

Rule 20 categories	California Ratepayer Contribution	Applicability
20 A	About 100%	Primarily ratepayer financed
20B	20%	Shared ratepayer and homeowner financed
20C	Minimal	Primarily homeowner financed
20D	About 80%	Used by San Diego Gas & Electric

Two existing Rule 20A funded undergrounding districts, formed in the early 1990s, are scheduled for completion in 2020 and 2025 respectively.

- Berkeley Grizzly Peak Summit, UUD #48 – in the engineering phase
- Berkeley Vistamont, UUD#35A - in the planning phase

Both undergrounding districts have paid their share for connection from the street to service boxes and for street light replacement.

Rule 20A is the preferred option for cities because the utility pays almost all of the cost for undergrounding. Unfortunately, the funds available are very small compared to the costs of undergrounding. Berkeley's current Rule 20A allotment is ~$0.53 million/year. The account balance as of June 30, 2019 was $9,009,455. Most of this, if not all of it, will be used on the UUD #48 project. A 5-year borrow amounts to about $2.6 million.

For most cities, the annual 20A allotment is inadequate to sustain an ongoing undergrounding program. Because cities and counties are able to trade or sell unallocated Rule 20A credits, some

cities selling their unused credits at a substantial discount. A recent proposal by CPUC staff is recommending discontinuation of selling or trading of unused credits. See Appendix G for this and other reforms and enhancements proposed by the CPUC staff. This was in response to a CPUC Order Instituting Rule Making issued by the CPUC in May 2017 as well as the recent audit of PG&E's Rule 20 performance.

The City rolled out 20B project guidelines in 2000 for neighborhoods interested in forming Rule 20B districts. Although many neighborhoods have expressed interest and continue to do so, one neighborhood, Thousand Oaks Heights, formed and completed an undergrounding district. In recent years, there has been a significant increase in neighborhood interest in both 20A and 20B utility undergrounding projects. A good source of information on recent neighborhood efforts can be obtained from Berkeley Citizens for Utility Undergrounding. Their website is: www.berkeleyundergrounding.com

Eleven Cities in California are leading the appeal to the CPUC to redefine eligibility for 20A funds to include and increase 20A fund allocations to communities in California's Very High Hazard Severity Fire Zones for the express purpose of fire safety. A supporting resolution was presented by the League of California Cities at their annual conference in October 2019. The League took no action on the resolution and sent it back to the Committee on Environment for further review. Despite this action, the League continues to lobby the CPUC. At its January 24, 2020 meeting, the Environmental Quality Policy Committee of the League of California Cities endorsed a proposal to revise Rule 20, specifically for hazardous fire areas.

Utility User Tax, Sales Tax or Parcel Tax Funding

Another strategy for funding undergrounding projects would be the adoption of a local sales tax, an increase in the Utility User's Tax (UUT) or a Parcel Tax that would be dedicated to funding utility undergrounding projects. All three would be a "special tax" as defined by Proposition 218 and Proposition 26 and require a 2/3 voter approval for adoption.

1. **Utility Users Tax**
   The UUT is the 4th largest source of GF revenue for the City of Berkeley. The annual revenue has been stable between $12 and $15 million over the last two decades. See Figure 4. The UUT is charged at a rate of 7.5% to all users of a given utility (electricity, gas, telephone, cable, and cellular), other than the corporation providing the utility. The tax is not applicable to State, County, or City agencies, or to insurance companies and banks. About 60% of the UUT revenues are generated from gas and electric services and about 40% from telecommunications.

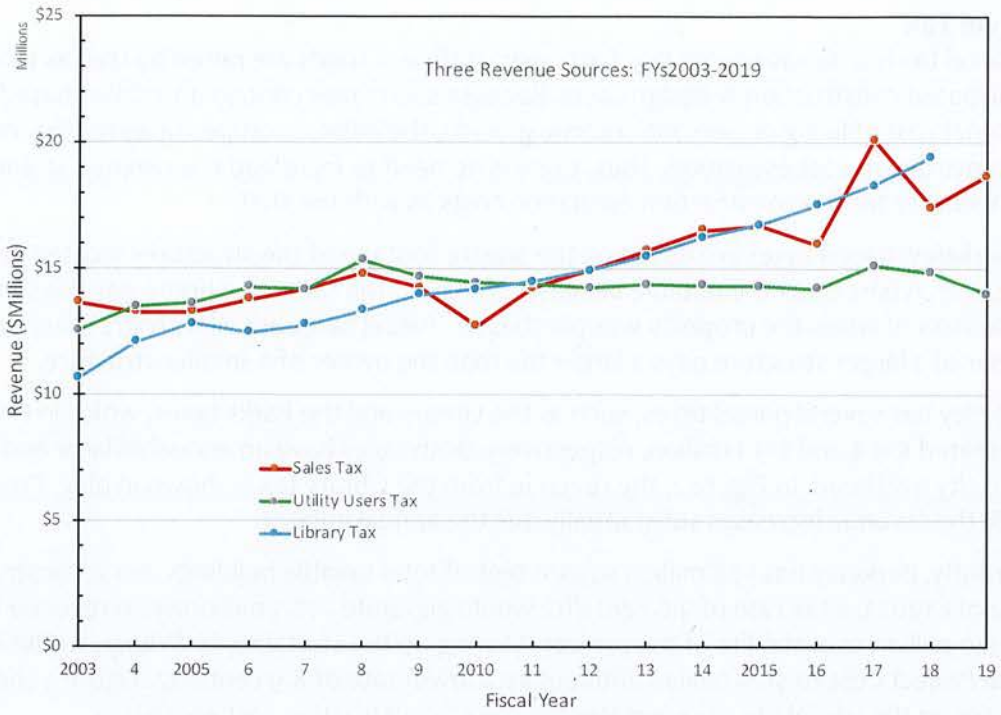


Figure 4 – Revenue from the UUT, Sales Tax, and the Library Tax for FY2003 - 2019

Because the UUT is a tax on utilities, it has an obvious nexus with undergrounding. While the 7.5% tax rate has not increased in two decades, it has little potential for future growth and has recently decreased by ~$1 million. Thus, the UUT would have to be increased by ~4.5% percentage points to cover the substantial construction cost escalation (4%/yr.) over the lifetime of the undergrounding. A 4.5% increase would generate additional revenue of ~$9.0-million/yr., which is required to cover the total project cost of $139 million. See Table 3.

Table 3 – Existing and Potential New Revenue from UUT

UUT	7.5%	12.0%
Revenue ($millions)	$15	$24
Additional Revenue ($millions)	0	$9

2. Sales Tax

The total sales tax rate for Alameda County is currently 9.25% and Berkeley receives 1.00%. Over the last twenty years, the sales tax revenue has increased from about $14 million in 2000 to ~$18 million in 2019. If Berkeley were to increase its sales tax rate from 1.0 to 1.5%, additional revenue of ~$8.5 million/year could be generated that is sufficient to finance the undergrounding of utilities along emergency exit routes. Furthermore, its 3% annual growth over the last decade, if continued, would compensate expected construction cost escalation. After some discussion with the Subcommittee, this option was not pursued due to concerns that a sales tax is regressive.

3. Parcel Tax

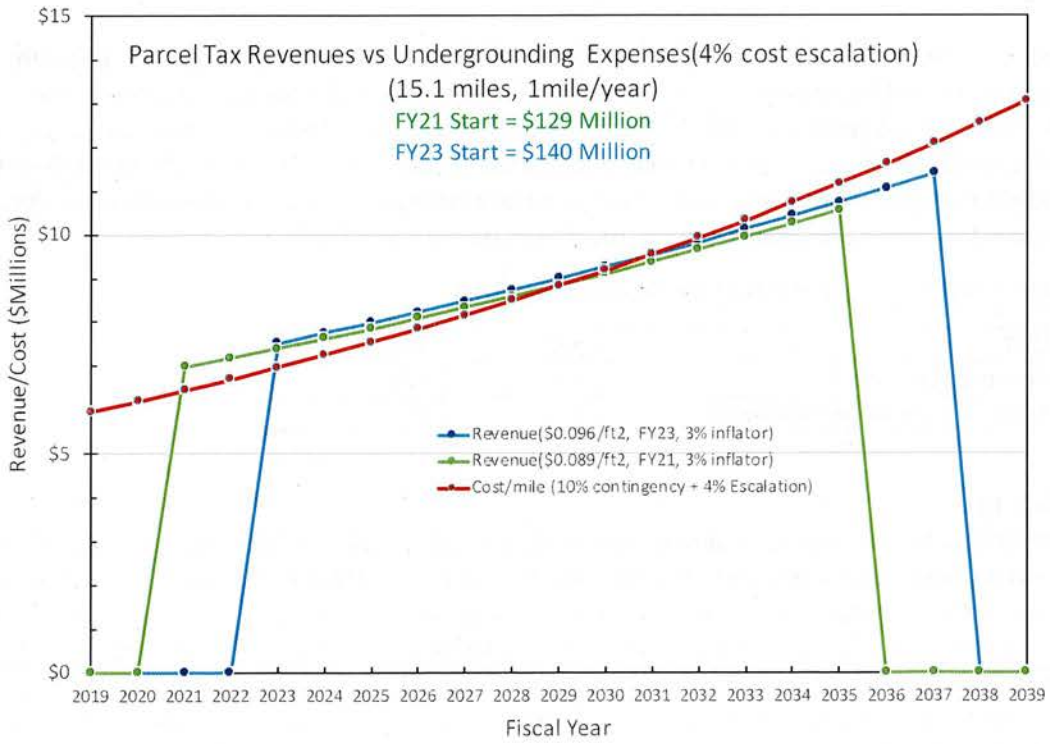
A parcel tax is a pay-as-you go tax. Each year, sufficient funds are raised by the tax to cover the anticipated construction & design costs. Because such taxes contain an inflator based on the regional cost of living or personal income growth, the inflator compensates for the increases due to construction cost escalation. Thus, there is no need to frontload the revenue stream to compensate for the construction escalation costs as with the UUT.

In Berkeley, parcel taxes are based on the square footage of the structures located on the property. A parcel tax is equitable because owners of the same size home pay the same amount regardless of when the property was purchased. Parcel taxes are also progressive, since the owner of a larger structure pays a larger tax than the owner of a smaller structure.

Berkeley has several parcel taxes, such as the Library and the Parks taxes, which in FY2018 generated $19.4 and $13.1 million, respectively. Both taxes have an annual inflator and are exempt from city overhead. In Figure 2, the revenue from the Library tax is shown in blue. From 2003 to 2018, the revenue increases substantially due the annual inflator.

Currently, Berkeley has ~78 million square feet of total taxable buildings. For a construction start date of FY2023, a tax rate of 9.6 cents/ft2 would generate ~$7.5 million/yr. in revenue for a total of $140 million over the life of the project. Moving up the start date to FY2021, would decrease Total Project Cost to $129 million and require a lower rate of 8.9 cents/ft2. Figure 5 shows how 3% inflator on the parcel tax compensates for the 4% construction cost escalation.

Figure 5 – Parcel tax revenue vs. undergrounding expenses



Franchise Fee Funding

Cable and electric & gas companies pay the City a franchise fee to use the public right-of-way. In 2018 franchise fees totaled ~$2.0 million and are projected to increase slightly to $2.1 million by 2021. The rate of the franchise fees is fixed by state law and cannot be changed by the City.

Currently, franchise fees accrue to the General Fund. However, as stated in the Moody's Rating Agency Report, the City's ration of General Fund operating revenues to expenses is a strong 1.08 times. The City ended fiscal 2019 with general fund available balance of $93 million or a very strong 46% of general fund revenue. This followed a $9 million surplus for the year, resulting from strong revenue growth and strong expenditure management.

Since franchise fees are generated by private utilities that utilize the public right-of-way, it would be appropriate to consider assigning these funds to a public right-of-way account to finance revenue bonds for undergrounding utilities.

Unlike the City of Berkeley, Santa Barbara imposed a 1% franchise fee on its electric provider, after Proposition 13 had passed and before Propositions' 26 and 218 were passed. In 1999, Santa Barbara increased that fee to 2%. In 2001, the City of San Diego increased its franchise fee and imposed a franchise surcharge to pay for undergrounding its residential streets. These costs were then passed on to the utility users by the utility providers.

Santa Barbara was sued by a local businessman who argued that the imposition of this additional fee was an illegal tax because, contrary to Proposition 218, it was imposed without voter approval. A similar lawsuit was filed against San Diego whose surcharge fee was specifically earmarked for undergrounding residential streets, had an end date of 2065 and a provision that what was not spent in any given year would be deposited in the city's General Fund.

The trial court accepted the City of Santa Barbara's argument that the franchise fee increase was not a tax as defined by Propositions 26 and 218. This decision was later overturned by an Appeals Court but a California Supreme Court decision in June 2017 ruled in favor of Santa Barbara. The decision was based on Proposition 13 law which preceded Propositions 26 and 218. The decision is briefly summarized as follows:

- Fees for use of government property are not taxes requiring voter approval as the fee payor gets something of value in return
- Such fees generate discretionary (General Fund) revenues to be used for any lawful purpose of the agency
- Standing to challenge a revenue measure is limited to those having a legal duty to pay it
- Fees must not exceed any reasonable value of the franchise but be reasonably relating to the value of the franchise
- The 2% franchise fee imposed by the municipality on Southern California Edison must recover cost of fee only from customers in the city imposing the fee and shown as a separate line item on the utility billing statement

The lawsuit filed against the City of San Diego alleging that the surcharge was an illegal tax imposed by the City without voter approval was dismissed by a Superior Court judge in August 2018, who agreed with the City that the surcharge is a fee paid to the City in exchange for the right to use the City's electric infrastructure.

General Obligation Bond Funding

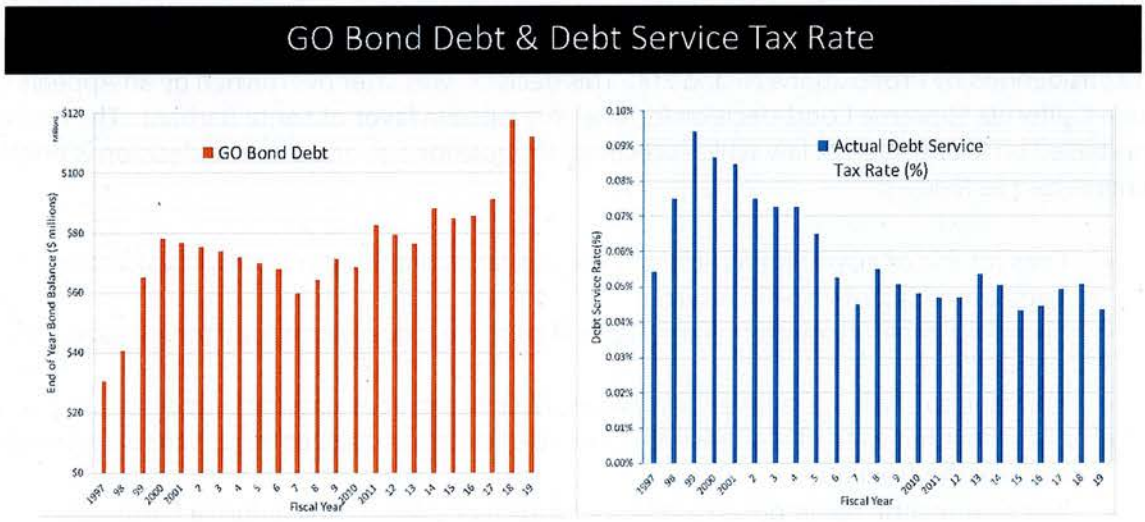
From 1997 to 2000, the City increased its General Obligation (GO) bond debt from $30 million to $80 million. However, due to a strong increase in total property assessed values (AVs), the debt-service rate only doubled from 0.05% to 0.09%. Moreover, during the next six years, the debt-service rate decreased back to ~0.05%, as Berkeley's AVs continued to increase and bond principal was paid down.

After the Financial Crisis of 2008, interest rates fell dramatically. The City took advantage of the lower rates to refinance old debt and to issue new debt: Measures FF, M & T1. *From 2007 to 2019, the City doubled its bond debt, while keeping its debt service rate constant due to lower interest rates and the strong appreciation in* property *AVs.*

Because of Berkeley's robust tax base and strong economy, which benefits from its central Bay Area location, it should be able to issue additional GO bonds during the coming decade, while keeping the debt-service rates within the historic range.

Although Berkeley has additional bonding capacity, GO Bonds have several disadvantages for funding long-term-construction projects, where construction cost escalation is increasing by 4%/year. First, 85% GO bond funds must be spent within three years, requiring multiple tranches of bond funding, which makes the funding more sensitive to potential interest rate increases. Second, GO bond authorization must be approved by the voters for the total 15-year Project Cost of $140 million. Third the City will have to continue to pay substantial interest payments for ~25 years after the completion of the project.

Figure 6 -- GO Bond Debt & Debt Service Tax Rate for FYs1997-2019



Assessment District

Property assessments districts can be formed to provide certain services to property owners for a fee which is collected on the annual property tax bill. An example is Berkeley's Clean Storm Water fee, which was adopted in 1991, but never increased in the subsequent quarter century. Recently, a Prop 2018 process was used to increase the fee in 2018 to provide sufficient funding to ensure that clean, safe water is entering our creeks and the bay, and to prevent flooding. Assessment district fees can include an inflator to compensate for inflation and require a majority approval from the

voting property owners. Further development of this option requires support from a specialized consultant.

Recommended Financing Options for Berkeley

The project team has evaluated a wide range of funding options. We have considered the level of required funding, the number of years to carry out the undergrounding program, advantages and disadvantages of each option and equity issues. Due to the high probability that the City will experience either a major wildland fire and/or and major earthquake in the next two decades, we believe that it is important to complete the undergrounding of the emergency evacuation routes expeditiously. The Public Works Dept. believes that it has the capacity to design and construct about 1.0 miles of undergrounding per year. Thus, our goal is to provide sufficient financing to underground about 1.0 miles per year so that the evacuation routes can be completed in 15 years.

Table 4 – Summary of Funding Options

Funding Option	Approval Requirement	Who Pays	Fairness	Inflator	Funding Stability
Parcel Tax	High[1]	Property owners	High[3]	Yes	High[5]
Assessment District City wide	Medium[2]	Property owners	Medium	Yes	High
GO Bond	High	Property owners	Low[4]	No	Medium[6]
Utility Users Tax	High	All Utility bill payers	Medium	No	Medium[7]

[1]Requires a 2/3 approval in a general election
[2]Requires a 50% approval of the property owners in a Prop 2018 process
[3]Owners of the same size structure pay the same amount
[4]A GO bond is an ad valorem tax, where two homeowners with the same size house may pay substantially different amounts, depending on how long they have owned the property
[5]Parcel tax are collected annually via the property tax bill
[6]Since the GO bonds will be issued in several tranches over the 15-year project lifetime, interest rates may rise increasing the cost
[7]Since the UUT revenue has shown little growth, with a recent $1 million decline, it may not be able to cover the cost of construction escalation

The project team recommends the following ranking of the four financing options.

1. Place a parcel tax with an inflator, similar to the Library and Parks taxes, on the ballot to fund undergrounding. A parcel tax of 9.6 cents/ft2 will generate ~$7.5 million/yr. Although the approval threshold is high (2/3 of voters), a parcel tax is the most fair, since owners of the same size home pay the same tax amount. Includes an inflator and the funding is stable.
2. Create an Assessment District for Utility Undergrounding, similar to the City's recent Prop 218 Street Lighting & Storm Sewer. Although the approval threshold is lower for a Prop. 2018 fee, there are unanswered legal questions on the required nexus with the service provided.

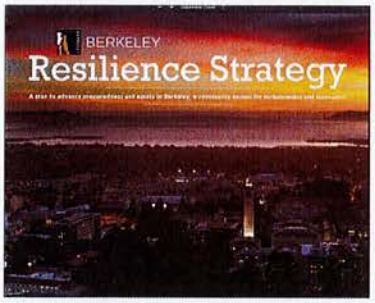
3. Place a GO bond on the ballot to authorize $140 million to fund the emergency evacuation routes. The approval threshold is high and Ad Valorem taxes are less fair due to Prop 13 restrictions. In addition, since different tranches of bonds would have to be issued over the lifetime of the project, interest rate could increase above the current low rates.
4. Increase the Utility User Tax from 7.5% to 12.0% (increase of 4.5%). This will produce additional revenue of ~$9 million per year to fund the emergency evacuation routes. Since there is no inflator, a higher initial cost/yr. is require to compensate for construction cost inflation. Although the revenue from this tax has been stable over the last decade, it has recently decreased and could decrease further over the lifetime of the project.

Section 3
FRAMEWORK FOR BERKELEY'S INFRASTRUCTURE DEVELOPMENT

Understanding the big picture of Berkeley's current infrastructure condition and the framework for its future development is important and useful. As the Subcommittee has worked over the past five years in carrying out the Council referral, many initiatives are in development:

- Resilience Strategy
- Vision 2050
- We are in a time of transition in electric power delivery
- CPUC re-evaluation of Rule 20

Resilience Strategy



In 2014 the City of Berkeley, along with our neighboring cities of Oakland and San Francisco, was one of the first 32 cities selected to participate in 100 Resilient Cities (100RC)—Pioneered by The Rockefeller Foundation. 100RC helps cities around the world build resilience to the social, economic, and physical challenges of the 21st century. A city's resilience is defined by the ability of the individuals, institutions, businesses, and systems within the community to survive, adapt, and grow no matter what chronic stress or acute shock it experiences. A resilient city lives well in good times and bounces back quickly and strongly from hard times.

Building on existing efforts and with guidance from the Mayor, the City Council, and the community, the Berkeley Resilience Strategy identified six long-term goals and recommended specific short-term actions to help address some of Berkeley's most pressing challenges. Berkeley's interconnected resilience challenges are:

- Earthquakes
- Wildfires
- Climate change impacts – drought and flooding

The six goals are:

Goal 1: Build a connected and prepared community
Goal 2: Accelerate access to reliable and clean energy
Goal 3: Adapt to the changing climate
Goal 4: Advance racial equity
Goal 5: Excel at working together within City government to better serve the community
Goal 6: Build regional resilience

The Resilience Strategy report was completed in 2016.

Vision 2050

Mayor Arreguin launched the Vision 2050 initiative in 2018 – a long-term infrastructure plan to create a City that is resilient and sustainable for future generations. Berkeley, along with many older U.S. cities, is built on infrastructure that was designed and constructed before most of our residents were born. Much of the City's electrical system, streets, storm drains, sewers, and water lines date to the early decades of the 20th century.

Aging infrastructure is not only costly to maintain but it doesn't meet current or future requirements. This leaves the community vulnerable to unplanned failure and service interruptions. For residents, workers and businesses trying to go about their daily lives, this can translate to unsafe conditions, unexpected costs, and inequity between neighborhoods.

Vision 2050 looks forward, over the next 30 years, to encourage long-term planning to begin to meet the serious challenges to our infrastructure - including climate change, inequality, population increases and obsolescence. It is meant to move beyond business-as-usual and accelerate the building of climate-smart, technologically-advanced, integrated, and efficient infrastructure in Berkeley.

The concepts coming out of the Vision 2050 process include:

- **Plan for environmental impacts** – Our City has declared a Climate Emergency. According to the 4th California Climate Assessment, new climate conditions will lead to more frequent major fires and intense precipitation events, reduce our air quality and regional biodiversity, and gradually flood the coastal highways, parks and neighborhoods along the shoreline.
- **Incorporate technology advances** – Technological change is affecting the way we use the City's infrastructure and is challenging the ability of existing infrastructure to meet future needs. The City should plan for new trends in technology and actively seek to incorporate new technologies that are sustainable and resilient.
- **Provide quality of life benefits** – All decisions made in infrastructure planning must include how they will impact the community's quality of life, today and in the future. This includes public safety, clean air, open spaces, serving diverse populations and other factors.
- **Ensure integrated and balanced planning** – Planning for infrastructure should not be done in isolation and should be integrated across City functions. It also needs to be adaptive to changes that will most certainly occur.
- **Manage infrastructure from cradle to grave** – Managing our infrastructure should start with a structured Master Planning process for all infrastructure systems. It should continue with an Asset Management system that forecasts the needs for maintenance and replacement. The goal is the have infrastructure provide effective and efficient service throughout its service life.

A Time of Transition

We are in a time of change and uncertainty in planning for our future infrastructure. The issues that are relevant to planning for electrical distribution systems include the following.

- **Climate emergency** – Berkeley has declared a climate emergency. The two main approaches to address the emergency are to: a) reduce our use of gas-powered vehicles and to increase the use of public transit, biking and walking, and b) to electrify our homes and business and to use clean electrical energy. This trend places a higher need for reliable electric distribution.
- **Interest in micro-grids** – With PG&E's Public Safety Shutoff Program, there is increasing interest in the use of micro-grids to increase our resiliency. These systems also use solar power and will reduce our dependence on the "grid".
- **Broadband development** – We are living in a connected world of high-speed information transfer. Many of the telecom companies are placing more wires on existing old poles. There is a need to have these systems be reliable and resilient in a major disaster.
- **Uncertainty of PG&E's future** – PG&E is in bankruptcy and there are uncertainties of how the company will be structured in the future.
- **CPUC Energy Division's staff proposal for Rule 20 program reform and enhancements** – The California Public Utilities Commission (CPUC) hired a consulting company to audit the PG&E Rule 20A undergrounding program. The firm, AzP Consulting, LLC, issued a final report in October 2019. The CPUC's Energy Division staff issued a report "Staff Proposal for Rule 20 Program Reform and Enhancements" in February 2020. The report is included in Appendix G. A summary of staff's recommendations are as follows:

  • ***Refine and Expand the Rule 20 Public Interest Criteria****: This will consist of refinements to the existing criteria for Rule 20A and the addition of new criteria based on safety and reliability concerns, such as if the street serves as an egress, ingress, or is designated as an evacuation route, and if the overhead facilities cross through Tier 2 or Tier 3 areas of the State's High Fire Threat District (HFTD). These criteria would be applicable towards a Rule 20A sunset phase and a modified Rule 20B program should either come into fruition.*

  • ***Modify Rule 20B to Incorporate Tiered Ratepayer Contributions Commensurate with Public Benefits****: The CPUC should utilize a three-tiered Rule 20B program with higher portions of ratepayer contribution commensurate with greater public benefits and public policy objectives. The three tiers are: - Tier 1 – 20% Ratepayer contribution – Meets existing Rule 20B criteria. - Tier 2 – 30 % Ratepayer contribution – Meets Tier 1 criteria and one or more of the expanded public interest criteria of this staff proposal, including wildfire safety mitigation. - Tier 3 – 50% Ratepayer contribution – Meets Tier 2 criteria and one or more equity criteria.*

  • ***Sunset the Rule 20A and 20D Programs as Currently Designed****: The existing allocation-based Rule 20A and Rule 20D programs should be sunsetted over a 10-year period and either be replaced with the modified Rule 20 B program, other new programs or be terminated.*

  • ***Incentivize Municipal Utility Surcharge Undergrounding Programs****: The CPUC encourages governmental bodies to pursue self-taxation programs in collaboration with their local utilities and Staff proposes for the utilities to provide municipalities matching funds of up to $5 million per year per participating community. An example of such a program is the City of San Diego's utility surcharge program (see page 10) which has accelerated undergrounding in San Diego. The CPUC does not oversee this type of program but can authorize the utility to collect the franchise fee through rates that goes directly to funding the undergrounding.*

- ***Eliminate Work Credit Trading with Limited Exceptions**: The CPUC should prohibit the trading of work credits and review all utility requests to apply additional Rule 20A work credits to a project that has insufficient funds. The limited exceptions are to allow intra-county non-monetary transfers from a county government to cities and towns within the county and to allow credit pooling amongst R.17-05-010 ALJ/EW2/nd3 11 / 103 Undergrounding Proceeding (R.17-05-010) Staff Proposal 9 two or more adjoining municipalities for a project with community benefit.*

- ***Modify the Rule 20A Annual Completion and Allocation Reports**: The utilities should provide more details to the CPUC, communities and the public regarding the projects that are underway, cost breakdowns for projects, project cost trends, performance metrics, and modify the summary statistics. Additionally, the utilities' allocation reports should include how the utilities derive the allocations from the general rate case and the allocation formula in the Rule 20A Tariff.*

- ***Adopt an Updated Rule 20 Guidebook**: The utilities should meet and confer with the League of California Cities, the California State Association of Counties, AT&T and the CPUC Staff to draft an updated version of the Rule 20 Guidebook that would be subject to CPUC review prior to its formal adoption and circulation among the cities and counties.*

- ***Improve Communications with the Communities and Publish Relevant Rule 20 Program Information, Documents and Reports Online**: New utility program communication strategies should include annual meetings with interested cities and counties to discuss their ten-year plans for undergrounding. The utilities should coordinate more closely with the communities and the broader public to enhance transparency and allow them public to have a greater voice in the planning process for projects. Staff also recommends publishing the relevant Rule 20A program information and reports online on dedicated utility and CPUC undergrounding webpages to enhance the public's access to information about the Rule 20 program.*

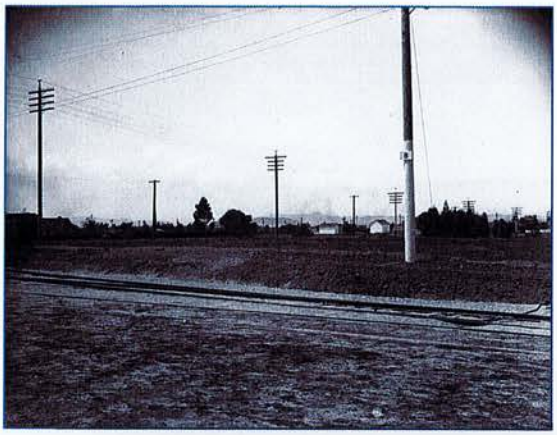
- ***Implement Incentives to Reduce Project Completion Timelines and Costs**: These new incentives would include requiring the communities to serve as the default project lead, establishing threshold timeframes for project milestones, and delineating all Task and Cost Responsibilities in updated guidance documents.*

There are also other changes to those mentioned above.

What is the Broader Context for Undergrounding?

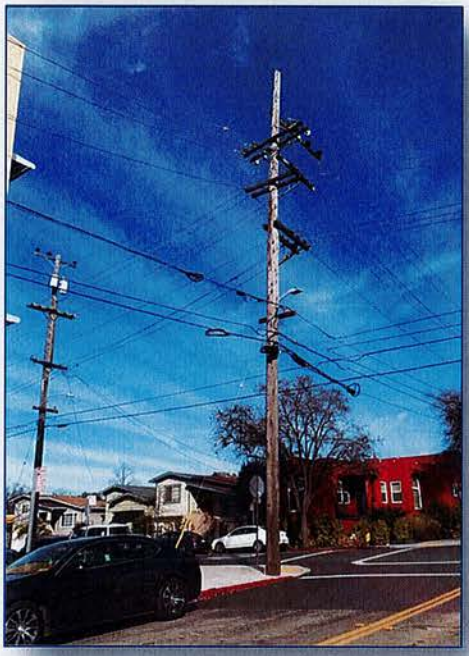
What does this broader context mean to this study on undergrounding? The Resilience Strategy and Vision 2050 initiative is leading us to "*move beyond business-as-usual and accelerate the building of climate-smart, technologically-advanced, integrated, and efficient infrastructure in Berkeley*". This is planning for the future.

The use of wooden poles dates back to the 1840's when the telegraph system was developed. The adjacent pictures shows wooden poles on Addison Street in Berkeley in 1885 and in 2020. A history of the wooden utility pole, prepared by the CPUC, is included in Appendix F.



The context is that Berkeley needs reliable, resilient infrastructure systems for the future and to not rely on old infrastructure concepts. The amount of wires on poles have increased dramatically. Converting to undergrounded systems supports Berkeley to do the following:

- Meet our climate action goals with reliable electrical distribution.
- Add to our quality of life, including public safety.
- Support broadband expansion and other integrated needs in our public right of way.
- Use new technology.



Section 4
PROGRAM RECOMMENDATIONS

This section presents the Subcommittee's recommended undergrounding program. After five years of research and study and considering the bigger picture of infrastructure development in Berkeley, we are presenting a long-term vision for utility undergrounding.

A Long-term Vision for Undergrounding in Berkeley

The use of wooden poles and overhead electrical wires is a technology used for over 150 years. New cities and developments have their utilities underground. This is the same with advanced countries, such as in much of Europe. The future direction stated in the Resilience Strategy and Vision 2050 calls for infrastructure that is climate-smart, technologically-advanced, integrated, and efficient. With that context, we propose the following long-term vision for undergrounding in Berkeley.

Undergrounding Development Phase	Timeframe, year	Description
Previous work	1970's – present	49% of arterial streets and 31% of collector streets are already undergrounded.
Near term	2020 - 2040	Underground key evacuation routes as described in this report. The work will be done is about 15 years.
Near term	2020 – continuing	Create and implement a Rule 20B program that includes a revolving fund to provide for upfront costs of proposed projects. Once a 20B project is approved by a vote of the parcel owners, the advanced upfront funds will be returned to the revolving fund.
Long term	2040 - 2070	Underground Berkeley citywide.

Program to Underground the Key Evacuation Routes

In response to the Council referral, Phase 4 is the implementation of a program to underground overhead utilities along key evacuation streets in Berkeley. We recommend the following program for Council consideration.

Recommend a 15-year Undergrounding Program

Considering the urgency to improve safety and the complex infrastructure conditions in Berkeley, we are recommending a 15-year program to underground the utilities along the key evacuation routes. To determine the priority of the streets to underground, we recommend preparing a set of criteria that will include the following:

- Coordination with Berkeley's Fire Department on their evacuation planning and safe passages analysis
- The time needed for coordination with Caltrans, PG&E, and telecom companies
- Dividing each street into manageable project lengths (approximately 1 mile each)
- Consider undergrounding the more complex and costly streets early in the program
- Coordinate with street paving and other utility work in the public right of way
- Undergrounding to benefit all Council districts
- Other criteria

The project team prepared the following preliminary priority list to illustrate a 15-year program.

Year	Street	Section	Council districts
1	Dwight Way	Fernwald Rd. to Shattuck Ave.	3, 4, 7, 8
2	Dwight Way	Shattuck Ave. to San Pablo Ave.	2, 3, 4
3	Marin Avenue	Tulare Ave. to Grizzly Peak Blvd.	5, 6
4	Grizzly Peak Blvd.	Spruce St. to Marin Ave.	6
5	Grizzly Peak Blvd.	Marin Ave. to Arcade Ave.	6
6	Ashby Ave., Tunnel Road	Vicente Rd to Telegraph Ave.	7, 8
7	Ashby Ave.	Telegraph Ave. to San Pablo Ave.	2, 3, 7
8	Cedar Street	La Loma Ave. to MLK Way	4, 5 6
9	Cedar Street	MLK Way to San Pablo Ave.	1, 5
10	Hopkins Street	Sutter St. to Gilman St.	5
11	Gilman Street	Gilman St. to San Pablo Ave.	1, 5
12	Spruce Street	Grizzly Peak Blvd. to Rose St.	5, 6
13	Rose Street, Oxford Street	Rose from Spruce to Oxford and Oxford from Rose to Cedar	5
14	Claremont Ave., Alcatraz Ave.	Ashby Ave. to Telegraph Ave.	8
15	Alcatraz Avenue	Telegraph Ave. to San Pablo Ave.	2, 3

This preliminary list has the following assumptions:

- The Fire Department has stated that Dwight Way is a high priority due to the risks in the Panoramic Hills area.
- Ashby Avenue will take significant time to coordinate the work with Caltrans.
- The work on Alcatraz Avenue is uncertain due to coordination with the City of Oakland.
- The street sections for specific projects are planned to be approximately 1 mile in length each.
- Undergrounding is planned only east of San Pablo Avenue. The cost estimates prepared by Bellecci & Associates includes undergrounding between San Pablo Avenue and I-80. We now consider those areas too far from the fire areas and those areas are subject to high groundwater levels. The total centerline length of streets to be undergrounded is now 15.1 miles and the total cost is about $90 million (in 2019 dollars).
- If we underground to San Pablo Avenue, the percentage of streets in the hills is 37% and in the flat lands is 63%.

Use a Program Approach

Research by the project team and information from Bellecci & Associates shows that it is important to develop an overall program approach to undergrounding. This is to promote cost effectiveness

and to achieve completion in a reasonable schedule. Upon authorization to proceed from Council, we recommend that a Program Plan be prepared that includes the following:

- Outcome objectives
- Project priorities, work scopes, budgets and schedules
- Program organization, staffing, consultants and resources needed
- Design criteria
- Coordination with utilities and telecom companies
- Change management process
- Reporting and oversight
- Other

Use "Dig Once" Approach

The undergrounding work should be coordinated with street paving, water lines, sewer lines and other utility work in the public right of way.

Opportunity exists to prepare streets for future undergrounding during regular routine paving or maintenance work. For example, clear routes for future underground cables can be drawn into present day plans, to avoid creating expensive future rerouting.

Significant opportunity exists to install empty City-owned conduit pipe, installed to published utility standards, in any full depth street reconstruction along a priority underground route. Such City owned empty conduit pipe would be left sealed at construction time, and later sold or traded for Rule 20A credits at the time of the undergrounding project. Extra conduit space would be available for sale to broadband providers or for use on City projects.

Community Engagement

Upon authorization from Council to proceed, a robust community engagement process shall be implemented. This shall include community workshops, methods for the public to submit questions, regular updates and other actions. Public input will be valuable in determining the priority and extent of undergrounding.

Section 5
RECOMMENDED NEXT STEPS

The Subcommittee recommends the following next steps for Council consideration.

1. Review this report and provide direction on whether to proceed with the Phase 4 program.
2. Work with the Council's Facilities, Infrastructure, Transportation, Environment, and Sustainability Policy Committee on further development of the undergrounding program.
3. Work with the Finance Department, the Council's Budget committee, and consultant support, to select the funding option.
4. Implement a public engagement process in 2020.
5. Staff to prepare a Program Plan for the Phase 4 undergrounding program.
6. Close out the original Council referral to the participating commissions. We recommend forming an Undergrounding Task Force to ensure public input in the future planning of utility undergrounding.

Appendix A

Baseline Study for the Development of a Utility Undergrounding Program by Harris & Associates

CITY OF BERKELEY

Baseline Study for the Development of a Utility Undergrounding Program

July 22, 2016

Prepared by:

Harris & Associates

Harris & Associates

Mr. Kenneth Emeziem
Senior Civil Engineer
City of Berkeley
1947 Center Street, 4th Floor
Berkeley, CA

Re: Baseline Study for the Development of a Utility Undergrounding Program – Final Submittal

Dear Mr. Emeziem:

The attached "Baseline Study for the Development of a Utility Undergrounding Program" incorporates the comments received from the commission and City staff. As the baseline, it occupies the starting point for the future studies and developing an undergrounding program with the goal of undergrounding all of the overhead utilities in the City of Berkeley.

From the study we identified that there are approximately 13.1 miles of Arterial and 24.8 miles of Collector streets remaining to be undergrounded. The estimated cost of undergrounding the total 37.9 miles is $134,800,000.

We are pleased to have provided this study and be a part of the City's goal to underground the City.

If you have any questions, please contact me at (925) 348-1098.

Sincerely,

Harris & Associates

Rocco Colicchia

Project Manager

Baseline Study for the Development of a Utility Undergrounding Program

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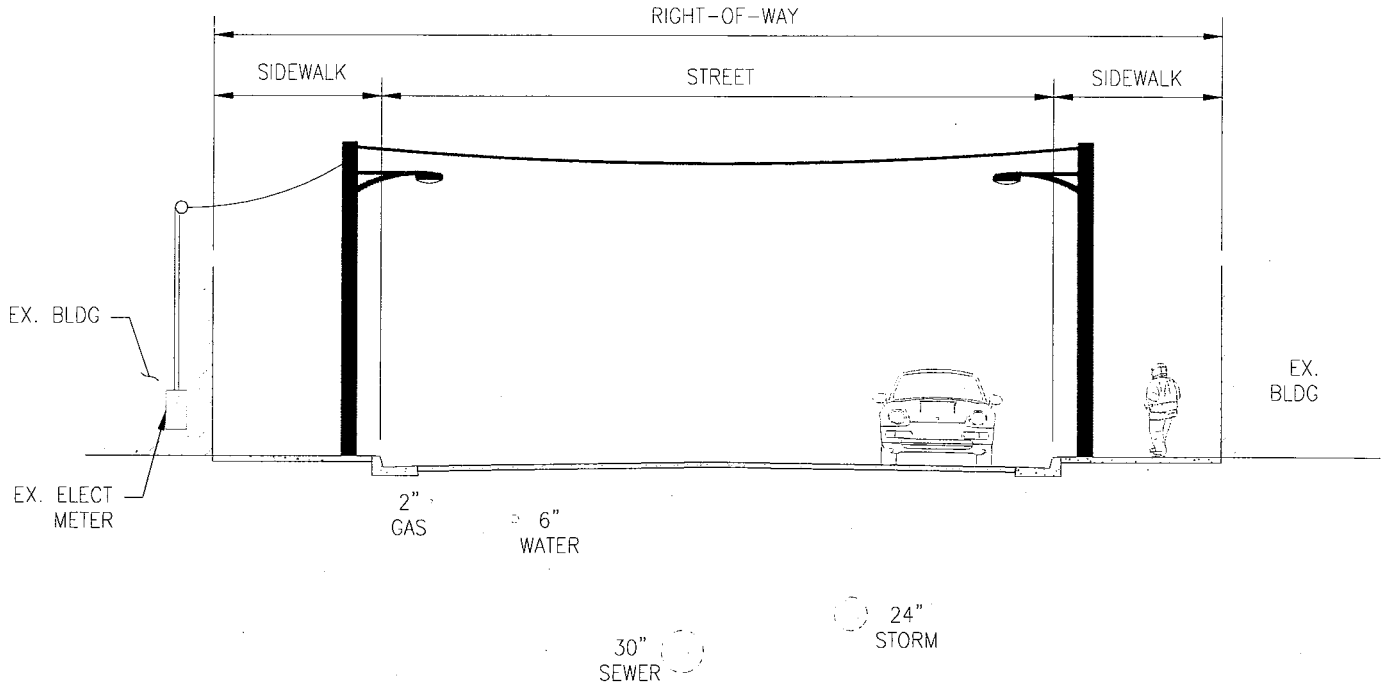
INTRODUCTION

Harris & Associates has been retained by the City of Berkeley to prepare this "Baseline Study for the Development of a Utility Undergrounding Program". This document will provide a starting point, as the City develops a plan to underground all of the overhead facilities in the City of Berkeley. This study includes identification of the streets to be undergrounded, high level costs and high level timing. Both costs and timing will be further developed in subsequent studies.

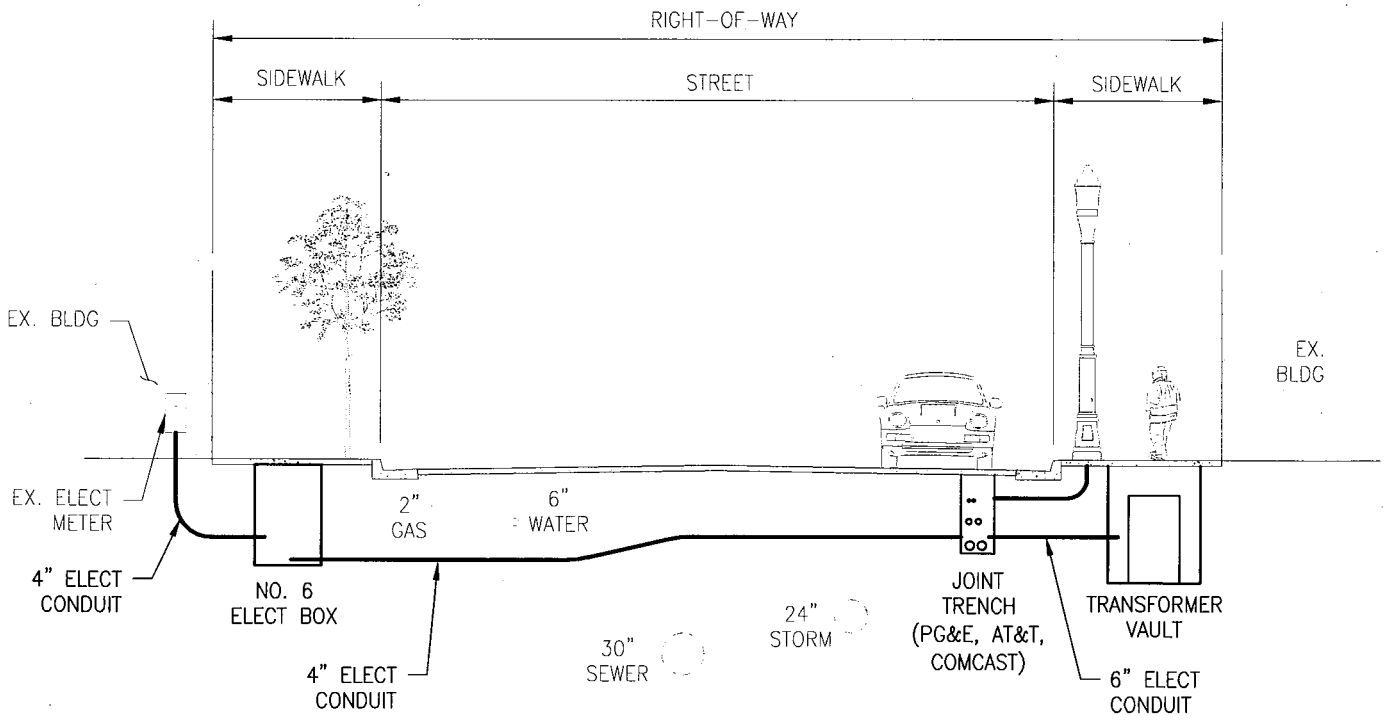
The City of Berkeley has been involved in utility undergrounding for many years. Most of the undergrounding projects within the City have relied on the provisions of electric Rule 20A and telephone Rule 32.1, to fund the undergrounding in various areas of the City. In addition, the City has also seen interest from property owners within specific neighborhoods who have worked together to fund the undergrounding of the existing overhead utilities within their neighborhood after submitting a petition to the City and agreeing to fund a majority of the costs of the undergrounding through the formation of an assessment district.

This study includes information we have developed and collected based upon our scope of work, and is intended to provide the baseline information and data needed as the City begins the development of a comprehensive citywide strategy for undergrounding the City's overhead utilities. The following items are included as part of this baseline study and help to describe the starting point for the undergrounding program:

1. A map showing the arterial and collector streets in Berkeley and current zoning. This information was taken from the city website. In addition, the map also shows those streets where the utilities have already been undergrounded. This map will become the basis for the underground plan.
2. A planning level estimate of the construction costs for utility undergrounding. These costs do not include the cost of undergrounding service on private property or the cost of the electric service panel conversion.
3. A description of Rule 20A, 20B, and 20C, and how those programs could be used to fund future utility undergrounding projects in the City.
4. An overview of other funding options that could be used, including a discussion of how other communities have funded their utility undergrounding programs, and the pros/cons of those approaches.
5. The current status of the City's Rule 20A funding and anticipated future contributions
6. The process of creating an underground district.
7. A review of emerging technologies and their impact on the cost of utility undergrounding programs.
8. A discussion of the pros and cons of undergrounding arterial and collector streets in non-residential areas.
9. The City's undergrounding history.
10. A "Diagram of a Typical Street Section"



BEFORE: STREET SECTION WITH OVERHEAD UTILITIES



AFTER: STREET SECTION WITH UNDERGROUND UTILITIES

NOTES:
1. LOCATIONS ASSUME ADEQUATE CLEARANCES
2. SHADED FACILITIES ARE EXISTING

FIGURE - 1

DIAGRAMS OF TYPICAL STREET SECTION SHOWING OVERHEAD AND UNDERGROUND FACILITIES IN COMMERCIAL AREA

SCALE: NTS

I. PROJECT OBJECTIVES

The City of Berkeley's City Council has requested that three commissions (Public Works, Disaster and Fire Safety, and Transportation) collaborate to develop a comprehensive funding plan to underground utilities along arterials and collector streets in Berkeley. The commissions shall work with Public Works staff and specialty consultants to draft a plan for the Council's consideration.

The goal of the City of Berkeley is improve public safety by undergrounding utility lines. Undergrounding minimizes the impacts of fallen electric lines and poles. Downed power lines can spark a serious fire, negatively affect power delivery to households for an extended period of time, impact the ability of persons to leave their homes and/or first responders to reach persons in need. Undergrounding increases the safety of residents while strengthening the infrastructure of the region's delivery of these utility services increasing reliability, all of which positively contributes to the capability of our community. Undergrounding increases pedestrian access and beautifies the streetscape.

The overall project objective is to develop a comprehensive plan to underground the overhead facilities in a manner that will provide the greatest benefit to all of Berkeley. This study is the first step in that effort. The following are some guiding principles for the project:

- The primary driver is to provide reliability of utility service and safety to Berkeley's residents in an emergency.
- The scope of the study shall be all of the City of Berkeley.
- Implementation of the plan shall be prioritized to the streets that will have the greatest benefit to all of Berkeley. These will be the arterial and collector streets.
- Learn from other cities that have studied and implemented programs to underground utilities.
- Incorporate new concepts (such as utility corridors) and work with various utility pole users (such as cable TV, power, telephone) to find cost effective solutions.
- Conduct the study in two phases to allow for effective decision making and use of resources.

II. ARTERIAL AND COLLECTOR STREET AND ZONING MAP

The first task in creating this study was to assemble the available information and create a map showing the streets that have already been undergrounded. The attached Arterial and Collector Street and Zoning Map (See Attachment 1 in Appendix 1) shows the streets that have been undergrounded and consolidates the information requested by the City.

The map shows all of the arterial and collector streets based on the City's Circulation Element, current zoning, and the streets that have already been undergrounded within Berkeley city boundaries. In order to identify the streets that have already been undergrounded, Harris utilized the history document provided by the City, reviewed streets on Google, and we obtained undergrounding information from PG&E. This information was then field verified for the arterial and collector streets in the areas zoned non-residential. The multi-colored hatched areas represent the street segments that have been utility

undergrounded. The residential streets located outside the arterial and collector street network that have been undergrounded were mapped and tabulated based on the available resources. The varying colors denote where or how the data was obtained. We have also shown the 2 upcoming underground utility districts (Grizzly Peak and Vistamont) in the residential areas that will be completed in the future.

The arterial and collector streets have been separated by residential and non-residential to aid in a future prioritization model.

III. PLANNING LEVEL ESTIMATE OF THE CONSTRUCTION COSTS OF UTILITY UNDERGROUNDING.

Table 1 below summarizes the costs tabulated in Attachment 2 (see Appendix 1) and shows the estimated lengths and percentages of the arterial and collector streets in the City of Berkeley that have been undergrounded and needs to be undergrounded. A list of residential streets that have been undergrounded based on data provided by the City has been added to Attachment 2. Residential streets shown in the residential zones (R and MUR) that have not been undergrounded were not included in Attachment 2, however, we estimated in the table below the percentage of residential streets to be undergrounded. Attachment 2 also includes" impact ratings", which were considered when determining the unit cost for undergrounding. The costs to install the private property trench and conduits, and the service panel conversions have not been included as well as costs for financing and engineering and construction management.

The impact ratings were based on a scale of 1 to 5 with 1= Low Impact to 5= High Impact. This rating represents a level of difficulty associated with utility undergrounding based on the existing conditions of the street layout and facilities. In the field, we looked at the impacts to sidewalk clearances, traffic volume, and utility density on the existing joint poles and assessed the 1 to 5 rating scale. Sidewalk impact rating was based on space availability for locating the proposed underground utility vaults, existing obstructions in the sidewalk and pedestrian traffic. Traffic volume impact rating was based on the number of vehicles using the street and estimate of traffic control that may be required during the utility trench construction. Utility density impact rating was based on the estimate of number of utilities that needed to be undergrounded and the quantity and quality (thickness and existing connectivity at poles) of the overhead wires.

The unit costs were based on current unit prices from utility underground projects that we have designed. We used typical bid items including trench excavation, pavement resurfacing, basic utility conduits for PG&E, AT&T, and Comcast, street lighting, traffic control and mobilization to calculate a base unit cost per foot for construction. The base unit cost was used as our baseline for medium level of difficulty streets. We then added and subtracted 30% to the baseline to establish the high and low level unit cost.

Our estimate produced a baseline of joint trench construction costs based on current bid unit costs. We assumed number of vaults and length of conduits needed for each utility, without actual designs from utility agencies, and added a 25% contingency. Field measurements were not taken at peak driving times, therefore, traffic volumes were estimated.

The estimate does not include trenching on private property, service conduits, service panel conversions, cost of financing, engineering, construction management, and street lighting.

Disclaimer: The impact ratings and costs were developed and gathered for the purpose of this report in order to produce a baseline of unit costs. The costs may change in future years due to inflation and also the fluctuation of oil prices that affect the cost of PVC conduit and asphalt material.

TABLE 1: Summary of Undergrounding Lengths and Costs

Arterial Streets	Length (Feet)	Length (Miles)	Estimated Cost	% Underground
Total arterial streets	135,095	25.6	N/A	N/A
Total arterial streets undergrounded	66,015	12.5	N/A	49%
Non-residential arterial streets to be undergrounded*	14,830	2.8	$11,380,000	11%
Residential arterial streets to be undergrounded**	54,250	10.3	$31,550,000	40%
Total arterial streets to be undergrounded	69,080	13.1	$42,930,000	51%
Collector Streets				
Total collector streets	190,460	36.1	N/A	N/A
Total collector streets undergrounded	59,660	11.3	N/A	31%
Non-residential collector streets to be undergrounded*	23,275	4.4	$15,100,000	12%
Residential collector streets to be undergrounded**	107,525	20.4	$76,770,000	57%
Total collector streets to be undergrounded	130,800	24.8	$91,870,000	69%
Residential Streets				
Total residential streets***	832, 666	157.7	N/A	N/A
Total residential streets undergrounded	57,267	10.8	N/A	7%
Total residential streets to be undergrounded	775,399	149.9	N/A	93%

* Non-residential includes Zones M, C-DMU, C, and SP

** Residential includes Zones MUR and R

*** Residential Streets include all non-arterial and non-collector streets falling in multiple zones

IV. FUNDING UTILITY UNDERGROUNDING PROJECTS

This section looks at the options available to the City and property owners for funding utility undergrounding projects. Some of the funding options may be limited in terms of the types of projects that can be funded, or require the approval of property owners or registered voters.

A.1 Rule 20A Funds

The California Public Utilities Commission (CPUC) and utility companies established a program to underground utilities across the State in 1967, commonly known as Rule 20. Rule 20 consists of three parts, A, B and C (for San Diego Gas & Electric ((SDG&E) there is also a D). Under Rule 20A, each utility company regulated by the Public Utilities Commission (PUC) allocates funds annually to each entity within its service boundaries to be used to convert existing overhead electrical facilities to underground electrical facilities within the community. Based upon the funds available each agency is able to prioritize undergrounding projects within their respective jurisdictions. Because of the high costs of most undergrounding projects, agencies must accumulate Rule 20A funds until they have accumulated the funds needed. Since a portion of the rates collected from all rate payers are used to fund the Rule 20A program, to qualify a project for Rule 20A funds, the City is required to:

- determine that the undergrounding of the existing overhead utilities will be in the public's interest,
- receive concurrence from utility that they have set aside or accumulated sufficient Rule 20A funds for the proposed undergrounding,
- create an Underground Utility District by City Ordinance which will require all property owners within the undergrounding district to convert their service connections to the undergrounded utilities at their expense, and
- meet at least one of the 4 criteria in the rate tariff to qualify for Rule 20A funds which include:
    1. the undergrounding will eliminate a heavy concentration of overhead facilities,
    2. the street to be undergrounded must be at least one block or 600 feet,
    3. the street is heavily travelled by pedestrian or vehicular traffic,
    4. the street adjoins a civic area, a recreation area or an area of unusual scenic interest, and/or
    5. The street is an arterial or collector in the General Plan.

The annual allocation of Rule 20A funds to agencies is based upon a formula, in the Rule, that compares the above ground facilities to underground facilities and the total number of overhead utility meters within the City in relationship to the total number of overhead utility meters within the utility's service area. The City of Berkeley is currently allocated approximately $533,000 per year for undergrounding of electrical services that are eligible for funding under Rule 20A. The City currently has a balance in its Rule 20A account of $6.4 million that could be used for undergrounding. In addition, the City can also "mortgage" up to 5 years of future Rule 20A allocations. Additionally, the City can "borrow" allocation from the County. The allocation can also be used to fund the installation of the service conduit up to 100 feet and the conversion of the electric service panel up to $1,500. Rule 20A allocations continue to be made by PG&E for projects that meet the criteria established in the Rule.

A.2 Other Financing Options under Rules 20B and 20C

Since the use of Rule 20A funds are limited to utility undergrounding projects typically along major roadways or other locations which provide a public benefit, Tariff Rule 20 includes two other options in addition to Tariff Rule 20A for financing utility undergrounding projects: Rules 20B and 20C.

Under Rule 20B, the utility is responsible for approximately 20 percent of undergrounding project costs (using rate payer revenues), and property owners and/or the local jurisdiction is responsible for 80 percent of costs. Under Rule 20C, projects are paid for entirely by property owners, with no utility (ratepayer) funds used, though the electric utility is still involved in the installation of the underground wiring. Undergrounding projects approved under these two options are still subject to CPUC regulations and project criteria.

Since a majority or all of the project costs are the responsibility of property owners under Rule 20B or 20C, most agencies work with property owners to create special tax or benefit assessment districts which allow bonds to be sold to fund the undergrounding projects and allow property owners to pay for the projects over a 20-30-year period. State law, either as part of the Government Code or the Streets & Highways Code, governs the rules for the formation of a special tax or benefit assessment district. The following provides a general description of the steps required for the formation of a benefit assessment or special tax district to fund utility undergrounding projects.

B. Funding sources to Supplement Rule 20A, B and C

Due to the high costs for undergrounding existing overhead utilities, most agencies work with property owners to establish a funding mechanism that will allow bonds to be sold and allow property owners to repay their financial obligation over a 20-25-year period. If a property is sold, the remaining financial obligation is the responsibility of the new property owner. The most commonly used funding mechanism by City's is the Municipal Improvement Act of 1913 or the Mello-Roos Act of 1982 as described below.

B.1 Municipal Improvement Act of 1913 (the "1913 Act")

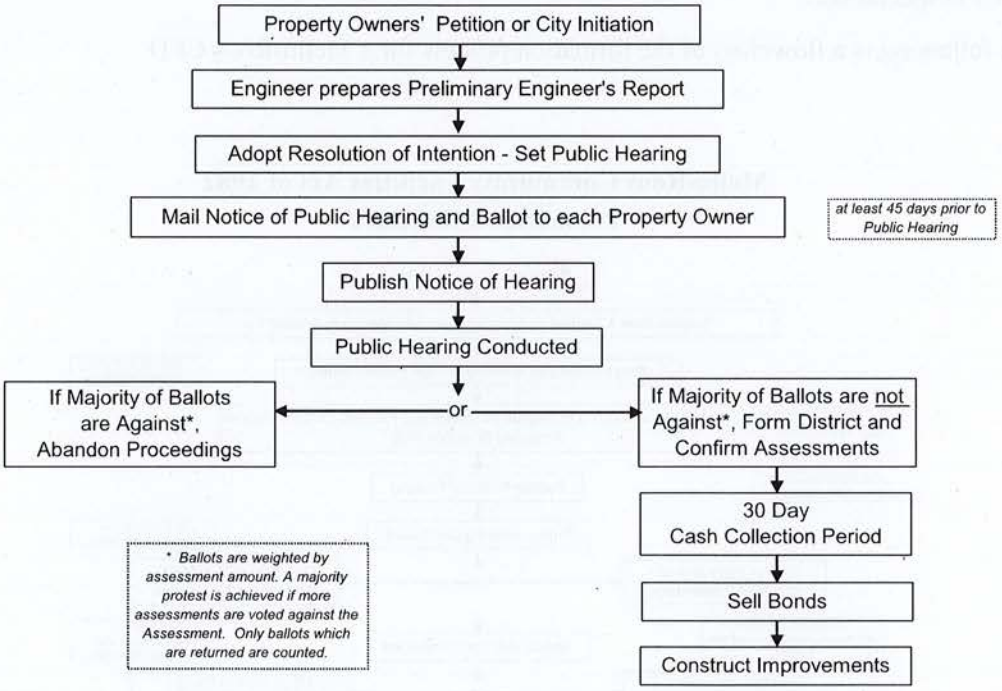
The 1913 Act has been used by many cities throughout the state working with property owners within the area to be undergrounded to create an assessment district to fund the non-utility portion of the costs for utility undergrounding. Under the 1913 Act, the City can fund the utility undergrounding project including the costs of design and other related project costs. The Act also authorizes the sale of bonds under the Improvement Bond Act of 1915 to allow repayment by property owners over an extended period (typically 20-25 years).

Formation of the assessment district is based upon the requirements of Proposition 218, and as such requires an analysis of special / general benefit (general benefits may not be assessed), and the approval of 50% of the property owners based upon the ballots returned weighted by assessment amount. Below are some pros and cons of this approach:

Pros:	Cons:
1. authorizes the sale of bonds under the 1915 Improvement Bond Act 2. requires 50% approval, by assessment amount, of the property owners returning their ballots 3. once bonds are issued, assessment to pay back bond debt is protected by Federal Law	1. requires the identification of "special benefit" and development of a benefit methodology to allocate costs to each parcel 2. must include public property and identify a funding source to pay for any general benefit since it may not be assessed. 3. Additional limitations imposed by recent case law

The flowchart below shows the steps required for the formation of a 1913 Act District.

Municipal Improvement Act of 1913
Formation Procedure



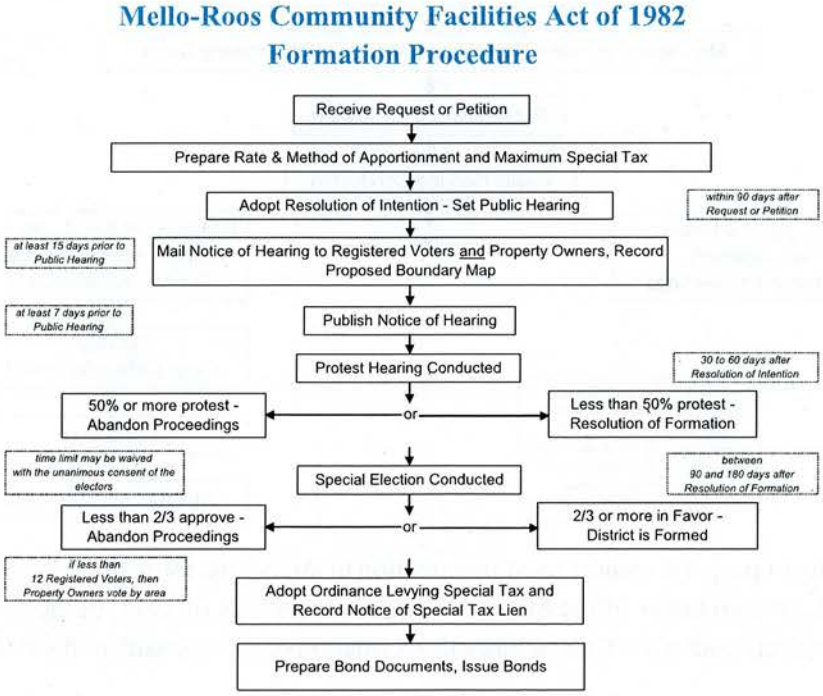
Note: Majority of property owners must sign petition to initiate the formation of the assessment district based upon the requirements of the Municipal Improvement Act of 1911, or the City must contribute 50% of the project costs if the City initiates the formation of the assessment district.

B.2 Mello-Roos Community Facilities District

The Mello-Roos Community Facilities Act of 1982 allows an agency to create a Community Facilities District (CFD) to finance the costs of utility undergrounding by the adoption of a special tax on parcels within the utility undergrounding district. Since a CFD imposes a special tax on parcels and not an assessment, it does not require the allocation of costs based upon special benefits as required by Prop. 218 for benefit assessment.

Since a CFD creates subject parcels to a special tax, it requires a two-thirds majority approval of the registered voters within the boundary of the CFD. It can be approved at a general election or special election. The special tax to be levied upon parcels is based upon the special tax formula that is established at the time the district is created. Although, there is no requirement that the special tax formula be based upon benefit, it must be reasonable. This allows the Agency a great deal of flexibility to create a special tax formula that will be acceptable to both the Agency and the registered voters. In the case of a utility undergrounding district, the special tax formula could levy a uniform tax on each parcel within the undergrounding district, which might not be possible in an assessment district, since some parcels may receive a greater benefit than others may. It also allows the tax to change over time, although it can never exceed the maximum special tax approved by the voters when the district is created. This flexibility can allow the tax to change based upon changes to a parcel. For example, if there are underdeveloped parcels within the undergrounding district, the special tax formula might levy a reduced tax on those parcels until such time as they develop. In addition, under the Mello-Roos Act, all publically owned properties in existence at the date of formation of the CFD are exempt from the CFD special tax.

The following is a flowchart of the formation process for a Mello-Roos CFD:



Harris has assisted many neighborhood groups and also cities such as Tiburon, Belvedere, Oakland, Newport Beach, Manhattan Beach, Laguna Beach, and others to utilize assessment district funding to underground overhead utilities.

V. FUNDING OPTIONS USED BY OTHER COMMUNITIES

A. Inter-Municipal Trading of Tariff Rule 20A Credits

Cities and counties are able to trade or sell unallocated Rule 20A credits if they will not be used to fund local undergrounding projects. There have been several cases where one agency has sold their unused credits, often for less than the full dollar value of the credits themselves to another agency. For example, in July of 2013, the City of Newport Beach entered into a memorandum of understanding (MOU) with the City of Mission Viejo to purchase unallocated Rule 20A credits at a cost of $0.55 on the dollar. Mission Viejo also granted Newport Beach the first right of refusal to purchase future Rule 20A allocations between July 1, 2013 and July 1, 2015 at the same rate of $0.55 on the dollar. In June of 2014, the City of Mission Viejo agreed to sell the City of Newport Beach a balance of $99,143 in Rule 20A funds. Newport Beach will pay Mission Viejo a total of $54,528 for the allocation. Mission Viejo agreed to sell its credits because it did not have undergrounding projects planned for the near future.

Similarly, the City of Foster City recently negotiated the transfer of $1.7 million of its Rule 20A credits to the City of Belmont. According to a representative from PG&E, cities and counties in the service area can create agreements between themselves to transfer Rule 20A credits under varying conditions as long as they provide PG&E documentation of the agreements.

B. Establishment of Local Surcharge for Undergrounding

Given the limited availability of Rule 20A funds for undergrounding, the City of San Diego working with SDG&E and the CPUC adopted a local surcharge as part of the utility rate structure to fund undergrounding projects. Until 2002, the undergrounding program in San Diego (as in the rest of California) proceeded under CPUC Rule 20-A. However, the amount of funding generated for Rule 20-A projects and the expenditure of those funds had significant limitations, including:

- the funds could only be used for undergrounding streets that would effect a "general public benefit" (such as arterial rights of way) and generally excludes residential streets;
- the funds could not be used to cover the cities' costs related to the replacement of traffic signals and street lights, or street trees as part of a utility undergrounding project, and
- the funds could not be used to cover the property owns costs of converting their service to connect to the street trench wiring.

In 2002, the City of San Diego and SDG&E entered into an agreement (which required the approval of the CPUC) to adopt a small surcharge on the electric bills of all residential power users to provide a stream of revenue that would be sufficient to cover the costs of a phased program to underground all the utility wires on all of the City's residential streets. This was adopted without a ballot measure. The surcharge funds non-Rule 20A projects. While in place for many years, the surcharge is being challenged in court. The case will be heard in 2017. Other agencies have adopted similar surcharges to fund utility undergrounding projects.

C. Adoption of Local Sales Tax or Utility Tax for Undergrounding

Another strategy for funding local undergrounding projects would be the adoption of a local sales tax or Utility User's Tax that would be dedicated to funding utility undergrounding projects. Both of these would be a "special tax" as defined by Proposition 218 and Proposition 26 and require 2/3's voter approval for adoption. Bonds could be issued secured by the sales tax or utility user's tax to fund the costs of the undergrounding projects. One benefit of this approach is that it could be done on a citywide basis and it may spread the tax burden across a broader base of taxpayers beyond just property owners. One agency, which is using this strategy, is the City of Anaheim, which has implemented a 4% surcharge on all electric bills and is used to underground the arterials and collector streets including services. Phone and cable pay to underground their facilities. The approach has been very successful and well received by the public.

D. Rule 20D (SDG&E only)

Rule 20D (http://regarchive.sdge.com/tm2/pdf/ELEC_ELEC-RULES_ERULE20.pdf) applies to circumstances other than those covered by Rule 20A or 20B where the utility will at its expense replace overhead with underground where after consultation with the utility and the local fire agency and after holding public hearings that the undergrounding is in the general public interest. The undergrounding will "(1) Occur in the SDG&E Fire Threat Zone as developed in accordance with the California Public Utilities commission (D.) 09-08-029: and (2) Occur in an area where the utility has determined that undergrounding is a preferred method to reduce fire risk and enhance the reliability of the facilities to be undergrounded."

While currently included only in SDG&E's Rule 20, the option may be a consideration for Berkeley to explore.

VI. STATUS OF RULE 20A, 20B, AND 20C FUNDING IN THE CITY OF BERKELEY.

PG&E continues to provide an allocation to the City of Berkeley under Rule 20A. The following table describes the allocation balance for 2016:

City of Berkeley 2016 Estimate of Current Rule 20A Account Balance		
	Allocations	Estimated Expenditures
(a) Account Balance as of 05/13/14	$6,365,851	
(b) 2015 Allocation	+$528,394	
(c) 2016 Allocation	+$523,888	
(d) 5 year borrow	+$2,619,440	
(e) Total Available Allocations	=$10,037,573	
(f) Grizzly Peak Blvd - Current FAC		-$4,682,736
(g) Vistamont Ave - Preliminary Ballpark Figure		-$6,085,703
(h) Adjusted Account Balance as of 5/17/16	=$730,866	

The factors making up the table are:

(a) Account Balance as of 5/13/14. This is the balance as of 5/13/14 of the annual Rule20A allocation. The balance is then added to the allocations to determine the amount available to fund Rule 20A projects.
(b) 2015 Allocation. This is the amount of Rule 20A allocation received by the City of Berkeley in 2015. It is added to the Account Balance as of 2014.
(c) 2016 Allocation. This is the amount of Rule 20A allocation received by the City of Berkeley in 2016. It is added to the Account Balance as of 2014.
(d) 5 year borrow. Under the provisions of Rule 20A the City can borrow forward 5 years of allocation. The $2,619,440 is 5 times the 2016 allocation. Please note that if the City uses the 5-year borrowing provision, the negative balance must be repaid from future allocations before another project can be done.
(e) Total Available Allocations. The Total Available Allocations is the sum of the Account Balance as of 5/13/14, the 2015 Allocation, the 2016 Allocation and the 5 year borrow.
(f) Grizzly Peak Blvd. The estimated value of the Grizzly Peak Blvd. Rule 20A is subtracted from the Total Available Allocations.
(g) Vistamont Ave. The estimated value of Vistamont Ave. is subtracted from the Total Available Allocations.
(h) Adjusted Account Balance as of 5/17/16. The Adjusted balance is the Total Available Allocations minus the next project where resolutions have been passed. The balance can still change depending on the actual construction cost of the Grizzly Peak project.

It is anticipated that PG&E will continue to provide an annual allocation for the near future to fund Rule 20A projects. However, in recent years PG&E has changed the allocation methodology. Under Rule 20A, the City can borrow forward up to 5 years of allocation to fund a qualified project. The allocation can also be used to fund the service lateral, up to 100 feet and the service panel conversion, up to $1,500. The City of Berkeley has undergrounded many miles utilizing Rule 20A funds. The City utilizes a streetlight assessment to fund the installation of the streetlights in a Rule 20A district. Rule 20A continues to be an available funding mechanism to underground the arterial and collector streets within the City of Berkeley. If the street is not an arterial or collector, but is heavily conductored, heavily travelled or is scenic, it may also qualify for funding under Rule 20A

Under Rule 20B, the source of funding is typically an assessment or special tax district to fund the property owner's share of the costs. Prior to the dissolution of the RDA's they were also used to fund the local share of undergrounding projects. The City of Berkeley has done one undergrounding project under Rule 20B using an assessment district. Neighborhoods such as Bay View, Terrace View and La Loma have shown interest in pursuing undergrounding using Rule 20B. These are in areas of the City that are predominately residential and where it appears that funding with Rule 20A will not be available for many years. Rule 20B seems to be gaining interest with certain neighborhoods that would not qualify under Rule 20A, but still have a desire to enjoy the benefits associated with underground utilities.

It should also be noted that other than the arterials and collectors the remaining residential streets would not qualify for Rule 20A funding.

Under Rule 20C, the costs with the exception of a small salvage credit are all borne by the property owners. These projects are less popular than Rule 20A and Rule 20B projects and are usually done where small groups of property owners are interested in undergrounding a small area. While available, no projects have been identified as Rule 20C, and has not been utilized in the City. Generally having a project that is large, enough for a Rule 20B is more advantageous.

Rule 20D is specific to projects within SDG&E's service boundaries.

VII. CREATING A DISTRICT TO FUND NEIGHBORHOOD UNDERGROUNDING PROJECTS

The steps required to create a special district to fund utility undergrounding projects typically consists of five stages, including Public Hearing/Outreach, District Formation, Design, Notification, and Construction. Each element is described in greater detail below.

Step 1. Establish Utility Undergrounding District

In accordance with the City's Municipal Code, the City Council holds public hearings in order to create an Underground Utility District (UUD) which provides the legal mechanism to require property owners to convert their existing overhead utility services to underground service. All residents and property owners with the proposed UUD are mailed a Public Hearing Notice and a map of the proposed UUD location. The Public Hearing Notice informs property owners that they are within an area being considered for undergrounding by the City Council. The notice explains the potential impacts of the project. Any member of the public may attend or speak at a public hearing. Prior to the start of design work, the City Council must create an underground utility district.

Step 2. Identify Funding Mechanism.

As discussed there are several ways that the undergrounding of utilities can be funded. If the costs will not be fully funded under Rule 20A or other City funds, the City will typically work with property owners to form an assessment or special tax district. The first step in the creation of an assessment district is to develop a preliminary costs estimates and a map showing the parcels that would be included in the assessment district that will be used during the petition process. The petition must be signed by property owners representing at least of 50% of the land area within the proposed boundary of the district. The specific steps for the formation of the financing district (either special tax or benefit assessment) is governed by either the Government Code or the Streets & Highways Code, depending upon the type of district. In both cases the City, typically create a financing team, that includes a special tax consultant/assessment engineer, bond counsel and legal counsel. District formation typically takes 3-6 months. Once established, the financing district establishes the financial obligation of each property owner and the manner in which each property owner will pay their portion of the project's costs. Typically, bonds would be sold and property owners would repay their share of the project costs over a 20-25-year period. The annual obligation is collected as part of the annual property tax bill. If a property is sold, the remaining obligation is the responsibility of the new property owner.

Step 3. Design Process.
Once an Underground Utility District and financing district has been created, the design process starts. Design typically takes 1-2 years after SCE has approved the project and involves field surveying, utility research, and coordination among impacted utilities.

Step 4. Notification.
Prior to the start of undergrounding, residents and property owners will receive additional outreach materials regarding planned construction activities. If trenching on private property is required, utility companies will coordinate right-of-entry permits from property owners. In addition, immediately prior to construction, utility companies will distribute additional construction notices making the public aware of construction dates and times.

Step 5. Construction.
Depending on the size of an undergrounding project, construction can range in duration from a few months to over a year. The initial step in construction involves installation of the underground plastic conduit below the surface of the roadway. Trenching may also occur up to individual properties to allow for conversion to underground services. Next, contractors install new utility lines within the conduit and new transformers/pedestals adjacent to trench areas. These boxes are necessary for the underground system and are placed above ground. Once utility lines are installed, each property's electrical panel is modified to allow for underground service and then transitioned from overhead to underground services. Finally, once all properties are converted to underground services, poles are removed in the project area.

VIII. EMERGING TECHNOLOGIES

Harris was also asked to look at emerging technologies and the effect they may have on undergrounding. The following technologies were investigated:

- Photovoltaics and energy storage,
- Distributed generation and micro grids,
- Trenchless construction using horizontal directional drilling.

Photovoltaics and energy storage. While solar (photovoltaics) is gaining in popularity and energy storage is more and more efficient, the effect of solar on electric distribution systems is still unclear. The issue continues to be the lack of an efficient method of storing the power generated by photovoltaic system. The Village of Minster in Ohio, has constructed a utility scale storage project combined with a solar array. The battery storage is owned by the utility and works to offset power purchased on the open market. (Solar Meets Energy Storage, T&D World Magazine, April 25, 2016). In a separate article, the author compares the growth of solar to that of mobile phones and speculates that people will cut utilities ties in much the same way as they have with telephone wires. (Why living off the grid will be easier in 25 years, Cadie Thompson). However, energy storage continues to be a significant factor in the success of solar, distributed generation or micro grids. While still very expensive, there is progress in technologies such as Lithium-ion battery storage, Vehicle-to-Grid, and Fuel Cell energy storage. (Mayor's Undergrounding Task Force, October 2013)

Distributed generation and micro grids refers to small size electric generation (typically from a renewable fuel) located close to electric load centers. This would eliminate the need for large transmission towers to deliver electric energy from a large generation facility to a city. However, there is still a need for a local distribution network. The issue with this technology is properly sizing the generation, or having a consistent fuel source, so that a back-up source is not needed. (Mayor's Undergrounding Task Force, October 2013) Similar to solar, the ability to store energy during times of low demand so that is available during peak load periods is a significant factor with this technology as well.

Horizontal directional drilling (HDD) is a steerable trenchless method of installing underground pipe, conduit, or cable in a shallow arc along a prescribed bore path by using a surface-launched drilling rig, with minimal impact on the surrounding area. It is a relatively common method for installation of power and communication conduits. It is generally used where there is a desire not to "open cut" a trench and where the presence of existing underground facilities is well defined.

A brief description of the process starts with a pilot hole drilled from the surface to the required depth on the designed alignment. Lengths of 300' are relatively common. The pilot drill pushes its way through the soil and is tracked and guided by electronic signals emanating from the drill head. The pilot drill head surfaces at the termination point and a back reamer is attached to the pilot drill rod. At this point, the drilling is reversed and the back reamer is pulled back toward the drilling rig enlarging the hole to the desired diameter for the plastic conduit carrier pipe. The conduit, which has been fuse welded together in one continuous pipe string, is then pulled back in the hole created by the reamer to the starting point. Costs can be as much as half of what open-cut construction would be and can range from $60 to $150 per foot depending on the conduit size and specific site constraints.

HDD is a viable option for use in Berkeley in streets that are not congested with existing underground utilities and for locations where landscaping and hardscape cannot be disturbed. However, to avoid damaging existing underground facilities it is imperative to know their exact locations.

IX. SUMMARY OF THE ADVANTAGES AND DISADVANTAGES OF UNDERGROUNDING ARTERIALS AND COLLECTORS

The structure of Rule 20 favors undergrounding in areas used frequently by the public. Roads that are heavily conductored (many overhead wires) and heavily travelled benefit the public by being undergrounded. Public buildings since the public also frequents them also benefits. Expanding the qualifications of Rule 20A by including arterials and collectors provide more confirmation that utility funded undergrounding should benefit the public.

ADVANTAGES

1. Enhanced public safety (during fire and earthquake events).
2. Enhanced reliability (less frequent outages)
3. Improved aesthetics.
4. Improved pedestrian access.
5. A reduction in car pole accidents.

6. Eliminate tree limb contacts with overhead wires
7. Improved public perception.
8. Reduced tree trimming cost.

DISADVANTAGES

1. High construction costs.
2. Construction noise.
3. Impacts to traffic.
4. Higher utility rates.
5. Finding space for conduits and substructures in already crowded streets.
6. Complaints from the public during construction.

Comment on undergrounding the arterials and collectors within residential areas

Undergrounding the arterials and collectors in the residential areas will share similar pros and cons as the non-residential areas. Property owners and the public alike benefit from a safety and reliability standpoint. Views are enhanced by removing the overhead conductors and poles.

However, there is much more effort in public education and information required in working with homeowners in residential areas. One of the biggest challenges in this regard is identifying homeowner participation in costs and estimating an early, accurate construction cost estimate.

X. CONCLUSION

As this study is intended to provide a base case for future studies on undergrounding the City of Berkeley conclusions may be pre-mature. It appears there are compelling reasons to underground all or a portion of the remaining streets in Berkeley. The utility funded program (Rule 20A) can continue to be used to fund the undergrounding on the arterials and collector streets. The remaining streets may need to be funded by neighborhood groups, or some type of City –wide assessment.

There are several potential next steps to this process, they include:

- Refining the costs,
- Developing a prioritization model,
- Developing the funding model,
- Exploring the impact of technology.

XI. HISTORY OF UNDERGROUNDING OF OVERHEAD UTILITIES

For reference, attached in Appendix 2 is the City's "Undergrounding of Utility Wires – A Brief History, December 2015" document.

XII. COMMENTS FROM COMMISSIONERS

For reference, attached in Appendix 3 are the comments and questions from Commissioners and the Harris response.

APPENDIX 1

ARTERIAL AND COLLECTOR STREET MAP AND ZONING MAP

ATTACHMENT 2

CITY OF BERKELEY ARTERIAL AND COLLECTOR ROAD NETWORK UTILITY UNDERGROUNDING PLANNING LE

07/22/16

ARTERIAL ROAD NETWORK

STREET NAMES AND LIMITS					SECTIONS UNDERGROUNDED			OVERHEAD SECTIONS PER ZONE (NOTE: ZONES BASED ON CI				
NO	STREET	FROM	TO	TOTAL LENGTH (FT)	FROM	TO	LENGTH (FT)	FROM	TO	M ZONE (FT)	MUR ZONE(FT)	C-DMU ZONE (FT)
1	ADELINE ST	WARD ST	CITY LIMIT	5280								
					WARD ST	CITY LIMIT	5280					
2	ALAMEDA/MLK WAY	SOLANO AVE	CITY LIMIT	15380								
								SOLANO AVE	HOPKINS ST			
					HOPKINS	BANCROFT WAY	6780					
								BANCROFT WAY	DWIGHT WAY			
								DWIGHT WAY	DWIGHT WAY			
								DWIGHT WAY	ASHBY AVE			
					ASHBY AVE	ADELINE ST	1450					
					ADELINE ST	CITY LIMIT	320					
3	ASHBY AVE	BAY ST	DOMINGO AVE	15465								
								EAST OF BAY ST	SAN PABLO AVE			
								SAN PABLO AVE	SACRAMENTO ST			
								SACRAMENTO ST	SACRAMENTO ST			
								SACRAMENTO ST	MLK WAY			
					MLK WAY	ADELINE ST	1160					
								ADELINE ST	LORENA ST			
								LORENA ST	TELEGRAPH AVE			
					TELEGRAPH AVE	TELEGRAPH AVE	450					
								TELEGRAPH AVE	BENEVENUE AVE			
					BENEVENUE AVE	PIEDMONT AVE	1215					
								PIEDMONT AVE	CLAREMONT AVE			
								CLAREMONT AVE	DOMINGO AVE			
4	CEDAR ST	EASTSHORE HWY	6TH ST	1765								
								EASTSHORE HWY	4TH ST	1120		
								4TH ST	6TH ST		645	
5	COLLEGE AVE	DWIGHT WAY	ALCATRAZ AVE	5300								
								DWIGHT WAY	RUSSELL ST			
					DWIGHT WAY	WEBSTER ST	1125					
								WEBSTER ST	ALCATRAZ AVE			
								ALCATRAZ AVE	ALCATRAZ AVE			
6	DERBY ST	WARRING ST	BELROSE AVE	1195								
								WARRING ST	MID DERBEY ST			
					MID DERBY ST	BELROSE AVE	715					
7	DWIGHT WAY	7TH ST	PIEDMONT AVE	12445								
								7TH ST	9TH ST	675		
								9TH ST	SAN PABLO AVE			
								SAN PABLO AVE	SACRAMENTO ST			
								SACRAMENTO ST	SACRAMENTO ST			
								SACRAMENTO ST	MLK WAY			
								MLK WAY	MLK WAY			

ATTACHMENT 2

CITY OF BERKELEY ARTERIAL AND COLLECTOR ROAD NETWORK UTILITY UNDERGROUNDING PLANNING LE

07/22/16

ARTERIAL ROAD NETWORK

STREET NAMES AND LIMITS					SECTIONS UNDERGROUNDED			OVERHEAD SECTIONS PER ZONE (NOTE: ZONES BASED ON CIT				
NO	STREET	FROM	TO	TOTAL LENGTH (FT)	FROM	TO	LENGTH (FT)	FROM	TO	M ZONE (FT)	MUR ZONE(FT)	C-DMU ZONE (FT)
9	HASTE AVE	MLK WAY	PEIDMONT AVE	5980								
								MLK WAY	MILVIA			
								MILVIA	SHATTUCK AVE			
								SHATTUCK AVE	SHATTUCK AVE			535
								SHATTUCK AVE	FULTON AVE			
								FULTON AVE	TELEGRAPH AVE			
								TELEGRAPH AVE	TELEGRAPH AVE			
								TELEGRAPH AVE	BOWDITCH			
					BOWDITCH AVE	COLLEGE AVE	640					
								COLLEGE AVE	PIEDMONT AVE			
10	HEARST AVE	MLK AVE	HIGHLAND PL	5160								
								MLK AVE	MILVIA ST			
					MILVIA ST	OXFORD AVE	1360					
								OXFORD AVE	SCENIC AVE			
								SCENIC AVE	LA LOMA			
					LA LOMA AVE	HIGHLAND PL	390					
11	HENRY ST	EUNICE ST	ROSE ST	1360								
					EUNICE ST	ROSE ST	1360					
12	MARIN AVE	TULARE AVE	THE CIRCLE	2920								
								TULARE AVE	THE CIRCLE			
13	OXFORD ST	ROSE ST	DWIGHT WAY	6620								
								ROSE ST	CEDAR AVE			
								CEDAR AVE	HEARST			
					HEARST AVE	DURANT AVE	2670					
								DURANT AVE	DWIGHT WAY			
14	SACRAMENTO ST	HOPKINS ST	ALCATRAZ AVE	12375								
								HOPKINS ST	CEDAR AVE			
								CEDAR AVE	UNIVERSITY AVE			
					UNIVERSITY AVE	UNIVERSITY AVE	360					
								UNIVERSITY AVE	DWIGHT AVE			
								DWIGHT AVE	BLAKE ST			
								BLAKE ST	OREGON ST			
					OREGON ST	ALCATRAZ AVE	3180					
15	SAN PABLO AVE	N CITY LIMIT	S CITY LIMIT	12405								
					N CITY LIMIT	S CITY LIMIT	12405					
16	SHATTUCK AVE	ROSE ST	WARD ST	8250								
					ROSE ST	WARD ST	8250					
17	SHATTUCK PL	ROSE ST	SHATTUCK AVE	400								
					ROSE ST	SHATTUCK AVE	400					
18	SUTTER ST	HOPKINS ST	EUNICE ST	1200								

ATTACHMENT 2

CITY OF BERKELEY ARTERIAL AND COLLECTOR ROAD NETWORK UTILITY UNDERGROUNDING PLANNING LE

07/22/16

SUMMARY OF STREETS TO BE UNDERGROUNDED SHOWING TOTAL LENGTH PER ZONE AND TOTAL COSTS

CLASS	M ZONE (FT)	C-DMU ZONE (FT)	C ZONE (FT)	SP ZONE (FT)	TOTAL LENGTH (FT)	Total Cost ($)
Arterial (Non-residential)	4115	535	10180	0	14830	$11,380,000
CLASS	**MUR ZONE (FT)**	**R ZONE (FT)**				**Total Cost ($)**
Arterial (Residential)	645	53605			54250	$31,550,000

LEGEND:

SECTION OF STREETS TO BE UNDERGROUNDED

SECTION OF STREETS ALREADY UNDERGROUNDED

NOTE:

1. IMPACT RATING IS THE LEVEL OF DIFFICULTY ASSOCIATED WITH UTILITY UNDERGROUNDING. IT IS ASSESSED IN THREE AREAS AS SHOWN BELOW PER FIELD REVIEW. IMPACT RATING IS TABULATED IN A SCALE FROM 1 (LOW IMPACT) TO 5 (HIGH IMPACT). REFER TO THE BASELINE STUDY IN SECTION III FOR MORE INFORMATION ON IMPACT RATING.

ABBREVIATIONS:

M Zone = Manufacturing (Districts M,MM, MUU)
MUR Zone = Mixed Use-Residential (District MUR)
C-DMU Zone = Commercial Downtown Mixed Use (District C-DMU)
C Zone = Commercial (Districts C-1, C-E, C-N, C-NS, C-SA, C-SO, C-T,
SP Zone = Specific Plan (District SP)
R Zone = Residential (Districts R-1, R-1A, R-2A, R-3, R-4,R-5, ES-R, R

ATTACHMENT 2
CITY OF BERKELEY ARTERIAL AND COLLECTOR ROAD NETWORK UTILITY UNDERGROUNDING PLANNING LE
07/22/16

COLLECTOR ROAD NETWORK

STREET NAMES AND LIMITS					SECTIONS UNDERGROUNDED			OVERHEAD SECTIONS PER ZONE (ZONES BASED				
NO	STREET	FROM	TO	TOTAL LENGTH (FT)	FROM	TO	LENGTH (FT)	FROM	TO	M ZONE (FT)	MUR ZONE(FT)	Z
1	4TH ST	ADDISON ST	DWIGHT WAY	2535								
								ADDISON ST	DWIGHT WAY	2535		
2	6TH ST	GILMAN ST	DWIGHT WAY	7290								
								GILMAN ST	CAMELIA ST	670		
								CAMELIA ST	CEDAR ST		1325	
					CEDAR ST	UNIVERSITY AVE	2295					
								UNIVERSITY AVE	DWIGHT WAY		3000	
3	7TH ST	DWIGHT WAY	FOLGER AVE	3810								
								DWIGHT WAY	CARLETON ST	1210		
								CARLESTON ST	HEINZ AVE	1300		
								HEINZ AVE	ANTHONY ST	480		
								ANTHONY ST	ASHBY AVE			
								ASHBY AVE	FOLGER AVE	370		
4	ALCATRAZ AVE	COLLEGE AVE	CLAREMONT AVE	850								
								COLLEGE AVE	COLLEGE AVE			
								COLLEGE AVE	CLAREMEONT AVE			
5	ALCATRAZ AVE	W OF IDAHO ST	E OF ADELINE ST	3970								
								W OF IDAHO ST	SACRAMENTO ST			
								SACRAMENTO ST	E OF CALIFORNIA ST			
								E OF CALIFORNIA ST	ADELINE ST			
								ADELINE ST	E OF ADELINE ST			
6	ARLINGTON AVE	BOYNTON AVE	MARIN AVE	5515								
					BOYNTON AVE	MARIN AVE	5515					
7	BANCROFT WAY	MILVIA ST	PIEDMONT AVE	5270								
					MILVIA ST	PIEDMONT AVE	5270					
8	BELROSE	DERBY ST	CLAREMONT AVE	1550								
					DERBY ST	CLAREMONT AVE	1550					
9	CEDAR ST	6TH ST	LALOMA AVE	12290								
								6TH ST	SAN PABLO AVE			
								SAN PABLO AVE	ACTON ST			
								ACTON ST	SACRAMENTO ST			
								SACRAMENTO ST	MLK AVE			
								MLK AVE	SHATTUCK AVE			
								SHATTUCK AVE	EUCLID AVE			
								EUCLID AVE	LA LOMA AVE			
10	CLAREMONT AVE	ALCATRAZ AVE	TANGLEWOOD RD	4015								
								ALCATRAZ AVE	PARKSIDE DR			

ATTACHMENT 2

CITY OF BERKELEY ARTERIAL AND COLLECTOR ROAD NETWORK UTILITY UNDERGROUNDING PLANNING LE

07/22/16

COLLECTOR ROAD NETWORK

STREET NAMES AND LIMITS					SECTIONS UNDERGROUNDED			OVERHEAD SECTIONS PER ZONE (ZONES BASED (				
NO	STREET	FROM	TO	TOTAL LENGTH (FT)	FROM	TO	LENGTH (FT)	FROM	TO	M ZONE (FT)	MUR ZONE(FT)	Z
14	COLUSA AVE	SOLANO AVE	VISALIA AVE	3430								
								SOLANO AVE	VISALIA AVE			
15	DELAWARE ST	6TH ST	SACRAMENTO ST	4750								
								6TH ST	SAN PABLO AVE			
								SAN PABLO AVE	SACRAMENTO ST			
16	DURANT AVE	MILVIA ST	PEIDMONT AVE	5280								
								MILVIA ST	SHATTUCK AVE			
								SHATTUCK AVE	FULTON ST			
								FULTON ST	TELEGRAPH AVE			
								TELEGRAPH AVE	BOWDITCH ST			
								BOWDITCH ST	COLLEGE AVE			
								COLLEGE AVE	PEIDMONT AVE			
17	DWIGHT WAY	4TH ST	7TH ST	960								
								4TH ST	6TH ST		650	
								6TH ST	7TH ST		310	
18	DWIGHT CR	6TH ST	DWIGHT WAY	420								
								6TH ST	DWIGHT WAY		420	
19	EAST SHORE HWY	HEARST AVE	N CITY LIMIT	5100								
					HEARST AVE	GILMAN ST	3770					
								GILMAN ST	N CITY LIMIT	1330		
20	EUCLID AVE	CEDAR ST	HEARST AVE	1615								
								CEDAR ST	RIDGE RD			
					RIDGE RD	HEARST AVE	375					
21	EUCLID AVE	GRIZZLY PEAK BLVD	CRAGMONT AVE	5185								
								GRIZZLY PEAK BLVD	CRAGMONT AVE			
22	EUCLID ST	EUNICE ST	CEDAR ST	2780								
					EUNICE ST	CEDAR ST	2780					
23	FOLGER AVE	HOLLIS ST	EAST OF 7TH ST	880								
								HOLLIS ST	EAST OF 7TH ST	880		
24	GRIZZLY PEAK BLVD	CRAIGMONT AVE	EUCLID AVE	930								
								CRAIGMONT AVE	EUCLID AVE			
25	GRIZZLY PEAK BLVD	EUCLID AVE	GOLF COURSE DR	10885								
								EUCLID AVE	MARIN AVE			

ATTACHMENT 2
CITY OF BERKELEY ARTERIAL AND COLLECTOR ROAD NETWORK UTILITY UNDERGROUNDING PLANNING LE
07/22/16

COLLECTOR ROAD NETWORK

STREET NAMES AND LIMITS					SECTIONS UNDERGROUNDED			OVERHEAD SECTIONS PER ZONE (ZONES BASED				
NO	STREET	FROM	TO	TOTAL LENGTH (FT)	FROM	TO	LENGTH (FT)	FROM	TO	M ZONE (FT)	MUR ZONE(FT)	Z
29	KEITH AVE	SPRUCE ST	GRIZZLY PEAK BLVD	8080								
								SPRUCE ST	MILLER RD			
					MILLER RD	GRIZZLY PEAK BLVD	280					
30	LA LOMA AVE	GLENDALE AVE	VIRGINIA ST	3705								
								GLENDALE AVE	BUENA VISTA WAY			
					BUENA VISTA WAY	CEDAR ST	790					
								CEDAR ST	VIRGINIA ST			
31	LOS ANGELES AVE	THE CIRCLE	SPRUCE ST	1795								
					THE CIRCLE	OXFORD ST	1495					
								OXFORD ST	SPRUCE ST			
32	MARIN AVE	MARIN CR	GRIZZLY PEAK BLVD	3985								
								MARIN CR	GRIZZLY PEAK BLVD			
33	MARINA BLVD	UNIVERSITY AVE	SPINNAKER WAY	2300								
					UNIVERSITY AVE	VIRGINIA ST EXT	1665					
								VIRGINIA ST EXT	SPINNAKER WAY			
34	MENDOCINO AVE	MARIN CR	MID-BLOCK	330								
								MARIN CR	MID-BLOCK			
35	MILVIA ST	CEDAR ST	BLAKE ST	5640								
								CEDAR ST	VIRGINIA AVE			
								VIRGINIA AVE	FRANCISCO ST			
								FRANCISCO ST	UNIVERSITY AVE			
					UNIVERSITY AVE	CHANNING WAY	2300					
								CHANNING WAY	HASTE AVE			
								HASTE AVE	BLAKE ST			
36	MONTEREY AVE	HOPKINS ST	MARIN AVE	3550								
								HOPKINS ST	MARIN AVE			
37	PIEDMONT AVE	HASTE ST	OPTOMETRY LN	1750								
								HASTE ST	BANCROFT AVE			
					BANCROFT AVE	OPTOMETRY LN	725					
38	ROSE ST	SACRAMENTO ST	SPRUCE ST	5090								
								ROSE ST	MLK WAY			
					MLK WAY	MLK WAY	225					
								MLK WAY	HENRY ST			
					HENRY ST	SHATTUCK PL	550					

ATTACHMENT 2

CITY OF BERKELEY ARTERIAL AND COLLECTOR ROAD NETWORK UTILITY UNDERGROUNDING PLANNING LE

07/22/16

COLLECTOR ROAD NETWORK

STREET NAMES AND LIMITS					SECTIONS UNDERGROUNDED			OVERHEAD SECTIONS PER ZONE (ZONES BASED				
NO	STREET	FROM	TO	TOTAL LENGTH (FT)	FROM	TO	LENGTH (FT)	FROM	TO	M ZONE (FT)	MUR ZONE(FT)	Z
43	TELEGRAPH AVE	BANCROFT WAY	DWIGHT WAY	1310								
					BANCROFT WAY	DWIGHT WAY	1310					
44	THOUSAND OAKS BLVD	COLUSA AVE	ARLINTON AVE	2840								
								COLUSA AVE	SANTA CLARA AVE			
								SANTA CLARA AVE	ARLINTON AVE			
45	UNIVERSITY AVE	SEAWALL DR	FRONTAGE RD	3825								
					SEAWALL DR	FRONTAGE RD	3825					
46	VIRGINIA ST	SACRAMENTO ST	MLK WAY	2640								
								SACRAMENTO ST	MLK WAY			
47	W FRONTAGE RD	ACROSS DWIGHT WAY	GILMAN ST	7500								
					ACROSS DWIGHT WAY	UNIVERSITY AVE	3000					
								UNIVERSITY AVE	GILMAN ST	4500		
48	WARRING ST	DWIGHT WAY	DERBY ST	1580								
								DWIGHT WAY	DERBY ST			
49	WILDCAT CANYON RD	WOODMONT AVE	CITY LIMIT	9750								
					WOODMONT AVE	CITY LIMIT	9750					
			TOTAL LENGTH (FT)=	190460		TOTAL LENGTH (FT)=	59660		TOTAL LENGTH (FT)=	13275	5705	

SUMMARY OF STREETS TO BE UNDERGROUNDED SHOWING TOTAL LENGTH PER ZONE AND TOTAL COSTS

CLASS	M ZONE (FT)	C-DMU ZONE (FT)	C ZONE (FT)	SP ZONE (FT)	TOTAL LENGTH (FT)	Total Cost ($)
Collector(Non-Residential)	13275	1260	8105	635	23275	$15,100,000
CLASS	**MUR ZONE (FT)**	**R ZONE (FT)**				**Total Cost ($)**
Collector (Residential)	5705	101820			107525	$76,770,000

LEGEND:

SECTION OF STREETS TO BE UNDERGROUNDED
SECTION OF STREETS ALREADY UNDERGROUNDED

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C Zone = Commercial (Districts C-1, C-E, C-N, C-NS, C-SA, C-SO, C-T, C-V
SP Zone = Specific Plan (District SP)
R Zone = Residential (Districts R-1, R-1A, R-2A, R-3, R-4,R-5, ES-R, R-S, F

ATTACHMENT 2

CITY OF BERKELEY ARTERIAL AND COLLECTOR ROAD NETWORK UTILITY UNDERGROUNDING PLANNING LEVEL ESTIMATE
07/22/16

RESIDENTIAL ROADS ALREADY UNDERGROUNDED

STREET NAMES AND LIMITS				
NO	STREET	FROM	TO	TOTAL LENGTH (FT)
1	ADDISON ST	MLK WAY	OXFORD ST	2040
2	ALTA RD	SPRUCE ST	CRAIGMONT AVE	390
3	ALVARADO RD	CITY LIMIT	WILLOW WALK	1890
4	AMADOR AVE	SUTTER ST	SHATTUCK AVE	920
5	ARCADE AVE	GRIZZLY PEAK BLVD	FAIRLAWN DR	310
6	ATLAS PL	HILL RD	SUMMIT RD	200
7	AVALON AVE	OAK KNOLL TERRACE	CLAREMONT AVE	800
8	BENVENUE AVE	ASHBY AVE	WOOLSEY ST	1165
9	BONAR ST	BANCROFT WAY	DWIGHT WAY	1320
10	BOYNTON AVE	COLORADO AVE	FLORIDA AVE	280
11	BROWNING ST	BANCROFT WAY	DWIGHT WAY	1320
12	BUENA VISTA WAY	EUCLID AVE	LEROY AVE	380
13	BUENA VISTA WAY	LA LOMA AVE	DEAD END	3340
14	CAMELIA ST	SAN PABLO AVE	STANNAGE AVE	520
15	CENTER ST	MLK WAY	OXFORD ST	2020
16	CHANNING WAY	SAN PABLO AVE	VALLEY ST	1750
17	CHANNING WAY	BOWDITCH ST	COLLEGE AVE	670
18	COLBY ST	ASHBY AVE	WEBSTER ST	299
19	COLORADO AVE	BOYNTON AVE	MICHIGAN AVE	510
20	CLAREMONT BLVD	DERBY ST	BELROSE ABE	1400
21	FOREST AVE	MID POINT	CLAREMONT BLVD	600
22	GARBER ST	OAK KNOLL TERRACE	DEAD END	550
23	THE CRESCENT	PARK HILLS RD	PARK HILLS RD	1020
24	HAWTHORNE TERR	EUCLID AVE	LEROY AVE	365
25	HILL RD	GRIZZLY PEAK BLVD	DEAD END	950
26	HILLGRASS AVE	WESBTER ST	CITY LIMIT	840
27	HILLVIEW RD	WOODSIDE RD	PARK HILLS RD	1265
28	KAINS AVE	GILMAN ST	HOPKINS ST	1900
29	KENTUCKY AVE	VASSAR AVE	MICHIGAN AVE	1315
30	LATHAM LN	MILLER AVE	GRIZZLY PEAK BLVD	550
31	LATHAM LN	CRESTON RD	OVERLOOK RD	275
32	LEROY AVE	ROSE ST	HAWTHORNE TERR	735
33	MARIN AVE	CRESTON RD	DEAD END	450
34	MARIPOSA AVE	AMADOR AVE	LOS ANGELES AVE	1070
35	MIDDLEFIELD RD	PARK HILLS RD	LIMIT	1185
36	MILLER AVE	NORTH OF LATHAM LN	SHASTA RD	2180
37	MUIR WAY	GRIZZLY PEAK BLVD	PARK HILLS RD	385
38	OAK KNOLL TERRACE	GARBER ST	AVALON AVE	475
39	OAKVALE AVE	CLAREMONT AVE	DOMINGO AVE	1190
40	OVERLOOK RD	PARK HILLS RD	DEAD END	1715
41	PARK HILLS RD	MUIR WAY	SHASTA RD	1575
42	PARK HILLS RD	MUIR WAY	WILDCAT CANYON RD	1500
43	ROSE ST	LA LOMA AVE	LEROY AVE	750
44	STANNAGE AVE	GILMAN ST	HOPKINS ST	1685
45	STERLING AVE	WHITAKER AVE	SHASTA RD	710
46	STEVENSON AVE	GRIZZLY PEAK BLVD	MILLER AVE	520
47	SUNSET LN	CRESTON RD	WILDCAT CANYON RD	468
48	VASSAR AVE	NORTH CITY LIMIT	SPRUCE ST	1535
49	VINCENTE RD	ALVARADO RD	EAST CITY LIMIT	550
50	VINCENTE RD	TUNNEL RD	CITY LIMIT	1310
51	WEBSTER ST	COLLEGE AVE	REGENT ST	1070
52	WHITAKER AVE	STERLING AVE	MILLER AVE	550
53	WOODMONT AVE	WILDCAT CANYON RD	SUNSET LN	3055
54	WOODSIDE RD	CRESCENT RD	PARK HILLS RD	1450
			TOTAL LENGTH (FT)=	57267

APPENDIX 2

Undergrounding of Overhead Utility Wires – A Brief History

Berkeley, CA Public Works Commission – December 2015

Pursuant to a referral from the Berkeley City Council in December 2014 and approval by the Council on September 28, 2015 –

1) "Approve a work plan, as attached hereto, to develop a comprehensive plan (the "Undergrounding Plan") for the funding of the undergrounding of utility wires for all streets in Berkeley. The Undergrounding Plan would be developed in coordination with the City's existing related plans and activities, including the City's Resiliency Program.
2) Establish a Utility Undergrounding Special Commission consisting of the Public Works Commission, Transportation Commission, the Disaster and Fire Safety Commission representatives, and subject matter experts as needed to oversee the preparation of the Undergrounding Plan. The Special Commission shall be a manageable size and composed similar to the commission that developed the downtown Street and Open Space Improvement Plan".

Background:

The history of undergrounding utilities in the United States is over 125 years old, it was after the Great Blizzard of 1888[1] that Manhattan decided to put all its infrastructure from power to water, to gas lines, steam and subways, all went underground, and at great cost at that time. A second notable example was the Galveston, Texas in 1900. As the largest city in Texas at the time, Galveston, was the Wall Street of the South, but was destroyed by a great storm on Sept. 8, 1900. The 8,000+ people killed by that storm, 20 percent of the island's total population, is still the largest single loss-of-life event from a natural disaster in U.S. history. Galveston built a 17-foot-high seawall that has protected the city from subsequent 44 hurricanes. But they also put all other vital infrastructure underground (natural gas, water, sewage and electricity telecom).

The California State Legislature in 1911 enacted laws to regulate erection and maintenance of poles and lines for overhead construction. Additionally, the "Municipal Improvement Act' of 1913 allowed for the financing of or acquisition of public improvements. This California State act is the enabling statue that municipalities use to construct and finance public works projects.

The history of undergrounding of overhead utility wires for older cities in the US is varied in its funding approach but mostly characterized by the incompleteness of efforts to fully experience the attributes and benefits of utility wire undergrounding. Currently utility customers in California pay about a dollar a month for a program that is supposed to bury all wires. (The amount that is in PG&E's energy bill is to fund undergrounding that has already been completed.)

This ratepayer charge is based upon the California Public Utilities Commission action on September 19, 1967, as a result of their Case No. 8209. The California Public Utilities Commission (CPUC) adopted a rule requiring electric and telephone companies to initiate and participate in an active program to underground utilities in areas of general public benefit.

[1] http://www.history.com/this-day-in-history/great-blizzard-of-88-hits-east-coast

European countries have much more of their power and telecommunications utilities undergrounded, as part of the post-WWII rebuilding and much like in the US where overhead wires are buried for new construction in the suburbs or special circumstances like the Oakland/Berkeley hill fires of 1991. Additionally, for example, there is an incentive for the State owned monopolies, like the French Post and Telegraph (now French Telecom) to see the long term view of the cost/ benefit of undergrounding utility wires. The "incident of repair" for buried utility wires during normal conditions is 47% lower. There are increased costs for construction to underground utility wires, which most current analysis sees as prohibitively expensive at $2-$4 (Should be $3-$5 million)a mile in urban areas, and repairs of utility outages do take longer in an undergrounded system2. However, these long term cost/benefits studies do not include the economic externalities, like business and individual loss of life and lost productivity, resulting from fire caused by the lack of tree trimming, snow/ice storms, earthquakes and other climate costs related to extreme weather phenomenon. Nor do these studies clearly address the time horizon for the payback period for their 'prohibitively expensive' judgments – 10, 20, 30, 50 or 100 years.

Understanding the consequences of undergrounding of utilities:

There have been a number of studies on the consequence of utility undergrounding by both private and public sources. They almost start out from the perspective that power outages over extended periods present major health and safety concerns and economic losses. According to a report by the Edison Electric Institute, "almost 70 percent of the nation's distribution system has been built with overhead power lines. "Over the past 15 years or so, however, "approximately half the capital expenditures by U.S. investor -owned utilities for new transmission and distribution wires have been for underground wires." Making such a conversion is rarely justified solely on the basis of costs. For utility companies, undergrounding provides potential benefits through reduced operations and maintenance (O&M) costs, reduced tree trimming costs, less storm damage, reduced loss of day -to-day electricity sales, and reduced losses of electricity sales when customers lose power after storms[3].

Potential Benefits of Underground Electric Facilities

An advocacy group called Underground 2020 summarizes the potential benefits of undergrounding as the following;

Advantages of underground lines include aesthetics, higher public acceptance, perceived benefits of protection against electromagnetic field radiation (which is still present in underground lines), fewer interruptions, and lower maintenance costs. Failure rates of overhead lines and underground cables vary widely, but typically underground cable outage rates are about half of their equivalent overhead line types.

Potentially far fewer momentary interruptions occur from lightning, animals and tree branches falling on wires which de-energize a circuit and then re-energize it a moment later.

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[2] http://www.ncuc.net/reports/undergroundreport.pdf

[3] http://www.underground2020.org/documents/Advantages%20of%20Undergrounding%20Utilities%20White%20Paper%2005-09.pdf

Primary benefits most often cited can be divided into four areas:

Potentially-Reduced Maintenance and Operating Costs

- Lower storm restoration cost
- Lower tree-trimming cost

Improved Reliability

- Increased reliability during severe weather (wind-related storm damage will be greatly reduced for an underground system, and areas not subjected to flooding and storm surges experience minimal damage and interruption of electric service.
- Less damage during severe weather
- Far fewer momentary interruptions
- Improved utility relations regarding tree trimming

Improved Public Safety

- Fewer motor vehicle accidents
- Reduced live-wire contact injuries
- Fewer Fires (Lake County, Ca just a current example)

Improved Property Values

- Improved aesthetics (removal of unsightly poles and wires, enhanced tree canopies)
- Fewer structures impacting sidewalks

Tangible Savings

The following chart, which summarizes the total benefits that the Virginia State Corporation Commission calculated Virginia utilities might realize if the state's entire electric distribution system were placed underground, shows tangible metrics for projecting savings to utilities. It shows an annual projected savings of approximately $104 million.

Cost Saving Item:	**$/Year**
Operations & Maintenance	no savings
Tree Trimming	$ 50,000,000
"Hundred-Year" Post Storm Rebuild	$ 40,000,000
Reduction in Day-to-Day Lost Electricity Sales	$ 12,000,000
Elimination of Lost Electricity Sales From "Hundred-Year" Storms	$ 2,000,000
Total	$ 104,000,000

Source: Virginia State Corporation Commission, January 2005, "Placement of Utility Distribution Lines Underground" Societal Benefits

The following summarizes some of the societal benefits, including enhanced electric reliability to the economy, reduced economic losses to customers due to fewer power outages after major storms, and reduced injuries and deaths from automobiles striking utility poles.

Cost Saving Item:	**$/Year**
Avoided Impact of Day-to-Day Outages	$ 3,440,000,000
Avoided Impact of "100-Year" Storm Outages	$ 230,000,000
Avoided Impact of Motor Vehicle Accidents	$ 150,000,000
Total	$ 3,820,000,000

The State of Virginia study, while not directly applicable, it does give us a template to use. We can substitute the "100-year storm" with know earthquake science that sees that every 35 years approximately the Bay Area experiences a greater than 6.0 quake. The risk is knowable the exact timing is uncertain.[4] Using a yearly per capita savings, based on the summary savings above, Berkeley can benefit from undergrounding of utilities by nearly $60 million annually.

The PG&E Program:

PG&E places underground each year approximately 30 miles of overhead electric facilities, within its service area. This work is done under provisions of the company's Rule 20A, an electric tariff filed with the California Public Utilities Commission.
Projects performed under Rule 20A are nominated by a city, county or municipal agency and discussed with Pacific Gas and Electric Company, as well as other utilities. The costs for undergrounding under Rule 20A are recovered through electric rates after the project is completed. Rule 20 also includes sections B and C. Sections A, B and C are determined by the type of area to be undergrounded and by who pays for the work.

Rule 20A

Rule 20A projects are typically in areas of a community that are used most by the general public. These projects are also paid for by customers through future electric rates. To qualify, the governing body of a city or county must, among other things, determine, after consultation with Pacific Gas and Electric Company, and after holding public hearings on the subject, that undergrounding is in the general public interest for one or more of the following reasons:

- Undergrounding will avoid or eliminate an unusually heavy concentration of overhead electric facilities.
- The street or road or right-of-way is extensively used by the general public and carries a heavy volume of pedestrian or vehicular traffic.
- The street, road or right-of-way adjoins or passes through a civic area or public recreation area or an area of unusual scenic interest to the general public.
- The street or road or right-of-way is considered an arterial street or major collector as defined in the Governor's Office of Planning and Research General Plan Guidelines.

[4] "The Signal and the Noise; Why So Many Predictions Fail -but Some Don't", Nate Silver, 2012

Rule 20B

Rule 20B projects are usually done with larger developments. The majority of the costs are paid for by the developer or applicant.
Undergrounding under Rule 20B is available for circumstances where the area to be undergrounded does not fit the Rule 20A criteria, but still involves both sides of the street for at least 600 feet. Under Rule 20B, the applicant is responsible for the installation of the conduit, substructures and boxes. The applicant then pays for the cost to complete installation of the underground electric system, less a credit for an equivalent overhead system, plus the ITCC (tax), if applicable. Berkeley has one 20B District - Thousand Oaks Heights

Rule 20C

Rule 20C projects are usually smaller projects involving a few property owners and the costs are almost entirely borne by the applicants.
Undergrounding under the provisions of Rule 20C is available where neither Rule 20A nor Rule 20B applies. Under Rule 20C, the applicant pays for the entire cost of the electric undergrounding, less a credit for salvage.

Rule 20 Process Flow

A cross-functional team that includes representatives from Pacific Gas and Electric Company, the phone and cable companies, local governments and the community at-large oversees Rule 20A projects. Projects are accomplished by:

- Identifying and reviewing potential projects
- Developing preliminary costs for the projects
- Refining associated boundaries and costs
- Coordinating the schedules of other public works projects
- Developing final project plans
- Passing a municipal underground resolution
- Developing an underground design
- Converting service panels for underground use
- Starting construction
- Installing underground services
- Completing all street work
- Removing existing poles from the project area

City of Berkeley's Undergrounding Efforts

Berkeley has a total of 237 miles of utility wires, with 86 miles or 36% of the total miles currently undergrounded and 151 miles or 64% remain aboveground. Arterials and Emergency access routes comprise 29% of the total 237 miles. Of the nearly 86 miles currently undergrounded 51% are Arterials and Emergency access routes – thus barely ½ of the Arterials and Emergency Access routes have been undergrounded out of the total that experienced undergrounding using statewide PG&E ratepayer 20A funds. Nearly 50% of the 20A undergrounding funds from PG&E funds have been allocated to

residential streets or nearly $26(??) million of the total $65(??) million PG&E rate payer 20A funds that Berkeley received.

Undergrounding Districts Completed

1970s	1980s	1990s	2000s
Hearst (Freeway to 6th)	Oxford St (Hearst to University)	Ashby/Benvenue	Los Angeles/Mariposa
Sixth St (University to Cedar)	Sacramento St (Oregon to South City Limit)	Hearst Ave (LaLoma to Cyclotron)	Park Hills
Sutter/Henry St	Ajax PL/Hill Rd.	Grizzly Peak/Cragmont	Miller Stevenson
San Pablo Avenue	Kains/Cedar/Hopkins/Jones/Page	Vicente/Alvarado	Grizzly Peak/Summit (estimated completion date 2020)
Eastshore Highway (Hearst to Gilman)	Oakvale Ave (Claremont to Domingo)	MLK Jr Way	Vistamont/Woodmont (estimated completion date 2025)
Stannage Ave (Gilman to Hopkins)	LaLoma (Buena Vista to Cedar)	Woodmont Ave	
Buena Vista Way	Channing/Bonar	Hill Rd	
Camelia St. (Stannage to San Pablo)	West Frontage Rd (South to North City Limit)	Spruce Vassar	
Colby (Ashby to Webster)	MLK Jr Way (University to Hopkins)	Leroy/Euclid	
So. Hospital Drive (Ashby to Webster)	Amador Ave (Shattuck to Sutter)	Benvenue (Woolsey to Stuart)	
Telegraph (Bancroft to South City Limit)	Woodmont Ave Area	College /Hillegas	
	Hill Rd/ Atlas Pl	Cragmont	
	Spruce St/Vassar	Arlington Avenue (Marin Circle to City Limit)	
	Benvenue Ave (Ashby to Stuart)		
1970s	**1980s**	**1990s**	**2000s**

	University Avenue		
	Solana Avenue		

Districts Completed with Additional Funds other than PG&E Ratepayer 20 A funds

Shattuck/Adeline	BART
University Avenue	Caltrans, Private
6th Street	Redevelopment
Kains, etc.	CDGB
Bancroft Ave	UC
San Pablo	Caltrans

Districts formed since 1990:

- Number of Districts formed: 9
- Criteria for Selection: First come/first served based upon organization and initiative of citizens in local area/district
- Annual obligations committed to these Undergrounding districts can borrow up to 5 years in advance on PG&E ratepayer 20A funds

Rule 20A Districts in Berkeley as written by PWC in 2004

"Berkeley and Oakland were two cities who aggressively went after Rule 20A funds and formed a long queue of assessment districts in their areas. They convinced PG&E to bend the guidelines and use Rule 20A monies in residential neighborhoods where residents were more willing to pay for private connection costs ($2000+ per parcel).
When PG&E started to face their own problems (rapid demand caused by internet server farms & bankruptcy hearings) they began to refuse to deviate from the original criteria established by the CPUC under Rule 20. The first instance was PG&E's outright rejection of a proposed Rule 20A district in Oakland's Piedmont Pines neighborhood.
At that point, Berkeley still had a number residential districts approved by PG&E in queue and their Rule 20A monies committed years into the future. As a result, the City Council issued a moratorium on Rule 20A districts until a new policy for future Rule 20A monies could be developed.

Today there are still three residential districts which have paid their connection and street light costs, but are still waiting for PG&E to schedule construction.

1) Miller/Stevenson/Grizzly Estimated construction 2007-2008
2) Grizzly Peak/Summit To be scheduled
3) Vistamont (Woodmont) To be scheduled

Rule 20B -Most Residential Neighborhoods

- In December 2000, the City rolled out guidelines for neighborhoods interested in forming Rule 20B districts. Although many neighborhoods have expressed interest and continue to do so, only one neighborhood (Thousand Oaks Heights) actually formed a district which is now complete.
- Although cost estimates are being updated based on the experience of Thousand Oaks Heights, the estimates from August 2005 give you some indication. At that time the range was $25-$30k per household, not including the conversion costs on each parcel or $2.5k-$5K. In broad terms this translated into approximately $2000 annual costs added to county property tax bills. Of course, these costs would probably be a little higher today."

Moratorium established in 2000 on forming new districts until new criteria for forming districts:

Criteria developed passed unanimously by both the Public Works Commission and Transportation Commission in January of 2009

- It recommends that the Council reaffirm its December 19, 2000, to prioritize major arterial routes which were additionally emergency and evacuation routes, by adopting priority routes that meet the convergence of three criteria
- a major arterial route as designated by the General Plan
- major emergency/first responder/evacuation route as designated by the General Plan
- highest traffic volumes as determined by the Public Works/Transportation division

This recommendation to Council was never agenized or acted upon by Council.

Current Situation - 2015: These Districts were established between FY 1991 and FY 1992

- Berkeley Alameda Grizzly Peak Blvd "Engineering Phase"
- Berkeley Alameda Vistamont Ave "Planning Phase"

These two remaining Undergrounding Districts will not be completed until 2020 and 2025 respectively. Additionally, PG& E current allocation of 20 A funds for those districts being completed means that new 20A funds will not be available until 2025

Funding Decisions

Few alternatives exist for utilities themselves when it comes to financing the undergrounding of power lines; primarily through either rate increases or special charges to monthly utility bills. Conversely, jurisdictions have much greater flexibility and alternatives to consider in paying for undergrounding, for example:

- Charging a flat fee to all property owners within the jurisdiction;
- Create special districts within communities which could be added to monthly utility bills or tax bills;
- Community-financing through their operating budgets and General Obligation Bonds;
- Pooling monies from residents to pay for their own lines, or at least the portion that runs from the pole to their home meters;
- Implementing a small local tax on rooms, meals, liquor, and/ or retail sales;
- Using economic development, housing and community development, and other creative grant funding from resources such as the State Highway Administration, FEMA, and the State General Assemblies;

- Coordinate the timing and location with State and local infrastructure projects such as road, water, or gas line replacement to save on overall costs. [5]

All the above.

[5] Prepared by: Navigant Consulting, Inc., A Review of Electric Utility Undergrounding Policies and Practices March 8, 2005

APPENDIX 3

Comments and Questions from Commissioners

1. Inclusion of a street cross section diagram showing placement of trench, transformers, etc. compared to the public right of way and potential private land. This would not even have to have measurements just a crude diagram to help a laymen understand what the actual underground looks like.
   a. We have attached Figure 1 "Diagram of Typical Street Section Showing Underground Facilities in Commercial Area"
2. Please mention if Harris has come across in your research any cities that have had private organizations fund any portion of the undergrounding such as a telecom company funding it in coordination with replacement of their own infrastructure. If yes, expand a bit on how that worked out.
   a. There have been projects where PG&E has offered a credit to underground in lieu of an overhead relocation for a road widening, but not for maintenance. In this case, PG&E credited the City with the avoided cost of the overhead relocation. This does involve a great deal of coordination, so that the undergrounding does not interfere with the road widening project.
3. Include a table showing the time it takes per mile to underground on various street or topography types.
   a. We have attached typical schedules for 1 mile of undergrounding under Rule 20A and Rule 20B.
4. If possible, put some numbers to the potential cost savings in maintenance and power outage avoidance in the pro and con discussion.
   a. Harris does not have this information.
5. Summary totals for all areas where data is presented.
   a. Done.
6. Summary of new information about Rule 20 that is not available on the City's and PG&E's websites and put Rule 20 discussion in appendix.
   a. In reviewing the rule, there is a new provision acknowledging "that wheelchair access is in the public interest and will be considered as a basis for defining the boundaries of projects that otherwise qualify for Rule 20A".
7. Expanded discussion of the time frame to realistically complete undergrounding given various funding mechanisms (bonding, surcharge, combination, etc.)
   a. See schedules.
8. Totals miles and % of total residential of non-Arterial and Collector residential streets that already have been undergrounded and remaining total of residential streets to be undergrounded.

TABLE 1: Summary of Undergrounding Lengths and Costs				
Arterial Streets	**Length (Feet)**	**Length (Miles)**	**Estimated Cost**	**% Underground**
Total arterial streets	135,095	25.6	N/A	N/A
Total arterial streets undergrounded	66,015	12.5	N/A	49%
Non-residential arterial streets to be undergrounded*	14,830	2.8	$11,380,000	11%
Residential arterial streets to be undergrounded**	54,250	10.3	$31,550,000	40%
Total arterial streets to be undergrounded	69,080	13.1	$42,930,000	51%
Collector Streets				
Total collector streets	190,460	36.1	N/A	N/A
Total collector streets undergrounded	59,660	11.3	N/A	31%
Non-residential collector streets to be undergrounded*	23,275	4.4	$15,100,000	12%
Residential collector streets to be undergrounded**	107,525	20.4	$76,770,000	57%
Total collector streets to be undergrounded	130,800	24.8	$91,870,000	69%
Residential Streets				
Total residential streets***	832, 666	157.7	N/A	N/A
Total residential streets undergrounded	57,267	10.8	N/A	7%
Total residential streets to be undergrounded	775,399	149.9	N/A	93%

* Non-residential includes Zones M, C-DMU, C, and SP
** Residential includes Zones MUR and R
*** Residential Streets include all non-arterial and non-collector streets falling in multiple zones

9. Expand the discussion of PROS AND CONS OF UNDERGROUNDING (e.g., if it is high cost CON - what about safety and emergency situations and associated risk assessment costs). Does Harris have any expertise in this area?
   a. Harris does not have this expertise.
10. Create discussion on savings that can be accrued to the City when the City's Transportation Engineering and Paving Engineering are combined with Undergrounding Construction.

a. While we do not have actual cost savings, combining paving projects with undergrounding would have several savings. Paving the street after an undergrounding project, would help to complete the cleaner aesthetics of the projects. The pole and wires would be underground and the newly paved street would help the street look new. The public's perception of the project would be improved, especially if the paving is performed directly after the undergrounding, instead of several years later. Related to the timing, if the paving were done after the undergrounding, the public would be inconvenienced less.

11. Can we figure out the percentage of street underground from the figures we already have? The Harris report specifies how many feet are already undergrounded and how many feet remain to accomplish, right?

    a. See summary Table 1.

12. Overall, I think the report is pretty good. It would be nice to have the map in a scalable digital format (AutoCAD or ARC-GIS type format preferably, but at least a vector based map rather than a low resolution raster format), but I assume that is not part of the contract.

    a. Thank you. Harris will provide 6 full size color copies and the CAD file.

13. On the map, and in the list of Arterials and collectors, Ashby Ave is not listed, and San Pablo is not listed. Even if this has to be dealt with through the State, these streets should be shown as Arterials.

    a. The map now includes Ashby Ave. and San Pablo as arterials.

14. The unfilled outlines designated for the proposed areas are shown in the map legend, but are not marked on the map.

    a. The map now shows the proposed areas as cross hatched.

15. Doing a Google inspection of MLK Jr. Way, the section at the south end of Berkeley to the Boarder with Oakland (actually, all the way to the bay) appear to already be undergrounded. Also the section of MLK north from Adeline to Ashby.

    a. This has been updated.

16. In the Undergrounding Planning Level Estimate charts, where are the zones (M, MR, CB, C, SP and R) defined? It would be nice to have this definition as part of the chart legend for those not intimately familiar with the City zoning maps.

a. The planning zones have been defined on the map and the estimate.

17. To be clear, the cost per foot (or mile) of undergrounding should include the cost to extend the conduits to the property line of each property. If this is not included, this should be clearly stated, and some estimate or formula should be provided, as this will ultimately be included in the cost to the city.

a. The estimate does include the cost of the conduits from the main trench or splice box to the property line.

18. I am not sure where to fit this, but a discussion of the cost of connecting a house from the property line extension to the house itself should be discussed. Depending on current codes, this could include the cost of a pull box or the cost of a new service panel, the cost of the conduit, the cost of trenching, etc. Utility imposed rules not normally covered by code (for instance two-foot radius bends in two-inch conduit) should be noted. I would expect this cost (and the control of some of the specific details) would be the responsibility of the property owner.

a. Since there are many variables in the cost of the service, we have included Table 2 below with the range of costs for commercial and residential services.

	TABLE 2: SERVICE CONVERSION COSTS FOR:	
	RESIDENTIAL (SINGLE FAMILY)	**Range of Costs**
A	Trench from property line to meter	$50-$100/foot
B	Conduits for electric, cable and phone	$6-$15/foot
C	Service Panel Conversion	$1500-$3000/each
D	Driveway restoration	$25-$50/foot
E	Landscape restoration	$10-$25/square foot
F	Trenching in steep slopes > 10%	$100-$200/foot
G	Drain box where meter is lower than sidewalk grade	$200-$400/each
	COMMERCIAL	**Range of Costs**
	Trench from property line to meter	$50-$100/foot
	Conduits for electric, cable and phone	$6-$15/foot
	Service Panel Conversion (Up to 400 amps)	$3000-$10000/each
	Driveway restoration	$25-$50/foot
	Landscape restoration	$10-$25/square-foot
	Trenching in steep slopes > 10%	$100-$200/foot

For example, the approximate cost to provide the trench, conduit and service panel conversion where the slope is greater than 10% for a residence would be: (B+D+E+F) x Footage +C =+/- $$$

19. Please provide a link to the details of San Diego's use of 20D funding and the San Diego utility lawsuit re: rate setting for 20D funds.

    a. Here's the link to Rule 20D

    http://regarchive.sdge.com/tm2/pdf/ELEC_ELEC-RULES_ERULE20.pdf

    and an article about the Rule 20 lawsuit. We didn't see anything specific to a Rule 20D lawsuit.

    http://www.sandiegoreader.com/news/2016/may/13/ticker-sdge-undergrounding-case-court/

Comments from Commissioner Bruzzone

1. Pages 3 and 4. I think I'd have a summary here that there are 35 miles of street to underground for 100%. Of that 35 miles, about 11 miles is on arterials and the remaining on collector streets.
A summary has been included on this version.

If I am doing the math right, the cost is $40 million for the 11 miles of arterial streets (about $3.6 million per mile) and about $90 million for the 24 miles of collector streets (about the same cost per mile).

I think if the costs per mile are unit costs, we should note that and note if there is a cost difference between arterial and collectors. *The unit costs have been noted.*

2. I'd like some discussion of any efficiencies we gain if we package all street rights-of-way improvements at once (i.e., sewer, water, gas, electric, telecom) along with repaving. This can be a range or a percentage.
We have included a limited discussion.

3. I'd like some discussion on what, in the future, needs to be directly connected to the building (house/office/etc.). I'm hearing that the telecom companies want to beam wireless into the residential units, eliminating that hard-wire link. Let's have a discussion on this (doesn't have to be a conclusion).
This is outside the scope of this study. It could be provided on a future phase.

4. If we don't need to have hard connections for telecom, how much does that save?
We can address this in a future submittal.

5. Thinking of which, the stated cost per mile (I believe) does not include the hard wire connection to the utility user. We should state that explicitly, and then give a range of what that cost would be (a range is fine, as I understand and appreciate Rocco's observation on the vastly different costs to provide access to the individual utility users).
We have provided items that would make up estimated costs per foot of the trench, conduit and service panel conversion.

6. Street lighting should be included in all estimates of undergrounding. Many streets (especially those around the University) are much to dark -- this is a public safety issue.
This is outside the scope of this study however, we could provide a unit cost to replace the street lights in a future submittal.

7. After listening to Rocco's comments, and the comments of the Subcommittee, I think we have a real opportunity to rethink the architecture of our utilities. On the energy side, with solar, we can work with PG&E and design the system to actually work for renewables -- i.e., storing power, islanding microgrids for both storage and for emergencies when the rest of the

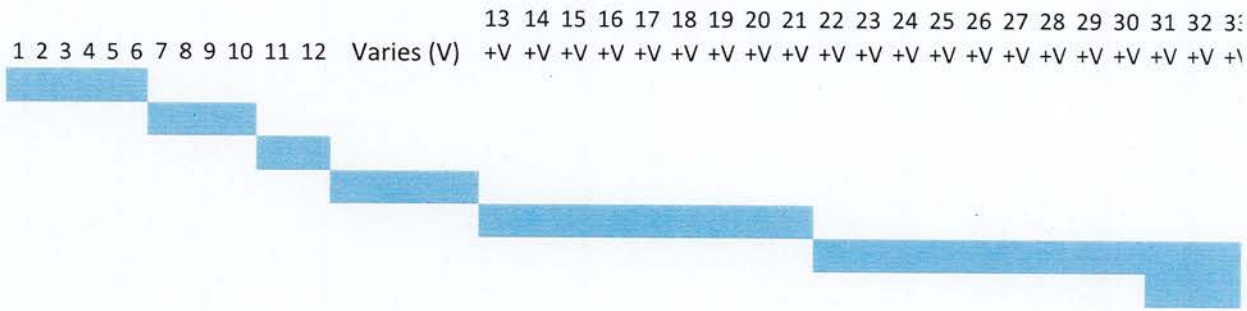
gird goes down, etc. -- as well as recognizing that the telecoms may be changing their technology for access into the homes. If the study could include this as a sidebar someplace, I think that will be valuable.
This is interesting, but outside the scope of this study.

8. Some discussion of reliability increases that come with undergrounding -- including during an earthquake and the impacts of falling poles -- will also be valuable.
This is outside the scope of this study.

9. Finally, from my point of view, this work cannot be funded under the CPUC ratepayer program for a very long time, and, as is said, in the long-run we're all dead. We need to look at a citywide GO Bond -- or a series of bonds -- to get this done within at least some of our lifetimes. I think a broad discussion of developing an undergrounding program that coordinates with other utility and street infrastructure over a 20-year period, at a reasonable number of distances annually, will be our most effective way forward. We'll need to prioritize any program based on these coordinations and also based on important places to clear the wires from first (like fire stations!).
This is outside the scope of this study however, we could provide some discussion in a future phase.

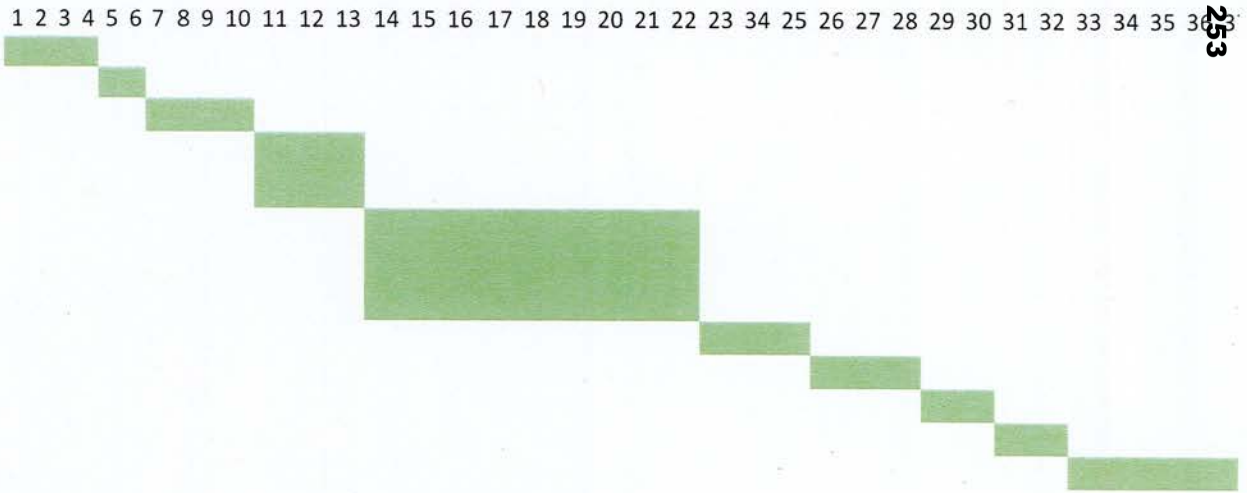
CHAPTER IX
TYPICAL SCHEDULE
7/20/2016

Typical Rule 20A (approximately 1 mile, 100 parcels)



Discuss with utilities	6 months
Create district boundaries	4 months
Pass Resolution	2 months
Allocation Available at $500k/year	varies
Engineering and Land	9 months
Construction and Procurement	12 months
Install service trench and conduits	3 months
PG&E installs underground facilities	5 months
Panel conversion and cut over (PG&E)	6 months
Phone installs underground facilities	3 months
Cut over phone	2 months
Cable installs underground facilities	3 months
Cut over cable	2 months
Install and cut over street lights	3 months
Remove Poles	3 months

Typical Rule 20B (approximately 1 mile, 100 parcels)



Fund preliminary estimate	4 months
Prepare preliminry estimate	2 months
Property Owner Petition	4 months
Fund detailed design and assessment engineering	3 months
Prepare detailed design, assessment engineering and identify needed easements	9 months
Bid construction project	3 months
Finalize assessment	3 months
Pass Resolution	2 months
Acquire bonds	2 months
Construction and Procurement	12 months
Install service trench and conduits	3 months
PG&E installs underground facilities	5 months
Panel conversion and cut over (PG&E)	6 months
Phone installs underground facilities	3 months
Cut over phone	2 months
Cable installs underground facilities	3 months
Cut over cable	2 months

Appendix B
Fire Risks and Mitigation Measures

Fire History and Environmental Risk Factors

Fire Risk in California

2017 was the hottest year on record in California, following 5 years of drought that killed 129 million trees in California. Seven of the ten deadliest and most destructive fires in California's history took place during the last 10 years, each one worse than ever experienced before. The most destructive fires in California, in order were:

- **CAMP FIRE - (Butte County), November 2018**
  Structures destroyed: 18,804
  Acres burned: 153,336
  Deaths: 86

- **TUBBS FIRE - (Napa County, Sonoma County), October 2017**
  Structures destroyed: 5,636
  Acres burned: 36,807
  Deaths: 22

- **TUNNEL FIRE - Oakland Hills (Alameda County), October 1991**
  Structures destroyed: 2,900
  Acres burned: 1,600
  Deaths: 25

- **CEDAR FIRE (San Diego County), October 2003**
  Structures destroyed: 2,820
  Acres burned: 273,246
  Deaths: 15

- **VALLEY FIRE (Lake, Napa & Sonoma County), September 2015**
  Structures destroyed: 1,955
  Acres burned: 76,067
  Deaths: 4

- **WITCH FIRE (San Diego County), October 2007**
  Structures destroyed: 1,650
  Acres burned: 197,990
  Deaths: 2
- **WOOLSEY FIRE (Ventura County), Nov. 2018**
  Structures destroyed: 1,643
  Acres burned: 96,949
  Deaths: 3

- **CARR FIRE (Shasta County, Trinity County), July 2018**
  Structures destroyed: 1,614
  Acres burned: 229,651

Deaths: 8

- **NUNS FIRE (Sonoma County), October 2017**
  Structures destroyed: 1,355
  Acres burned: 54,382
  Deaths: 3

- **THOMAS FIRE (Ventura County, Santa Barbara), December 2017**
  Structures destroyed: 1,063
  Acres burned: 281,893
  Deaths: 2

2017 was a devastating fire year highlighted by the Tubbs Fire, 2018 was highlighted by the Camp Fire, and 2019 is another severe fire year in northern and southern California. The Tubbs Fire in Santa Rosa made it clear that the flatlands are not immune from catastrophic fires. Fire raced down from the hills and flying embers started multiple smaller fires that burned down the Coffey Park neighborhood.

The following is an excerpt from the State of California's Fourth Climate Change Assessment, 2018, regarding projections on wildfires:

Impact: Climate change will make forests more susceptible to extreme wildfires. By 2100, if greenhouse gas emissions continue to rise, one study found that the frequency of extreme wildfires burning over approximately 25,000 acres would increase by nearly 50 percent, and that average area burned statewide would increase by 77 percent by the end of the century. In the areas that have the highest fire risk, wildfire insurance is estimated to see costs rise by 18 percent by 2055 and the fraction of property insured would decrease.

Fire Risk to Berkeley

The Berkeley and Oakland area has had a long history of wildland fires. The following is excerpted from the Hills Wildfire Working Group, Wildfire Problem Statement, as posted on the East Bay Regional Park District website:

Fire records for the East Bay Hills are sketchy, yet newspaper clips and old fire planning studies document an active and dangerous fire history. During the 75-year period between 1923 and 1998, eleven Diablo wind fires alone burned 9,840 acres, destroyed 3,542 homes, and took 26 lives, with over 2 billion dollars in financial loss. During the same period, three large west wind fires burned 1,230 acres of grass, brush, trees, and 4 homes.

News reports document the major fires that have threatened the East Bay Hills:

- ***1923 Berkeley**- A Diablo wind fire that started east of the Main ridge at 12 noon on a Monday in September destroyed 584 homes North of the U.C. Campus. No conflagration was ever more out of control. None ever demonstrated more vividly its power to defy all defensive resources once it gained headway. It was extinguished only by an act of providence.*

Figure B-1 – 1923 Fire in Berkeley
Photo by Cal Alumni Assoc.

- ***1931 Leona***- *5 homes were lost and 1,800 acres burned by a Diablo wind fire that started at 7 a.m. on a Monday morning in November. "Splitting of the fire into two huge infernos left the hundreds of fire fighters almost helpless to combat the double conflagration."*
- ***1933 Redwood/Joaquin Miller***- *1 life and 5 homes were lost with 1,000 acres burned by a Diablo wind fire that started on the ridge at 7 a.m. on a Monday morning in November. "The fire traveled along the tops of the thick groves of trees for great distances, never reaching the ground until after the main blaze had passed."*
- ***1937 Broadway Terrace***- *4 homes were lost and 1,000 acres burned by a West wind fire that started at 3 p.m. on a hot Saturday afternoon in September. "Lack of water caused by exhaustion of reservoirs in the hills hampered fire fighters. The fire at times crept slowly through the brush and at other times leaped from treetop to treetop."*
- ***1946 Buckingham/Norfolk***- *1,000 acres were burned by a rekindled ridge top Diablo wind fire* ***at*** *5:00 am on a Monday morning in September. "Sheer-walled canyons were quickly raging infernos. Flames raced so fast in the stiff wind they formed a fiery canopy over stands of pine and eucalyptus." In the ten years following this fire, at least 2 other large fires occurred in Claremont Canyon (Claremont above water tank to Stonewall) and Panoramic Hill (South of Panoramic to fire road) that did not involve structures because few existed at the time.*
- ***1960 Leona***- *2 homes were lost and 1200 acres were burned by a Diablo wind fire that started at* ***11 a.m.*** *on Saturday morning in October. "The 84-degree temperature and low humidity aided the flames which roared with express train speed up steep slopes. Flames roared 50 ft. into the air."*
- ***1970 Buckingham/Norfolk***- *37 homes lost, 36 damaged, and 204 acres burned in a Diablo wind fire that started near the ridge* ***at*** *10 a.m. on a Tuesday morning in September. The wind was swirling in every direction. The heat was so great that some houses were exploding before the fire actually reached them.*
- ***1980 Berkeley/Wildcat***- *5 ridge top homes were lost in a Diablo wind fire that started at 2 p.m. on a Saturday afternoon in December. The blaze, fed by thick underbrush and tree (eucalyptus) debris, was so hot and fast that homes literally exploded.*

- ***1991 Oakland/Berkeley***- *The fire was rekindled at 10:45 a.m. below Buckingham/Norfolk roads, on a Sunday morning in October by a ridge top Diablo wind. The firestorm burned over 3 square miles, killed 25 people, gutted 2,900 homes and caused $1.68 billion in damage. It was the most destructive wildfire in California history until 2017.*

Figure B-2 – 1991 Oakland Hills fire
Photo by SF Chronicle

- ***1994 Castro Valley***- *3 homes were lost in a windy October afternoon near Lake Chabot Road when fireworks ignited a grass fire in a horse pasture below homes that provided no defendable space behind their residences.*

If a fire occurs in Berkeley or the East Bay hills, how rapidly will it spread, and to where? While fires can occur under a wide variety of conditions, fires are most likely to rapidly spread and grow when high winds typically from the northeast direction coincide with hot dry conditions. This condition, winds descending the western slopes of the Coast range and known locally as a Mono or Diablo wind, is similar to the Santa Ana winds in southern California.

Given specified wind speed, fuel moisture and other data, fire spread can be computed using methods such as embodied in FlamMap (https://www.firelab.org/project/flammap). Such calculations are beyond the scope of this study. However, an estimate of how rapidly a fire might spread under Red Flag conditions can be gleaned by studying fire spread for events similar to those of concern. Such events include:

- The 1991 Oakland Hills fire began about 11 am during a Diablo wind – within 15 minutes it had run 2km (6,600 ft.) downhill – six hours later it had run 4.5 km (15,000 ft.). From Wildcat Canyon Road at Berkeley's border with Tilden Park, to the Marin Avenue intersection at the Marin Circle, is 2.2 km. In other words, the East Bay Hills fire would have spread from Tilden Park to Marin Circle in about 20 minutes.
- The 2017 Tubbs fire spread at a rate of about 2 miles per hour, meaning it would have spread from Tilden Park to Marin Circle in about 37 minutes.

The North Berkeley Hills are a Wildland Urban Intermix area with about 26,000 residents and 7,453 assessor parcels. The likelihood of a major fire in this area similar to the Oakland Hills fire is about 0.002 per year, with Tilden Park itself having much higher likelihood (as much as 0.01 per year). Climate change may be increasing this likelihood, although how much is difficult to say. Diablo winds ("Red Flag" conditions) occur on average about 2.5 times each year, with about half those occurrences being in October to November when wildland fuels are very dry. Major WUI fires often burn the same areas that have burned in previous years. This is another reason why Berkeley is at risk.

CalFire has expanded its designation of high and extreme hazard fire zones as a result, with the subsequent loss of home insurance by many who live in these hilly and windy areas of Berkeley.

Cities that expect to rebuild after fires must develop a resilience strategy ahead of time to ensure that they don't lose citizens and businesses.

Reducing the Risk of a Fire

With the increasing risks of wildland fires from extreme climatic conditions, there are actions that the City of Berkeley, our residents, and local agencies can take to reduce the risk of a fire. The following summarizes the actions we can take through educating the public of the risks, reducing vegetation that fuels fires, and PG&E's plans to shut off power during high risk climatic conditions.

Public Education

The National Weather Service issues Red Flag Warnings & Fire Weather Watches to alert fire departments of the onset, or possible onset, of critical weather and dry conditions that could lead to rapid or dramatic increases in wildfire activity. A Red Flag Warning is issued for weather events which may result in extreme fire behavior that will occur within 24 hours. During these times extreme caution is urged by all residents, because a simple spark can cause a major wildfire. The type of weather patterns that can cause a warning include low relative humidity, strong winds, dry fuels, the possibility of dry lightning strikes, or any combination of the above.

Figure B-3 – AC Alert with Red Flag Warning

East Bay Regional Parks District

The East Bay Regional Parks District issues the following restrictions to the danger of fires on Red Flag days:

- No open fires, campfires, wood burning or charcoal barbecues are permitted.
- Campground visitors must clear all flammable material for ten feet from their camp stove.
- Smoking is prohibited in all East Bay Regional Parks.
- No use of gasoline powered equipment (generators).
- Increased monitoring, patrol and strict enforcement of these restrictions.

City of Berkeley

The public is notified of Red Flag conditions through AC Alert, City of Berkeley notifications, Mayor and Coucilmember newsletters and local news broadcasts. Berkeley Councilmembers Susan Wengraf, Lori Droste, and Sophie Hahn hold an annual Fire Safety Town Hall every May. Representatives from the Berkeley Fire Department, the East Bay Regional Parks, the Orinda Fire Department, CalFire and UC Berkeley give presentations about what their jurisdictions are doing to mitigate and prevent wildfires. Topics covered included:

- Safe Passages pilot program (vehicle access and egress)
- Evacuation routes

- Vegetation management
- Notification and warning systems
- East Bay Regional Parks fire mitigations
- New technologies
- State legislation
- What neighboring jurisdictions are doing

Vegetation Management

Wildland fire behavior is controlled by three factors: fuels, weather and topography. Because it is impractical to control the weather and topography around us, the only practical way to modify fire is by managing its fuel source. Fire fuel refers to anything that has the ability to burn and spread fire, like trees, shrubs and dried grass.

State of California

In March 2019, Governor Newsom proclaimed a state of emergency throughout California ahead of the coming fire season. The Governor directed his administration to immediately expedite forest management projects that will protect 200 of California's most wildfire-vulnerable communities. This action follows the release of a report earlier by the California Department of Forestry and Fire Protection (CalFire), which identified 35 priority fuel-reduction projects that can be implemented immediately to help reduce the public safety risk for wildfire. The state of emergency provides time-saving waivers of administrative and regulatory requirements to protect public safety and allow for action to be taken in the next 12 months, which will begin to systematically address community vulnerability and wildfire fuel buildup through the rapid deployment of forest management resources. But will there be funding to maintain wildland fuelbreaks in the years that follow?

Regional Agencies

The East Bay Regional Park Fire Department uses several different methods to modify or reduce the amount or availability of wildland fuels for any fire that may occur. Ladder and surface fuels such as grass, brush, forest litter, and down logs and branches are modified or removed by hand crews, prescribed fire, mowing, weed-eating, masticating, or animal grazing. Dense tree stands are often thinned to remove some of the trees that contribute to fuel loading and to reduce the potential for wildfire to spread in the tree canopies. Visitors to the East Bay Regional Parks may encounter cattle, sheep or goats grazing on the grasslands. The District uses grazing animals as a practical and economic resource management tool. Grazing helps reduce fire hazards by controlling the amount and distribution of grasses and other potential fuel.

The Orinda-Moraga Fire District entered into an agreement with CalFire in May 2019 to begin planning and work on the North Orinda Shaded Fuel Break (NOSFB) project. The project area encompasses 1,515 acres along 14 miles of open space in the East Bay between the eastern portions of Tilden Regional Park and Pleasant Hill Road. This project is being carried out to reduce dangerous wildfire fuels in a deliberate manner designed to minimize environmental impacts to wildlife and

protected plants. This area receives seasonal "Diablo winds", that were the dominant influence in several major nearby wildfires. These fuels are understory vegetation, dead/dying trees, and highly combustible brush. Reducing the quantities of these fuels will lower the intensity and speed of a wildfire. This fuel break will provide essential opportunities for firefighting success by providing areas of lower fire intensity and enhanced fire line production rates.

Figure B-4 – North Orinda Fuel Break Map from SF Chronicle

City of Berkeley

Berkeley currently has an active vegetation management program both for its public space and for property owners in the Very High Hazard Fire Zone. Property owners can learn about appropriate vegetation management on its Wildfire Evacuation- City of Berkeley webpage. We know that effective vegetation management includes reducing fire laddering fuels, removing dead limbs, limbing up trees, regulating the height of hedges, and maintaining at least 5 feet of vegetation-free space next to homes. Currently, compliance is largely voluntary except for annual inspections of vacant properties in the Very High Hazard Fire Zone (VHHFZ) and all properties in the Extreme Hazard Fire Zone (EHFZ).

PG&E

PG&E also has a vegetation management program. The following is from the PG&E website:

In response to the growing risk of wildfire in our state, we are enhancing our vegetation and safety work. Our focus will be on addressing vegetation that poses a higher potential for wildfire risk in high fire-threat areas as designated by the California Public Utilities Commission (CPUC). Our Enhanced Vegetation Management program involves multiple steps to help further reduce the risk of trees, limbs and branches from coming into contact with power lines in high fire-threat areas.

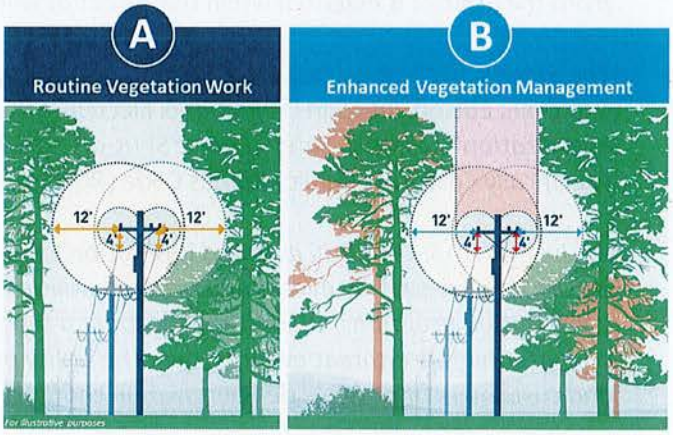


Figure B-5 – PG&E Vegetation Management

The San Francisco Chronicle reported in October 2019 that PG&E was behind schedule in carrying out their vegetation management program. The following is an excerpt from their report:

As the most dangerous part of California's wildfire season continues, Pacific Gas and Electric Co. says it has finished only about 31% of the aggressive tree-trimming work it planned this year to prevent vegetation from falling on power lines and starting more deadly infernos.

PG&E told a federal judge Tuesday that as of Sept. 21, the company had completed 760 miles out of the 2,455 miles of power lines where it intends to take extra steps to cut back vegetation. The company said its ability to meet the tree-trimming target by the end of the year depends on whether it can "significantly increase the number of qualified personnel engaged" in the effort.

Electrical Power Service Curtailments

The cause for some of the recent wildland fires has been traced back to faulty overhead electrical wires or equipment. As an extreme measure to help reduce the risk of a fire, PG&E has proposed shutting electricity to high risk areas under Red Flag conditions. This program, called Public Safety Power Shutoff (PSPS), has been approved by the CPUC. It has now been done twice.

CPUC

The CPUC has reviewed the risks of wildfires and worked with the State's investor-owned utilities and determined the following:

Wildfires are more destructive and deadlier than in the past, and the threat of wildfires is more prevalent throughout the state and calendar year. The overall pattern shows the emerging effects of climate change in our daily lives.

Throughout the year, the CPUC works with CalFire and the Office of Emergency Services to reduce the risk of utility infrastructure starting wildfires, to strengthen utility preparedness for emergencies, and to improve utility services during and after emergencies. Interagency coordination, and cooperation from the utilities is essential when the threat of wildfires is high.

The State's investor-owned electric utilities, notably Pacific Gas and Electric Company (PG&E), Southern California Edison, and San Diego Gas & Electric (SDG&E), may shut off electric power, referred to as "de-energization" or Public Safety Power Shut-offs (PSPS), to protect public safety under California law, specifically California Public Utilities Code (PU Code) Sections 451 and 399.2(a).

On July 12, 2018, the CPUC adopted Resolution ESRB-8 to strengthen customer notification requirements before de-energization events and ordered utilities to engage local communities in developing de-energization programs. Utilities must submit a report within 10 days after each de-energization event, and after high-fire-threat events where the utility provided notifications to local government, agencies, and customers of possible de-energization though no de-energization occurred.

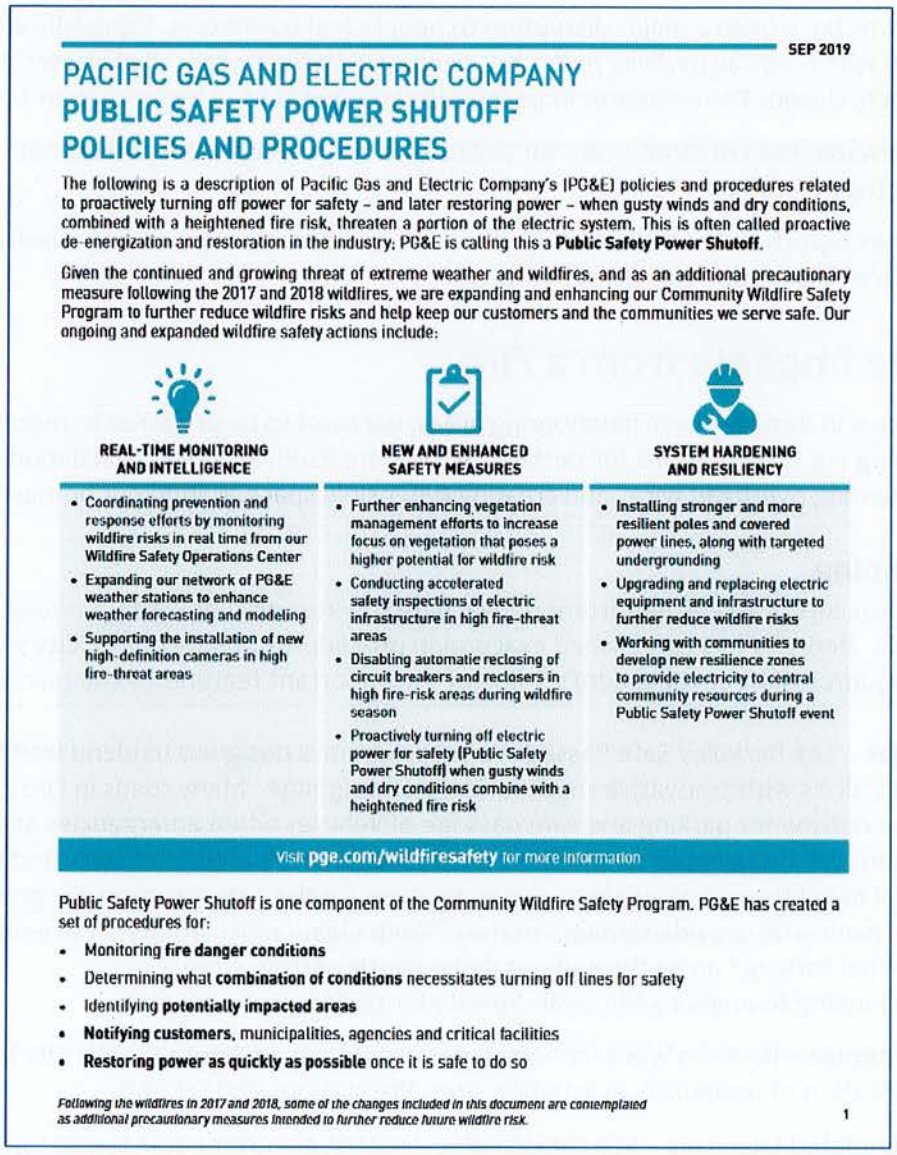
PG&E

PG&E has implemented the PSPS program. October 2019 saw the occurrence of dry conditions, Red Flag days and strong Diablo and Santa Ana winds in California. The following events have happened:

- **October 9 – 10, 2019** -- PG&E implemented its first major PSPS. About 800,000 homes and businesses in 34 counties lost power. This event tested the readiness of PG&E's public notification system and saw their website overwhelmed with contacts. Also, other facilities (such as the Caldecott Tunnel) scrambled to find back up power.

- **October 26 - 28, 2019** -- PG&E implemented a PSPS that affected about 1 million homes and businesses in 36 counties. The total number of people affected was more than 2.5 million. This was the largest intentional power shutoff in PG&E's history. This shutoff was in response to a very strong Diablo wind condition and very dry conditions.

Other shutdowns are proposed, depending on climatic conditions. PG&E's policies and procedures require inspection of their power lines and equipment before re-energizing. An outage can last several days. Figure 9 shows a summary of PG&E's PSPS policies and procedures.



SEP 2019

PACIFIC GAS AND ELECTRIC COMPANY
PUBLIC SAFETY POWER SHUTOFF
POLICIES AND PROCEDURES

The following is a description of Pacific Gas and Electric Company's (PG&E) policies and procedures related to proactively turning off power for safety – and later restoring power – when gusty winds and dry conditions, combined with a heightened fire risk, threaten a portion of the electric system. This is often called proactive de-energization and restoration in the industry; PG&E is calling this a **Public Safety Power Shutoff**.

Given the continued and growing threat of extreme weather and wildfires, and as an additional precautionary measure following the 2017 and 2018 wildfires, we are expanding and enhancing our Community Wildfire Safety Program to further reduce wildfire risks and help keep our customers and the communities we serve safe. Our ongoing and expanded wildfire safety actions include:

REAL-TIME MONITORING AND INTELLIGENCE

- Coordinating prevention and response efforts by monitoring wildfire risks in real time from our Wildfire Safety Operations Center
- Expanding our network of PG&E weather stations to enhance weather forecasting and modeling
- Supporting the installation of new high-definition cameras in high fire-threat areas

NEW AND ENHANCED SAFETY MEASURES

- Further enhancing vegetation management efforts to increase focus on vegetation that poses a higher potential for wildfire risk
- Conducting accelerated safety inspections of electric infrastructure in high fire-threat areas
- Disabling automatic reclosing of circuit breakers and reclosers in high fire-risk areas during wildfire season
- Proactively turning off electric power for safety (Public Safety Power Shutoff) when gusty winds and dry conditions combine with a heightened fire risk

SYSTEM HARDENING AND RESILIENCY

- Installing stronger and more resilient poles and covered power lines, along with targeted undergrounding
- Upgrading and replacing electric equipment and infrastructure to further reduce wildfire risks
- Working with communities to develop new resilience zones to provide electricity to central community resources during a Public Safety Power Shutoff event

Visit **pge.com/wildfiresafety** for more information

Public Safety Power Shutoff is one component of the Community Wildfire Safety Program. PG&E has created a set of procedures for:

- Monitoring **fire danger conditions**
- Determining what **combination of conditions** necessitates turning off lines for safety
- Identifying **potentially impacted areas**
- **Notifying customers**, municipalities, agencies and critical facilities
- **Restoring power as quickly as possible** once it is safe to do so

Following the wildfires in 2017 and 2018, some of the changes included in this document are contemplated as additional precautionary measures intended to further reduce future wildfire risk.

1

Figure B-6 – PG&E's PSPS Policies and Procedures

Issues that have arisen from the shutdowns have included:

- The Diablo winds were very strong with speeds up to 100 miles per hour in the upper peaks. The high winds caused tree limbs to take down overhead power lines in the shutdown and non-shutdown areas.
- Public notification on the timing and extent of the shutdowns were critical. The shutdown on October 9th saw the PG&E website overwhelmed from the volume of contacts. AC Alert, City of Berkeley notifications, and local news broadcasts were effective.
- The shutdowns have been a major disruption to people and businesses. Especially affected were people with medical, mobility and other needs. UC Berkeley cancelled classes and many school districts closed. The economic impact has been estimated to be more than $1 billion.
- Governor Newsom has criticized PG&E for decades of mis-management and for not maintaining their system.
- The local news reported that PG&E is beginning to think that undergrounding overhead utility wires may be needed to improve safety.

Reducing the Impacts from a Fire

If a wildland fire occurs in Berkeley or in neighboring areas, we need to be prepared to reduce the impacts. The following are some options for Berkeley to prepare itself, including evacuation planning, undergrounding overhead wires and creating defensible space around our homes.

Evacuation Planning

When a wildland fire occurs, it will be important to evacuate the area with or without notice from public safety officials. Berkeley has established evacuation procedures posted on the City's website (www.cityofberkeley.info/wildfireevacuation/). Some of the important features of the plan include:

- **Safe Passages** – The Berkeley Safe Passages pilot program is designed to blend traditional parking restrictions with innovative road markings and signage. Many roads in Fire Zones 2 and 3 are too narrow for parking and safe passage of vehicles when emergencies arise. Three locations will be selected so staff and the public can evaluate the efficacy and impact. The Fire Chief listed three actions that need to be done for the Safe Passages Program:
  - Identify, paint, and provide signage for new "Keep Clear" pinch points on streets
  - Expand "No Parking" areas throughout dangerously narrow streets
  - Identify funding to enable additional capacity for parking enforcement
- **Evacuation Routes** – Berkeley's evacuation routes are shown on Figure 10. The City has also shown the location of temporary evacuation sites, fire stations and schools.
- **CERT and Simulated Exercises** -- In a catastrophic disaster, government resources (people and supplies) may not be available for several days following the event. The Community Emergency Response Team (CERT) Program provides education in disaster preparedness and provides training in basic emergency skills. By preparing neighborhoods and community groups with basic emergency skills, we can lessen the effects of a disaster and help sustain

ourselves until assistance can arrive. Berkeley held simulated evacuation exercises in three parts of the City in the summer of 2019.

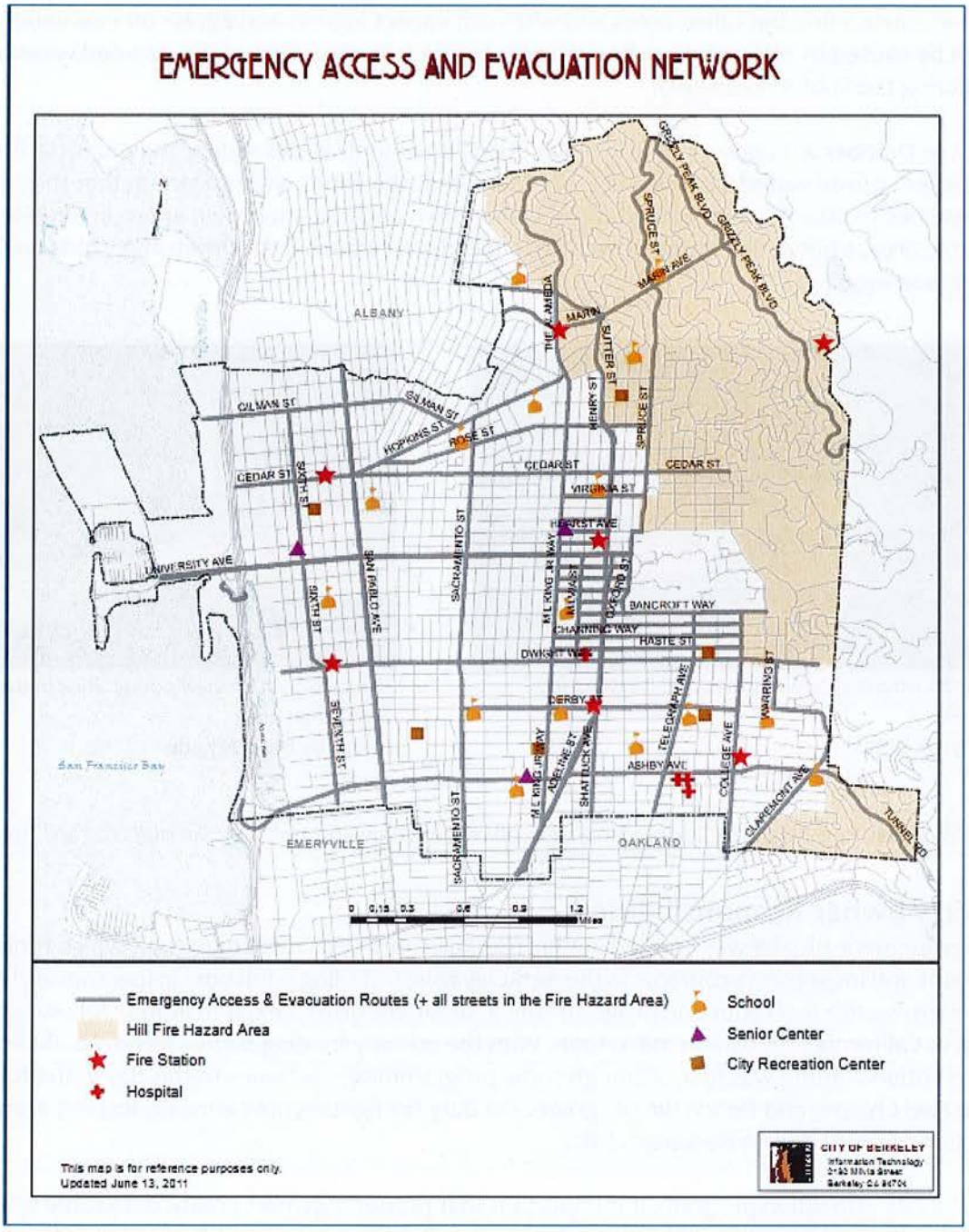


Figure B-7 – Berkeley's emergency access and evacuation network

Undergrounding Overhead Wires

Each wildland fire in California is investigated for the cause of the fire. In many cases, problems with PG&E's overhead wires or equipment have been contributing factors. Overhead wires not only can spark and cause a fire, but fallen poles and wires can impact ingress and egress on evacuation routes. This can be caused by high winds or fire damage. Figure 11 shows some of the downed wires and poles during the Tubbs Fire in 2017.

During the October 2019 power shutdown by PG&E, the intent was to reduce the potential for overhead energized wires to cause a fire. We found that the winds were so strong that they caused tree branches to take down overhead wires in shutdown and non-shutdown areas. In Berkeley's Northbrae area, a power line came down with a felled tree branch from the strong winds on October 27, 2019 (see Figure 12).

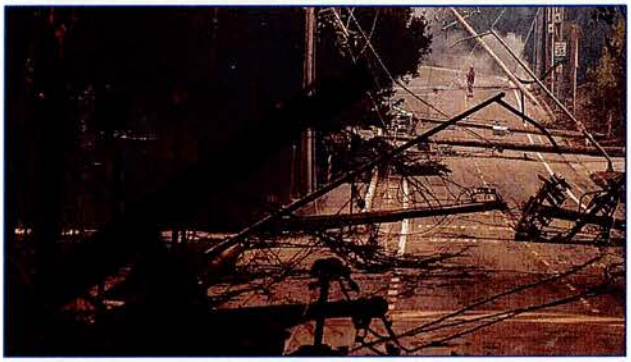


Figure B-8 - Downed power poles and lines in 2017 Tubbs Fire
Photo by LA Times

Figure B-9 – Downed power lines in Berkeley's Northbrae area
Photo by Berkeleyside

This shows that Red Flag conditions can affect all of Berkeley and not just the high hazard fire zones.

Property owner Responsibilities

A Fire Assessment District was created in 1992 (Berkeley City Ordinance 6129-N.S.) which funded fuel abatement and inspection programs in the Berkeley hills, including 3 full-time inspectors and a comprehensive fire fuel reduction program. The assessment district expired in 1997 following the passing of California Proposition 218 in 1996. With the primary funding source removed, dedicated Fire Prevention staffing was lost, although some programming continues to this day in the form of the Fire Fuel Chipper and Debris Bin programs. On-duty firefighters now annually inspect a small proportion of properties in Berkeley's hills.

Without a City inspection program, it is important that property owners create defensible space and harden their homes to reduce the impacts from a fire. Guidance information is available from the California Fire Safe Council (www.cafiresafecouncil.org).

- **Hardening Your Home** -- Fire hardened means your home is prepared for wildfire and an ember storm. It does not mean fireproof. Home hardening addresses the most vulnerable components of your house with building materials and installation techniques that increase resistance to heat, flames, and embers that accompany most wildfires.
- **Key Elements of a Defensible Space**
  - Keep your gutters and roofs clear of leaves and debris.
  - Maintain a 5-foot noncombustible zone around your home and deck.
  - Break up fuel by creating space between plants and between the ground and the branches of trees.
  - Mow grass to a height of less than 4 inches.
  - Keep mulch away from the house. Bark mulch helps plants retain water but ignites and becomes flying embers during a wind-driven fire.
  - During a wildfire, move anything burnable—such as patio furniture or gas BBQ tanks—30 feet away from structures.

Appendix C

Declaring Wildfire Prevention and Safety a Top Priority in the City of Berkeley

27

Susan Wengraf
Councilmember District 6

CONSENT CALENDAR
October 15, 2019

To: Honorable Mayor and Members of the City Council

From: Councilmember Wengraf

Subject: Declaring Wildfire Prevention and Safety a Top Priority in the City of Berkeley

RECOMMENDATION
Adopt a Resolution declaring Wildfire Prevention and Safety a Top Priority in the City of Berkeley

FINANCIAL IMPLICATIONS
None

BACKGROUND
The East Bay hills are home to extremely high fire hazards due to proximity to park land where the fuel load is high; narrow, curvy roads, hampering access by first responders and obstructing efficient evacuation routes; and steep topography and changing weather conditions. On April 23, 2019 Governor Newsom held a press conference in Berkeley, at the edge of Tilden Park, restating his declaration of a state of emergency regarding wildfires in California. Historically, California is at high risk of wildfire and the Governor was dedicating new resources to wildfire prevention. The Governor, in choosing the location for his press conference, was no doubt aware of Berkeley's history.

In 1923, a wildfire swept through north Berkeley, ultimately destroying approximately 600 homes, including churches, schools, libraries, and student living quarters. At that time, the population of Berkeley was 52,000. Today, the population density has more than doubled. In 1980, a fire in Berkeley's Wildcat Canyon destroyed 5 homes and then, on October 17, 1991, a fierce and destructive wildfire consumed southeast Berkeley and Oakland, claiming 25 lives and reducing approximately 3,000 structures to ashes. Had the wind direction not shifted, it is likely that many more people would have died and more of Berkeley would have been destroyed.

Since 1991, due to climate change, wildfires have become larger, hotter, more destructive, and more difficult to control. Vulnerable communities throughout the state have been ravaged. Potentially greater risk exists today not only in the Berkeley Hills but to neighborhoods between the hills and the Bay, as evidenced by the total destruction of Coffey Park in the 2017 Tubbs Fire. Berkeley is ranked at the same risk

2180 Milvia Street, Berkeley, CA 94704 • Tel: (510) 981-7160 • TDD: (510) 981-6903 • Fax: (510) 981-7166
E-Mail: swengraf@cityofberkeley.info

level of many of the cities that have already been decimated by fire. Berkeley's risk is ranked as the highest designation in the state.

Berkeley is also at extreme risk for a devastating earthquake on the Hayward Fault, which cuts right though Berkeley's high fire severity zone; when fire ensues it will cause even further destruction to life, property and further challenge the City's resiliency.

It is time for Berkeley to acknowledge our risk and make wildfire prevention and safety a top priority. Our full commitment, by resolution, will allow us to move forward with projects and programs to achieve our shared goals of wildfire prevention and safety; ensure wildfire prevention and safety are reflected in allocation of resources and city policies; and make certain wildfire prevention and safety are addressed as the highest priority in the next updates to the City's General Plan, Climate Action Plan, Local Hazard Mitigation Plan, Resiliency Strategy, 2050 Vision and any other plans where it may be appropriate.

ENVIRONMENTAL SUSTAINABILITY

This item supports the City's environmental sustainability goals. Fire prevention is critical for environmental sustainability. In 2018, California wildfires emitted as much carbon dioxide as an entire year's worth of California's electricity according to a November 30, 2018 press release from the U.S Department of the Interior.

CONTACT PERSON

Councilmember Wengraf	Council District 6	510-981-7160

Attachments:
1: Resolution

RESOLUTION NO. ##,###-N.S.

Declaring Wildfire Prevention and Safety a Top Priority in the City of Berkeley

WHEREAS, wildfires have grown larger and increased in intensity over the last several decades due to climate change and increased density in the wildland/urban interface (WUI), and

WHEREAS, areas of the City of Berkeley are designated by CAL FIRE as having the highest rating of "very high severity" risk to wildfire, and

WHEREAS, on March 22, 2019, Governor Newsom declared a state of emergency in of California with regard to wildfire risk, and

WHEREAS, since 1922, more than a dozen major wildfires have impacted the Berkeley hills, resulting in extensive damage, economic harm and loss of life. The 1991 Oakland/Berkeley firestorm, considered the third most deadly fire in California, burned over 1,500 acres, caused the deaths of 25 people and injured over 150 people, and

WHEREAS, wildfires in this decade are larger, faster and more destructive than in 1991, potentially causing greater risk to not only the Berkeley Hills but to neighborhoods between the hills and the Bay, as evidenced by the total destruction of Coffey Park in the 2017 Tubbs Fire, and

WHEREAS, Berkeley is also at extreme risk for a devastating earthquake on the Hayward Fault, which cuts right though Berkeley's high fire severity zone; when fire ensues it will cause even further destruction to life, property and further challenge the City's resiliency, and

WHEREAS, when a wildfire destroys a neighborhood, the short and long-term economic impact multiplies exponentially. The 1991 Berkeley/Oakland Tunnel Fire resulted in the loss of 2,900 structures and 25 lives. The 1923 North Berkeley fire destroyed about 600 homes and burned all the way to the corner of Hearst and Shattuck, before the winds shifted.

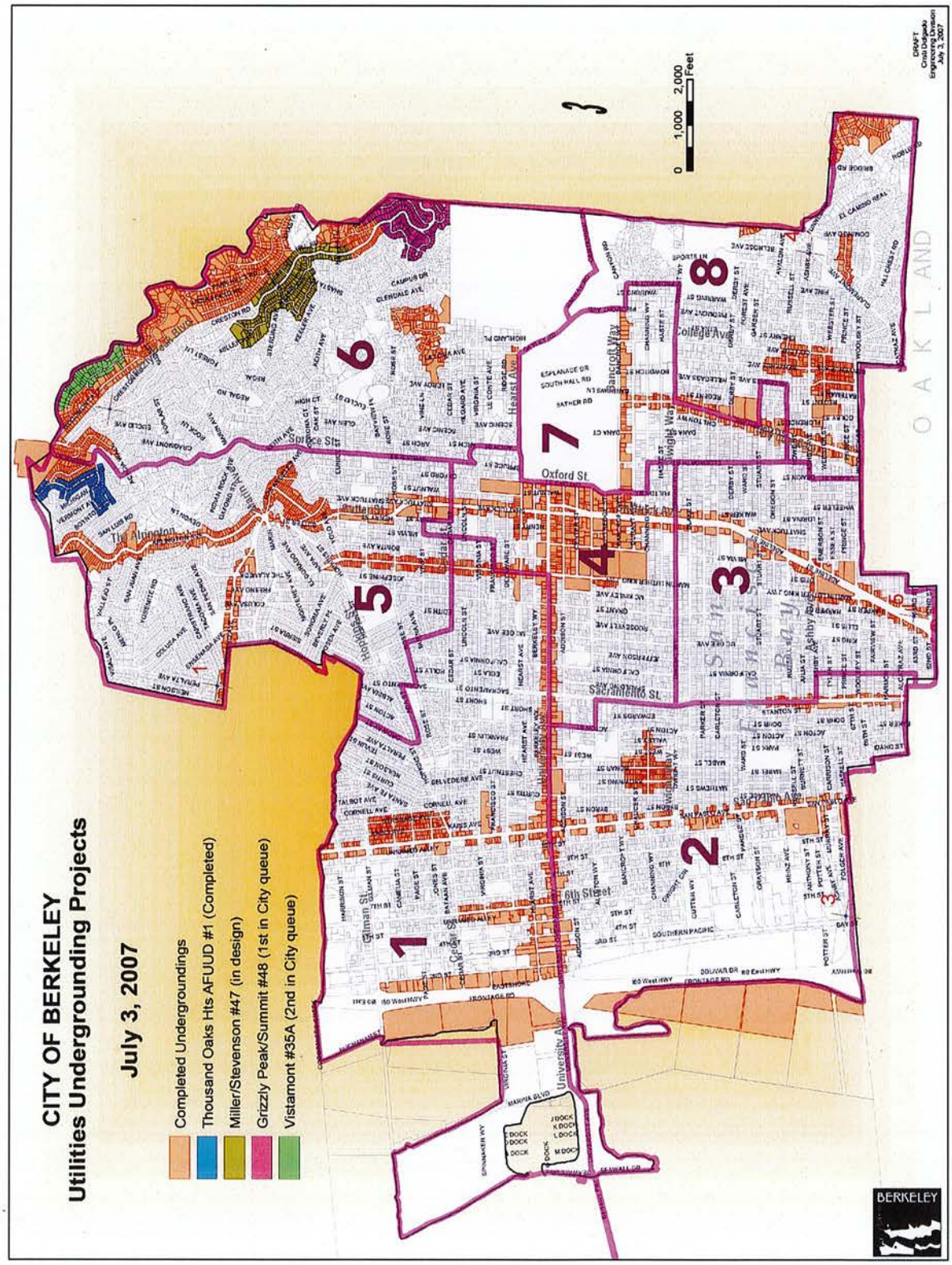
WHEREAS, major disasters such as the 2017 Tubbs Fire and the 2018 Camp Fire severely strain the limited housing stock in a community when survivors are forced to replace housing destroyed in the wildfire. Berkeley already has an affordable housing crisis, and nearby communities would be hard pressed to accommodate thousands of residents displaced by a wildfire or other major disaster, and

WHEREAS, a wildfire in the Berkeley hills threatens the entire City of Berkeley, both hill areas and flat areas and impacts air quality, loss of housing, injury as well as the tragic loss of life.

NOW, THEREFORE, BE IT RESOLVED, that the City Council pass this resolution making wildfire prevention and safety a stated top priority for the City of Berkeley.

BE IT FURTHER RESOLVED, that wildfire prevention and safety be addressed as the highest priority in the next updates to the City's General Plan, Climate Action Plan, Local Hazard Mitigation Plan, Resiliency Strategy, 2050 Vision and any other plans where it may be appropriate; and be reflected in city policies and allocation of resources.

Appendix D
Utilities Undergrounded in Berkeley



Appendix E
Report on Undergrounding Costs by Bellecci & Associates

Projected Costs of Undergrounding Utilities along City of Berkeley's Evacuation Routes

City of Berkeley

January 2020

Bellecci & Associates

7077 Koll Center Pkwy, Suite 210
Pleasanton, CA 94566

p. 925-681-4885
www.bellecci.com

Table of Contents

Acknowledgements

City of Berkeley Staff:

- Andrew Brozyna, PE – Deputy Director of Public Works

PREPARED BY:

Bellecci and Associates, Inc.:

- Daniel Leary, PE, PTOE, Project Manager
- Anoop Reddy Admal, PE, Senior Civil Engineer
- Emma Schoenthal, EIT, Assistant Engineer

Section I – Executive Summary

In December 2014, the Berkeley City Council directed "the Public Works Commission, Transportation Commission and Disaster and Fire Safety Commission [to] develop a comprehensive funding plan to underground utilities along all arterials and collectors in the City of Berkeley." An Underground Subcommittee was formed of representatives from these commissions, and has begun a four-phase study for the City Council's referral. Phase 1 was a report titled "Baseline Study for the Development of a Utility Undergrounding Program," prepared by Harris & Associates in 2016. Phase 2 conducted a "Conceptual Study to Underground Utility Wires in Berkeley", which was presented by the Public Works, Disaster and Fire Safety, and the Transportation Commissions in 2018. The program is proceeding into the third phase, which involves multiple tasks: defining the phase 3 projects, developing the financing plan, conducting community input, coordinating with utilities, and preparing an implementation plan. Phase 4 will include implementing the plan, including financing, design and construction.

The priority evacuation routes, which have been designated in the City's General Plan, are the routes along state highways and major streets that would allow citizens to evacuate in case of emergencies and disasters. The City provides a map for East/West evacuation routes along with fire zones (Appendix A). With the considerations of both safety and power reliability, these routes are the highest priorities for utility undergrounding and are the focus of this report.

This report mainly studies the utility status along the evacuation routes and provides a planning level cost estimate for undergrounding the overhead utilities along the routes. The major objectives are to:

a) Summarize the current status of overhead and underground facilities along the City's major evacuation routes;
b) Identify the segments of the City's major evacuation routes with existing overhead facilities to be undergrounded;
c) Prepare a tabular documentation with percentage of overhead and underground facilities for each roadway;
d) Provide an opinion of probable construction costs for undergrounding the existing overhead facilities along these evacuation routes.

Section II – Methodology

The City's major East/West evacuation routes are the highest priorities for utility undergrounding and a map of these routes is included in Appendix A. These routes include:

- Spruce Street, Oxford Street, Rose Street, Grizzly Peak Boulevard
- Marin Avenue
- Gilman Street, Hopkins Street
- San Pablo Avenue, Cedar Street
- University Avenue, 6th Street, Dwight Way
- Ashby Avenue, Tunnel Road
- San Pablo Avenue, Alcatraz Avenue, Claremont Avenue

The presence of overhead and underground facilities along these routes were verified using a combination of these three methods: a) utility maps, b) field visits, and c) Google Street View.

Utility Maps

The major utility companies that possess dry utilities within the City are PG&E, AT&T, Comcast, Verizon and Century Link (Level 3). Utility map request letters were sent to the aforementioned utility companies in June 2019. The utility maps provided by PG&E, AT&T, and Comcast identified the status of their existing dry utilities. However, these maps are not included in this report due to the utility companies' confidentiality clauses.

- The Comcast maps were received on June 27, 2019.
- The AT&T maps were received on July 22, 2019.
- The PG&E Electric maps were received on August 20, 2019.
- Verizon maps were received on September 18, 2019
- Century Link Level 3 utility maps were received on August 1, 2019

The utility maps listed above were evaluated for the presence of existing overhead and underground wires, conduits, joint trenches and duct banks. While other dry utilities exist within the city, it is assumed that the utility maps listed above provide sufficient coverage of existing overhead and underground facilities.

Field Visits

Field visits of the City's major evacuation routes were performed by driving along each route and noting the presence of utility poles and overhead wires. The field visits were conducted on July 2 and 3, 2019. The observations from the field visits were compared with the utility maps and the images from Google Street View to verify the presence of existing utility poles and overhead wires. Photos were taken for perceptual understanding with selected photos shown below. More photos from the field visits are included in Appendix C.

Street View Images

Google Street View provides panoramic images from positions along streets and other paths of travel. The entirety of each of the City's major evacuation routes were captured in Google Street View. The Google Street View images were compared with the utility maps to evaluate the presence of existing utility poles

and overhead wires. Google Street View, by default, shows the most recently captured images. If available, previously captured images can be shown for the location. At the time of this report, the majority of the Google Street View images along the major evacuation routes were most recently captured within the past six (6) months.

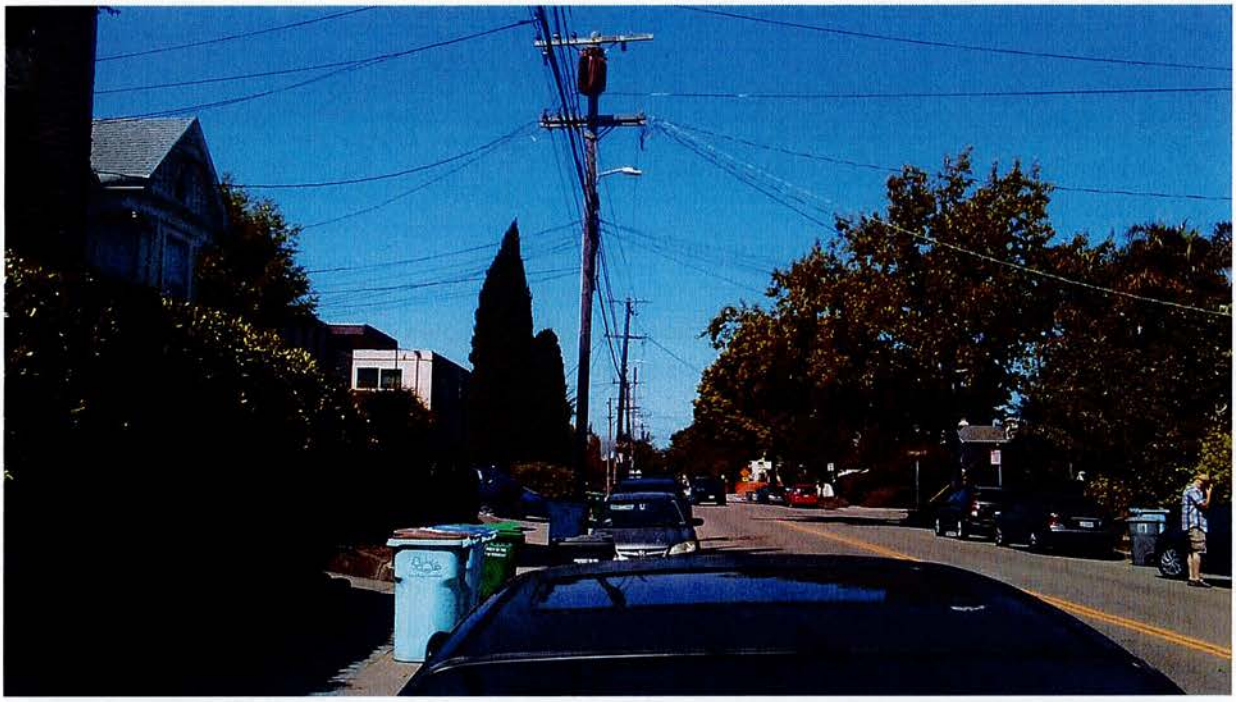


Photo 1: Taken from Dwight Way facing West near Jefferson Avenue with poles and overhead utilities

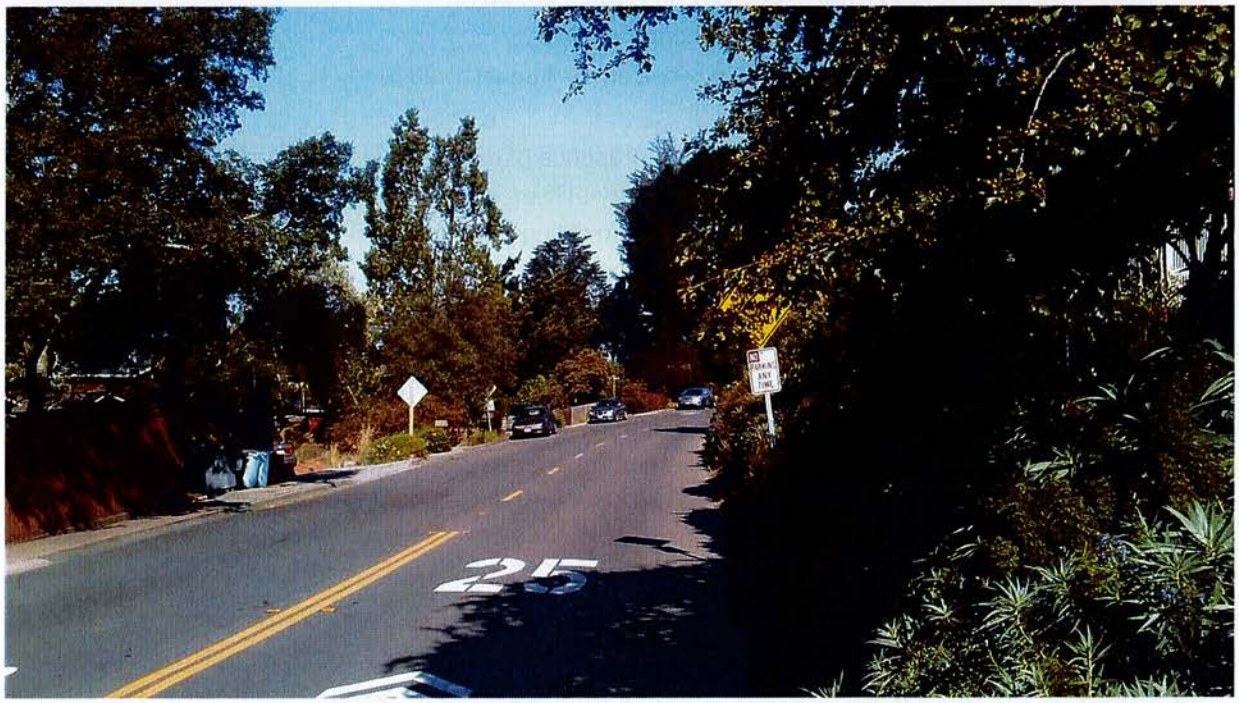


Photo 2: Taken from Grizzly Peak Boulevard facing West near Hill Road with no overhead utilities

Section III – Analysis

In general, utility maps provide a comprehensive understanding of the utility status along the City's major evacuation routes. However, utility maps can be outdated. When discrepancies between utility maps and the field visit observations are spotted, Google Street View provides insight by showing the changes in the status of undergrounding over time. For example, along Grizzly Peak Boulevard between Latham Lane and Arcade Avenue, the utility map shows overhead Comcast utilities. However, the utility poles and overhead wires were removed between May 2011 and March 2015, based on Google images captured during those times. And field visits verify the findings from Google Street View by providing the current conditions. With the information combined and verified by all three methods, a mapping exhibit that shows the presence of overhead and underground facilities along the City's major evacuation routes was created and included in Appendix B, with overhead facilities marked in red and underground facilities marked in green. A route by route analysis is presented below with tables and figures showing utility status with descriptions. The length of overhead utility (OH) is the length of street that exists with overhead utilities. It also includes segments of street that have both overhead and underground utilities, indicating that the undergrounding status is incomplete. The length of underground utility (UG) is the length of street with only underground dry utilities. There are more north-south segments of streets that are completely undergrounded than east-west segments. Because the evacuation routes are established to bring emergency access to citizens through the Interstate 80/580, the streets that travel east-west form the basis of the evacuation routes, while the undergrounded streets that travel north-south do little to optimize evacuation. However, evaluation and adjustments of the existing evacuations routes are not part of the scope of this report, and will not be discussed further.

Street classifications are based on the volume of traffic, services, and functions that the streets are intended to provide. From the Highway Design Manual, a highway is "in general a public right of way for the purpose of travel or transportation"; an arterial highway is "a general term denoting a highway primarily for through travel usually on a continuous route"; and a collector road is " a route that serves travel of primarily intra county rather than statewide importance in rural areas or a route that serves both land access and traffic circulation within a residential neighborhood, as well as commercial and industrial areas in urban and suburban areas". The Federal Highway Administration provides definitions to the following applicable terms:

- The Interstate System is the highest classification of roadways in the United States. These arterial roads provide the highest level of mobility and the highest speeds over the longest uninterrupted distance. Interstates nationwide usually have posted speeds between 55 and 75 mph.
- Other Arterials include freeways, multilane highways, and other important roadways that supplement the Interstate System. They connect, as directly as practicable, the Nation's principal urbanized areas, cities, and industrial centers. Land access is limited. Posted speed limits on arterials usually range between 50 and 70 mph.
- Collectors are major and minor roads that connect local roads and streets with arterials. Collectors provide less mobility than arterials at lower speeds and for shorter distances. They balance mobility with land access. The posted speed limit on collectors is usually between 35 and 55 mph.
- Local roads provide limited mobility and are the primary access to residential areas, businesses, farms, and other local areas. Local roads, with posted speed limits usually between 20 and 45 mph, are the majority of roads in the U.S.

Spruce Street, Oxford Street, Rose Street, Grizzly Peak Boulevard Route

This evacuation route is within or along the perimeter of Fire Zone 2, indicating a relatively high potential of fire. It is composed of primarily residential areas with high population density. Grizzly Peak Boulevard and half of Spruce Street are hilly and winding with fire potential due to the presence of vegetation. Around three-quarters of the route has incomplete utility undergrounding as shown in Table 1 and Figure 1.

Spruce Street is a north-south minor arterial street. It is primarily residential and provides access to Cragmont School, Step One Nursery School, and Congregation Beth El pre-school and synagogue. There are bulb-outs at the intersection of Spruce Street and Rose Street, which narrow Spruce Street. The evacuation route along Spruce Street is 2 miles long. Overhead lines are present for 1.8 miles between Michigan Avenue and Rose Street, and between Cedar Street and Hearst Avenue. All the overhead utilities are distribution lines.

Oxford Street is a north-south minor arterial street. It is primarily residential with a few houses and apartment buildings. The evacuation route along Oxford Street is 0.25 miles long from Rose Street to Cedar Street. Overhead lines are present for the entire length. All of the overhead utilities are distribution lines.

Rose Street is an east-west residential hillside collector street. The evacuation route along Rose Street is 0.06 miles connecting Oxford Street and Spruce Street, with overhead lines present for the entire length.

Grizzly Peak Boulevard is a north-south minor arterial street and is a major access road for mutual responders from both El Cerrito and Oakland, and provides access to the Space Sciences Laboratory and other University of California properties. Shepherd of the Hills Lutheran Church resides near the intersection of Grizzly Peak Boulevard with Spruce Street. The evacuation route along Grizzly Peak Boulevard is 2.29 miles long from the City limit near Centennial Drive to Spruce Street. Overhead lines are present for 1.4 miles from Cragmont Avenue to Latham Lane and from Hill Road to the City limit near Centennial Drive.

Evacuation Route: Spruce/Oxford/Rose/Grizzly Peak (4.60 miles)						
Street	**Segment**			**Segment Length (mi)**	**Utility Length (mi)**	
					OH	**UG**
Grizzly Peak	Centennial Dr	to	Arcade Ave	0.60	0.44	0.16
Grizzly Peak	Arcade Ave	to	Lathan Ln	0.67	-	0.63
Grizzly Peak	Lathan Ln	to	Spruce St	1.02	0.91	0.06
Spruce St	Grizzly Peak Blvd	to	Rose St	1.69	1.45	0.24
Rose St	Spruce St	to	Oxford	0.06	0.06	-
Oxford	Rose	to	Cedar	0.25	0.25	-
Spruce St	Cedar	to	Hearst Ave	0.31	0.31	-
Total of each OH/UG Utilities					3.42	1.09
Percentage of each OH/UG Utilities					76%	24%
Total Utilities					4.51	

Table 1: Detailed utility status for route Spruce/Oxford/Grizzly Peak

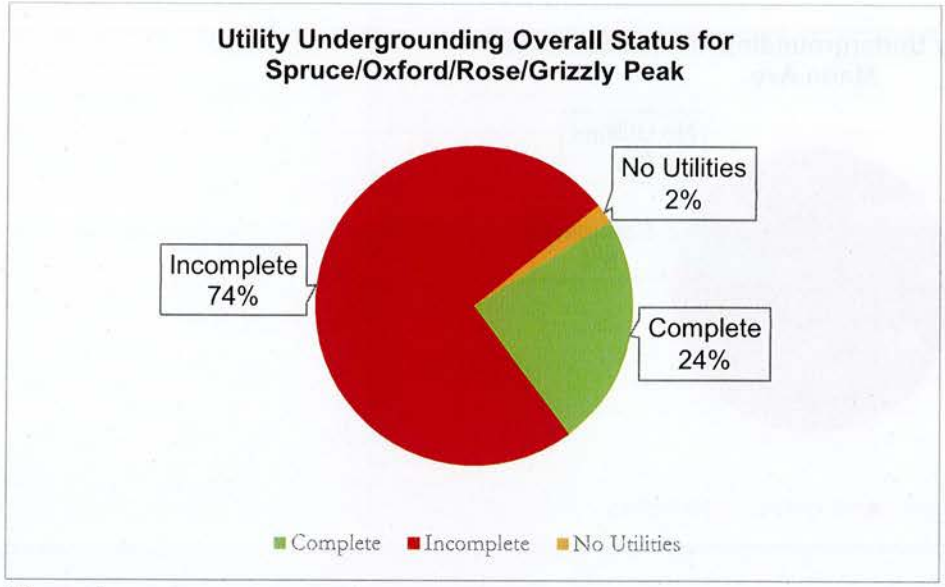


Figure 1

Marin Avenue Route

Marin Avenue is an east-west principal arterial street with primarily residential land uses along the evacuation route. It provides access to Cragmont School at the intersection with Spruce Street, Angel Academy Pre-school near the intersection with Oxford Ave, and Fire Station 4 at the intersection with The Alameda. Around 70% of the route is inside the boundary of Fire Zone 2. The evacuation route along Marin Avenue is 1.3 miles long from Tulare Avenue to Grizzly Peak Boulevard. Overhead lines are present for almost the entire length with a 94% incompletion rate for utility undergrounding as shown in Table 2 and Figure 2.

Evacuation Route: Marin Ave (1.32 miles)						
Street	**Segment**			**Segment Length (mi)**	**Utility Length (mi)**	
					OH	**UG**
Marin Ave	Tulare Ave	to	The Traffic Circle at Arlington Ave	0.53	0.53	-
Marin Ave	The Traffic Circle at Arlington Ave	to	Grizzly Peak	0.79	0.71	0.08
Total of each OH/UG Utilities					1.24	0.08
Percentage of each OH/UG Utilities					94%	6%
Total Utilities					1.32	

Table 2: Detailed utility status for route Marin Avenue

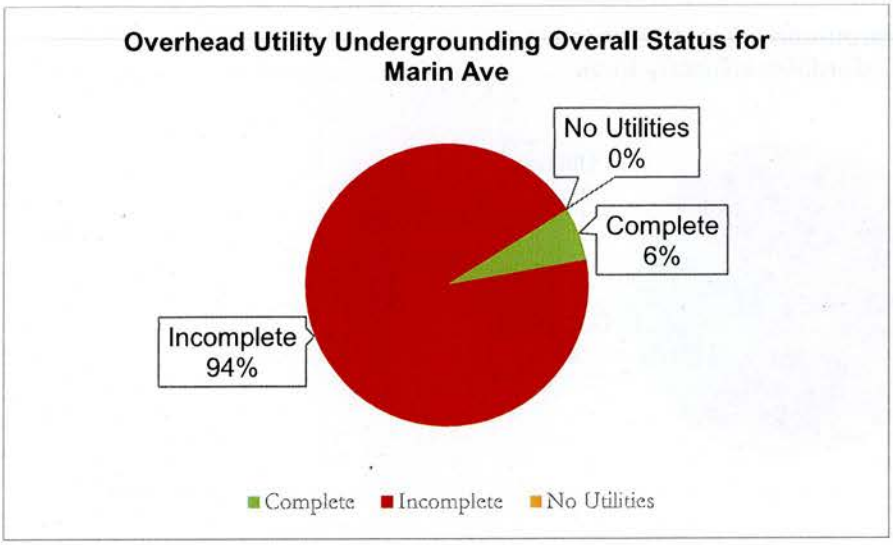


Figure 2

Gilman Street, Hopkins Street Route

This evacuation route is partially inside the boundary of Fire Zone 2 and connects to Interstate 80/580 with a railroad crossing near Interstate 80. It is composed of mostly residential areas towards the east side and mostly commercial areas towards the west side. It has over 90% incompletions for utility undergrounding as shown in Table 3 and Figure 3.

Gilman Street is an east-west principal arterial street connected to Interstate 80, and provides access to St. Ambrose Church. It is mostly commercial between Interstate 80 and San Pablo Avenue. However, between San Pablo Avenue and Hopkins Street, it is mostly residential. The evacuation route along Gilman Street is 1.2 miles long. Overhead lines are present for over 90% of the entire length.

Hopkins Street is an east-west major collector street. It is primarily residential with a few commercial buildings and a park, and it provides access to the North Branch Public Library, a couple of preschools, school facilities for Martin Luther King Junior High School, and two churches. The evacuation route along Hopkins Street is 0.9 miles long from Gilman Street to Sutter Street. Overhead lines are present for almost 90% of the entire length.

Evacuation Route: Gilman/Hopkins (2.16 miles)					
Street	**Segment**			**Segment Length (mi)**	**Utility Length (mi)**
					OH / **UG**
Gilman	Interstate 80 Ramp	to	San Pablo Ave	0.62	0.57 / 0.05
Gilman/Hopkins	San Pablo Ave	to	The Alameda	1.23	1.20 / 0.03
Hopkins	The Alameda	to	Sutter St	0.31	0.20 / 0.11
Total of each OH/UG Utilities					1.97 / 0.19
Percentage of each OH/UG Utilities					91% / 9%
Total Utilities					2.16

Table 3: Detailed utility status for route Gilman/Hopkins

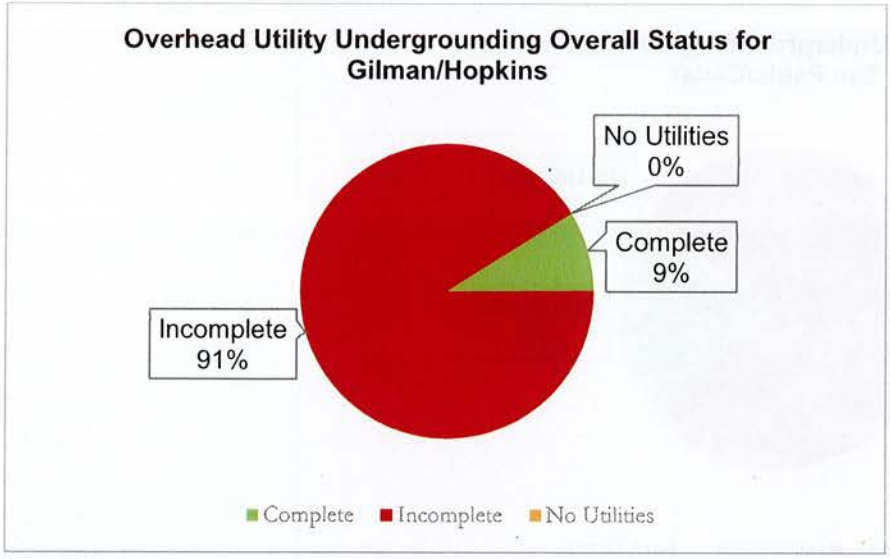


Figure 3

San Pablo Avenue, Cedar Street Route

This evacuation route is partially inside the boundary of Fire Zone 2 and connects to Gilman Street, which leads to Interstate 80. It has almost 80% incompletions for utility undergrounding as shown in Table 4 and Figure 4.

San Pablo Avenue is a north-south principal arterial street and is also State Highway Route 123 under Caltrans jurisdiction, with commercial land uses along the street frontage. The evacuation route along San Pablo Avenue, connecting Gilman Street and Cedar Street, is 0.4 miles long. There are no overhead lines along the evacuation route, and the whole street connecting Albany and Oakland has been completely undergrounded.

Cedar Street is an east-west minor arterial street. It is primarily residential, with a few businesses and provides access to two churches. The evacuation route along Cedar Street is 2.0 miles from San Pablo Avenue to La Loma Avenue. Overhead lines are present for almost the entire length.

Evacuation Route: San Pablo/Cedar (2.38 miles)						
Street	**Segment**			**Segment Length (mi)**	**Utility Length (mi)**	
					OH	**UG**
San Pablo	Gilman	to	Cedar	0.37	-	0.37
Cedar	Cedar	to	Juanita Way	0.39	0.32	0.04
Cedar	Juanita Way	to	MLK Jr Way	0.71	0.71	-
Cedar	MLK Jr Way	to	La Loma Ave	0.91	0.84	0.07
Total of each OH/UG Utilities					1.87	0.48
Percentage of each OH/UG Utilities					80%	20%
Total Utilities					2.35	

Table 4: Detailed utility status for route San Pablo/Cedar

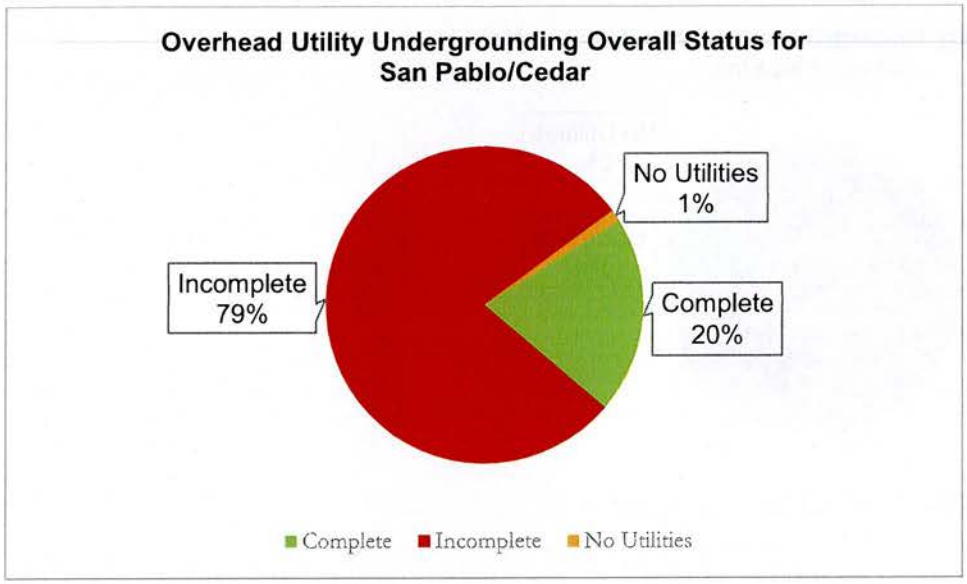


Figure 4

University Avenue, 6th Street, Dwight Way Route

This evacuation route is partially inside the boundary of Fire Zone 2, reaches the edge of Fire Zone 3, and connects to Interstate 80. It is composed of mostly residential areas towards the east side and mostly commercial areas towards the west side. Around one-third of the route only allows one-way traffic to the east, which is from Martin Luther King Junior Way to Piedmont Crescent on Dwight Way. It has around 93% incompletions for utility undergrounding as shown in Table 5 and Figure 5.

University Avenue is an east-west principal arterial street connected to Interstate 80 with primarily commercial land uses along the street frontage. The evacuation route along University Avenue is 0.3 miles from Interstate 80 to 6th Street. For the entirety of the street spanning from Interstate 80 to the University of California campus, there is only a small segment with overhead lines near Interstate 80. This street might be a better option for an evacuation route that provides safer access to citizens than many existing routes with overhead lines.

6th Street is a north-south minor arterial street. It is primarily residential with a few businesses. The evacuation route along 6th Street is 0.6 miles long connecting University Avenue and Dwight Way. Overhead lines are present for the entire length.

Dwight Way is an east-west minor arterial street. It is primarily residential with a few businesses and provides access to two urgent care centers, a couple of churches, a preschool, university residence halls, and many apartment buildings. The evacuation route along Dwight Way is 2.68 miles long from 6th Street to the street end near Fernwald Rd. Overhead lines are present for the entire length. Almost half of this segment only allows for one-way traffic to the east, however, evacuation routes should provide access to the Interstate 80 in the west side. Therefore, further investigations and discussions should be carried out for modifying the existing evacuation route.