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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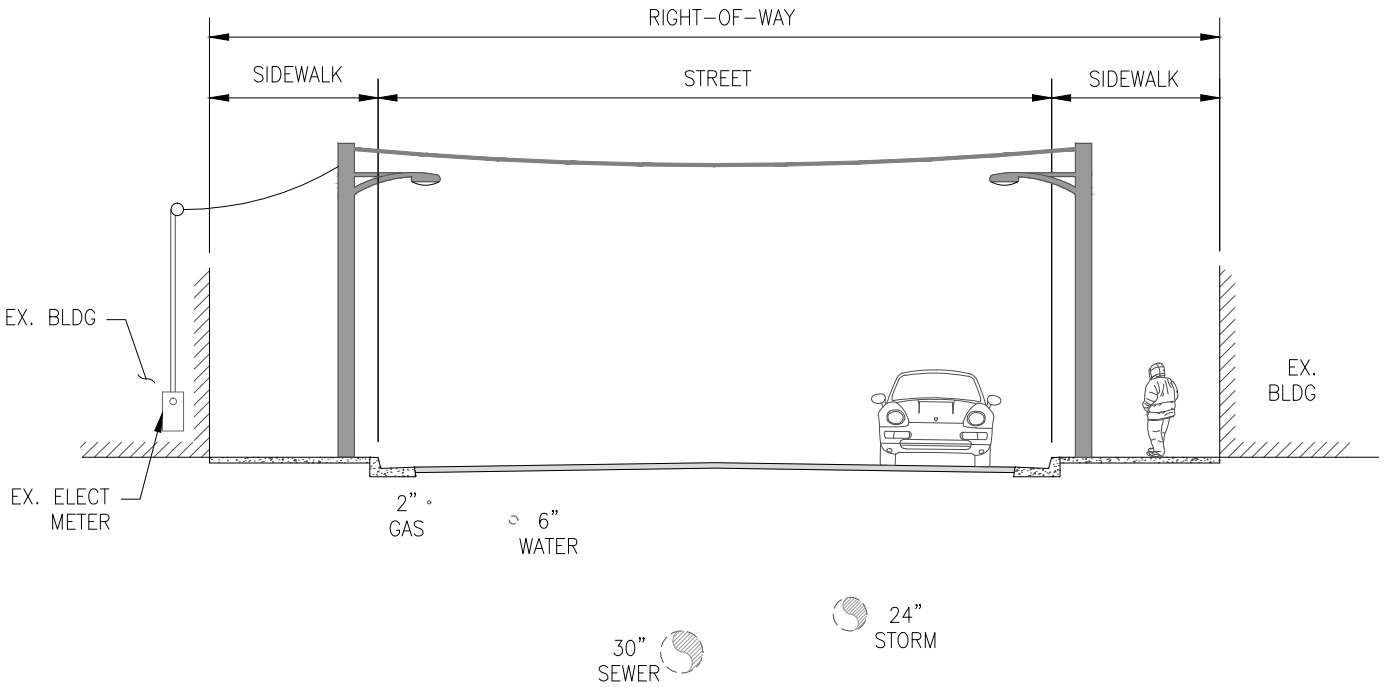
INTRODUCTION

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.

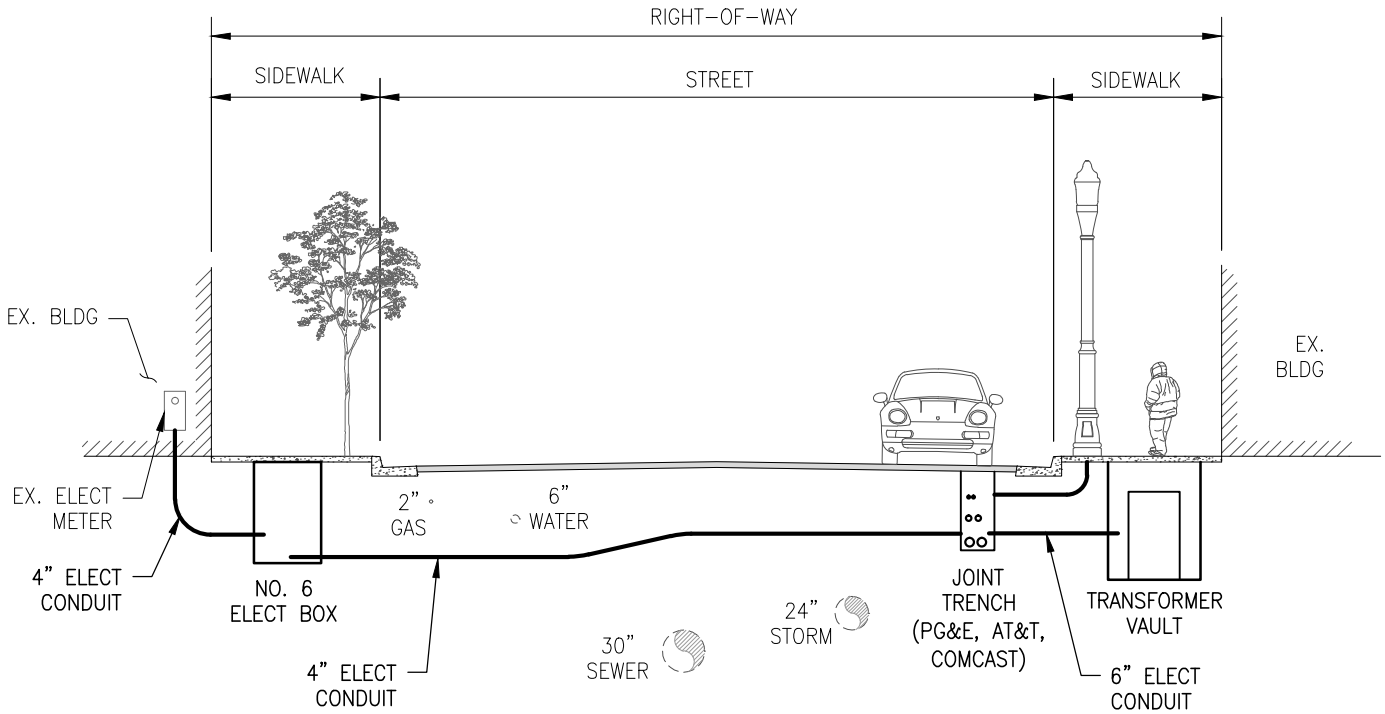
The City of Berkeley has been involved in utility undergrounding for many years. Most of the undergrounding projects within the City have relied on the provisions of electric Rule 20A and telephone Rule 32.1, to fund the undergrounding in various areas of the City. In addition, the City has also seen 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")

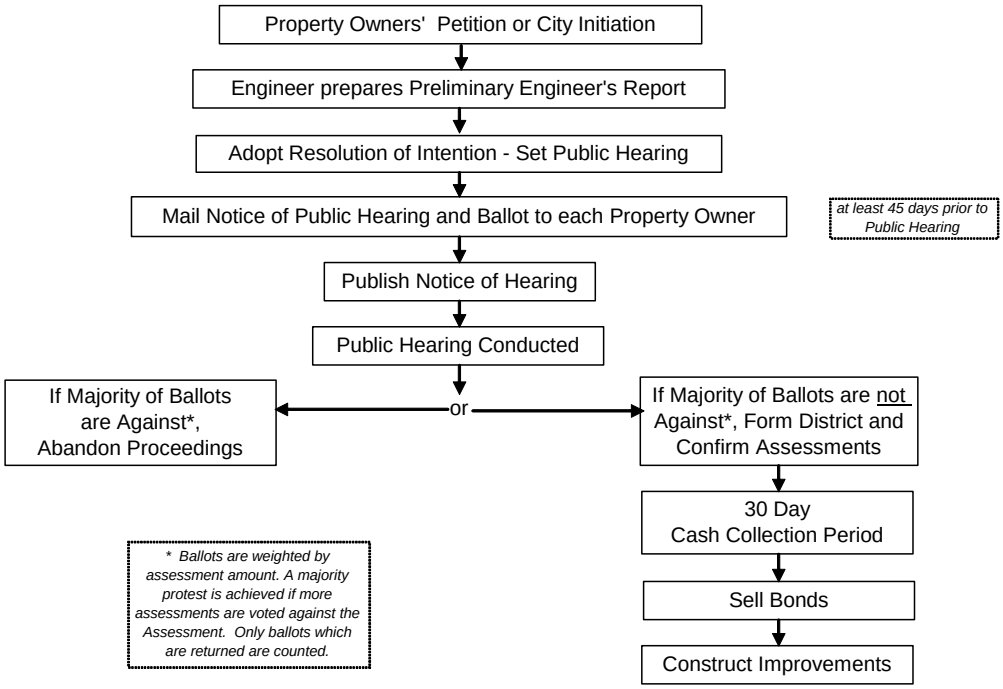
The 1913 Act has been used by many cities throughout the state working with property owners within the area to be undergrounded to create an assessment district to fund the non-utility portion of the costs for utility undergrounding. Under the 1913 Act, the City can fund the utility undergrounding project 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



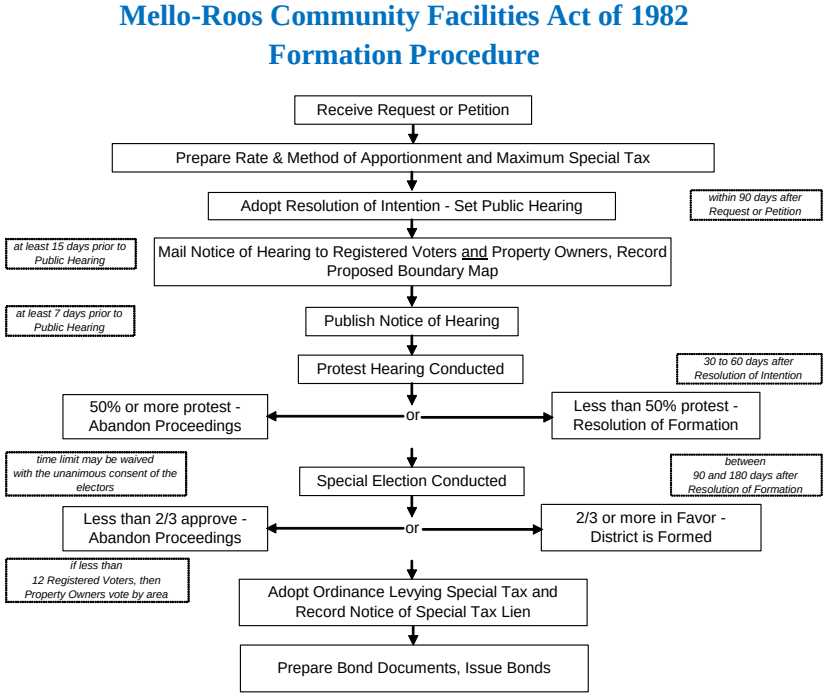
Note: Majority of property owners must sign petition to initiate the formation of the assessment district based upon the requirements of the Municipal Improvement Act of 1911, or the City must contribute 50% of the project costs if the City initiates the formation of the assessment district.

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

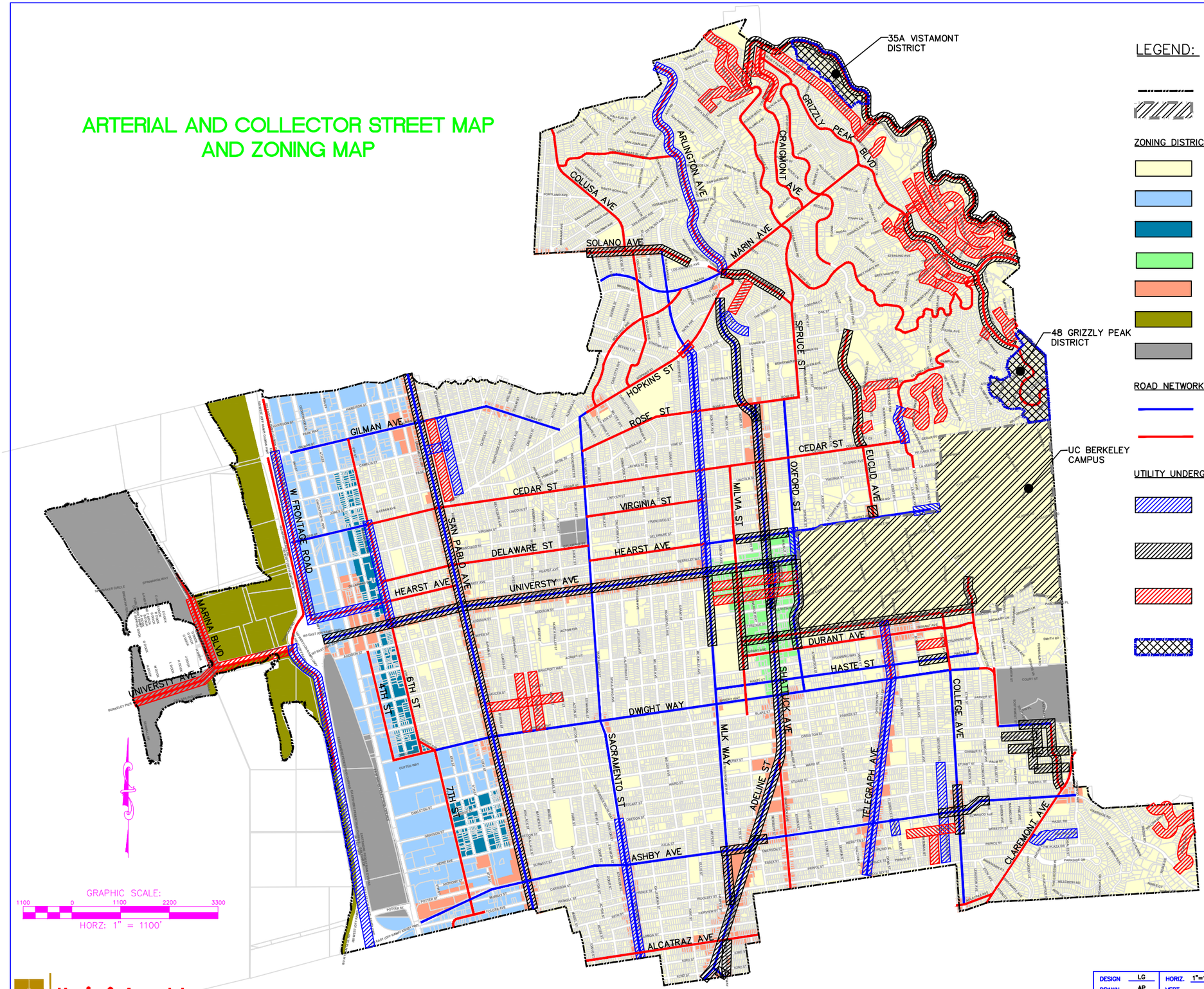
For reference, attached in Appendix 2 is the City's "Undergrounding of Utility Wires – A Brief History, December 2015" document.

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



GRAPHIC SCALE:
1100 0 1100 2200 3300
HORZ: 1" = 1100'

LEGEND:

- CITY RIGHT-OF-WAY
- UC BERKELEY CAMPUS

ZONING DISTRICTS:

- RESIDENTIAL (DISTRICTS R-1, R-1A, R-2,R-2A, R-3, R-4, R-5, ES-R, R-S, R-SMU)
- MANUFACTURING (DISTRICTS M, MM, MULI)
- MIXED USE-RESIDENTIAL (DISTRICT MUR)
- COMMERCIAL DOWNTOWN MIXED USE (DISTRICT C-DMU)
- COMMERCIAL (DISTRICTS C-1, C-E, C-N, C-NS, C-SA, C-SO, C-T, C-W)
- SPECIFIC PLAN (DISTRICT SP)
- UNCLASSIFIED (DISTRICT U)

ROAD NETWORK:

- ARTERIAL ROADS
- COLLECTOR ROADS

UTILITY UNDERGROUNDING HISTORY:

- STREET SEGMENTS ALREADY UNDERGROUNDED PER "UNDERGROUNDING OF OVERHEAD UTILITY WIRES – A BRIEF HISTORY"
- STREET SEGMENTS ALREADY UNDERGROUNDED PER GOOGLE MAP STREET VIEW
- STREET SEGMENTS ALREADY UNDERGROUNDED PER PG&E'S MAP "GENERAL AND APPROXIMATE LOCATIONS OF UNDERGROUND ELECTRIC DISTRIBUTION LINES IN THE CITY OF BERKELEY"
- PROPOSED UNDERGROUNDING DISTRICTS
  * DISTRICT 48 GRIZZLY PEAK
  * DISTRICT 35A VISTAMONT

NOTE:

- THIS BASELINE STUDY IS PRIMARILY FOCUSED ON UNDERGROUNDING THE EXISTING OVERHEAD UTILITIES IN THE ARTERIAL-COLLECTOR STREET NETWORK.
- THE ENTIRE STREET SEGMENTS OUTSIDE THE ARTERIAL-COLLECTOR ROAD NETWORK HAVE NOT BEEN TABULATED AND PLOTTED AS PART OF THIS STUDY.
- THE UNDERGROUNDED SEGMENTS OUTSIDE THE ARTERIAL-COLLECTOR ROAD NETWORK SHOWN IN THIS MAP ARE PER AVAILABLE DATA PROVIDED BY THE CITY.

ATTACHMENT 1

Harris & Associates
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harris-assoc.com (925) 827-4900

DESIGN LG	HORIZ. 1"=1100'	CITY OF BERKELEY	BASELINE STUDY FOR THE DEVELOPMENT OF A UTILITY UNDERGROUNDING PROGRAM	PLAN
DRAWN AP	VERT.	DEPARTMENT OF PUBLIC WORKS	HARRIS PROJECT NO-0810244003	FILE
CHECK RC	DATE 07/26/16			SHEET OF

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

ARTERIAL ROAD NETWORK

STREET NAMES AND LIMITS					SECTIONS UNDERGROUNDED			OVERHEAD SECTIONS PER ZONE (NOTE: ZONES BASED ON CITY'S ZONAL MAP)								IMPACT RATING (SEE NOTE 1)					
NO	STREET	FROM	TO	TOTAL LENGTH (FT)	FROM	TO	LENGTH (FT)	FROM	TO	M ZONE (FT)	MUR ZONE(FT)	C-DMU ZONE (FT)	C ZONE (FT)	SP ZONE (FT)	R ZONE (FT)	(1) SIDEWALK CLEARANCE IMPACT RATING (SCALE 1-5)	(2) TRAFFIC VOLUME IMPACT RATING (SCALE 1-5)	(3) UTILITY DENSITY IMPACT RATING (SCALE 1-5)	RATING TOTAL (1)+(2)+(3)	HIGH LEVEL COST TO UNDERGROUND FOR M, CB, C-DMU AND SP ZONES ($)	HIGH LEVEL COST TO UNDERGROUND FOR MUR AND R ZONES ($)
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						2340	1	2	2	5	$ -	$ 1,170,000
					HOPKINS	BANCROFT WAY	6780														
								BANCROFT WAY	DWIGHT WAY						1160	2	4	3	9	$ -	$ 846,800
								DWIGHT WAY	DWIGHT WAY				640			2	4	3	9	$ 467,200	$ -
								DWIGHT WAY	ASHBY AVE						2690	2	4	3	9	$ -	$ 1,963,700
					ASHBY AVE	ADELINE ST	1450														
					ADELINE ST	CITY LIMIT	320														
																			Total	$ 467,200	$ 3,980,500
3	ASHBY AVE	BAY ST	DOMINGO AVE	15465																	
								EAST OF BAY ST	SAN PABLO AVE				2730			2	3	2	7	$ 1,992,900	$ -
								SAN PABLO AVE	SACRAMENTO ST						1965	2	2	4	8	$ -	$ 1,434,450
								SACRAMENTO ST	SACRAMENTO ST				315			2	2	3	7	$ 229,950	$ -
								SACRAMENTO ST	MLK WAY						2020	2	2	3	7	$ -	$ 1,474,600
					MLK WAY	ADELINE ST	1160														
								ADELINE ST	LORENA ST				720			2	2	4	8	$ 525,600	$ -
								LORENA ST	TELEGRAPH AVE						1470	2	2	3	7	$ -	$ 1,073,100
					TELEGRAPH AVE	TELEGRAPH AVE	450														
								TELEGRAPH AVE	BENEVENUE AVE						1275	2	2	2	6	$ -	$ 637,500
					BENEVENUE AVE	PIEDMONT AVE	1215														
								PIEDMONT AVE	CLAREMONT AVE						1535	2	2	2	6	$ -	$ 767,500
								CLAREMONT AVE	DOMINGO AVE				610			2	1	2	5	$ 305,000	$ -
																			Total	$ 3,053,450	$ 2,478,100
4	CEDAR ST	EASTSHORE HWY	6TH ST	1765																	
								EASTSHORE HWY	4TH ST	1120						2	2	3	7	$ 817,600	$ -
								4TH ST	6TH ST		645					2	2	3	7	$ -	$ 470,850
																			Total	$ 817,600	$ 470,850
5	COLLEGE AVE	DWIGHT WAY	ALCATRAZ AVE	5300																	
								DWIGHT WAY	RUSSELL ST						2500	2	3	4	9	$ -	$ 1,825,000
					DWIGHT WAY	WEBSTER ST	1125														
								WEBSTER ST	ALCATRAZ AVE						1500	2	3	3	8	$ -	$ 1,095,000
								ALCATRAZ AVE	ALCATRAZ AVE				175			2	3	3	8	$ 127,750	$ -
																			Total	$ 127,750	$ 2,920,000
6	DERBY ST	WARRING ST	BELROSE AVE	1195																	
								WARRING ST	MID DERBEY ST						480	2	3	3	8	$ -	$ 350,400
					MID DERBY ST	BELROSE AVE	715														
																			Total	$ -	$ 350,400
7	DWIGHT WAY	7TH ST	PIEDMONT AVE	12445																	
								7TH ST	9TH ST	675						2	3	2	7	$ 492,750	$ -
								9TH ST	SAN PABLO AVE				685			2	3	2	7	$ 500,050	$ -
								SAN PABLO AVE	SACRAMENTO ST						2130	2	3	2	7	$ -	$ 1,554,900
								SACRAMENTO ST	SACRAMENTO ST				375			2	3	2	7	$ 273,750	$ -
								SACRAMENTO ST	MLK WAY						2380	2	3	4	9	$ -	$ 1,737,400
								MLK WAY	MLK WAY				270			2	3	4	9	$ 197,100	$ -
								MLK WAY	SHATTUCK AVE						990	2	3	4	9	$ -	$ 722,700
								SHATTUCK AVE	FULTON ST				880			2	3	5	10	$ 642,400	$ -
								FULTON ST	TELEGRAPH AVE						1810	2	3	5	10	$ -	$ 1,321,300
								TELEGRAPH	TELEGRAPH AVE				440			2	3	5	10	$ 321,200	$ -
								TELEGRAPH	PIEDMONT AVE						1810	2	3	4	9	$ -	$ 1,321,300
																			Total	$ 2,427,250	$ 6,657,600
8	GILMAN ST	2ND ST	HOPKINS ST	6290																	
								2ND ST	9TH ST	2320						3	5	4	12	$ 2,320,000	$ -
								9TH ST	SAN PABLO AVE				710			3	5	4	12	$ 710,000	$ -
								SAN PABLO AVE	SANTA FE AVE						1580	3	4	3	10	$ -	$ 1,153,400
								SANTA FE AVE	TEVLIN ST				740			2	3	3	8	$ 540,200	$ -
								TEVLIN ST	HOPKINS ST						940	2	3	3	8	$ -	$ 686,200
																			Total	$ 3,570,200	$ 1,839,600

ATTACHMENT 2

CITY OF BERKELEY ARTERIAL AND COLLECTOR ROAD NETWORK UTILITY UNDERGROUNDING PLANNING LEVEL ESTIMATE

07/22/16

ARTERIAL ROAD NETWORK

STREET NAMES AND LIMITS					SECTIONS UNDERGROUNDED			OVERHEAD SECTIONS PER ZONE (NOTE: ZONES BASED ON CITY'S ZONAL MAP)							IMPACT RATING (SEE NOTE 1)					
NO	STREET	FROM	TO	TOTAL LENGTH (FT)	FROM	TO	LENGTH (FT)	FROM	TO	M ZONE (FT)	MUR ZONE(FT)	C-DMU ZONE (FT)	C ZONE (FT)	SP ZONE (FT)	R ZONE (FT)	(1) SIDEWALK CLEARANCE IMPACT RATING (SCALE 1-5)	(2) TRAFFIC VOLUME IMPACT RATING (SCALE 1-5)	(3) UTILITY DENSITY IMPACT RATING (SCALE 1-5)	RATING TOTAL (1)+(2)+(3)	HIGH LEVEL COST TO UNDERGROUND FOR M, CB, C-DMU AND SP ZONES ($)	HIGH LEVEL COST TO UNDERGROUND FOR MUR AND R ZONES ($)
9	HASTE AVE	MLK WAY	PEIDMONT AVE	5980																	
								MLK WAY	MILVIA						650	2	2	3	7	$ -	$ 474,500
								MILVIA	SHATTUCK AVE						500	2	3	4	9	$ -	$ 365,000
								SHATTUCK AVE	SHATTUCK AVE			535				2	3	4	9	$ 390,550	$ -
								SHATTUCK AVE	FULTON AVE						265	2	3	4	9	$ -	$ 193,450
								FULTON AVE	TELEGRAPH AVE						1935	2	2	3	7	$ -	$ 1,412,550
								TELEGRAPH AVE	TELEGRAPH AVE				350			2	2	3	7	$ 255,500	$ -
								TELEGRAPH AVE	BOWDITCH						475	2	2	3	7	$ -	$ 346,750
					BOWDITCH AVE	COLLEGE AVE	640														
								COLLEGE AVE	PIEDMONT AVE						630	2	2	3	7	$ -	$ 459,900
																			Total	$ 646,050	$ 3,252,150
10	HEARST AVE	MLK AVE	HIGHLAND PL	5160																	
								MLK AVE	MILVIA ST						660	2	2	2	6	$ -	$ 330,000
					MILVIA ST	OXFORD AVE	1360														
								OXFORD AVE	SCENIC AVE						1225	2	3	3	8	$ -	$ 894,250
								SCENIC AVE	LA LOMA						1525	4	3	3	10	$ -	$ 1,113,250
					LA LOMA AVE	HIGHLAND PL	390														
																			Total	$ -	$ 2,337,500
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						2920	2	3	2	7	$ -	$ 2,131,600
																			Total	$ -	$ 2,131,600
13	OXFORD ST	ROSE ST	DWIGHT WAY	6620																	
								ROSE ST	CEDAR AVE						1320	2	3	3	8	$ -	$ 963,600
								CEDAR AVE	HEARST						1670	1	2	3	6	$ -	$ 835,000
					HEARST AVE	DURANT AVE	2670														
								DURANT AVE	DWIGHT WAY						960	2	3	3	8	$ -	$ 700,800
																			Total	$ -	$ 2,499,400
14	SACRAMENTO ST	HOPKINS ST	ALCATRAZ AVE	12375																	
								HOPKINS ST	CEDAR AVE						1565	2	3	3	8	$ -	$ 1,142,450
								CEDAR AVE	UNIVERSITY AVE						2330	2	2	2	6	$ -	$ 1,165,000
					UNIVERSITY AVE	UNIVERSITY AVE	360														
								UNIVERSITY AVE	DWIGHT AVE						2620	2	3	3	8	$ -	$ 1,912,600
								DWIGHT AVE	BLAKE ST				540			2	2	2	6	$ 270,000	$ -
								BLAKE ST	OREGON ST						1780	2	2	2	6	$ -	$ 890,000
					OREGON ST	ALCATRAZ AVE	3180														
																			Total	$ 270,000	$ 5,110,050
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																	
					HOPKINS ST	EUNICE ST	1200														
19	TELEGRAPH AVE	DWIGHT WAY	WOOLSEY ST	4475																	
					DWIGHT WAY	WOOLSEY ST	4475														
20	UNIVERSITY AVE	EASTSHORE HWY	OXFORD ST	10830																	
					EASTSHORE HWY	OXFORD ST	10830														
			TOTAL LENGTH (FT)=	135095		TOTAL LENGTH (FT)=	66015		TOTAL LENGTH (FT)=	4115	645	535	10180	0	53605			TOTAL COST=		$ 11,379,500	$31,549,650

ATTACHMENT 2
CITY OF BERKELEY ARTERIAL AND COLLECTOR ROAD NETWORK UTILITY UNDERGROUNDING PLANNING LEVEL ESTIMATE
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, C-W)
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, R-SMU)

Cost Conditions				
	Cost/FT			Total Cost ($)
IF	1000	+37 %	Cost/FT * Total Ft	Total Cost
IF	730	Base	Cost/FT * Total Ft	Total Cost
IF	500	-31.5%	Cost/FT * Total Ft	Total Cost

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

COLLECTOR ROAD NETWORK

STREET NAMES AND LIMITS					SECTIONS UNDERGROUNDED			OVERHEAD SECTIONS PER ZONE (ZONES BASED ON CITY'S ZONAL MAP)									IMPACT RATING (SEE NOTE 1)					
NO	STREET	FROM	TO	TOTAL LENGTH (FT)	FROM	TO	LENGTH (FT)	FROM	TO	M ZONE (FT)	MUR ZONE(FT)	C-DMU ZONE (FT)	C ZONE (FT)	SP ZONE (FT)	R ZONE (FT)	(1) SIDEWALK CLEARANCE IMPACT RATING (SCALE 1-5)	(2) TRAFFIC VOLUME IMPACT RATING (SCALE 1-5)	(3) UTILITY DENSITY IMPACT RATING (SCALE 1-5)	RATING TOTAL (1)+(2)+(3)	HIGH LEVEL COST TO UNDERGROUND FOR M, CB, C-DMU AND SP ZONES ($)	HIGH LEVEL COST TO UNDERGROUND FOR MUR AND R ZONES ($)
1	4TH ST	ADDISON ST	DWIGHT WAY	2535																	
								ADDISON ST	DWIGHT WAY	2535						1	2	4	7	$ 1,850,550	$ -
																			Total	$ 1,850,550	$ -
2	6TH ST	GILMAN ST	DWIGHT WAY	7290																	
								GILMAN ST	CAMELIA ST	670						2	2	3	7	$ 489,100	$ -
								CAMELIA ST	CEDAR ST		1325					2	2	3	7	$ -	$ 967,250
					CEDAR ST	UNIVERSITY AVE	2295														
								UNIVERSITY AVE	DWIGHT WAY		3000					2	2	2	6	$ -	$ 1,500,000
																			Total	$ 489,100	$ 2,467,250
3	7TH ST	DWIGHT WAY	FOLGER AVE	3810																	
								DWIGHT WAY	CARLETON ST	1210						2	3	4	9	$ 883,300	$ -
								CARLESTON ST	HEINZ AVE	1300						2	3	4	9	$ 949,000	$ -
								HEINZ AVE	ANTHONY ST	480						2	3	4	9	$ 350,400	$ -
								ANTHONY ST	ASHBY AVE				450			2	3	4	9	$ 328,500	$ -
								ASHBY AVE	FOLGER AVE	370						2	3	4	9	$ 270,100	$ -
																			Total	$ 2,781,300	$ -
4	ALCATRAZ AVE	COLLEGE AVE	CLAREMONT AVE	850																	
								COLLEGE AVE	COLLEGE AVE				300			2	2	2	6	$ 150,000	$ -
								COLLEGE AVE	CLAREMEONT AVE						550	2	2	2	6	$ -	$ 275,000
																			Total	$ 150,000	$ 275,000
5	ALCATRAZ AVE	W OF IDAHO ST	E OF ADELINE ST	3970																	
								W OF IDAHO ST	SACRAMENTO ST						1220	2	2	2	6	$ -	$ 610,000
								SACRAMENTO ST	E OF CALIFORNIA ST						965	3	3	3	9	$ -	$ 704,450
								E OF CALIFORNIA ST	ADELINE ST				850			3	3	3	9	$ 620,500	$ -
								ADELINE ST	E OF ADELINE ST				935			3	3	3	9	$ 682,550	$ -
																			Total	$ 1,303,050	$ 1,314,450
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						1660	2	2	3	7	$ -	$ 1,211,800
								SAN PABLO AVE	ACTON ST						2670	1	2	3	6	$ -	$ 1,335,000
								ACTON ST	SACRAMENTO ST						700	2	2	3	7	$ -	$ 511,000
								SACRAMENTO ST	MLK AVE						2590	2	2	2	6	$ -	$ 1,295,000
								MLK AVE	SHATTUCK AVE						1350	2	2	3	7	$ -	$ 985,500
								SHATTUCK AVE	EUCLID AVE						2350	2	2	3	7	$ -	$ 1,715,500
								EUCLID AVE	LA LOMA AVE						970	3	2	2	7	$ -	$ 708,100
																			Total	$ -	$ 7,761,900
10	CLAREMONT AVE	ALCATRAZ AVE	TANGLEWOOD RD	4015																	
								ALCATRAZ AVE	PARKSIDE DR						1275	2	2	2	6	$ -	$ 637,500
								PARKSIDE DR	PRINCE ST				370			2	2	2	6	$ 185,000	$ -
								PRINCE ST	ASHBY PL						1070	2	2	2	6	$ -	$ 535,000
								ASHBY PL	RUSSELL ST				640			2	2	2	6	$ 320,000	$ -
								RUSSELL ST	AVALON AVE						300	2	2	2	6	$ -	$ 150,000
								AVALON AVE	TANGLEWOOD RD						360	2	2	2	6	$ -	$ 180,000
																			Total	$ 505,000	$ 1,502,500
11	CLAREMONT AVE	WILDCAT CANYON RD	MARIN AVE	4390																	
					WILDCAT CANYON RD	ACACIA AVE	1565														
								ACACIA AVE	MARIN AVE						2825	4	3	4	11	$ -	$ 2,825,000
																			Total	$ -	$ 2,825,000
12	COLLEGE AVE	BANCROFT WAY	DWIGHT WAY	1310																	
								BANCROFT WAY	DWIGHT WAY						1310	2	3	3	8	$ -	$ 956,300
																			Total	$ -	$ 956,300
13	COLUSA AVE	SOLANO AVE	HOPKINS ST	3290																	
								SOLANO AVE	HOPKINS ST						3290	2	2	2	6	$ -	$ 1,645,000
																			Total	$ -	$ 1,645,000

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

COLLECTOR ROAD NETWORK

STREET NAMES AND LIMITS					SECTIONS UNDERGROUNDED			OVERHEAD SECTIONS PER ZONE (ZONES BASED ON CITY'S ZONAL MAP)									IMPACT RATING (SEE NOTE 1)					
NO	STREET	FROM	TO	TOTAL LENGTH (FT)	FROM	TO	LENGTH (FT)	FROM	TO	M ZONE (FT)	MUR ZONE(FT)	C-DMU ZONE (FT)	C ZONE (FT)	SP ZONE (FT)	R ZONE (FT)	(1) SIDEWALK CLEARANCE IMPACT RATING (SCALE 1-5)	(2) TRAFFIC VOLUME IMPACT RATING (SCALE 1-5)	(3) UTILITY DENSITY IMPACT RATING (SCALE 1-5)	RATING TOTAL (1)+(2)+(3)	HIGH LEVEL COST TO UNDERGROUND FOR M, CB, C-DMU AND SP ZONES ($)	HIGH LEVEL COST TO UNDERGROUND FOR MUR AND R ZONES ($)
14	COLUSA AVE	SOLANO AVE	VISALIA AVE	3430																	
								SOLANO AVE	VISALIA AVE						3430	2	3	4	9	$ -	$ 2,503,900
																			Total	$ -	$ 2,503,900
15	DELAWARE ST	6TH ST	SACRAMENTO ST	4750																	
								6TH ST	SAN PABLO AVE						1660	2	1	2	5	$ -	$ 830,000
								SAN PABLO AVE	SACRAMENTO ST						3090	2	2	3	7	$ -	$ 2,255,700
																			Total	$ -	$ 3,085,700
16	DURANT AVE	MILVIA ST	PEIDMONT AVE	5280																	
								MILVIA ST	SHATTUCK AVE			730				1	2	2	5	$ 365,000	$ -
								SHATTUCK AVE	FULTON ST			530				1	2	2	5	$ 265,000	$ -
								FULTON ST	TELEGRAPH AVE						1700	1	2	2	5	$ -	$ 850,000
								TELEGRAPH AVE	BOWDITCH ST				1100			1	3	3	7	$ 803,000	$ -
								BOWDITCH ST	COLLEGE AVE						630	1	3	3	7	$ -	$ 459,900
								COLLEGE AVE	PEIDMONT AVE						590	1	2	3	6	$ -	$ 295,000
																			Total	$ 1,433,000	$ 1,604,900
17	DWIGHT WAY	4TH ST	7TH ST	960																	
								4TH ST	6TH ST		650					2	2	2	6	$ -	$ 325,000
								6TH ST	7TH ST		310					2	2	2	6	$ -	$ 155,000
																			Total	$ -	$ 480,000
18	DWIGHT CR	6TH ST	DWIGHT WAY	420																	
								6TH ST	DWIGHT WAY		420					2	2	2	6	$ -	$ 210,000
																			Total	$ -	$ 210,000
19	EAST SHORE HWY	HEARST AVE	N CITY LIMIT	5100																	
					HEARST AVE	GILMAN ST	3770														
								GILMAN ST	N CITY LIMIT	1330						3	3	3	9	$ 970,900	$ -
																			Total	$ 970,900	$ -
20	EUCLID AVE	CEDAR ST	HEARST AVE	1615																	
								CEDAR ST	RIDGE RD						1240	2	2	2	6	$ -	$ 620,000
					RIDGE RD	HEARST AVE	375														
																			Total	$ -	$ 620,000
21	EUCLID AVE	GRIZZLY PEAK BLVD	CRAGMONT AVE	5185																	
								GRIZZLY PEAK BLVD	CRAGMONT AVE						5185	3	3	4	10	$ -	$ 3,785,050
																			Total	$ -	$ 3,785,050
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						2	3	4	9	$ 642,400	$ -
																			Total	$ 642,400	$ -
24	GRIZZLY PEAK BLVD	CRAIGMONT AVE	EUCLID AVE	930																	
								CRAIGMONT AVE	EUCLID AVE						930	5	4	4	13	$ -	$ 930,000
																			Total	$ -	$ 930,000
25	GRIZZLY PEAK BLVD	EUCLID AVE	GOLF COURSE DR	10885																	
								EUCLID AVE	MARIN AVE						2570	5	4	5	14	$ -	$ 2,570,000
								MARIN AVE	LATHAM LN						1635	4	3	4	11	$ -	$ 1,635,000
					LATHAM LN	HILL RD	4260														
								HILL RD	GOLF COURSE DR						2420	4	3	4	11	$ -	$ 2,420,000
																			Total	$ -	$ 6,625,000
26	HEARST AVE	SACRAMENTO ST	MLK WAY	2640																	
								SACRAMENTO ST	MLK WAY						2640	2	2	2	6	$ -	$ 1,320,000
																			Total	$ -	$ 1,320,000
27	HEARST AVE	SAN PABLO AVE	EASTSHORE HWY	3395																	
					6TH ST	EASTSHORE HWY	1740														
								6TH ST	SAN PABLO AVE						1655	3	1	3	7	$ -	$ 1,208,150
																			Total	$ -	$ 1,208,150
28	HOPKINS ST	HOPKINS CT	MARIN CR	4900																	
								HOPKINS CT	MC GEE AVE				530			2	2	2	6	$ 265,000	$ -
								MCGEE AVE	MARIN CR						4370	2	2	2	6	$ -	$ 2,185,000
																			Total	$ 265,000	$ 2,185,000

ATTACHMENT 2

CITY OF BERKELEY ARTERIAL AND COLLECTOR ROAD NETWORK UTILITY UNDERGROUNDING PLANNING LEVEL ESTIMATE

07/22/16

COLLECTOR ROAD NETWORK

STREET NAMES AND LIMITS					SECTIONS UNDERGROUNDED			OVERHEAD SECTIONS PER ZONE (ZONES BASED ON CITY'S ZONAL MAP)									IMPACT RATING (SEE NOTE 1)					
NO	STREET	FROM	TO	TOTAL LENGTH (FT)	FROM	TO	LENGTH (FT)	FROM	TO	M ZONE (FT)	MUR ZONE(FT)	C-DMU ZONE (FT)	C ZONE (FT)	SP ZONE (FT)	R ZONE (FT)		(1) SIDEWALK CLEARANCE IMPACT RATING (SCALE 1-5)	(2) TRAFFIC VOLUME IMPACT RATING (SCALE 1-5)	(3) UTILITY DENSITY IMPACT RATING (SCALE 1-5)	RATING TOTAL (1)+(2)+(3)	HIGH LEVEL COST TO UNDERGROUND FOR M, CB, C-DMU AND SP ZONES ($)	HIGH LEVEL COST TO UNDERGROUND FOR MUR AND R ZONES ($)
29	KEITH AVE	SPRUCE ST	GRIZZLY PEAK BLVD	8080																		
								SPRUCE ST	MILLER RD						7800		5	4	5	14	$ 0	$ 7,800,000
					MILLER RD	GRIZZLY PEAK BLVD	280															
																Total					$ -	$ 7,800,000
30	LA LOMA AVE	GLENDALE AVE	VIRGINIA ST	3705																		
								GLENDALE AVE	BUENA VISTA WAY						2250		4	4	4	12	$ -	$ 2,250,000
					BUENA VISTA WAY	CEDAR ST	790															
								CEDAR ST	VIRGINIA ST						665		2	2	3	7	$ -	$ 485,450
																Total					$ -	$ 2,735,450
31	LOS ANGELES AVE	THE CIRCLE	SPRUCE ST	1795																		
					THE CIRCLE	OXFORD ST	1495															
								OXFORD ST	SPRUCE ST						300		2	2	2	6	$ -	$ 150,000
																Total					$ -	$ 150,000
32	MARIN AVE	MARIN CR	GRIZZLY PEAK BLVD	3985																		
								MARIN CR	GRIZZLY PEAK BLVD						3985		3	4	4	11	$ -	$ 3,985,000
																Total					$ -	$ 3,985,000
33	MARINA BLVD	UNIVERSITY AVE	SPINNAKER WAY	2300																		
					UNIVERSITY AVE	VIRGINIA ST EXT	1665															
								VIRGINIA ST EXT	SPINNAKER WAY					635			1	1	1	3	$ 317,500	$ -
																Total					$ 317,500	$ -
34	MENDOCINO AVE	MARIN CR	MID-BLOCK	330																		
								MARIN CR	MID-BLOCK						330		2	2	2	6	$ -	$ 165,000
																Total					$ -	$ 165,000
35	MILVIA ST	CEDAR ST	BLAKE ST	5640																		
								CEDAR ST	VIRGINIA AVE						660		2	2	2	6	$ -	$ 330,000
								VIRGINIA AVE	FRANCISCO ST						340		2	2	2	6	$ -	$ 170,000
								FRANCISCO ST	UNIVERSITY AVE						1300		2	2	3	7	$ -	$ 949,000
					UNIVERSITY AVE	CHANNING WAY	2300															
								CHANNING WAY	HASTE AVE						360		2	2	2	6	$ -	$ 180,000
								HASTE AVE	BLAKE ST						680		2	3	3	8	$ -	$ 496,400
																Total					$ -	$ 2,125,400
36	MONTEREY AVE	HOPKINS ST	MARIN AVE	3550																		
								HOPKINS ST	MARIN AVE						3550		2	1	2	5	$ -	$ 1,775,000
																Total					$ -	$ 1,775,000
37	PIEDMONT AVE	HASTE ST	OPTOMETRY LN	1750																		
								HASTE ST	BANCROFT AVE						1025		2	3	3	8	$ -	$ 748,250
					BANCROFT AVE	OPTOMETRY LN	725															
																Total					$ -	$ 748,250
38	ROSE ST	SACRAMENTO ST	SPRUCE ST	5090																		
								ROSE ST	MLK WAY						2675		2	2	3	7	$ -	$ 1,952,750
					MLK WAY	MLK WAY	225										2	2	3	7		
								MLK WAY	HENRY ST						810		2	2	3	7	$ -	$ 591,300
					HENRY ST	SHATTUCK PL	550										2	2	3	7		
								SHATTUCK PL	SPRUCE ST						830		2	2	3	7	$ -	$ 605,900
																Total					$ -	$ 3,149,950
39	SHASTA RD	GRIZZLY PEAK BLVD	BAYTREE LN	1100																		
					GRIZZLY PEAK BLVD	BAYTREE LN	1100															
40	SHATTUCK AVE	WARD ST	CITY LIMIT	2930																		
								WARD ST	ASHBY				1520				2	3	3	8	$ 1,109,600	$ -
								ASHBY	CITY LIMIT				1410				2	3	3	8	$ 1,029,300	$ -
																Total					$ 2,138,900	$ -
41	SOLANO AVE	TULARE AVE	LOS ANGELES AVE	2390																		
					TULARE AVE	LOS ANGELES AVE	2390															
42	SPRUCE ST	WILDCAT CANYON RD	ROSE ST	9135																		
					WILDCAT CANYON RD	MICHIGAN AVE	1135															
								MICHIGAN AVE	MONTROSE RD						2860		3	3	4	10	$ -	$ 2,087,800
								MONTROSE RD	LOS ANGELES AVE						2900		4	4	4	12	$ -	$ 2,900,000
								LOS ANGELES AVE	ROSE ST						2240		2	2	3	7	$ -	$ 1,635,200
																Total					$ -	$ 6,623,000

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

COLLECTOR ROAD NETWORK

STREET NAMES AND LIMITS					SECTIONS UNDERGROUNDED			OVERHEAD SECTIONS PER ZONE (ZONES BASED ON CITY'S ZONAL MAP)								IMPACT RATING (SEE NOTE 1)					
NO	STREET	FROM	TO	TOTAL LENGTH (FT)	FROM	TO	LENGTH (FT)	FROM	TO	M ZONE (FT)	MUR ZONE(FT)	C-DMU ZONE (FT)	C ZONE (FT)	SP ZONE (FT)	R ZONE (FT)	(1) SIDEWALK CLEARANCE IMPACT RATING (SCALE 1-5)	(2) TRAFFIC VOLUME IMPACT RATING (SCALE 1-5)	(3) UTILITY DENSITY IMPACT RATING (SCALE 1-5)	RATING TOTAL (1)+(2)+(3)	HIGH LEVEL COST TO UNDERGROUND FOR M, CB, C-DMU AND SP ZONES ($)	HIGH LEVEL COST TO UNDERGROUND FOR MUR AND R ZONES ($)
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						1510	2	1	3	6	$ -	$ 755,000
								SANTA CLARA AVE	ARLINTON AVE						1330	2	3	3	8	$ -	$ 970,900
																			Total	$ -	$ 1,725,900
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						2640	2	1	2	5	$ -	$ 1,320,000
																			Total	$ -	$ 1,320,000
47	W FRONTAGE RD	ACROSS DWIGHT WAY	GILMAN ST	7500																	
					ACROSS DWIGHT WAY	UNIVERSITY AVE	3000														
								UNIVERSITY AVE	GILMAN ST	4500						2	2	1	5	$ 2,250,000	$ -
																			Total	$ 2,250,000	$ -
48	WARRING ST	DWIGHT WAY	DERBY ST	1580																	
								DWIGHT WAY	DERBY ST						1580	2	3	2	7	$ -	$ 1,153,400
																			Total	$ -	$ 1,153,400
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	1260	8105	635	101820			TOTAL COST=		$ 15,096,700	$ 76,761,450

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

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, C-W)
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, R-SMU)

Cost Conditions				
	Cost/FT			Total Cost ($)
IF	1000	+ 37 %	Cost/FT * Total Ft	Total Cost
IF	730	Base	Cost/FT * Total Ft	Total Cost
IF	500	-31.5%	Cost/FT * Total Ft	Total Cost

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.

[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

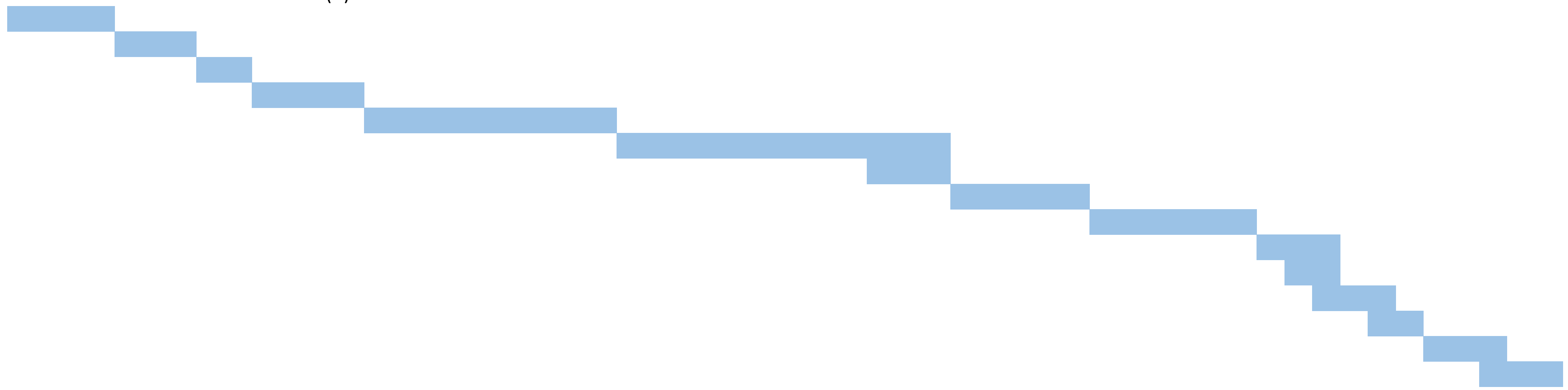
7/20/2016

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

13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60

1 2 3 4 5 6 7 8 9 10 11 12 Varies (V) +V +V +V +V +V +V +V +V +V +V +V +V +V +V +V +V +V +V +V +V +V +V +V +V +V 5+ +V +V +V +V +V +V +V +V +V +V +V +V +V +V +V +V +V +V +V +V +V +V

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)

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 34 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65

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
Install and cut over street lights	3 months
Remove Poles	3 months

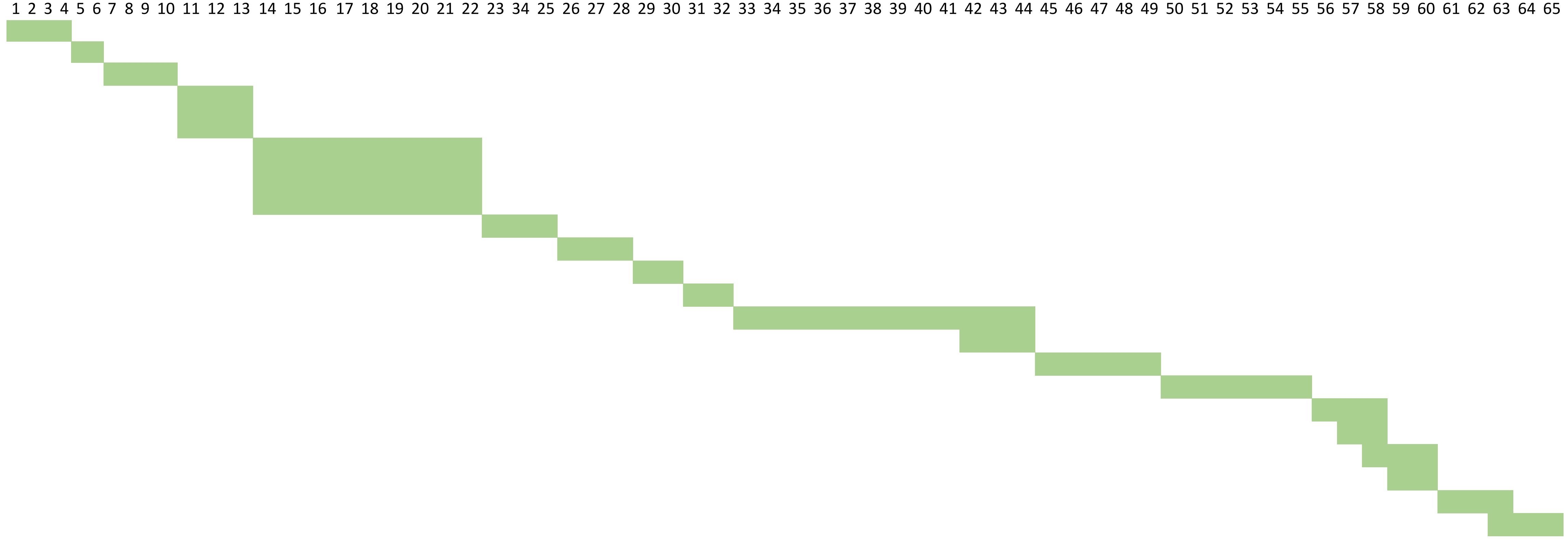


FIGURE 1