UUP MASTER PLAN UPDATE – FACTORS AND METHOD

DRAFT

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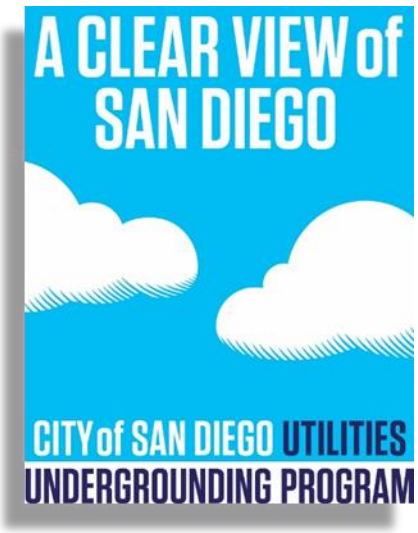
I. EXECUTIVE SUMMARY

This Utility Undergrounding Program (UUP) Master Plan Update – Factors and Method report is intended to document the methodology and development process to be used in updating the City of San Diego's (City) new Utility Undergrounding Master Plan scope of work. This report is intended to serve as the basis for future Master Plan updates by keeping a record of decisions and legislation changes throughout the years, and assist council members to facilitate residents' concerns and questions concerning any issues they may have with the development for updating the new Master Plan. The decisions and criteria made are documented and explained in greater detail throughout this report.



The new Master Plan will utilize ArcGIS Desktop software to incorporate advanced priority ranking and cost analysis per stakeholder best interests. Rule 20A projects will not be re-evaluated with exception to the implementation order. Surcharge block allocation will be centered on San Diego Gas & Electric (SDG&E) substations and branch circuitry. Transmission lines over 69kV will not be evaluated for undergrounding.

Summary of this Report's Key Conclusions:

- Implementing a new updated Master Plan will significantly improve the planning, accuracy, and the efficiency of the overall undergrounding program.
- The new Master Plan will modify and supersede the previous 2009 Master Plan (2009 MP) individual block boundaries.
- The new Master Plan will create new project blocks to target remaining overhead utilities located within open-space areas, which will be subject to undergrounding efforts after all residential and public areas that can feasibly be undergrounded are complete.
- The new Master Plan's block naming convention and boundary definitions will be based on San Diego neighborhoods.
- The new Master Plan's cost algorithms will be based on a geographic analysis of SDG&E utilities within ArcGIS Desktop for greater accuracy and repeatability.
- The new Master Plan will implement a new "Clustering" philosophy:
  - Sequence of block work in a Council District will be based on clustering work around 2 to 3 blocks in a neighborhood, while the sequence of those 2-3 blocks will be based on the priority level assigned through the geographic analysis.
  - Once a cluster of 2 to 3 blocks is completed in a Council District, the work will move to another part of the Council District to prevent construction fatigue for the local residences.

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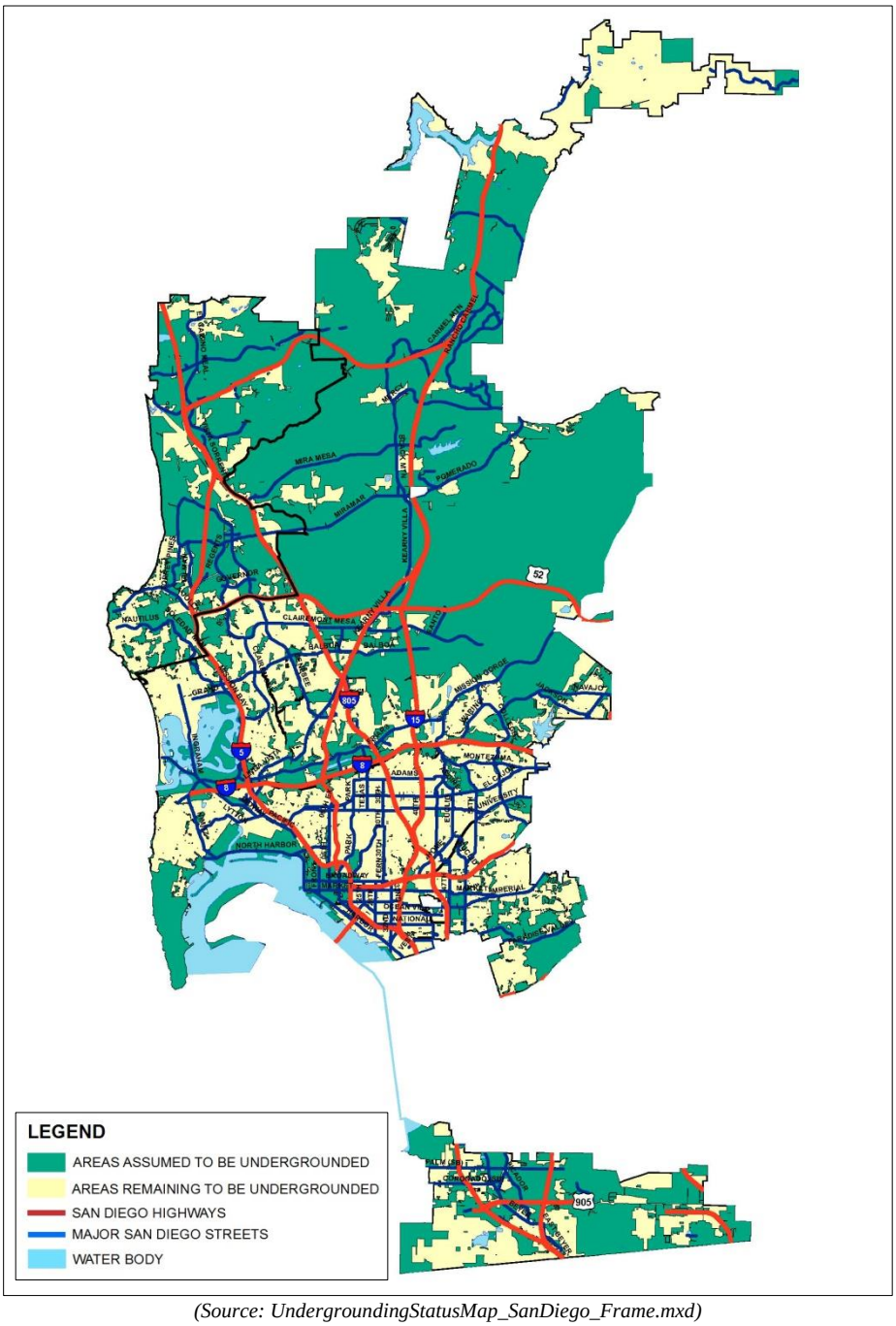
- The new Master Plan's block implementation will vary based on available budget per year.
- The new Master Plan will target 200± 25 individual service trenches (customers) and 6,000 linear feet of expected joint trenching per block.

The use of SDG&E utility information as a collaborative tool in developing the updated Master Plan is a significant improvement upon the 2009 MP. The map below demonstrates the City of San Diego's undergrounding needs as assumed through the analysis presented herein.

FIGURE 1 – UNDERGROUNDING STATUS MAP PER REMAINING SDG&E UTILITIES



(Source: UndergroundingStatusMap_SanDiego_Frame.mxd)

II. DEVELOPMENT METHODOLOGY

This UUP Master Plan Update – Factors and Method report is intended to document the methodology and development process that will be used in updating the City of San Diego's (City) new Utility Undergrounding Master Plan. Additionally, this report will study and identify the approach used in the creation of the previous 2009 Undergrounding Master Plan (2009 MP) and evaluate the previous 2009 MP's overall effectiveness to develop the necessary changes for a more accurate and effective new Master Plan. In evaluating the past metrics used throughout previous master plans, lessons learned can be utilized for more effective results. This report also includes discussion of ArcGIS Desktop software and modeling tools planned for use in developing the new updated Master Plan, as well as, incorporates a detailed explanation of the approach used to develop cost and priority algorithms which will be used within the software to automate the results of the considerations established herein.

This report summarizes the observations made to the methodologies used in the previous 2009 MP; identifies the progress and current status of its implementation; makes note of the changes in current conditions requiring the need for an updated master plan; amends projected block cost estimates with current cost data and includes a more sophisticated breakdown of anticipated costs for the successful completion of all undergrounding conversions; identifies and updates the criteria used in establishing project block priorities for the undergrounding program; and describes in detail how the updated cost estimates and priorities will be generated through use of the ArcGIS Desktop software for the new Master Plan. This report is intended to serve as the basis for future Master Plan updates, and all records of assumptions and decisions made for the development of the new Master Plan are documented herein.

A summary of the information discussed within this report is roughly organized into a chronological order as outlined below:

- Brief history of the City's overall Undergrounding Program
- Evaluation of the previous 2009 MP and its basis of design
- Evaluation of the "Big Data" available and the reliability of GIS data for accurate use in the 2016 MP
- Evaluation of current undergrounding conditions and the need for an updated master plan
- Development process of cost estimates and priority values for the new Master Plan
- The new Master Plan deliverables

III. UNDERGROUNDING PROGRAM BACKGROUND

Since 1970, the City of San Diego has been converting the overhead utility infrastructure to a new underground (UG) system in a joint effort with San Diego Gas & Electric (SDG&E), and other affected local dry utility telecommunication and cable companies. The underground conversions have been performed under California Public Utility Commission (CPUC) Rule 20 which has three parts: A, B and C. The CPUC rules govern how undergrounding funds are spent and what types of utility lines can be undergrounded. The undergrounding initiative first began with Rule 20A funded projects which focused on high traffic densities and tourism areas known as "General Public Benefit" areas which included dense overhead power lines that obstructed views and landmark features. Under Rule 20A, undergrounding projects are funded and performed by the local electric utility, SDG&E in our case, whereas Parts B and C programs are funded through other entities such as governmental agencies or private entities through maintenance assessment districts.

In January 2001, the CPUC approved Council Policy 600-08 (CP-600-08), an undergrounding surcharge component applied to San Diego residents' electric bills which established funding to include the undergrounding of utilities for residential areas which did not meet Rule 20A criteria, now known as Surcharge projects. In addition to the undergrounding of overhead utilities, the Surcharge program also funds the resurfacing or slurry sealing all trenched streets, installs new streetlights in accordance with the Street Design Manual Standards, installs curb ramps in compliance with Americans with Disabilities Act (ADA) requirements, and plants trees along City streets in coordination with adjacent property owners. Figure 2 shows the expected goal of the UG program.

FIGURE 2 – BEFORE AND AFTER RESULTS OF UG PROGRAM

BEFORE UG PROGRAM **AFTER UG PROGRAM**

(Source: The City of San Diego)

Following in 2003, the City developed an Undergrounding Master Plan which was based on the City Council District boundaries. The 2003 Master Plan encompassed the City's entire jurisdictional area and was the first comprehensive plan to underground all overhead utilities within the City. The 2003 MP coordinated the construction and project sequence in which to carry out the entire Undergrounding program. Furthermore, the Council Districts were broken into smaller project blocks, and the Undergrounding Master Plan assigned each block a funding year known as "allocation year" for tentative undergrounding start dates, along with corresponding cost estimates. In 2009, the use of computer GIS software allowed for more detailed analyses of project blocks. The previous 2009 MP was used as the basis of evaluation and the development of this report. The report in turn serves as the basis for development of the new Master Plan's planning and construction order.

For reference, the complete council policy CP-600-08, which provides guidelines for the funding implementation for all undergrounding conversions, is provided in Appendix 9.

IV. EVALUATION OF THE 2009 MASTER PLAN

The previous 2009 MP was approved by City Council on April 20, 2010 as part of Resolution R-305773. As a master planning document, the 2009 MP is a comprehensive plan encompassing both CPUC Rule 20A Projects, as well as, Surcharge Projects. The 2009 MP was updated to include a significantly higher level of engineering over the previous 2003 MP and included more accurate definition of project boundaries, and additional project attributes to provide more accurate mapping of the expected scope of work. The 2009 MP culminated in a set of maps delineating project block boundaries, their associated construction cost estimates, and the prioritization order in which they were to be undergrounded. However, supporting documentation specifying methodology or considerations applied in the development of the previous master plan was not documented, nor any records kept. For this reason, this report was put in place to document observed trends and assumptions used in the 2009 MP to serve as a basis for a more accurate and updated Master Plan. The observations made were documented and explained in greater detail below.

A. GIS SOFTWARE

The previous 2009 MP was generated by the City of San Diego using ArcGIS Desktop, a powerful mapping and data analysis software. ArcGIS Desktop has a map-making interface where designers are able to add several map layers containing geospatial data for storing, checking, and displaying data within a common geographic framework. Geographic features are accompanied by an attribute table, which has one (1) row per each feature containing further information relevant to each feature. The map layers and associated attribute data are manipulated as needed to produce the desired information regarding its geospatial location.

B. 2009 PROJECT ESTIMATOR

The previous 2009 MP used a Microsoft Excel Spreadsheet known as the “Project Estimator” for calculating project block costs. The excel spreadsheet was used in collaboration with the GIS software; the extent to what the GIS software was used in generating the 2009 costs was not documented. This Project Estimator was originally developed in 2005 by others and was used in determining the 2009 MP cost estimates. The Project Estimator utilized a few cost factors that largely depended on the number of properties and estimated trench lengths within each respective block, unless noted otherwise. An example of the 2005 Project Estimator for a sample Project Block 6Z is shown below (Table 1).

TABLE 1 – 2005 PROJECT ESTIMATOR – SAMPLE PROJECT BLOCK 6Z

Project Block 6 Z (October 2005)		Trenching	Cabling	Services	CP's	RFS	Lights	Slurry	Resurf	Ped Ramps	Trees
Footage	33,000	$ 249.51	$ 73.11			$ 25.00					
Customers	879	$ 2,491.74		$ 1,852.76							
Lights	120	$ 4,108.83					$ 3,832.64				
CP's	4	$ 11,040.93			$ 14,862.14						
SQ ft (slurry)	1,043,127							$ 0.16			
SQ ft (AC)	89,430								$ 1.05		
Ped Ramps	178									$ 2,800.00	
Trees	176										$ 100.00
SUB TOTALS		$ 10,961,293	$ 2,412,630	$ 1,628,576	$ 59,449	$ 825,000	$ 459,917	$ 166,900	$ 93,902	$ 498,400	$ 17,580
Contigency (20%)		2,192,259	482,526	325,715	11,890	165,000	91,983	33,380	18,780	99,680	3,516
TOTALS		$ 13,153,551	$ 2,895,156	$ 1,954,291	$ 71,338	$ 990,000	$ 551,900	$ 200,280	$ 112,682	$ 598,080	$ 21,096
		76.8%	16.9%	11.4%	0.4%	5.8%	3.2%	1.2%	0.7%	3.5%	0.1%

(Source: The City of San Diego – 2005 Project Estimator)

C. Cost Factors Considered

No records were documented describing how the 2009 MP calculated the quantities of the items that drove the total "cost factors" within each block's boundary. These cost factors included trenching, cabling, services, cable poles (CPs), removal from service (RFS), lights, slurry and AC pavement resurfacing, curb ramps, and trees. These quantities were manually entered into the "Project Estimator" excel sheet. The assumed definitions and summary of each cost factor used in the Project Estimator for the previous 2009 MP are outlined below.

- "Trenching" was assumed to be the distance required to facilitate the new underground utility joint trench system. This length accounted for the cost to excavate the required joint trench and install SDG&E conduits. This cost factor was dependent on the number of services (Customers), Lights, CPs and estimated trench length (Footage).

- "Cabling" accounted for the cost to install and pull SDG&E conductors within the new conduits and depended solely on the estimated trench length (Footage).

- The "Services" cost factor described the total number of SDG&E services within a project block. The 2009 MP considered this value to be equal to the number of properties within a project block. This factor, however, will be reviewed more closely in the 2016 MP as this is not the most accurate assumption due to the possibility that one property may contain an apartment complex or shopping center with several SDG&E services installed.

- "CPs" referred to the number of "cable poles" required for each project block. Cable poles were defined as power poles at locations where the power and utility lines went

from being overhead to underground at project block boundaries. Each project block will require a different number of cable poles depending on the amount of SDG&E circuits intersecting the project block.

- "RFS" referred to the "removal from service" of abandoned overhead conductors and power poles after the customers' power had been cut over to the new underground conductors. This cost factor was dependent solely on the estimated trench length.

- The "Trees" cost factor estimated the number of trees to be installed where old power poles were removed, if desired by the property owner. This factor was calculated by multiplying the number of properties by 0.2, which implies that an assumption was made where 20 percent of all properties within a block would require one tree installation.

It could not be derived how the "Lights," "Slurry," "Resurf," and "Ped Ramps" total costs were originally calculated. Part of the undergrounding process involves installing new light poles and ADA compliant pedestrian ramps. Slurry sealing and road re-surfacing is also required to restore impacted areas to original condition and current code requirements per CP-600-08 and San Diego Municipal Code (SDMC) Chapter 6, Division 2, Article 12 (Specifically 62.1210 and 62.1216). These factors will be taken into consideration in the new Master Plan.

D. 2009 MP BASIS OF DESIGN ANALYSIS

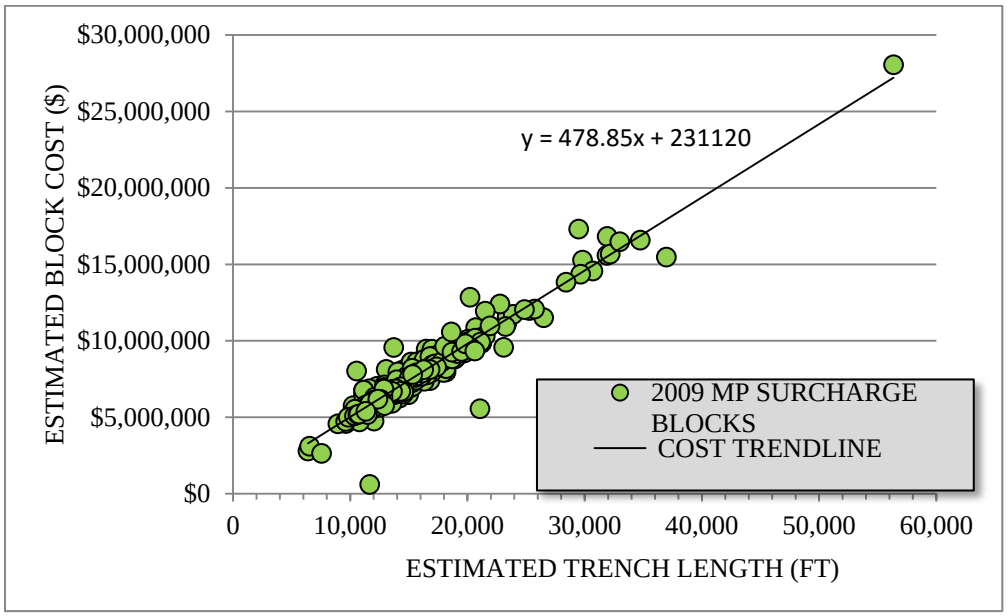
The new Master Plan will improve upon the 2009 Master Plan. Implementation will be directed to facilitate constructability issues, address current construction progress, and update current cost estimates and block implementation order. The results and observed trends from the 2009 MP are summarized below. For purposes of this study, only the analyses of Surcharge blocks were conducted.

1. 2009 Projected Cost Estimates

The previous 2009 MP project block cost estimates were reviewed to observe any trends or assumptions that were made in calculating the overall project costs. The difficulty lies in the lack of previous documentation. For example, the 2009 MP did not leave recorded documentation for how cost factors such as the number of cable poles (CP's) were quantified, how the quantities for slurry seal and asphalt pavement (AC) were generated, or how the numbers of curb ramps requiring ADA improvements were counted. Without these types of information, those cost algorithms cannot be recreated and directly reviewed or updated. Thus, a new method for projecting future cost estimates will be generated for the new Master Plan.

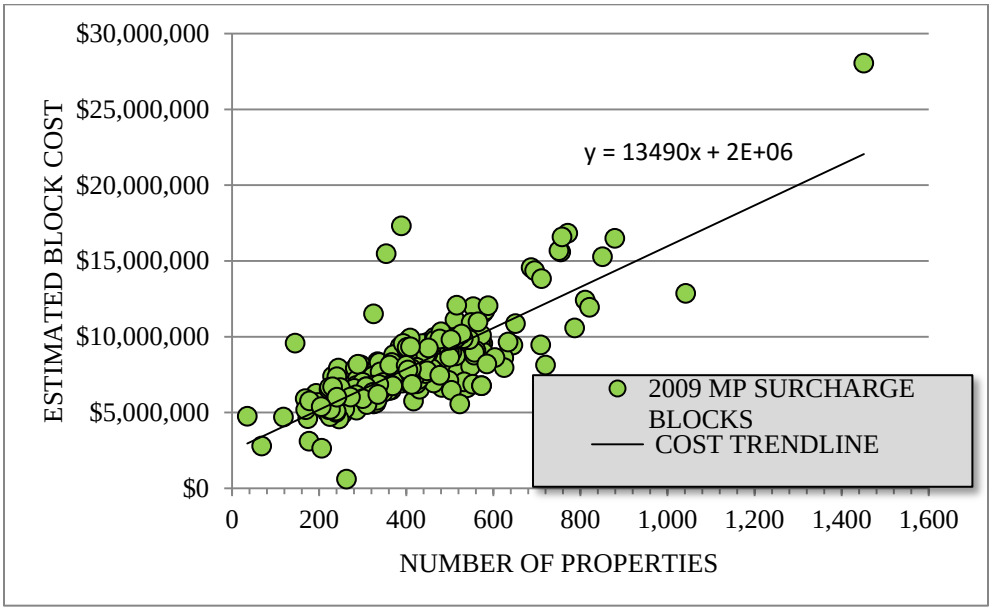
We can indirectly review the total cost estimates from the 2009 MP. The projected cost estimates were compared against the cost factors used in the Project Estimator to better identify any resulting patterns and understand the impact these factors had on the overall 2009 estimates. The patterns observed may be seen in Figures 3 and 4. These figures demonstrate the linear relationships found when estimated block costs were compared against estimated trench lengths (Figure 3) and the number of properties (Figure 4).

FIGURE 3 – TRENCH LENGTH VS ESTIMATED BLOCK COST



(Data Source: The City of San Diego – Online_Ug_Layer_Copy_8-25-15.Shp – Surcharge Blocks)

FIGURE 4 – NUMBER OF PROPERTIES VS ESTIMATED BLOCK COST



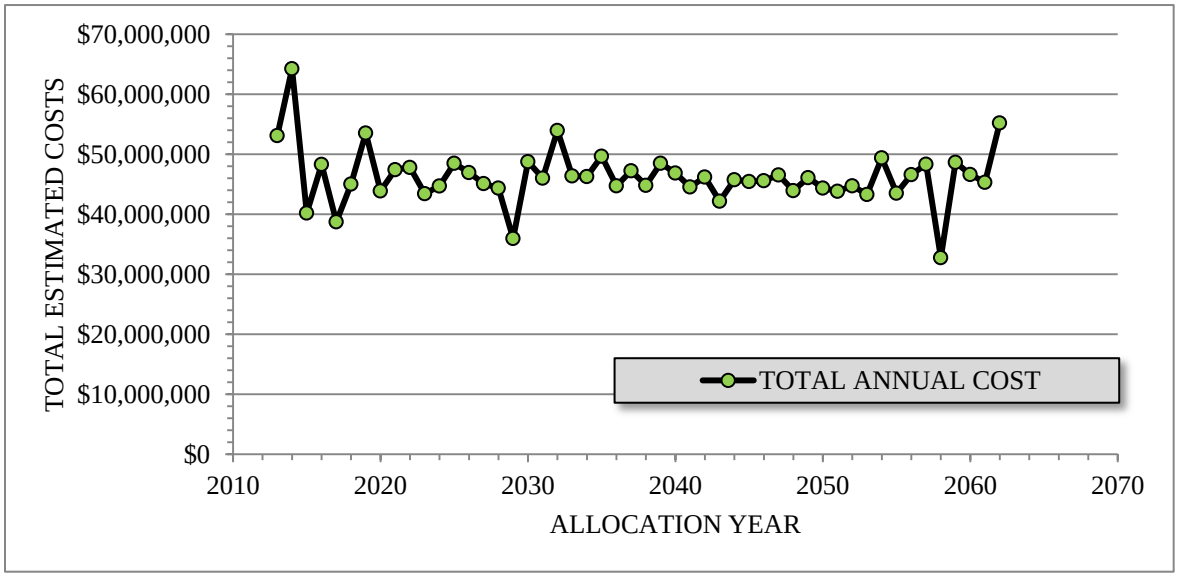
(Data Source: The City of San Diego – Online_Ug_Layer_Copy_8-25-15.Shp - Surcharge Blocks)

These relationships found infer that the 2009 cost estimates were largely based solely on the number of properties and estimated trench lengths. The project blocks' cost estimates ranged from $2 Million to $18 Million with an average block cost of $7.5 Million. A few exceptions were observed including estimates as low as $600,000 (Block 4W) and as high as $28 Million (Block 2BB1). All cost estimates will be re-evaluated and updated with current cost data in the new Master Plan.

2. Yearly Cost Estimate

The 2009 MP attempted to balance the total annual estimated surcharge costs to allow proper allocation of funding per CP-600-08 as shown in Figure 5. The total annual estimated surcharge costs ranged from $32 Million to $55 Million per year with an average of $44 Million per year. Refer to Appendix 1 for calculations and supporting data.

FIGURE 5 – 2009 MP ESTIMATED SURCHARGE BLOCK COST PER YEAR



(Data Source: The City of San Diego – Online_Ug_Layer_Copy_8-25-15.Shp – Surcharge Blocks)

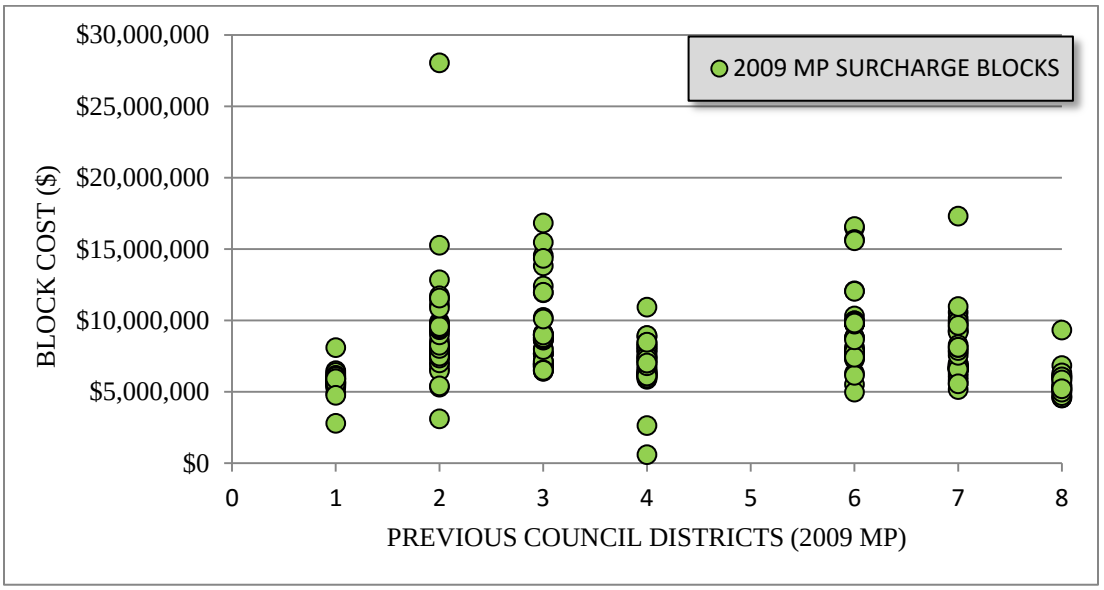
In the 2009 MP, the average project block cost estimate varied slightly between the previous eight Council Districts as shown in Figure 5 and Table 2. This analysis was conducted for use as a reference in the development of the new Master Plan. Refer to Appendix 1 for calculations.

TABLE 2 – 2009 MP AVERAGE COST ESTIMATE PER CITY COUNCIL 2009 DISTRICTS

District 1	District 2	District 3	District 4	District 6	District 7	District 8	Average
$5,719,500	$9,132,870	$8,585,719	$7,027,422	$9,357,863	$7,701,372	$5,641,179	**$7,595,132**

*This list was obtained using the "UUPProjects_17May2016.shp" GIS data provided by the City.

FIGURE 6 – ESTIMATED SURCHARGE BLOCK COSTS PER COUNCIL DISTRICT

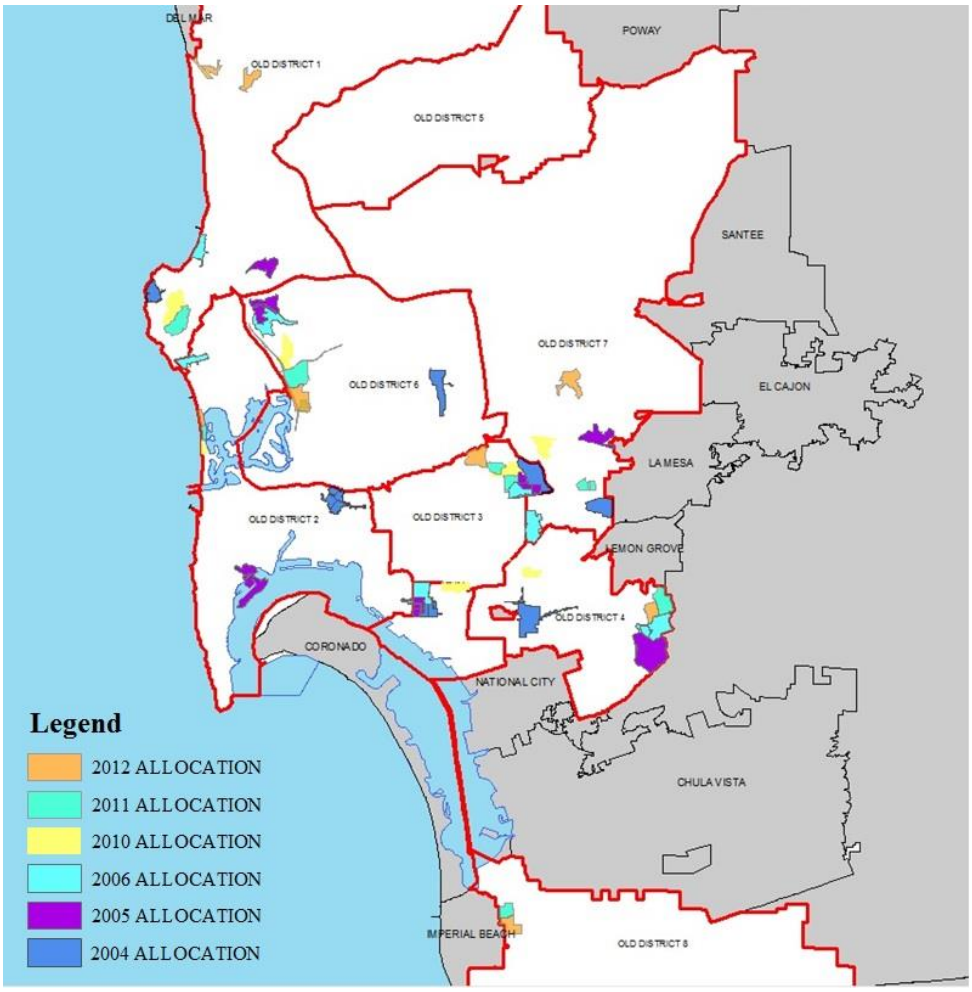


(Data Source: The City of San Diego – Online_Ug_Layer_Copy_8-25-15.Shp – Surcharge Blocks)

3. Allocation Year/ Project Block Sequencing Analysis

The 2009 MP began its allocation implementation in the year 2010 with projects already having been allocated for the years 2004 to 2009 (See Appendix 1) from the previous 2003 MP. The term "Allocation" referred to the year on which a block had been designated to go through environmental review and public hearing to be approved by the City Council. Once allocated, undergrounding projects progress to design and construction. Prior to the implementation of the 2009 MP, the very first initial Surcharge construction projects that took place in 2004 were generally located along district edge boundaries as shown below in Figure 7 in Blue.

FIGURE 7 – INITIAL SURCHARGE ALLOCATION TRENDS



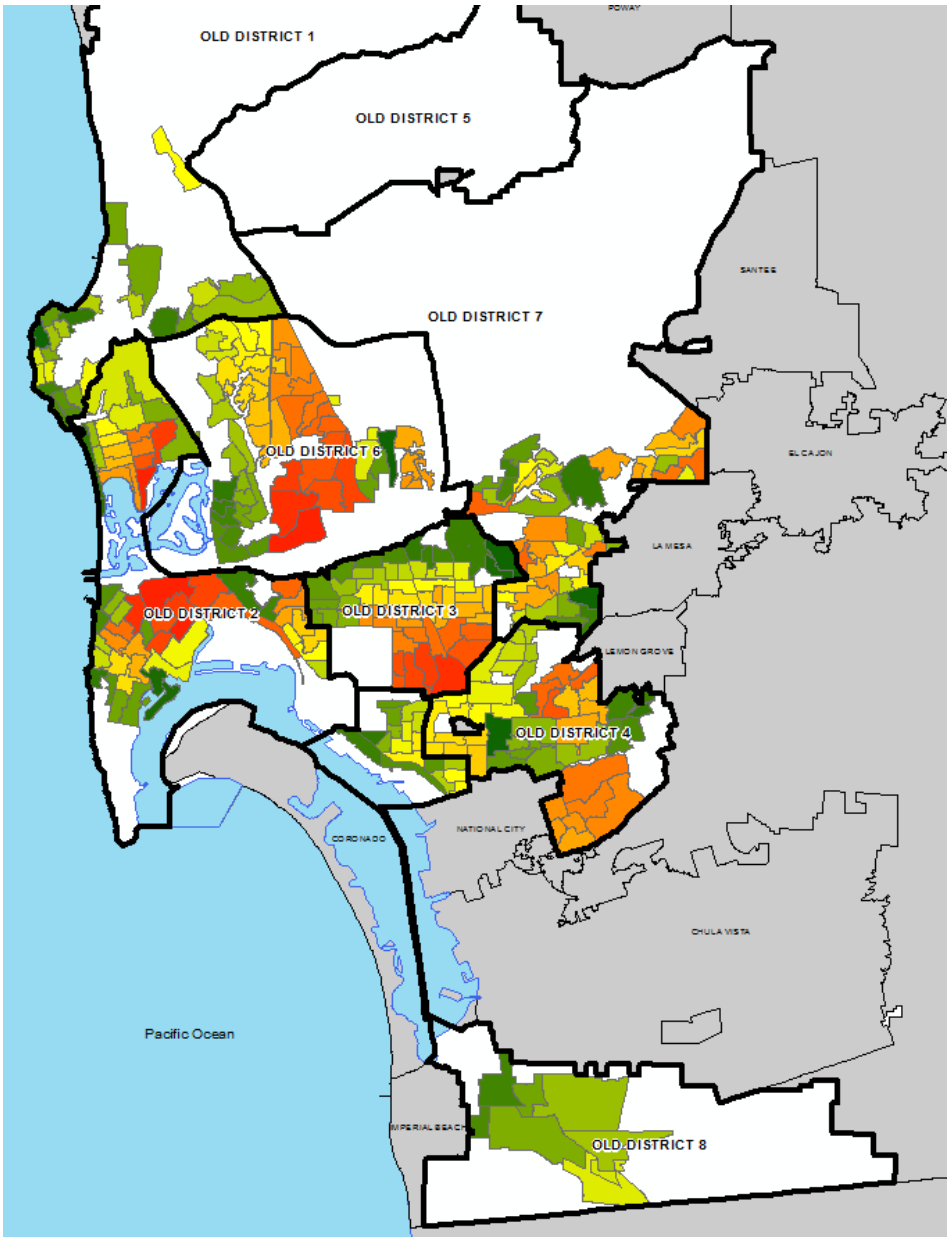
(Data Source: The City of San Diego – UUPProjects_17May2016.shp*)*

The 2009 MP Surcharge project blocks from 2010 and onward appear to be mostly based on a contiguous sequence. Blocks appear to have been allocated to start where adjacent project blocks from the previous year had ended, as stated by CP-600-08. However, exceptions were observed where project blocks seemed to have been geographically allocated at random such as Districts 2, 7, and 8 as shown above in Figure 7. This random selection method will be avoided in the new Master Plan.

Furthermore, due to construction delays, the planned allocation years set by the 2009 MP no longer mirror the project block's actual schedule. The 2009 MP as a planning document has become virtually unusable and is misleading. This discrepancy with the "allocation year" term has caused significant confusion with residents, as actual construction efforts do not often break ground in the year specified. To avoid future confusion, the new Master Plan will introduce an implementation order as opposed to established years for allocation. In addition, the lack of documentation in the 2009 MP associated with the prioritization sequence has left residents with

concerns regarding City transparency. Refer to Figure 8 for the geographic color ramp map for allocation of Surcharge project blocks based on the previous 2009 MP.

FIGURE 8 – GEOGRAPHIC COLOR RAMP MAP FOR ALLOCATION BASED ON 2009 MP



*The allocation years and associated shading for Figure 8 are as follows:

2003 2032 2062

(Data Source: The City of San Diego – UUPProjects_17May2016.shp*)*

This color ramp map from Figure 8 serves as a general timeline based on the previous 2009 MP remaining unallocated Surcharge projects. Additionally, this color ramp map may be used to depict residents' current expectations. Residents in green areas anticipate becoming undergrounded in the near future; these areas will require immediate public outreach as they will be the ones most affected by any changes to scheduling in the new Master Plan. Once allocated, the process typically lasts 5 years from initial public hearing to complete undergrounding conversion.

4. Program Completion

The 2009 MP anticipated completion of the entire undergrounding initiative to be in the year 2062 with three large project blocks totaling to about $55 Million in Fiscal Year (FY) expenses. Of these three (3) final project blocks, Block 2BB1 had an estimated construction cost of about $28 Million whereas the remaining two blocks had a combined estimated construction cost of $27 Million. A new final completion date will be estimated in the updated new Master Plan based on anticipated yearly funding and the amount of undergrounding conversions remaining in the Master Plan document.

V. VERIFICATION OF GIS INFORMATION

Due diligence investigations were performed in sample areas within several districts to validate the accuracy and reliability of the GIS information received. It was understood that verification of the entire project limits were not possible, but sample areas would serve as a census for the whole. The magnitude of accuracy for updating the new Master Plan is dependent on the accuracy of the "big data" received.

The investigations conducted below were done in an attempt to verify the accuracy of the City GIS data, the City of San Diego's SANDAG website (SANDAG) by means of the Land Use layer, and the accuracy of the SDG&E information. To verify the GIS data, the investigations were split into 4 steps and compared against each other for any discrepancies. The 4 steps conducted are listed below:

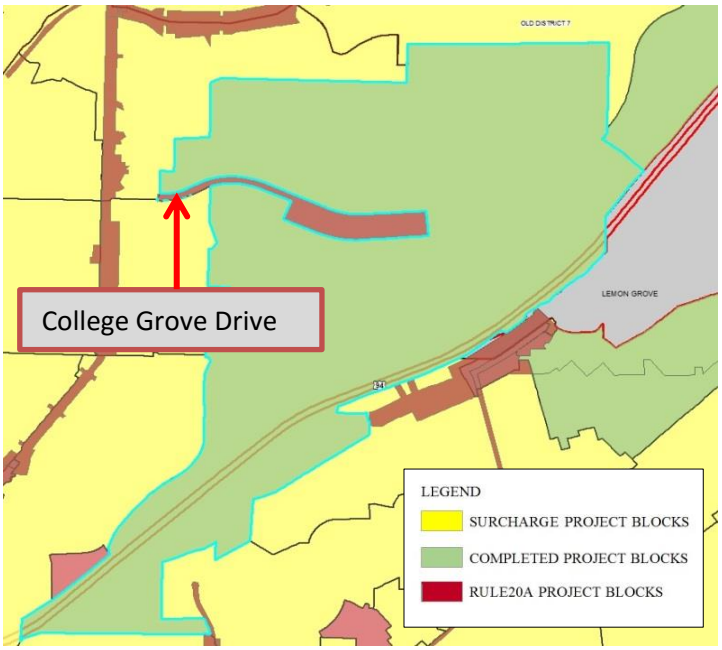
1. City GIS Block Boundary and Location
2. Land Use Data Verification
3. Satellite Imagery
4. Street View Imagery

A. SAMPLE INVESTIGATION

Residential Project Block 4 Open Space (Project Block 4OS) in the following verification procedures was chosen for investigation due to its complexity. This project block was not included in the 2009 MP, but was recently added to the City's GIS project inventory database from May 2016. The current City inventory does not contain any assigned project classifications such as funding source, allocation year or any other project information for this project block. This project block was also observed to contain an imbedded completed Rule 20A project block (shown in Red) within its boundary along College Grove Drive as shown in Figure 9. For these reasons, the block is a prime candidate for investigation to verify the accuracy of the "big data" and confirm reliability for use in developing the new Master Plan. Additionally, areas already undergrounded or denoted as "Completed" are assumed to not have any SDG&E utilities remaining overhead in the area. Due to the sensitive nature of SDG&E information, utilities were not shown below and only referenced in general terms.

1. City GIS Block Boundary and Location

FIGURE 9 – PROJECT BLOCK 4OS



Sample Block 4OS outlined in Blue shows an imbedded completed Rule 20A Block within its boundary. This project block was not previously included in the 2009 MP. This reference falls within District 4 along College Grove Drive.

*Although completed, the Rule 20A project block is shown in Red for identification purposes. The following Figures will denote the area in green for completed.

(Data Source: The City of San Diego – UUPProjects_17May2016.shp*)*

2. Land Use Data Verification

FIGURE 10 – PROJECT BLOCK 4OS LAND USE

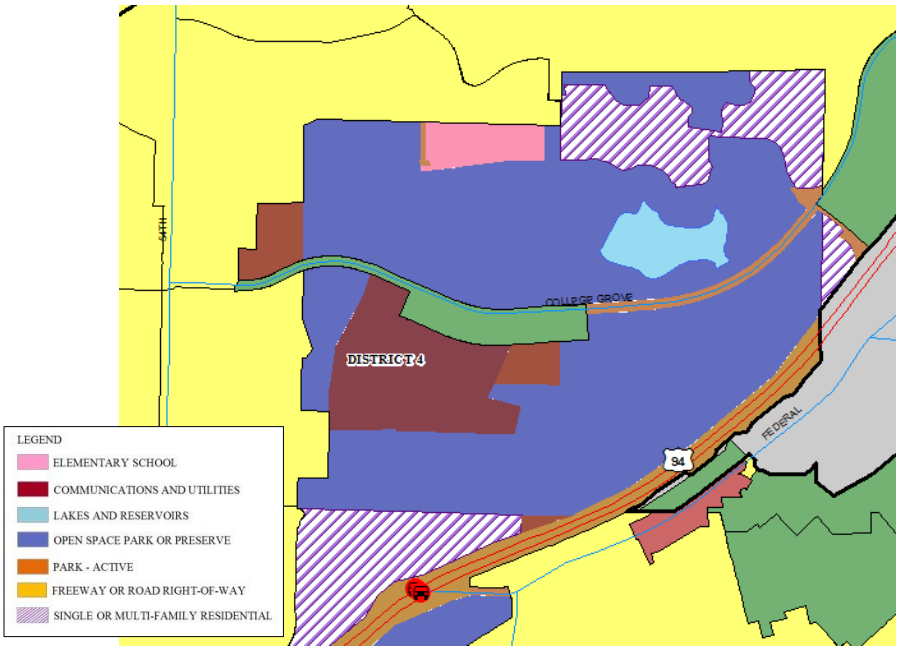


Figure 10 shows the project block's land use. This land use layer is a GIS shapefile that was determined by SANDAG for the Regional Growth Forecast. We can see the majority of the block is listed as "open-space", verifying the reason it was not previously included in the 2009 MP for undergrounding efforts. Likewise, only few SDG&E utilities were observed in the area. They were observed along resident boundaries transitioning to open-space areas. This is likely for continued connectivity to areas not yet undergrounded.

(Data Source: The City of San Diego – UUPProjects_17May2016.shp*)*

The Rule 20A project block along College Drive (previously denoted in red) is denoted in green for completed. The colors denoting the different land use areas are listed below.

3. Satellite Imagery

FIGURE 11 – PROJECT BLOCK 4OS SATELLITE VIEW

(Source: Google Earth Pro – 2015 Imagery, Digitally Edited)

Figure 11 shows a satellite image verifying Project Block 4OS's land use and lack of need for undergrounding conversion. The undergrounding of open-space areas is not included under CP-600-08. The two (2) residential areas outlined in pink were observed to already be undergrounded as shown below. These observations, along with the absence of SDG&E utilities in the residential areas, further validate the acceptable accuracy of the GIS data.

4. Street View Imagery

FIGURE 12 – BAYVIEW MOBILE HOME PARK & CHOLLAS HEIGHTS HOUSING

(Source: Google Earth Pro – 2015 Imagery)

After reviewing street imagery for the two (2) residential developments: Bayview Mobile home Park (left) and Chollas Heights Housing (right), it is clear that no undergrounding is required. In accordance, SDG&E utilities were also observed to not be in the area. One development is the Bayview Mobile Home Park built in 1971 and the other is the Lincoln Mobile Home Park built in 1971 and the other is the Lincoln Military Housing-Chollas Heights development built in the early 1990s. These developments are considered "new" construction. "New" construction refers to anything built after 1967 when the Undergrounding Program was first implemented under CPUC General Order 128 (GO 128). Any construction that began after GO 128 was implemented was required to install utilities underground unless overhead utility poles were already present.

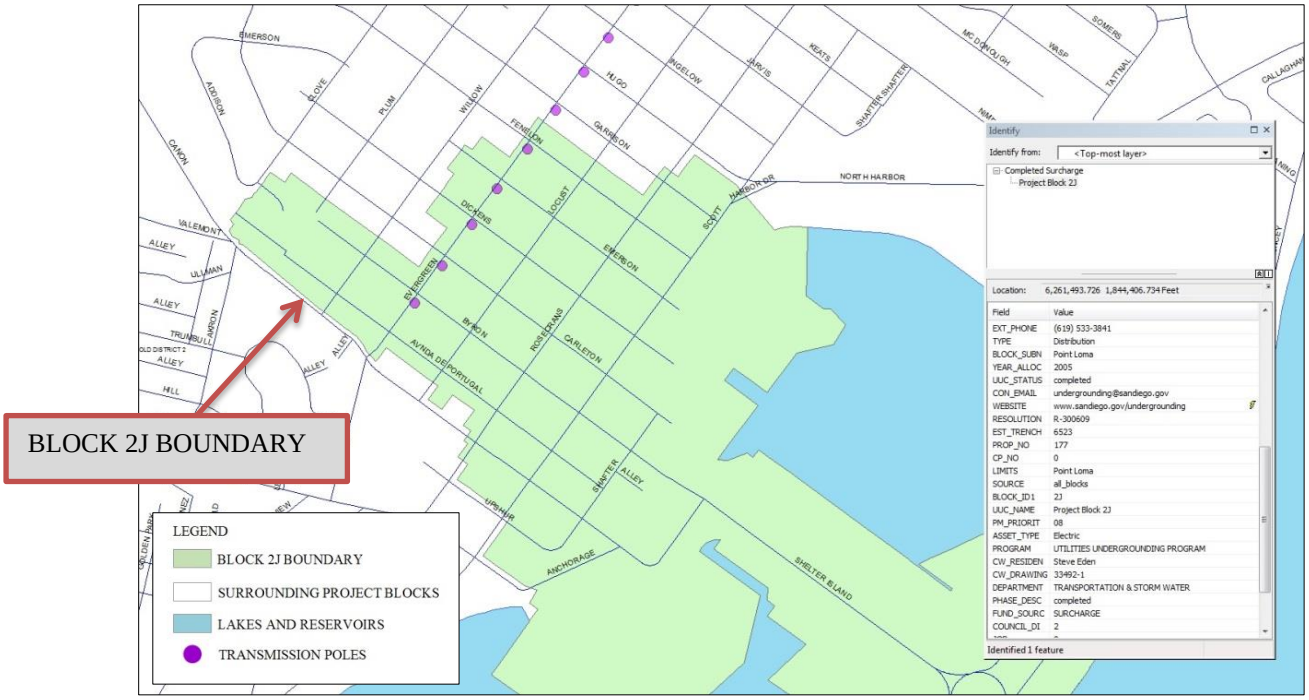
In summary, the same confirmation procedure was performed throughout the City of San Diego with at least one confirmation performed in each Council District, and is attached to this report as Appendix 4. Confirmation of the accuracy and reliability of the City GIS data, the LANDUSE_CURRENT data and by extent the other information obtained from SANDAG, and the SDG&E information allowed us to move forward with "big data" using GIS for the new Master Plan.

B. Additional Verification of SDG&E Information

In accordance with the above discussed verifications for the accuracy and reliability of GIS information, additional SDG&E features were further verified. Figure 13 shows completed Surcharge Project Block 2J (denoted in green) where all distribution poles and lines are assumed

to have been undergrounded and according to SDG&E data, only transmission poles remain overhead in the area.

FIGURE 13 – COMPLETED SURCHARGE BLOCK 2J GIS DATA



(Data Source: The City of San Diego – UUPProjects_17May2016.shp*)*

The area in green demonstrates the extent of completed Surcharge Project Block 2J. Based on the City's GIS data, block 2J was allocated in 2005 and completed in December of 2015. Due to the sensitive nature of SDG&E information, the purple transmission poles serve as a general outline of their location and no other information is provided. Figures 14 and 15 demonstrate the street view of areas within the completed project block boundary validating that the only remaining overhead lines in the area are that of Transmission lines.

FIGURE 14 – SURCHARGE BLOCK 2J TRANSMISSION LINE INVESTIGATION

Photo was taken at the intersection of Evergreen Street and Byron Street showing overhead Transmission lines. Upon investigation, the only remaining overhead lines are that of the Transmission lines. All overhead distribution utility lines in the area have been undergrounded and only the Transmission line services were observed to be remaining overhead.

(Source: Google Earth Pro – 2015 Imagery)

FIGURE 15 – SURCHARGE BLOCK 2J DISTRIBUTION LINE INVESTIGATION

(Source: Google Earth Pro – 2015 Imagery)

Continued investigation of the various streets within completed Block 2J demonstrate that no other SDG&E utilities remain overhead as shown on Figure 15 for the intersections of Byron Street and Locust Street, and Byron Street and Rosecrans Street.

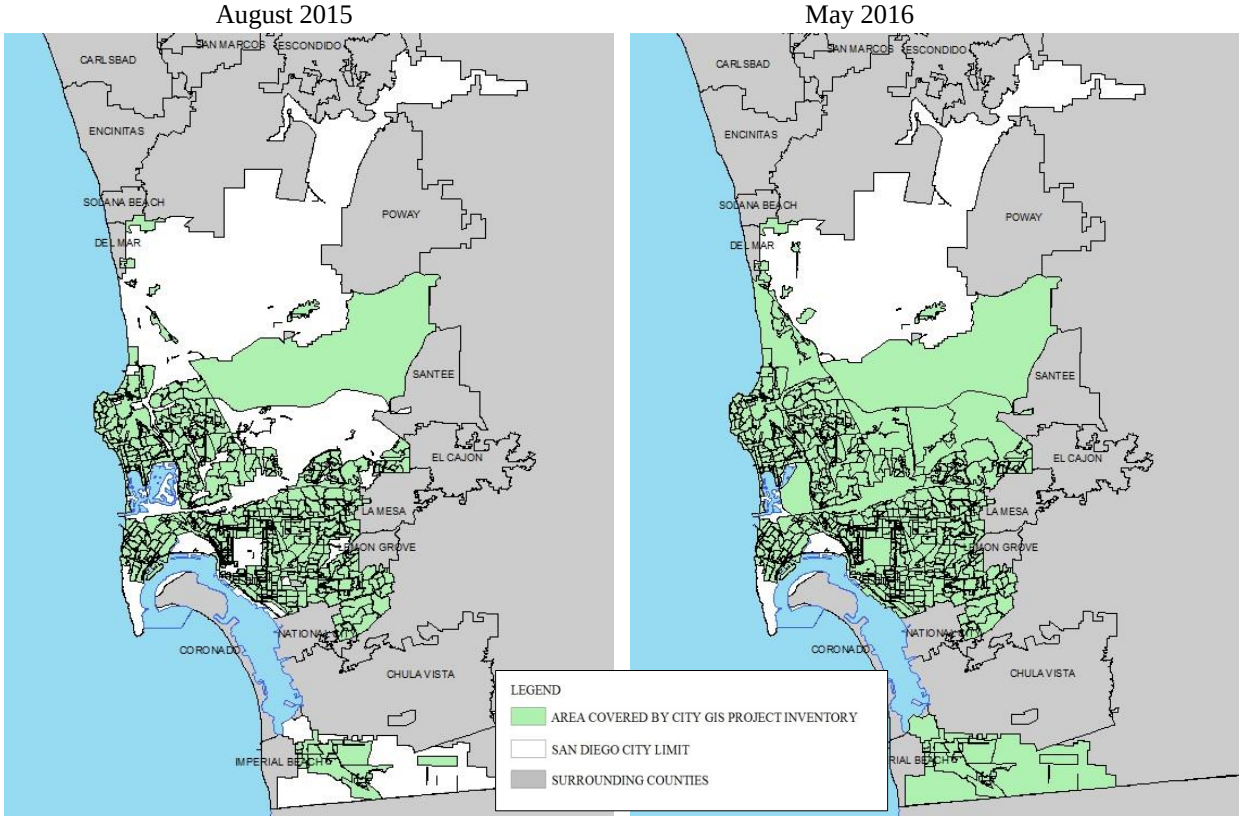
Minor instances of classification discrepancies were observed but were deemed negligible when compared to the size of information being evaluated for the 2016 MP. One example encountered was within City Project Block 7IND where an SDG&E pole was classified as "Subtype 1" denoting distribution pole. However, upon review through Google Earth, the pole was observed to be a street light pole. SDG&E has a classification for street lights and this was an instance demonstrating where minor misnomers may occur. It is assumed that other instances may occur throughout the data; however, these instances are immaterial for use as a basis for a Master Planning Document.

These investigations provide confidence for the use of SDG&E data as a basis for the new Master Plan.

VI. CURRENT CONDITIONS/REMAINING WORK

The use of SDG&E utility information as a collaborative tool in developing the updated Master Plan is a significant improvement upon the 2009 MP. SDG&E GIS information offers a realistic view of existing overhead utilities, and thus actual remaining work. In order to develop the new Master Plan, a base datum representing current conditions was established and documented herein. The datum was established in May 2016, the month the most current GIS data was received from both SDG&E and the City. Both SDG&E and the City's GIS data are continuously being updated; this datum serves as a snapshot in time with which observations and assessments can be made, and will be used as a starting point from which to update the new Master Plan. Any updates or changes to either party's information will not be reflected in this master plan. From this datum, the new Master Plan will have a traceable starting point from which all assumptions and decisions were built upon. As an overall planning document, establishing a documented record for current undergrounding completion statuses, remaining scope of work, and plans set for transitioning to the new Master Plan is paramount for moving forward. An example of the continuously changing information is captured in Figure 16 which demonstrates the change in the City's GIS data from August 2015 (left) to May 2016 (right). The figure on the left shows the extent of the area covered in the City GIS data as of August 2015 denoted in green while the figure on the right shows the extent of the area covered as of May 2016.

FIGURE 16 – CITY GIS DATA CHANGE FROM AUGUST 2015 TO MAY 2016



(Data Source: The City of San Diego – Online_Ug_Layer_Copy_8-25-15.Shp and The City of San Diego – UUPProjects_17May2016.shp*)*

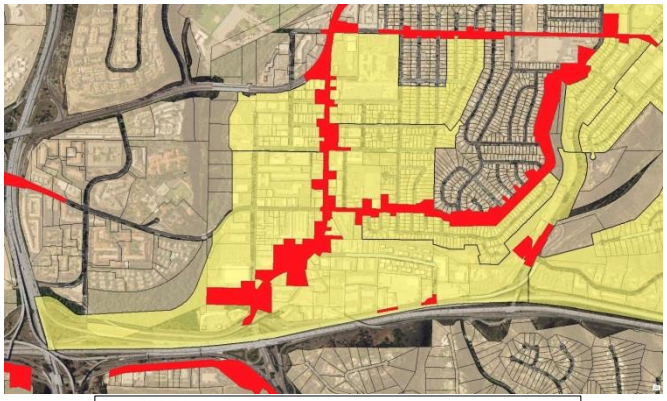
A. DATA UPDATES

The City's GIS data contains information regarding current project block size and shape, planned years for funding, and current undergrounding conversion statuses for the entire undergrounding program. The established base datum will be used to track completed projects, those currently in construction, and verify remaining work. Two sets of City GIS inventory data were reviewed to understand the continuously changing dynamic of the live file; the City initially provided their project inventory GIS data file in August of 2015 named "Online_UG_Layer_copy_8-25-15". However, due to SDG&E utility information delays with SDG&E non-disclosure agreements, the City resent their updated GIS database in May named "UUPProjects_17May2016.shp" once the SDG&E issues had been resolved. The SDG&E GIS data file "SanDeigoMasterPlan.gdb" contained information regarding general locations of substations, power lines, and utility poles.

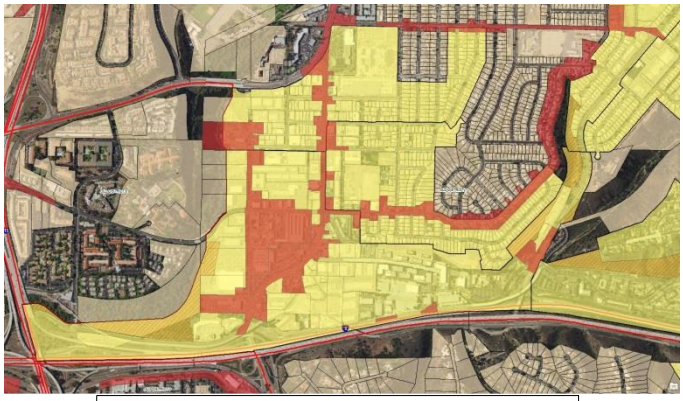
Due to the nature of City projects, updates and changes are continuously being made as necessary. As City policies and decisions are updated, so does the outlook of the City's GIS data. In reviewing the sets of information, it was observed that Rule20A blocks had been added since the August 2015 file was received; thus since the 2009 MP was published. The instances observed happened to be project segments classified under Public Review. The August 2015 GIS data contains 480 Rule 20A projects while the May 2016 GIS data contains 577. These newly defined Rule 20A projects overlap with existing Surcharge project blocks as shown in Figure 17. These changes to the 2009 MP are among the many reasons for the need for an updated new Master Plan.

FIGURE 17 – SURCHARGE PROJECT BLOCK 7 INDUSTRIAL

August 2015



May 2016

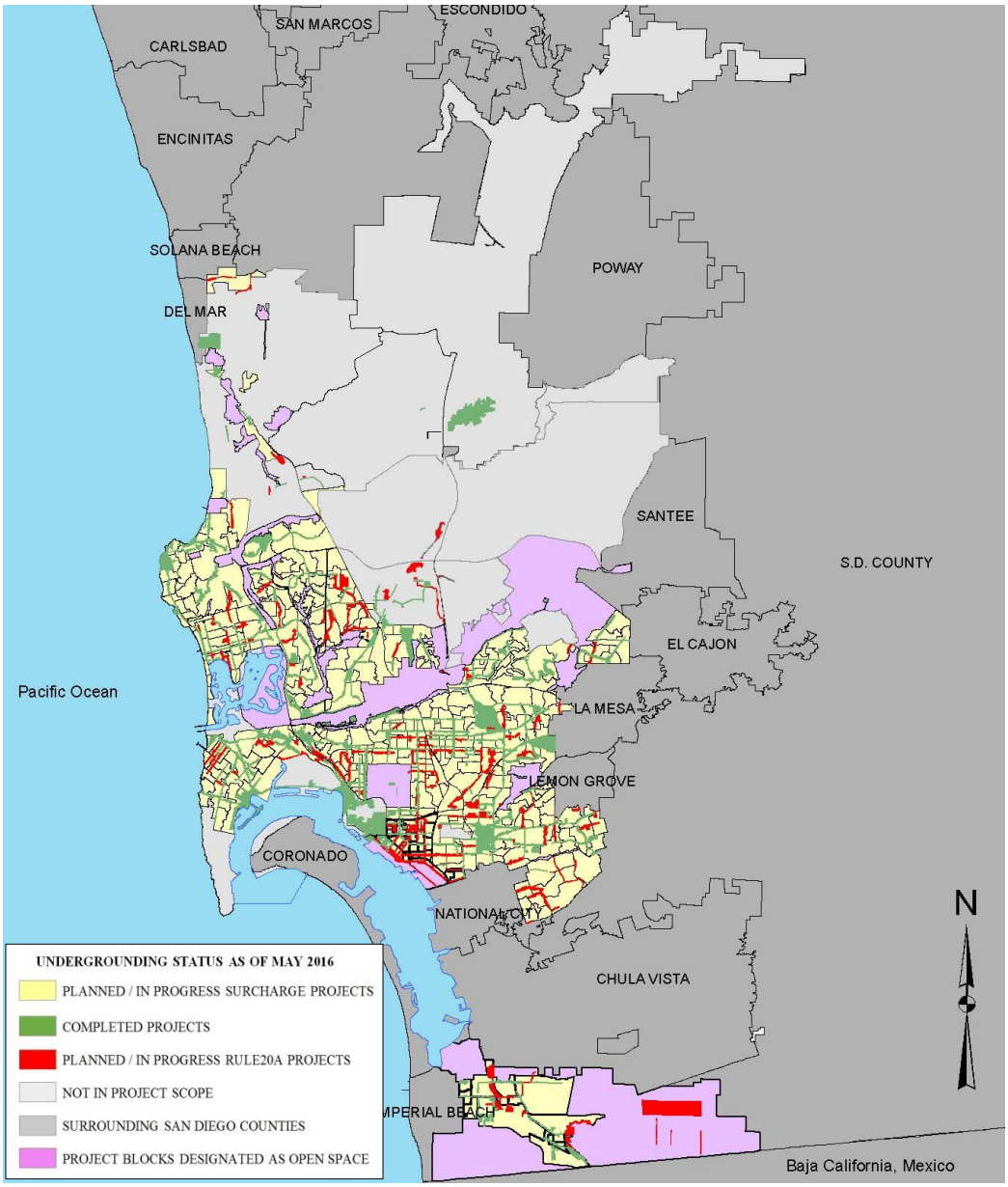


(Data Source: The City of San Diego – Online_Ug_Layer_Copy_8-25-15.Shp and The City of San Diego – UUPProjects_17May2016.shp*)*

The new Master Plan will use the City's project inventory GIS data file received in May of 2016 named "UUPProjects_17May2016.shp" as the datum for most current conditions on which the Master Plan will be updated. For the new Master Plan, all project blocks which are currently

listed as planned for allocation (i.e. in public review, in design, or currently in construction) by the UUC_STATUS category within the City's UUP project inventory data will be considered as "frozen" and will not be changed or re-ranked in order to accommodate community expectations and expedite the transition to the new master plan. The new Master Plan will only re-evaluate project block areas that remain listed as "unallocated" within the UUC_STATUS category and have not yet undergone public review, are currently in design, or are currently in construction. This will allow for construction efforts to continue as originally planned while the new updated Master Plan becomes finalized. Figure 18 shows the City of San Diego and the current status of the City's undergrounding program.

FIGURE 18 – CURRENT PROJECT CONDITIONS MAP AS OF MAY 2016



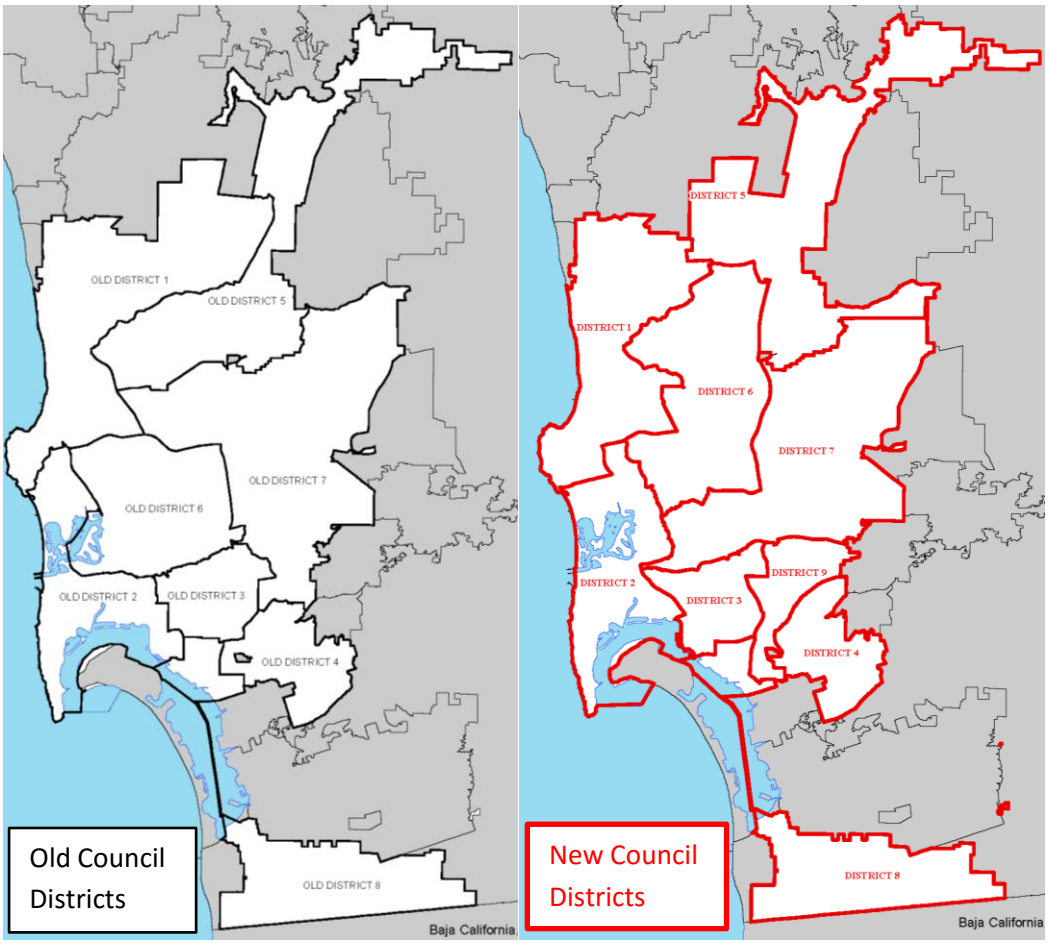
(Data Source: The City of San Diego – UUPProjects_17May2016.shp*)*

B. COUNCIL REDISTRICTING

The City of San Diego is currently classified into nine (9) Council Districts as opposed to the eight (8) districts that were present during the 2009 MP implementation. In 2010, the City underwent new redistricting as the San Diego City Charter, Article II, Section 5, requires redistricting every 10 years. A key change in the new Master Plan will be the inclusion of these new council redistricting results which have shifted district boundary lines. Several of the new district boundaries cut directly through old project blocks while other blocks now reside entirely within new district jurisdictions. These changes have affected project block names and the availability of jurisdictional funding. A list of the effected Surcharge blocks is shown in Table 3.

Figure 19 illustrates the City's Council redistricting results. In an attempt to mitigate continued project block renaming efforts every 10 years, a new regional naming convention will be implemented and all Surcharge project blocks within the scope of the new Master Plan (all blocks currently listed as unallocated) will be renamed. The new naming system will use the more stable neighborhood identifiers instead of District jurisdictions. Refer to Section VII.F for more detailed information on the new naming methodology and considerations made.

FIGURE 19 – CITY OF SAN DIEGO COUNCIL REDISTRICTING



(Data Source: The City of San Diego & SANDAG GIS Warehouse)

The GIS file containing the new Council District boundaries was obtained from the SANDAG website and the prior Council District boundaries data file was obtained from the City.

TABLE 3 – PROJECT BLOCKS IMPACTED BY CITY COUNCIL REDISTRICTING

BLOCK	COST ESTIMATE	ALLOCATION YEAR	COUNCIL DISTRICTS
2AA	$7,962,085	2022	1, 2
2W	$8,145,987	2031	1, 2
2W1	$8,356,354	2032	1, 2
3AA	$6,995,905	2033	3, 9
3D	$14,358,270	2061	3, 9
3II2	$7,710,365	2035	3, 9
4B	$8,928,436	2040	4, 9
4B1	$8,954,332	2041	4, 9
4C	$8,427,361	2042	4, 9
4J	$10,938,559	2032	4, 9
**6IND	0	2063	6,7
6AA	$9,852,939	2046	6, 7
6D	$15,593,232	2062	2, 7
6M	$8,135,027	2028	2, 6
6M1	$7,897,725	2027	2, 6
6T	$9,839,136	2049	6, 7
6V1	$9,830,895	2057	6, 7
6Y	$6,165,793	2033	6, 7
7D1	$6,992,142	2027	4, 9
8L	$5,837,775	2037	8, 9
8M1	$4,574,586	2028	8, 9
8O	$4,985,892	2035	8, 9

*This list was obtained using the "UUPProjects_17May2016.shp" GIS data provided by the City.
**Project Block 6IND was added to the City's project inventory after the 2009 MP was established and so does not currently have a project estimate. The project inventory assigned the project block to be undergrounded the final year of the program.

C. Current 2009 Project Schedule

The previous 2009 MP's scheduled years for allocation are no longer applicable for several key reasons. Firstly, the year scheduled for project blocks to be funded no longer applies to the 2009 districts because of the redistricting boundary changes which affect funding jurisdictions. Additionally, projects that are behind schedule have not been updated to reflect new scheduled plans for construction start dates. This has caused confusion for residents in its implementation. The current 2009 schedule does not allow for project blocks to be reevaluated or reorganized according to yearly progress, moratorium restrictions, or document how to address project blocks that have fallen behind in their implementation; no current contingency exists in the 2009 MP as a result of the "Allocation Year" term which will be another key change in the updated Master Plan. Secondly, the creation of the new District 9 has altered the yearly funding distribution requirements, which needs to be readjusted and redistributed among all districts. Lastly, an

increase in recent overall funding can allow for more undergrounding work to be completed every year by undergrounding more project blocks.

D. Work Completed

A percentage of the available funding depends on the remaining miles to be undergrounded and the current work completed will affect future planning. Tables 4 and 5 show the remaining work to be completed for each District in terms of miles remaining to be undergrounded and the associated funding totals based on the new Master Plan estimates. Per the project scope, the Rule 20A projects will only be updated for anticipated trench lengths and their respective costs; Projects' shape and size will not be reevaluated.

TABLE 4 – SUMMARY OF REMAINING RULE 20A WORK AFTER 2016 CY

	DISTRICT	1	2	3	4	5	6	7	8	9	TOTAL
TOTAL	TOTAL MILES	1.29	8.86	11.39	12.63	0.00	8.31	2.58	22.38	6.37	73.80
	*TOTAL COST	$4,231,032	$29,566,928	$38,291,265	$41,722,733	$0	$27,314,179	$8,288,568	$67,173,407	$20,816,569	$237,404,681
	% MILES	2%	12%	15%	17%	0%	11%	3%	30%	9%	100%
YEARLY	45% EQUAL FUNDING	$1,125,000	$1,125,000	$1,125,000	$1,125,000	$0	$1,125,000	$1,125,000	$1,125,000	$1,125,000	$6,750,000
	45% MILEAGAE FUNDING	$117,987.14	$810,153.66	$1,041,568.19	$1,154,971.21	$0	$760,157.98	$235,848.63	$2,046,569.88	$582,743.29	$6,750,000
	10% MAYORAL FUNDING										$1,500,000
	TOTAL FUNDING	$1,242,987	$1,935,154	$2,166,568	$2,279,971	$0	$1,885,158	$1,360,849	$3,171,570	$1,707,743	$15,000,000

** See Appendix 2 for calculations*
** Analysis was based on the information obtained in May 2016*
**Total miles and costs are based on the updated MP methodology estimates. Actual miles and costs will be verified during the design phase.*

TABLE 5 – SUMMARY OF REMAINING SURCHARGE WORK AFTER 2016 CY

	DISTRICT	1	2	3	4	5	6	7	8	9	TOTAL
TOTAL	TOTAL MILES	54.05	183.08	151.88	120.83	0.00	87.50	123.54	55.32	148.57	924.77
	*TOTAL COST	$194,892,104	$689,962,800	$568,789,569	$435,217,504	$0	$324,269,675	$441,208,593	$198,601,367	$551,510,685	$3,404,452,297
	% MILES	6%	20%	16%	13%	0%	9%	13%	6%	16%	100%
YEARLY	45% EQUAL FUNDING	$2,812,500	$2,812,500	$2,812,500	$2,812,500	$0	$2,812,500	$2,812,500	$2,812,500	$2,812,500	$22,500,000
	45% MILEAGAE FUNDING	$1,315,032	$4,454,456	$3,695,196	$2,939,790	$0	$2,129,018	$3,005,764	$1,345,989	$3,614,755.06	$22,500,000
	10% MAYORAL FUNDING										$5,000,000.00
	TOTAL FUNDING	$4,127,532	$7,266,956	$6,507,696	$5,752,290	$0	$4,941,518	$5,818,264	$4,158,489	$6,427,255	$50,000,000

** See Appendix 3 for calculations*
** Analysis was based on the information obtained in May 2016*
**Total miles and costs are based on the updated MP methodology estimates. Actual miles and costs will be verified during the design phase.*

As noted in Tables 4 and 5, the total funding expected per district vary significantly. Surcharge Project blocks in District 2 would need to be sized to almost twice the size as project blocks in District 8 to match projected funding numbers. Additionally, the difficulty in continued implementation of the 2009 MP would be an unnecessary expense of City staff efforts, involving a yearly reevaluation of project block sizes to keep in accordance with the projected funding as the completion percentages continually change. For example, Districts 2, 3, and 9 have the most mileage remaining to be undergrounded. According to the 2009 MP these districts would require larger block sizes to attempt to balance the City-wide completion percentages. However, as districts eventually reach parody for percent complete, these larger block sizes would need to be reevaluated and resized to meet the new funding limits to match the percent complete. To continue to implement the 2009 MP would require the need to define project block costs and priority simultaneously based on the changing District needs to meet the goals set by CP-600-08 until they ultimately reach parody. Lastly, the discrepancy between projected cost and actual cost leave the 2009 MP vulnerable to changes in project construction costs. Instances of additional Mitigated Negative Declaration (MND) efforts and costs are not currently taken into account by the 2009 MP which would disrupt the planned funding distributions.

The new updated Master Plan will focus on projects blocks being of similar block size and cost. The intent will be to avoid being bound by yearly changing funding costs for reshaping and prioritizing efforts. In this way, districts requiring additional undergrounding conversions based on percent complete can simply have more project blocks undergrounded in that district as needed in accordance with the overall yearly budget.

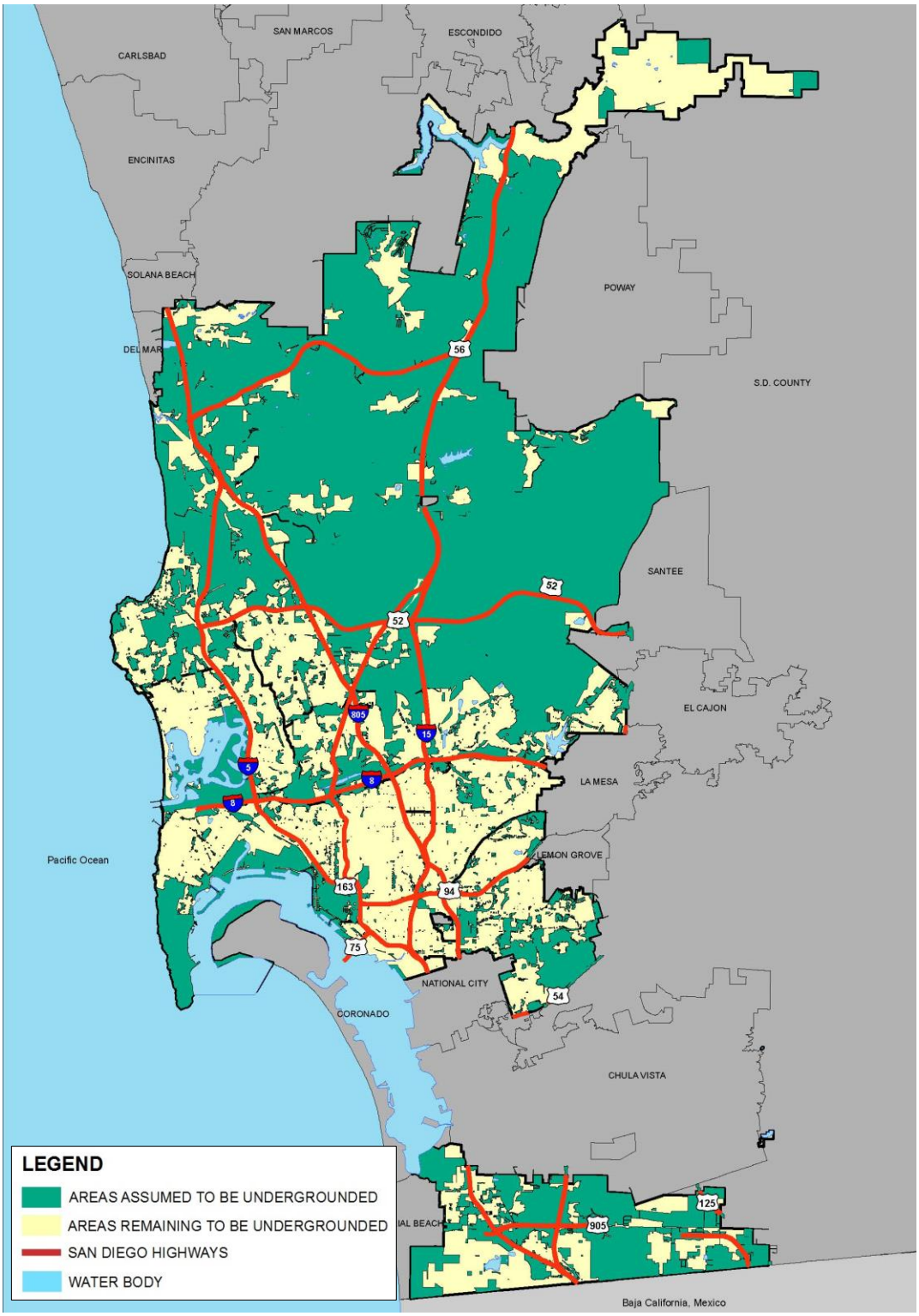
E. Remaining Overhead Utilities in Completed Blocks

In reviewing the City's GIS data, a few instances were observed where SDG&E distribution poles and pole lines remain in areas which have been designated as completed. Associated stub-poles and anchors which serve as pole reinforcement for wire tension loads were also observed to remain in conjunction with the remaining distribution poles. These instances were observed to generally occur at county and project boundaries or along open-space land use areas adjacent to residential homes; likely for continued connectivity and for utility service access to areas that transition from overhead to underground utility services. Temporary overhead power poles are often installed at project block boundaries to accommodate circuitry feeders and construction efforts where blocks with overhead utilities are found adjacent to blocks with undergrounded utilities. Additionally, Cabling poles are also required at the boundaries of project blocks transitioning from overhead to underground as circuitry feeders. The number of cable poles required is dependent on the number of circuits within a given project block.

A few outlier instances were also observed where overhead SDG&E distribution poles and pole lines remain within largely undergrounded areas such as District 5. Upon visual review of select areas, these instances appear to have remained to mitigate expensive costs for trenching through landscape or street medians to provide power to a particular side of a street. It will be up to the City's discretion to underground these instances on an individual basis. Figure 20 shows the

remaining parcels with overhead distribution utilities or within 100-feet of overhead distribution utilities throughout the City's limits.

FIGURE 20 – CITY OF SAN DIEGO AREAS WITH REMAINING OVERHEAD UTILTITES



(Source: UndergroundingStatusMap_SanDiego_Frame.mxd)

Per Surcharge fund requirements, the updated Master Plan will target remaining residential areas with overhead utilities. Block areas designated as military use by the City's UUP inventory were not considered eligible for Surcharge fund undergrounding efforts and were consequently considered "undergrounded" for purposes of this report. As demonstrated in Figure 18 for the City's current project conditions, the City does not currently have any Surcharge projects planned within District 5. In keeping with the City's Surcharge project areas and the 2009 MP, the District 5 boundary will not be included in the new Master Plan for creation of residential Surcharge project blocks as the majority of the district area already has underground facilities. However, according to current conditions by the SDG&E GIS information as shown in Figure 20, distribution poles remain overhead within District 5, and other largely undergrounded Districts along land use areas designated as "open-space" by the SANDAG LANDUSE dataset. Open-space project blocks will be created in the new Master Plan to target those remaining overhead utilities that reside along open-space areas, which will be subject to undergrounding efforts at the City's discretion after 'all public, Major, Collector, Residential and Alley ways that can feasibly be undergrounded are complete' per CP-600-08. For detailed maps of assumed undergrounding status areas see Appendix 10.

VII. NEW MASTER PLAN

The new updated Master Plan will culminate in a set of maps with associated estimated project costs and an assigned sequence order to assist the City in project implementation for the entire undergrounding conversion program. The focus will be on the City's remaining Surcharge funded project block areas where remaining SDG&E overhead lines are present. These Surcharge areas will be carved into new project blocks where previous project block boundaries will be resized and reshaped to create entirely new project blocks, and additional project blocks will be created to encompass all remaining overhead utilities in residential areas that may have otherwise been missed by prior project boundaries. These project blocks will be assigned a new priority implementation order in accordance with the methodology presented herein. A generated priority value will be used as a tool to establish the new implementation order. Remaining SDG&E overhead utilities will be used to quantify the extent of construction efforts anticipated per project block and calculate the resulting projected cost estimates for complete undergrounding conversions. Areas already undergrounded or completed will be determined through SDG&E GIS information based on remaining overhead utilities.

As a general guideline for overall implementation of the entire City-wide undergrounding program, specific design and engineering details will not be addressed. For example, placement of new surface level transformers and other utility obstructions, contractor staging areas, or any field changes that may cause resident discontent arising during design and construction efforts are not within the scope of the new Master Plan.

The following summarizes the major changes that will be incorporated into the methodology for updating the new Master Plan;

- New project blocks will be created doing away with the previous 2009MP project blocks,
- Project block's will target SDG&E remaining overhead utilities,
- Project block sizes will be smaller and therefore more manageable,
- Project block cost estimates will be refined for higher levels of accuracy,
- Project implementation order will be refined to include Electrical Engineering considerations.

Similar to the 2009 MP, ArcGIS Desktop will be used to develop the new Master Plan. It will be the intent to correlate all the new Master Plan's projected cost estimates to the remaining overhead utilities requiring underground conversions. This information will be leveraged within ArcGIS Desktop for analysis and planning. Use of the GIS platform automation will benefit the City by easily allowing changes or updates to the data or model as necessary. The new Master Plan will reflect the new council redistricting boundaries, develop a new block naming convention, provide a priority value, implementation order, and reevaluate current program revenues and cost estimates.

Through joint coordination with the City and SDG&E, several key issues have been discussed and are summarized as follows:

- Ideal project block size
- Cost data to be used for the new Master Plan's cost estimates
- Balancing the budget
- Project block sequence order impacts on circuitry engineering and undergrounding accuracy
  - Centering block allocation around SDG&E Substations
- Feasibility of undergrounding transmission lines with Surcharge funding
- Community concerns and concurrent outreach
- Rule 20A planning

A. Surcharge Scope

Land use areas listed as "open-space" will not be included in the initial analysis for the undergrounding conversion of residential Surcharge areas. Open-space areas will only be incorporated into the newly created Surcharge project blocks where electrical continuity is required and where the inclusion of the undergrounding of overhead poles in open-space areas is feasible per CP-600-08. Separate project blocks will be specifically created to target remaining outlier open-space areas, but will be given the lowest priority and will not be subject to undergrounding conversions until all residential Surcharge blocks have been completed. Areas designated as Military boundaries will not be included in the Master Plan analysis.

Further explanation on how surcharge blocks will be reshaped and sized is addressed in Section VII.E.

The inclusion of undergrounding transmission lines into the Master Plan analysis will continue to be reviewed by the City and SDG&E, and may be incorporated at a future time upon settlement of logistics and legal concerns. Per CP-600-08, "Underground Utility Districts may include all types and size of electrical transmission and distribution systems, or combination of systems." However, transmission line and distribution line undergrounding conversion design planning and material procurement differ vastly in terms of timelines making coordination for joint undergrounding feasibility difficult. Transmission lines require deeper separate trenching from distribution lines and require larger easement allotments for placement of their vaults and equipment. Additionally, the typical cost for undergrounding 69kv transmission lines range from $6 Million to $8 Million per mile making these conversions cost prohibitive with the current available funding. The most cost effective timeline for the undergrounding of transmission lines would be when the system needs upgrading, which would require reconductoring the transmission line for a higher ampacity and replacing transmission poles. SDG&E typically perform transmission line inspections every three (3) years and scheduling these maintenance windows to coincide with distribution line construction start dates would require tremendous

coordination between agencies. The City will continue to coordinate with SDG&E and addendums may be incorporated into the Master Plan at a later time if an agreement is reached.

B. Rule 20A Scope

Per the project scope, the shape, size, and defining of Rule 20A projects listed in the 2009 MP will not be re-evaluated. However, the year assigned for funding to be allocated for Rule 20A projects will be replaced with a new implementation order. SDG&E expressed their preference to separate Rule 20A projects from the new Master Plan's evaluation as these projects will be designed and constructed by SDG&E. There are currently instances where Rule20A blocks are imbedded within Surcharge project blocks, a circumstance proven to cause significant engineering and constructability issues. Moving forward in the new Master Plan, it will be the intent to use Rule 20A projects to serve as natural stopping points for boundary extents when reshaping Surcharge blocks. In doing so, Surcharge blocks will be delineated and split as necessary to ensure that Rule 20A projects no longer reside within the boundaries of Surcharge blocks. This will minimize the need for coordination between the separate undergrounding projects since the funding for each must be kept explicitly separate; separate funding entails separate work orders which means coordination has to be tight and this can now be avoided.

C. Information To the Public

Releasing the electrical utility infrastructure information provided by SDG&E for developing the master plan to the public is a major concern for SDG&E. SDG&E requires that all electrical information remain undisclosed to the public for security concerns. For this reason, the electrical justifications presented throughout this report and the new Master Plan will be referred to in generic terms. Although distribution and transmission circuitry mapping will be used for discussion and analysis, they will not be made available to the public due to the non-disclosure agreement between SDG&E, the City, and the professional consultant. Likewise, locations of substations and transformers along with detailed analysis of electrical systems used in the prioritization of electrical continuity for establishing priority order will not be documented.

Many of the electrical considerations will not be documented or open for disclosure to the public due to its sensitive nature. It is understood that many residents are concerned with government transparency and understanding how decisions are made. However, customer confidentiality and disclosure agreements with SDG&E do not allow sensitive electrical infrastructure information that may jeopardize public safety to be published.

D. Project Block Costs

The new Master Plan will utilize ArcGIS Desktop software to generate cost estimates. Coordination meetings with the City and SDG&E took place to identify the proper breakdown of estimated costs necessary for the successful completion of the undergrounding. Unlike the

previous 2009 MP, ArcGIS Desktop software will be used to automatically calculate the quantity of each item criterion within each block. The software then incorporates the line item cost attributes along with the respective quantities found in each block using the cost algorithm developed (discussed in Section VIII.D) and generates the total projected costs. The values generated from the algorithm are automatically outputted to a table known as an Attribute Table within the GIS platform. Further information on GIS tools used and outputs created for generating the new Master Plan's cost estimates are found in Section VIII and Appendix 7.

E. Block Size

The new Master Plan will focus towards smaller block sizes and smaller and consistently sized projects. As costs are based on the amount of customers, services, drops and trench lengths within each block, a linear reduction in size is linked proportionally to a reduction in block cost. Based on engineering judgement, smaller blocks sizes tend to be more manageable, ease constructability issues, and often mitigate potential issues resulting from resident complaints.

In addition, many older City neighborhoods frequently experience code-compliance issues which must be addressed before projects can proceed to completion. These non-compliance issues are often not discovered or addressed until construction efforts are underway and final permit inspections of all individual customer services are made, further delaying project completion. The likelihood of these delays is increased as the number of customers serviced within each project block increases, making smaller block sizes more desirable.

Through past experience with past utility undergrounding construction issues and difficulties, both SDG&E and the City have also recommended the use of smaller project blocks for future delineations. Both agencies already currently split the 2009 MP allocated project blocks into smaller more manageable separate construction "jobs", as seen with Project Block 2S1 – South Mission Beach Block 2S1 20SD Conversion Jobs #1 and #2. By decreasing the size of overall project blocks, the need to split them into separate "job" partitions in the design and construction phases would be eliminated, allowing for less confusion and easier overall budget control. The updated smaller blocks will target an ideal range of 200±25 individual service trenches (customers) and 6,000 linear feet of joint trenching. SDG&E has indicated that larger project blocks experience project management difficulties and struggle with additional impacts including schedule (final completion date), community outreach, budget constraints and traffic control. One such example of smaller project sizes are Rule 20A projects, which tend to be smaller than Surcharge projects, and have typically been completed with minimal difficulty. However, it is understood that any size containing less than 200 customers would then become counter-productive. Engineering judgement suggests that, although a monetary value to the expected savings in potential change orders and mitigation efforts cannot be simply calculated, savings will be realized with decreased construction delays, decreased project duration, and overall constructability.

F. Block Shape and Naming Convention

Many considerations were used in developing a new naming convention in accordance with the newly defined project block shapes: zip codes, community planning areas, quadrant zones based on latitude and longitude, and climate zones. However, a method easily identifiable for residents and project stakeholders was preferred.

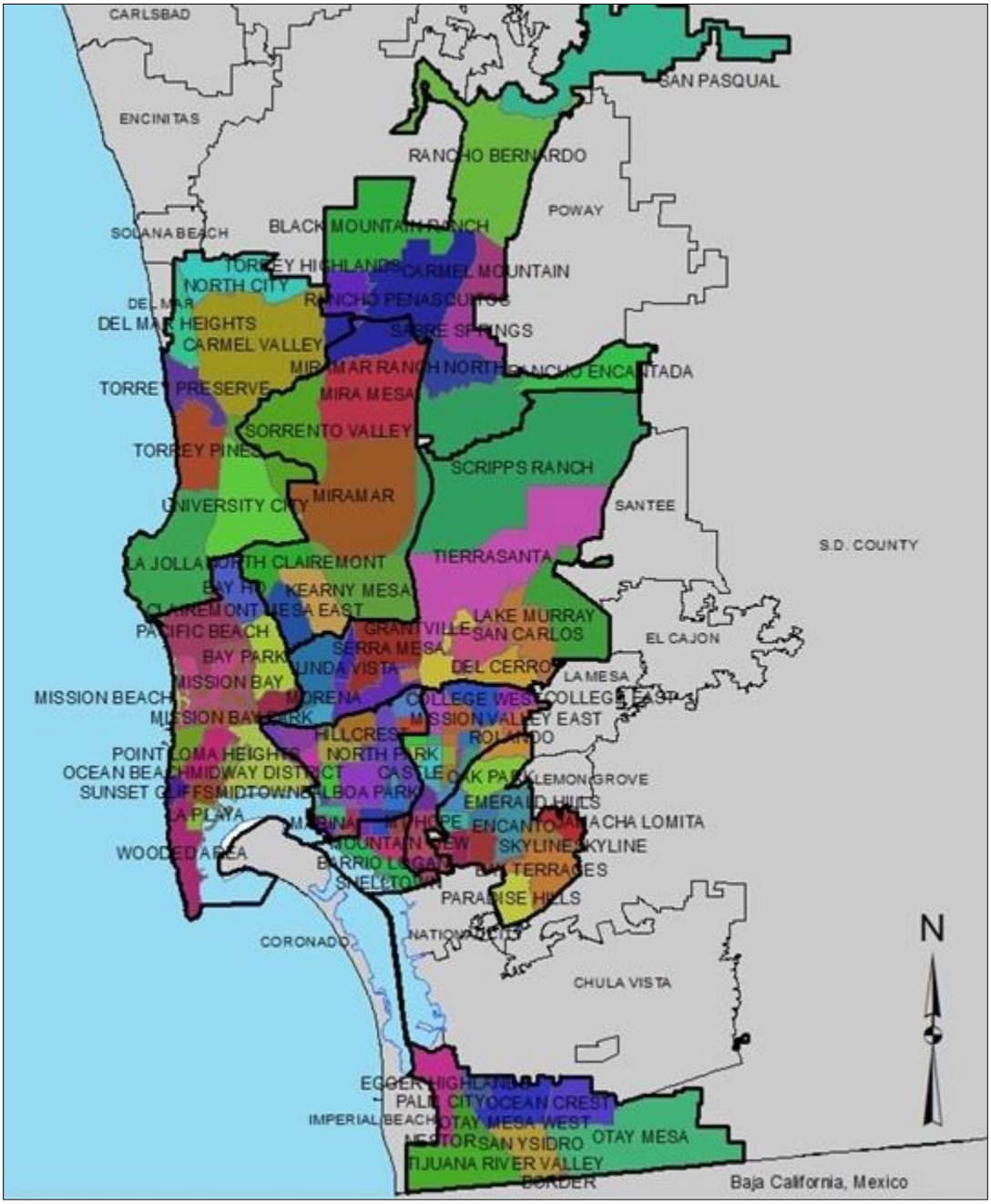
New project block shapes will utilize neighborhood limits as defined by the "SD_Neighborhoods" layer file obtained from ArcGIS Online, as well as major streets or geographical boundaries for their new block limits. Neighborhood layouts and remaining SDG&E overhead utilities will result in varying block shapes between project blocks; however the created shapes will target the ideal 200±25 customers and 6,000 linear feet of expected joint trenching to keep project costs consistent. When possible, Rule 20A projects will also be used as project limits in accordance to neighborhood outlines. The neighborhood classifications were derived from San Diego Law Beats to informally define communities as shown in Figure 21. This new method will not be affected by future redistricting changes and will remain consistently relatable to residents for years to come.

It is understood that these new project block shapes and boundaries will serve as an outline for the new Master Plan's analysis; however, residents' homes on both sides of a given boundary line may be shifted, either included or excluded, from the initial outlined boundary during the design and construction phases based on actual undergrounding conversion needs. Completed areas within this analysis are an assumption based on the proximity of remaining overhead SDG&E utilities in project areas.

The "SD_Neighborhoods" layer feature from ArcGIS Online used for reference was saved as a separate file to mitigate any changes made to the online layer's boundaries and will be added as a deliverable to the City for continued use. The layer is found within ArcGIS Online at:

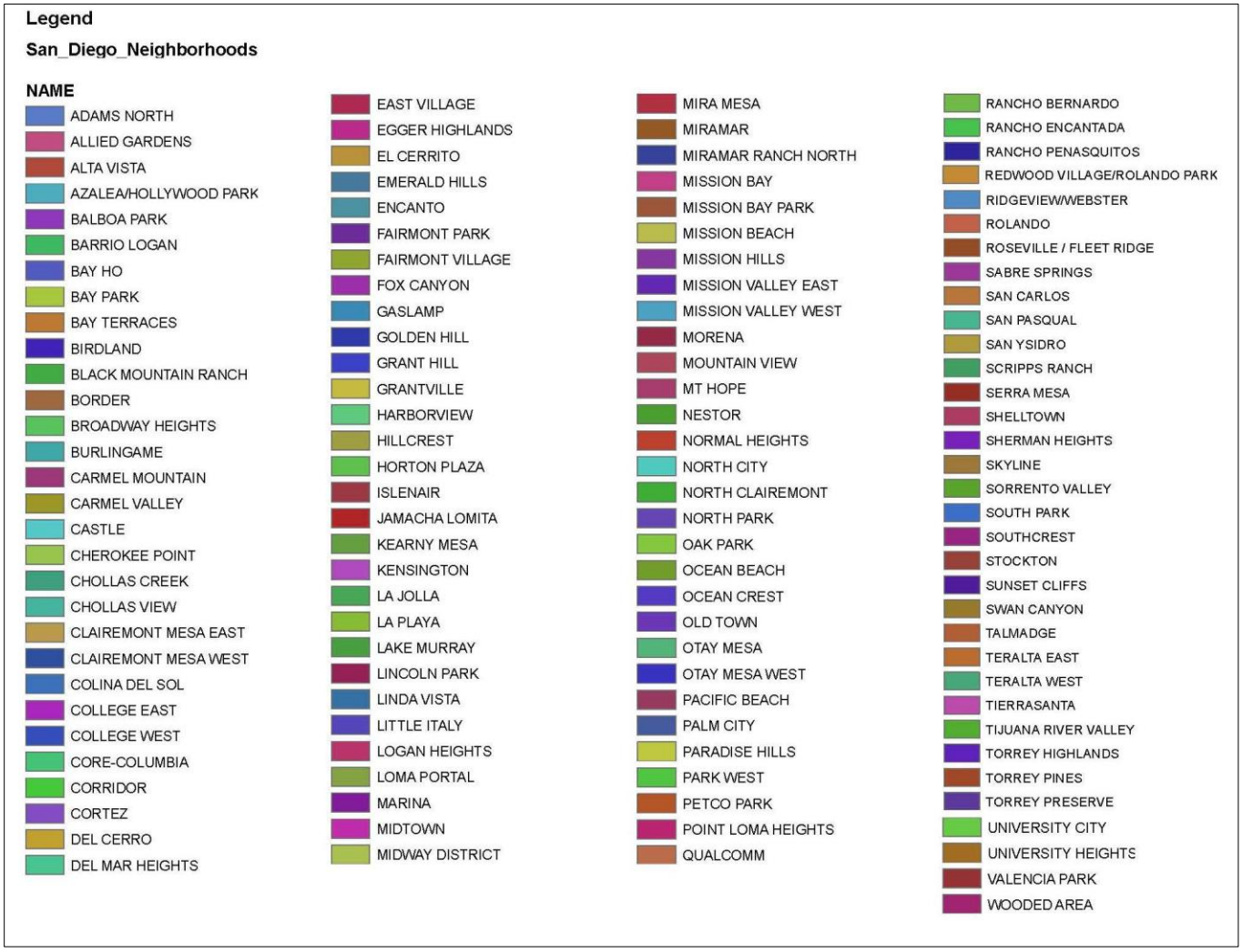
"http://services.arcgis.com/oxInpRhVIBxlo4pO/arcgis/rest/services/Neighborhoods/FeatureServer"

FIGURE 21 – SAN DIEGO NEIGHBORHOODS GIS LAYER



(Data Source: The City of San Diego – SANDAG Website)

FIGURE 22 – SAN DIEGO NEIGHBORHOODS LEGEND



(Data Source: The City of San Diego – SANDAG Website)

Depending on area population density, block sizes may differ. In areas where the entire block cannot reside within the same neighborhood, the naming convention will be based on the neighborhood in which the majority portion of the block resides.

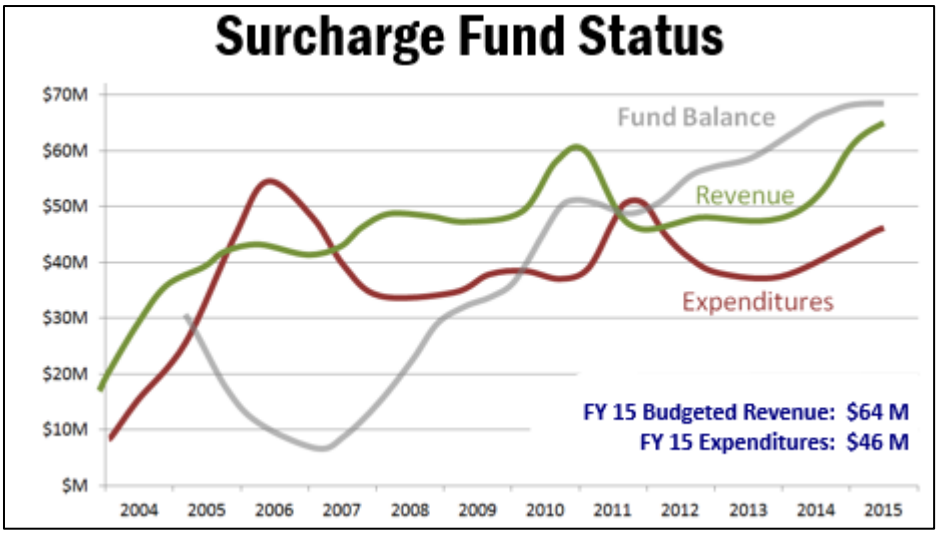
The naming convention will utilize an abbreviated form of the neighborhoods outlined within the layer followed by an alpha numeric suffix. Final decisions will be made during the reshaping efforts conducted in the Master Plan phase.

G. BALANCING THE BUDGET

Based on Revenues stated in the Report to the City Council dated September 28, 2015 (Report No: 15-073), the total funding available for the next FY was originally anticipated to be $16,128,411 for Rule 20A projects and $50,592,739 for Surcharge projects. However, more recently updated funding numbers place the total figures closer to $65 Million per year, with actual expenditures averaging only around $46 Million in recent years, see Figure 23. For the

purposes of this report and the new Master Plan forecasting, we will assume a constant yearly funding of approximately $15 million a year for Rule 20A projects and $50 Million a year for Surcharge. In addition, all dollar amounts shown throughout this report will be shown in 2016 dollars. Inflation and time value of money are not considered in this report; this will allow for direct comparison of work within each block to today dollars.

FIGURE 23 – FUNDING REVENUE FOR SURCHARGE BLOCKS



(Source: The City of San Diego)

Inherently there is always a lag in expenditures verse revenue collected for the program, due to the fact that once a project is allocated it can take up to 5 years to completely close out. In addition, due to inefficiencies inherent in the 2009 MP, the project block implementation is chronically behind schedule. To correct this imbalance, the City is currently implementing more than 8 blocks per fiscal year to catch up the expenditures with available funding. But due to issues with the 2009 MP, the City's effort to catch up with expenditures is a difficult process. Through coordination meetings between SDG&E and the City, it was agreed that one of the major obstacles causing delays to the process was trying to implement the large average block sizes typically defined in the 2009 MP. This was preventing blocks from being able to close out in a timely manner and taking up undergrounding resources. It was agreed, that implementing additional smaller blocks per year would allow more flexibility in project implantation and management, and free up undergrounding resources allowing projects to close out in faster duration.

Going forward with the use of smaller blocks and their associated lower costs, the City will have more flexibility in allocating additional project blocks on a yearly basis to better meet CP-600-08 goals. The current variances in size and cost from the previous 2009 MP make the efficient use and planning of available budget difficult.

According to CP-600-08 guidelines:

- 45 percent of project funding should be divided equally between each undergrounding council district within the public residential streets and public alleyways that have overhead electrical facilities.
- 45 percent of project funding should be divided based on the percentage of miles of overhead lines remaining within each district compared to the miles of overhead lines remaining within the entire City.
- 10 percent of project funding may be allocated at the discretion of the Mayor, with the approval of City Council. Based on conversations with the City, the 10 percent Mayoral allocation is typically allocated as needed to help maintain the ideal fund balance and allocation for the separate budgets of the Rule 20A and Surcharge programs.

Note, District 5 was excluded from CP-600-08 Surcharge funding since the majority of the district already has existing underground facilities.

By allowing more than 8 blocks a year to be allocated, the City will be able to manage the dispersion of funding to facilitate the funding percentages goals of each District while keeping within the spirit of CP-600-08. Although meeting all CP-600-08 guidelines on a yearly basis may not be achieved in any given year, the intent will be to balance the overall program budget and distribution throughout the course of several years to keep within the spirit of CP-600-08. Thus on the whole, the program will be able to balance the distribution of funds as originally intended. In addition, every Council District will likely have at least one block at minimum funded each year regardless. This process will be evaluated on a yearly basis and the project blocks will be assigned per the sequential priority order established in the new Master Plan. By implementing this approach, the overall spirit of CP-600-08 guidelines will be met in a more controlled, efficient, and equitable manner.

H. Block Priority

The 2009 MP scheduling has become virtually unusable and misleading. The updated Master Plan will turn away from the prior use of "allocation years" for planned construction start dates and will instead focus on establishing implementation in a sequential order as opposed to an expected date timeline. Through discussions with the City, the term "allocation year" has caused confusion among many residents as actual project construction start dates do not often mirror the year the block was set for allocation. Additionally, construction delays have rendered the implementation of future blocks to be out of sync with resident expectations. Use of the new order sequence methodology will allow for realistic expectations for when resident neighborhoods can expect to be undergrounded.

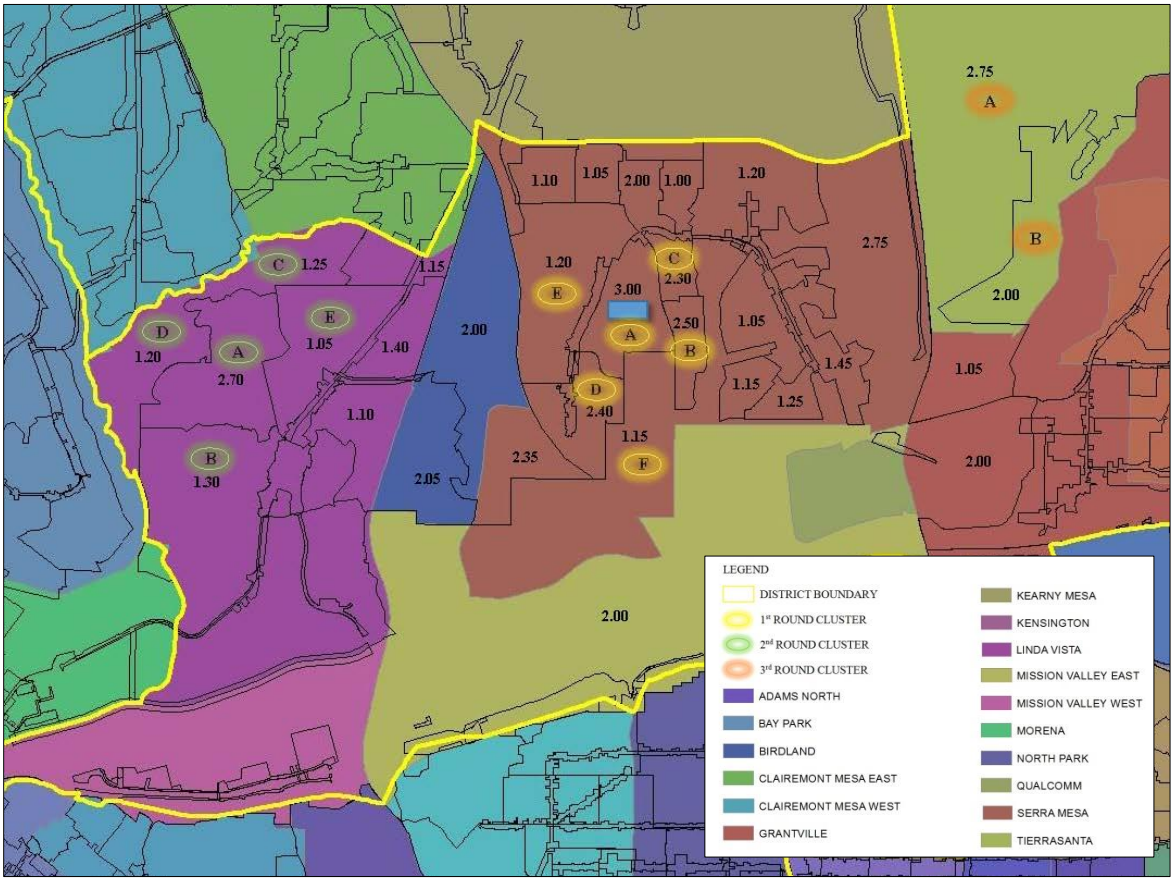
The new implementation order for both Rule 20A and Surcharge projects will be influenced by a priority value assigned to each block in accordance with CP-600-08 and City goals. Once project block sizes and boundaries have been set, a second GIS model will be run to generate a priority value for each project block. This GIS priority model will consider factors such as maintaining

electrical continuity, rank values based on land use percentages by block, and evaluate best public benefit factors to generate a weighted average representing each blocks priority value. The priority value will only be used to facilitate the manual creation of the new Master Plan's implementation order. As certain electrical consideration cannot be automated into a score with the limited amount of SDG&E GIS information that was provided, the priority value generated will solely be used in-house as a tertiary tool when deciding project implementation order in accordance with electrical continuity considerations.

Once priority values have been established, project blocks will be manually sorted by licensed Electrical Engineers into a project sequence for the new Master Plan's implementation order. This new project implementation order will focus on circuitry considerations and use the established priority values as a tool to best determine which adjacent blocks should then be undergrounded in the following years. The intent will be to "cluster" around the selected block with highest circuitry needs until sufficient undergrounding conversions have been achieved in an area before the onset of construction fatigue becomes too much for residents. Within this smaller cluster analysis, only the adjacent blocks will be evaluated for undergrounding regardless of the priority values from the remaining project blocks in other areas of the district. Upon sufficient clustering around one area, the next batch of clustering will be selected in a new location within the district, focusing again on one project block with the highest circuitry needs, and evaluating its adjacent project blocks, using their priority values to determine the order for which adjacent blocks are to be undergrounded next.

Figure 24 is a visual aid for demonstrating the methodology described above. In this hypothetical example, the blue rectangle represents a project block with a substation that has been selected to be undergrounded first (project blocks with substations are currently the highest priority for undergrounding conversions). The numbers within each block represent the priority values which will be generated by the GIS priority analysis, the letters are used to represent the sequence in which this scenario would be undergrounded (block A first, block B second, etc), and the colors (green and yellow) denote the cluster being considered. As discussed above, the priority value will solely be used to determine which of the adjacent blocks around the chosen cluster will be undergrounded in the following years (regardless of a higher priority value by another project block in another area). Once a sufficient amount of time has been spent in one cluster area (yellow), the next cluster (green) will be selected based on the next highest priority and a significant distance away to mitigate resident's construction fatigue.

FIGURE 24 – PRIORITY SEQUENCE ILLUSTRATION



This method of clustering has been chosen for more efficient undergrounding conversions as well as to mitigate resident construction fatigue. Multiple undergrounding projects in the same area will extend the time each resident will be subject to traffic delays and detours, loud noises, and other issues that often arise with construction in resident areas. Once the project order is determined for a given cluster, the timeline for converting project blocks will depend on the project block's order sequence, and City budget approval and design timelines. The entire undergrounding conversion for one (1) project block typically takes five (5) years from initial budget approval to construction completion. Individual project block construction typically last 2-3 years for undergrounding conversions.

The following is a summary of the overall priority ranking considerations for both Rule 20A and Surcharge project blocks that will be used for the new Master Plan:

1. Electrical engineering considerations (SDG&E substations, etc)
2. Blocks containing public facilities (parks, schools, etc.)
3. Blocks containing major streets w/ scenic views (tourist areas)
4. Block's containing best public benefits per Council Districts

For a detailed explanations and step-by-step process of the priority considerations and priority analysis refer to Section IX.

I. Previously Allocated Project Blocks

Project blocks that are currently in design or have begun the approval process for undergrounding conversions will not be included in the new Master Plan's analysis. The City has provided the set of project blocks for the 2016 CY that will be reviewed to begin the undergrounding conversion process. The conversion process goes through multiple stages of approval and design before construction is allowed to begin. These projects scheduled for council reporting allocation in 2016 are:

TABLE 6 – THE ALLOCATED PROJECTS OF 2016

District 1	District 2	District 3	District 4	District 6	District 7	District 8
1H	2BB	3AA	4R1	6K	7R1	8H
1S	2F	3AA1	4X	6K2	7U	8I
	2K	3BB	4X1			8N
	2S3	3BB2				
		3CC1				

*This list was provided by the City.

Based on City revenue and undergrounding fund balance, the City has elected to allocate more project blocks in the 2016 Calendar Year than the typical quantity of seven (7). The remaining unallocated project blocks not addressed within the 2016 CY will be included into the new Master Plan.

VIII. IMPLEMENTATION OVERVIEW

The new Master Plan will be developed from the GIS data provided by both the City and SDG&E. The City GIS database file "UUPProjects_17May2016.shp" contained the City's most current project inventory as of May 2016 for the entire undergrounding conversion program. The information provided addresses all of the current undergrounding project blocks with pertinent information such as block name, boundary shape, year scheduled for allocation in the 2009 MP, the 2009 estimated project costs, and project progress statuses: completed, in construction, in design, under public hearing, or unallocated. This information will be used to generate the new Master Plan in accordance with the GIS utility information provided by SDG&E. SDG&E's utility data will be counted, summarized, and ordered into fields, and added to the City's GIS project inventory's attribute table per project block through the algorithm analysis. The SDG&E GIS utility database file "SanDiegoMasterPlan.gdb" contains information on substation locations; transformer locations along with number of customers serviced by each respective transformer; geographic pole line representations with their corresponding lengths; and the number of overhead structures with a subtype category distinguishing the structures as either distribution, transmission, UG streetlights, or stub poles. These features are comprised of points, lines, or polygons meant to be used as a geographic representation of their location. The values generated from the algorithm will be automatically outputted into the Attribute Table for each project block feature. An example of an attribute table is shown in Table 7 in Section VIII.A.

A. PROCESSING INFORMATION RECEIVED

From the information received, new layers were created containing only the desired features to be used as inputs within each analysis for cost and implementation order. Filtering unwanted or excess information was done to minimize the number of variables processed within the algorithm calculations and optimize the overall duration of time required per iterative analysis anticipated for reshaping project blocks in the new Master Plan.

Of the 1,017 projects within the current City GIS data consisting of all Rule 20A, Rule 20B, and Surcharge Projects, only the Rule 20A and Surcharge project areas that remain listed as unallocated in the City's data will be considered for analysis. Of these projects, only Surcharge projects will undergo both cost and priority analyses, while Rule 20A projects will only be reviewed for prioritization. From the information provided, ArcGIS Desktop will be used to generate a single output table containing all the pertinent information necessary for the new updated Master Plan.

SDG&E utility information required that the data be sorted in such a way to be used without making sensitive information available to the public due to security concerns. To accomplish this, only the count or number of each utility feature or summarized lengths within a given block will be shown for general cost estimate and planning purposes. Detailed features such as

transformer and cable details along with overhead structure locations of SDG&E utilities will not be made available within the project block's attribute table. Some typical data layers that exist include substations, transformers, overhead structures, pole lines, and duct banks. Per the project scope, only utility distribution features and only those utilities remaining overhead will be considered; transformers listed as already undergrounded or on surface level will not be considered in the analysis. As a result of the analysis, the utility information will be calculated and summarized depending on their geographical location in respect to the existing Surcharge blocks. In this way, each existing Surcharge Block will be able to account for the estimated number of transformers, pole removals and estimated joint trench lengths anticipated for undergrounding. An example of how SDG&E utility information will be tallied and accounted by individual project block is shown in the block's attribute table in Table 7.

TABLE 7 – REPRESENTATIVE DATA UTILIZEED FOR COST ANALYSIS

Table

MP2016_Intersections_Spatia Minus June Projects

BLOCK_ID1	CD	INTERSECTIONS	Backlot_Poles	ALLEY_Poles	OH_Poles	XFMR_Count	Meters	SUB_Count	ServiceDrop	P_Length	BLOCK_AREA
1A	1	11	44	19	97	27	321	0	261	10700.488478	3621728.095641
1A1	1	31	10	50	99	22	287	0	260	12404.994861	2584202.392492
1A2	1	15	17	44	86	27	339	0	259	11468.502395	3638613.13177
1B	1	26	17	43	95	33	263	0	181	12089.02817	4325563.683744
1C	1	16	10	36	70	25	610	0	187	7313.006357	2593229.388844
1C1	1	21	51	5	109	27	557	0	248	12744.674841	3081034.705529
1D	1	13	24	23	99	21	415	0	184	10670.108892	2692985.286792
1E	1	15	16	15	71	23	524	0	245	7194.369049	2784443.621224
1G	1	10	16	45	89	27	473	0	152	6768.628052	4006717.329339
1I	1	13	26	1	68	20	285	0	157	7626.89016	3386369.808941
1K	1	16	70	0	143	31	306	0	273	22747.88803	38348227.616623
1L	1	18	28	31	121	35	633	0	181	10896.844451	3798000.09723
1L1	1	30	11	28	116	32	430	0	246	11828.071361	3298806.7541
1N	1	8	20	0	86	28	160	0	138	11376.660351	5976879.807609
1O	1	12	20	0	113	31	333	0	289	16405.92093	5810495.112642
1P	1	5	25	0	33	10	22	0	22	5262.694319	5532863.184296
1T	1	14	6	4	71	23	318	0	260	12361.57923	5523324.356778
1U	1	16	24	0	66	20	291	0	286	11680.969569	7494370.290542
1V	1	14	20	0	70	25	363	0	325	11986.261367	16428941.048063
1V1	1	16	10	0	85	26	354	0	314	13791.743007	28295853.527282
1W	1	2	45	0	66	16	79	1	36	11272.768051	13249581.526782
2A	3	21	87	0	128	38	859	0	169	13459.614347	2843648.943883
2AA	2	13	9	0	103	36	376	0	296	16025.556697	12043399.246535
2AA1	2	29	45	48	152	32	1132	0	189	15959.504003	14821118.048949
2AA2	2	53	11	78	183	50	1723	0	521	22471.10451	9466603.672683
2B	3	40	60	1	184	46	604	0	383	21093.498798	4822154.272729
2B1	3	25	29	0	110	28	601	0	251	10806.460592	2817887.716187
2B2	3	34	73	4	150	44	551	0	318	17957.03338	4991223.335895

99 (0 out of 276 Selected)

MP2016_Intersections_Spatia Minus June Projects

(Source: MP2016_Results Attribute Table– MasterPlan.mxd)

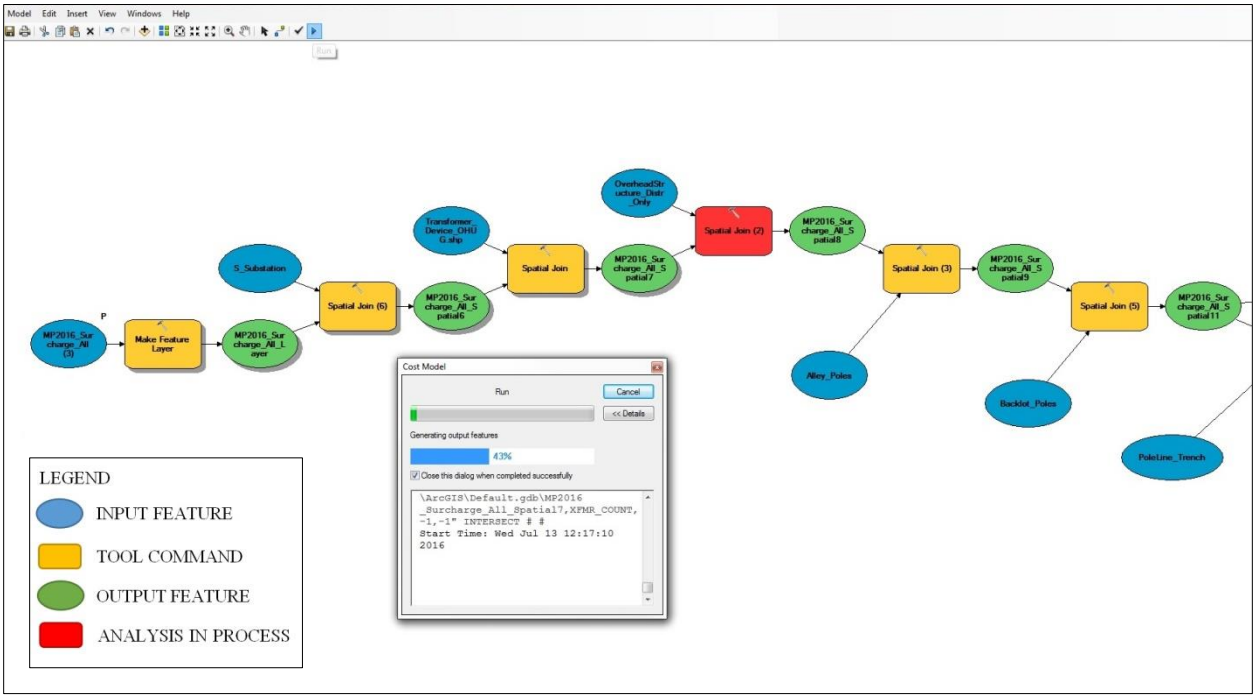
B. MODELBUILDER ANALYSIS

The new Master Plan's cost estimates will be generated through population of the nine (9) fields discussed in the section below. The process will be automated through the use of a computer model within ArcGIS Desktop known as ModelBuilder. Modelbuilder is an application available within ArcGIS Desktop used to create, edit, and manage models. Models are workflows that string together sequences of geoprocessing tools, feeding the output of one tool into another tool as an input. Geoprocessing is a GIS operation used to manipulate data. ModelBuilder is often

used to count the features within a block polygon, ie: Number of transformers or other utilities within a project block.

ModelBuilder can also be thought of as a visual programming language for building workflows. ModelBuilder serves as a process flow tool extension where several GIS data management tools connected in series and/or parallel with additional iterative processes can be created to develop an algorithm for calculating desired results. An example of the ModelBuilder analysis being performed is shown in Figure 25. This algorithm automation will take the selected input features and apply the desired tools and functions in the order specified. The outputs for all of the fields created above were generated as a result of the ModelBuilder analysis after the algorithm was run. Individual sample blocks were manually reviewed for comparison to verify the results from the ModelBuilder mirrored existing field conditions. The manual verifications of results were accomplished through tools such as Google Earth images and manual calculations of observed utility features. Trial and error were used to refine the tool processes within the computer algorithm until identical results compared to the manual sample block investigations were achieved by the ModelBuilder outputs.

FIGURE 25 – MODELBUILDER EXAMPLE



(Source: Cost Algorithm – MasterPlan.mxd)

Due to the length of the algorithm only a portion of the cost algorithm developed in ModelBuilder is shown. The icons demonstrated are denoted as follows:

- blue icons denote the inputs used

- yellow icons denote the tools that are to be applied to the inputs
- green icons denote the outputs generated
- red icons denotes the action the computer model is performing

Once the outputs are populated with the correct SDG&E remaining utility quantities and a level of confidence was achieved in the algorithm developed, the cost line items were created and input into the model, resulting in the projected cost estimates for the new Master Plan.

C. GIS Fields Created

To generate the new Master Plan cost estimates and priority values, multiple columns known as "Fields" within ArcGIS were created. These data fields will be used to account for the remaining SDG&E overhead utilities and desired cost factors and used as inputs within the cost and priority algorithms developed. These columns, or fields, serve as a place holder for the tally of counts and lengths of all necessary factors considered. The fields created for use in the cost estimates analysis are discussed below. Refer to Section IX for the fields created for use in the priority analysis.

TABLE 8 – GIS DATA FIELDS CREATED FOR COST ANALYSIS

	GIS Data Field	Feature Described	Layer Found
1.	XFMR_Count	Transformers	SDG&E: Transformer Layer
2.	Meters	No. of Customers	SDG&E: Transformer Layer
3.	ServiceDrop	Parcels	SANDAG: PARCELS
4.	SUB_Count	Substations	SDG&E: S_Substation Layer
5.	P_Length	Pole lines	SDG&E: PoleLine Layer
6.	OH_Poles	Distribution Poles	SDG&E: OverheadStructure Layer
7.	Alley_Poles	Alley_Poles	SDG&E: OverheadStructure Layer
8.	Backlot_Poles	Backlot_Poles	SDG&E: OverheadStructure Layer
9.	Intersections	No. of Intersections	SANDAG: ROADS_INTERSECTION

*These fields were created through ModelBuilder within the "MasterPlan.mxd" GIS file.

1. XFMR_Count Data Field

XFMR_Count is the number of transformers found within each block. The information can be found in the SDG&E Transformer layer. Only those transformers listed as remaining overhead will be used for the new Master Plan's analysis. The information will be obtained by spatially joining the SDG&E Transformer layer to the City GIS file to geographically select all the transformers found within the City project block boundaries. The total transformer count by block will be stored in the newly-created "XFMR_Count" field. This process was inputted into the ModelBuilder analysis to automate the process for any recalculations needed when City project block boundaries are changed.

2. Meters Data Field

Meters field is the total number of unique customer meters being serviced by the transformers located within each block. The information was obtained from the CustCount field in the SDG&E Transformer layer. The information will be obtained by spatially joining the SDG&E Transformer layer to the City GIS file to geographically select all the transformers found within the City project block boundaries. The total number of customers represented by meters by block will be stored in the newly-created Meters field. This analysis was inputted into the ModelBuilder analysis to automate the process for any recalculations needed when City project block boundaries are changed.

3. ServiceDrop Data Field

ServiceDrop is a field created to most accurately account for the total number of customer service laterals anticipated per project block which is a major driver of cost. Unfortunately, there is currently no metric for definitively obtaining the number of buildings within each block to accurately quantify the number of expected customer service laterals. However, use of the PARCELS layer from SANDAG, along with minor modifications, was ultimately selected as the most accurate method to account for the number of anticipated customer service laterals (Service Drops) from available data. The methodology developed in the creation of the ServiceDrop field is the most accurate representation for a City-wide planning document.

The method to most accurately represent the anticipated number of service drops was derived from the number of parcels bound by the defined block and subtracting parcels that are assumed to be already undergrounded based on their distance from an overhead pole line. It was assumed that if a parcel was located more than one hundred (100) feet away from a SDG&E overhead Pole line then the parcel was likely to be undergrounded either through past projects or due to new development construction. Only Parcels denoted as subtype 1 for “regular parcel with APN number” within the SUB_TYPE field in the PARCELS layer were used in the analysis. Additionally, Parcels located on areas defined as Open-Space by the SANDAG “LANDUSE_CURRENT” layer were also removed from the analysis.

Explanations of the considerations and methods developed to achieve the most accurate representation of service drops is described in detail below:

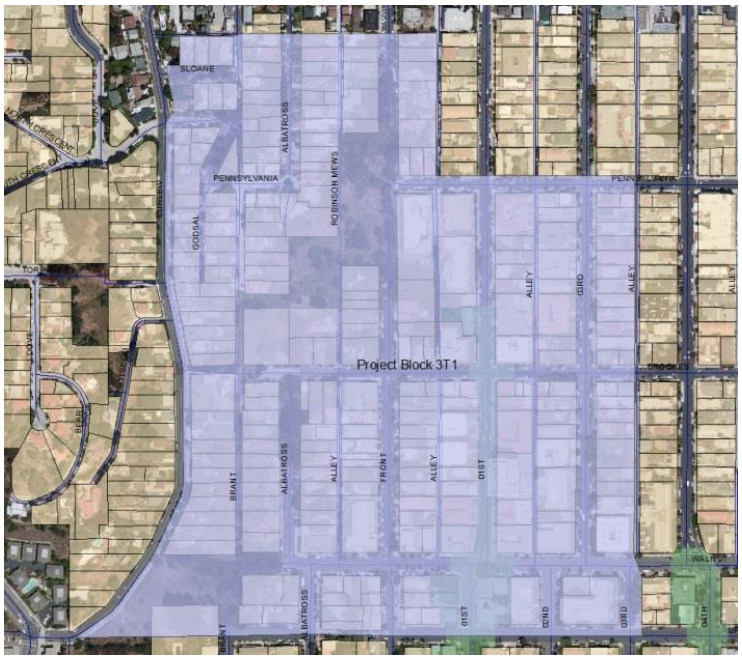
A. Previous 2009 MP property number estimates.
B. SDG&E customer information.
C. SANDAG address and parcel information.

A.) The existing properties count from the 2009 MP was initially considered for use. However, as this number was manually inputted, no numerical correlation could be made when resizing and reshaping blocks to accurately reallocate that number. Other available data, such as APN addresses, parcel numbers, and SDG&E customer numbers, when reviewed were also unable to

recreate the property numbers estimated in the 2009 MP. No direct correlation could be found. Being unable to account for how those numbers were originally calculated, its use in the new Master Plan was quickly reconsidered. The 2009 values may have been an estimate of customers and City-wide housing averages but that remains unknown. It was observed that the largest discrepancies in 2009 property number estimates compared to current parcel information used, occurred where Rule 20A blocks border Surcharge blocks.

B.) Utilization of the customer number values from the SDG&E CustCount field found in the Transformer layer (as used in the Meter field described above) encountered misrepresented values in project block areas where apartments or condominiums are present as shown Project Block 3T1 in Figures 26 and 27 below.

FIGURE 26 – GIS BOUNDARY OF PROJECT BLOCK 3T1



Based on the GIS output table analysis, Project Block 3T1 contains values of 1,021 meters compared to 210 parcels. We can observe that the meter information provided by the SDG&E Transformer layer cannot be used to accurately represent the number of customer trench service laterals required for undergrounding conversion of this block.

LEGEND
PROJECT BLOCK 3T1 BOUNDARY
SAN DIEGO PARCELS

(Data Source: The City of San Diego – UUPProjects_17May2016.shp*)*

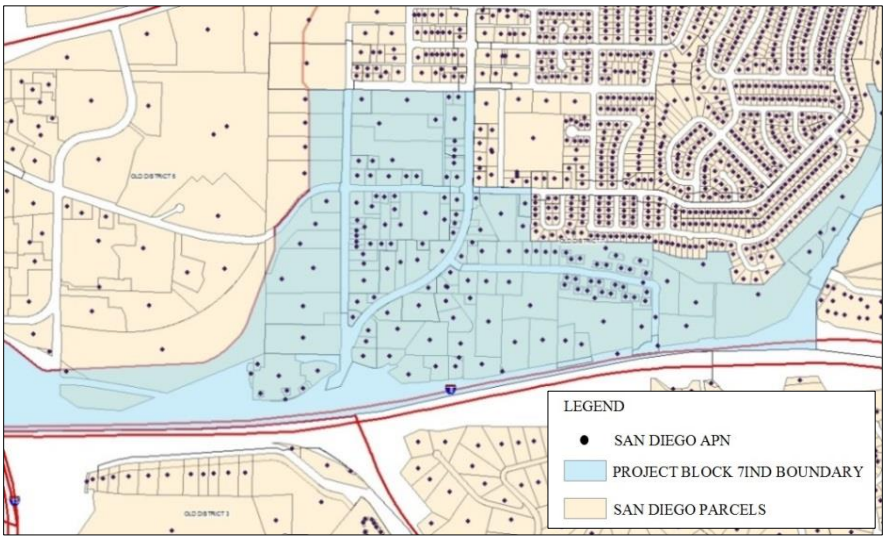
FIGURE 27 – AERIAL IMAGE OF PROJECT BLOCK 3T1

(Source: Google Earth Pro – 2015 Imagery)

The number of individual apartment units significantly increased the values used to represent the number of expected services each block would actually require. Generally, one service drop or customer lateral will be required per building. For apartment complexes with multiple units and meters, a single stub out will likely be used for the undergrounding conversion from the joint trench to the main panel. From this main panel, all the meters for the individual apartment units will be serviced. Coordination was done with SDG&E for available service drop information, but SDG&E does not currently have that information available.

C.) Other approaches considered for calculating the number of properties or service drops were the ADDRESS_APN and PARCELS layers, obtained from SANDAG. However, the ADDRESS_APN layer was found to consist of point features rather than polygons. The point features were placed along centroids of the areas it was meant to represent. For visual purposes the PARCELS layer shown in tan was turned on for perspective to compare the APN_Address point features in Figure 28.

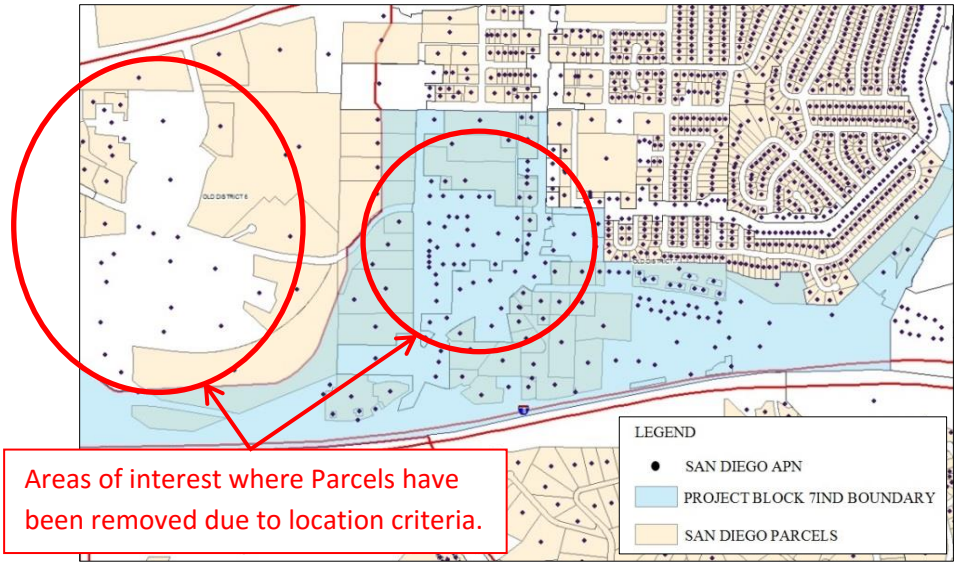
FIGURE 28 – APN_ADDRESS LAYER VS. PARCEL LAYER



(Data Source: The City of San Diego –SANDAG)

These centroids or points made selecting by distance difficult for omitting those areas denoted as already completed. Distances from overhead poles to centroids ranged from 150 to 350 feet. In comparison, Figure 29 shows the result of isolating and removing parcels that were selected at a distance further than 100 feet from existing SDG&E distribution poles as shown in areas circled in red. Per SDG&E concerns, distribution poles were not shown.

FIGURE 29 – PARCELS REMOVED



(Data Source: The City of San Diego – SANDAG)

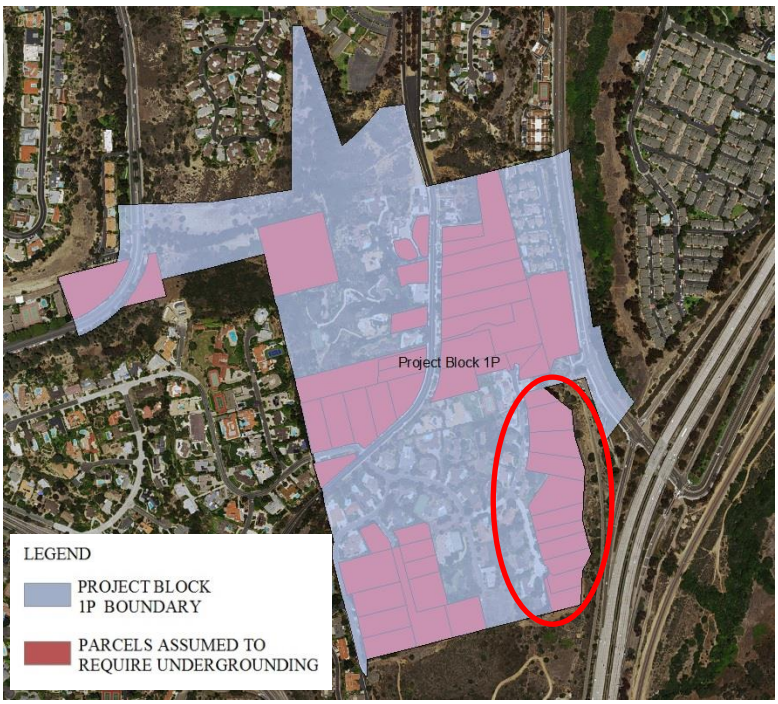
The PARCELS layer was selected as the most appropriate baseline data input for use in accounting for service drops. The information was obtained through numerous processes as described herein:

- The PARCELS layer obtained from SANDAG contained parcel and land value information for the entire county of San Diego. To make the information more manageable and optimize efficiency during analysis, a new layer "Parcels_Surcharge_Clip" was created by clipping the SANDAG PARCELS layer by the City limits to remove information beyond the extents of our project scope.
- Upon analysis of the PARCEL layer attribute table, multiple records were found for the same parcel I.D. accounting for the multiple units residing in the same taxable parcel lot as seen in apartment and condominium complexes. The "Dissolve" tool within ArcGIS Desktop was used to create a new layer named "Parcels_Surcharge_Clip_Dissolve" to merge the records by PARCELID. Merging records with the same parcel I.D. was done to remove any duplicate counts in values to resolve the multiple count discrepancies.
- The service drop tally was then obtained by spatially joining the newly created "Parcels_Surcharge_Clip_Dissolve" layer to the City GIS data to geographically select all the parcels found within the City project block boundaries, and summarizes the tally

count by each block to an output attribute table under the "ServiceDrop" field created. This process was inputted into the ModelBuilder analysis to automate the process for any recalculations needed when City project block boundaries are changed.

However, instances were observed where the numbers of parcels found within project blocks were greater than the number of SDG&E meters as in Figure 30. These instances were observed to occur in new development areas and neighborhoods that had partial areas already undergrounded. The number of parcels selected by the algorithm includes all parcels which are near SDG&E distribution poles (as discussed further below) regardless if neighboring homes are already undergrounded. The existing data is unable to distinguish which parcels have already been undergrounded. Without individually inspecting every parcel in the City, this algorithm remains the most accurate representation for a City-wide planning document.

FIGURE 30 – GIS BOUNDARY OF PROJECT BLOCK 1P



Investigation of the area was done to identify the discrepancy in parcel values and customer meters being serviced by SDG&E. Upon review, the homes circled in red have already been converted to underground. However, the GIS analysis still accounts for these parcels in its analysis due to their proximity to the distribution pole lines running through open-space areas behind their homes. The remaining distribution poles are likely for continued connectivity to the areas which have not yet been converted and remain using overhead utilities.

(Data Source: The City of San Diego – UUPProjects_17May2016.shp*)*

In summary, use of the new layer we created from the SANDAG PARCELS layer is the most accurate estimate for representing service drops which in turn most accurately anticipates the quantity of customer lateral trenching required. The estimated property numbers from the 2009 MP are shown for rough comparison below. It was not documented how the 2009 MP estimated the property numbers or even what purpose they served in terms of cost. The values obtained through the new master planning method are reflective of current City parcel information which serves as the most accurate method for calculating the number of anticipated customer lateral trenching.

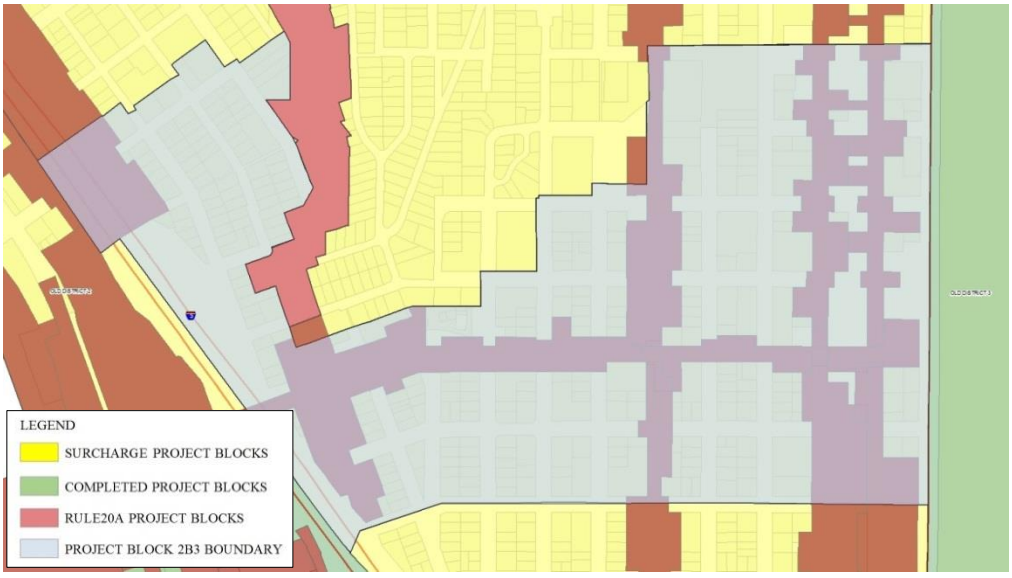
TABLE 9 – SAMPLE PROPERTY NUMBER VS SERVICE DROP COMPARISON

SAMPLE BLOCK_ID1	2009 PROP_NO	2016 ServiceDrop	% Difference
1A1	283	260	-8%
1A2	254	259	2%
2A	333	169	-49%
2B3	1042	235	-77%
3A	499	303	-39%
3AA	306	311	8%
4A	287	368	14%
4A1	323	246	-48%
6A2	477	464	-3%
6AA	477	388	-6%
7AA	412	461	-8%
7AA1	503	223	1%
8D	221	296	9%
8D1	272	260	-8%

*This list was obtained using the "UUPProjects_17May2016.shp" GIS data provided by the City and the results of the Cost Algorithm Analysis.
*The first 2 blocks from every district were chosen for comparison

It was observed that the majority of property count decreases from the 2009 MP to current City parcel information were due to project boundaries that contained parcels in areas that have already been undergrounded and were removed by the GIS analysis. A significant percent decrease was observed in Project Block 2B3 shaded in blue in Figure 31 and used as a further example to observe the difference in the 2009 property number estimates compared to the GIS quantities obtained from current City parcel information.

FIGURE 31 – Project Block 2B3



(Data Source: The City of San Diego – UUPProjects_17May2016.shp*)*

The 2009 MP listed 1,042 properties within the Project Block 2B3 boundary while current parcel quantities are counted to be 235 by GIS. Manually counting each parcel in this project block determined that the GIS count was significantly more accurate. Overlapping Rule 20A project boundaries may have also played a part in the 2009 MP's property estimates. Figure 31 is used to demonstrate the discrepancy in the 2009 property number estimates compared to current conditions, as well as increase City confidence in the methodology used for generating the new Master Plan. By manually counting each parcel for selected sample areas, we were able to conclude that the new Master Plan's methodology will be more accurate than those used in 2009.

4. SUB_Count Data Field

SUB_Count is the number of substations remaining to be undergrounded. The field will tally substations residing within a project block. The information was obtained from the SDG&E S_Substation data. Only those substations remaining in Surcharge project blocks were considered. The information was obtained by spatially joining the SDG&E S_Substations data to the City's project block GIS data to geographically select all the substations found within the City project block boundaries. The total number of customers by block will be stored in the newly-created SUB_Count field. This process was inputted into the ModelBuilder analysis to automate the process for any recalculations needed when City project block boundaries are changed.

5. P_Length Data Field

P_Length is the footage of SDG&E pole lines remaining overhead bound by the defined block. This information was obtained from the SDG&E PoleLine layer. Overhead pole line lengths were selected to most accurately represent the amount of joint trenching along City right-of-ways that each block will require. A multiplier of 1.15 will be added to the pole line length to account for additional trenching near the end of streets and along project boundaries. Pole lines crossing "open-space" areas were kept in the analysis due to their need for service connectivity and electrical continuity; these potential issues will be addressed during design on an individual basis.

Many variations were considered to determine the most appropriate method for calculating the anticipated joint trench length per block. Utilizing the length of overall road in a given project block was initially considered for estimating the anticipated joint trenching lengths. However, the lengths returned from GIS observations were factors of magnitude greater than both the 2009 trench estimates and the expected length based on remaining overhead pole line lengths, as well, engineering judgement. The overall length of road did not accurately account for the remaining lines to be undergrounded as these values included sections of roads of project blocks that had already been undergrounded, highways and on/off ramps were also included. Attempts at selecting only those roads within a distance of overhead distribution poles or pole lines, similar to what was done with parcels, returned inaccurate estimates. Additionally, this metric would

also not account for instances where pole lines traversed open-space areas or cut across lots that were not near roadways.

Data value discrepancies were observed in instances of multiple pole lines within the same overhead pole span. This was resolved by creating a selection method to omit pole lines found at a distance greater than one foot away from SDG&E overhead poles, resulting in the removal of multiple lines within the same span length. Removal of these multiple lines resolved trench length values from being double counted. Additionally, pole lines assumed to be transmission lines were removed from the analysis as they are not subject to undergrounding efforts under the existing project scope. As the SDG&E PoleLine layer did not distinguish between transmission and distribution lines, another selection method was conducted with the use of distribution poles which are denoted by subtype in the SDG&E OverheadStructure layer. In doing this, pole lines for use as transmission lines were removed.

Currently Pole lines running along both sides of the sidewalk remains a minor issue. After much investigation, there is no way to automate GIS to select out those features or combine them correctly so as to mirror a single joint trench length in instances of parallel pole lines. Tools such as "Collapse Dual Lines to Centerline" and "Buffer" were attempted but with no success. However, these instances are very few and far between. Furthermore, when manually edited in sample blocks in the few effected blocks in which this has been encountered, the percentage difference only accounts for 10 percent of the overall length. Below is a comparison of the currently remaining pole line lengths compared to the 2009 MP estimates.

TABLE 10 – ESTIMATED TRENCHING COMPARISON

SAMPLE BLOCK_ID1	2009 EST_TRENCH	2016 P_Length	% Difference
1A1	10596	12405	17.07%
1A2	9857	11469	16.35%
2A	17387	13460	-22.59%
2AA	18172	16026	-11.81%
3A	18458	8477	-54.08%
3AA	14854	16238	9.32%
4A	15196	18352	20.77%
4A1	15488	14758	-4.71%
6A	16321	14932	-8.51%
6A2	13952	15723	12.69%
7AA	15623	21805	39.57%
7AA1	19805	20508	3.55%
8D	11082	10970	-1.01%
8D1	12373	13802	11.55%

(Data Source: The City of San Diego – UUPProjects_17May2016.shp*)*

In summary, use of the SDG&E pole line lengths was determined to be the most accurate estimate for representing joint trench lengths. The estimated trench lengths from the 2009 MP

are shown for rough comparison. Unfortunately, it was not documented how the 2009 estimated trench lengths were calculated. The values obtained through the new master planning method are reflective of actual SDG&E utilities remaining overhead that will require undergrounding conversions which serve as the most accurate method for calculating anticipated joint trenching lengths.

6. OH_Poles Data Field

OH_Poles is the number of distribution and stub poles (aka riser poles which are used for anchoring to support tension loads) found in each block that may require removal to complete the undergrounding process. This information was obtained from selecting only the respective overhead structure subtypes denoted as distribution poles and stub poles as found in the SDG&E OverheadStructure data. A new layer "OverheadStructures_Distr_Sub" was created containing only those poles designated by the query. Stub poles distanced further than 75-feet from distribution poles were assumed to be used as support for transmission poles and were then removed from the analysis. To determine the total pole tally per block, the alley and backlot poles found below were subtracted from this count. The information was obtained by spatially joining the newly created "OverheadStructures_Distr_Sub" data to the City's project block GIS data to geographically select all the distribution poles found within the City project block boundaries, and summarize the tally count by each block to an output attribute table under the "OH_Poles" field created and subtracting the quantities from the "Alley_Poles" and "Backlot_Poles" fields described below. This process was inputted into the ModelBuilder analysis to automate the process for any recalculations needed when City project block boundaries are changed. The analysis can be generalized and broken down into its component functions listed below.

$$OH\_Poles = OverheadStructures\_Distr\_Sub - (Alley\_Poles + Backlot\_Poles)$$

7. Alley_Poles Data Field

The alley pole count was obtained from the OverheadStructure layer by selecting those poles that resided within 10 feet of alleyways which were delineated from the ROADS_ALL data found in the SANDAG website. The ROADS_ALL layer contains information separating the City of San Diego's streets into different classifications such as Alley, Avenue, Boulevard, Bike Path, Bridge, etc. The complete list of all classifications and information provided by the SANDAG ROADS_ALL layer can be found in Appendix 8. A layer was created by selecting all the roads classified as alleys. The alley information was pulled out of the ROADS_ALL layer. The information was obtained by creating a layer where all poles minus those assumed to be alley poles were removed from the original SDG&E OverheadStructure layer. The information was obtained by spatially joining the "Alley_Poles" data to the City's project block GIS data to select and count the alley poles found within the City project block boundaries. The count of alley

poles in each project block is programmatically entered into the "ALLEY_Poles" field created with the project Block's attribute table. This process was inputted into the ModelBuilder analysis to standardize and streamline the process for any recalculations needed when City project block boundaries are changed.

8. Backlot_Poles Data Field

The backlot pole count was obtained from the OverheadStructure data by selecting those poles which were 30 feet or farther from street center lines. As Surcharge projects are generally comprised of small residential neighborhoods, the 30 foot distance was assumed as sufficient distance for the location of standard home backyards. The distances were delineated from the ROADS_ALL layer found in the SANDAG website. The complete list of all classifications and information provided by the SANDAG ROADS_ALL layer can be found in Appendix 8. It is understood that this selection is assumed and discrepancies may arise in instances where wider main streets have a distance greater than 30 feet from their centerline. In those instances, poles although on the City curb side, will be counted as backlot poles. It is also understood that the backlot pole count established by the datum may vary as new equipment to replace these poles are typically placed on the streets and may occur prior to the project blocks undergrounding conversion based on resident needs. However, the percent error per project block will be negligible. These backlot pole result counts will not be double counted in the OH_Poles tally as it will subtract those poles categorized as backlot poles; the information was obtained by creating a layer where all poles minus those assumed to be backlot poles were removed from the original SDG&E OverheadStructure data. The Backlot_Poles layer content was then spatially joined to the City GIS file to geographically select all the assumed backlot poles found within the City project block boundaries, and summarized the tally count by each block to an output attribute table under the Backlot_Poles field created. This process was inputted into the ModelBuilder analysis to automate the process for any recalculations needed when City project block boundaries are changed.

9. Intersections Data Field

The Intersections field accounts for the number of intersections in each block that will be used as an initial basis for the amount of curb ramps which may require ADA installation or improvements. The intersections count was obtained from the ROADS_INTERSECTION found in the SANDAG website. The information was obtained by spatially joining the ROADS_INTERSECTION data to the City GIS project block data to geographically select all of the intersections found within the City project block boundaries, and summarizes the tally count by each block to an output attribute table under the "Intersections" field created. This process was inputted into the ModelBuilder analysis to automate the process for any recalculations needed when City project block boundaries are changed.

C. COST ALGORITHM

The ModelBuilder cost analysis can be generalized and broken down into its component functionalities listed below.

Total Block Cost =
f (Average Civil Work Costs) +
f (Basic Electrical Services Cost)+f (Special Electrical Services Cost) +
f (Contractor Overhead and Profit, and Design service Fees)

The cost algorithm will be based on practical construction components necessary for the successful completion of the undergrounding conversion and summarized into cost line items. The line items considered will be split into three (3) categories: Civil Work, Basic Electrical Services cost, and Specialized Electrical Services cost. Refer to Appendix 5 for the spreadsheet summarizing unit cost data to be utilized for the new block cost estimates. The final estimated costs were cumulated through workshops between SDG&E and City Staff involved with the undergrounding program, review of historical information, RMS cost indexes, review of current City JOC programs being used for undergrounding, as well as vendor quotes, and standard engineering practices for cost estimating.

1. CIVIL WORK:

The Civil work criterion created includes Public Notifications, Joint Trenching, Customer Service Trenching, Road Resurfacing, Streetlights, Curb Ramps, Permits and Inspections, Trees, Stormwater Pollution Prevention Programs (SWPPP), and Traffic Control.

2. BASIC ELECTRICAL SERVICES:

The Basic electrical services criterion created includes Customer Paneling, Overhead Cable Removal, Overhead Customer Cable Removal, Frontage Street Power Pole Removal, Alley Pole Removal, and Backlot Pole Removal.

3. SPECIALIZED ELECTRICAL SERVICES:

The Specialized electrical services criterion created include Pad Mounted Transformers, Primary Backbone Cabling, Secondary Backbone Cabling, Customer Service Cabling, Customer Cut-Overs, Boundary Circuit Feeders, and Substation Circuits.

TABLE 11 – COST LINE ITEMS SUMMARY

1. Civil Work	2. Basic Electrical Services	3. Specialized Electrical Services
Public Notifications	Customer Paneling	Pad Mounted Transformers
Joint Trenching	Overhead cable Removal	Primary Backbone Cabling
Customer Service Trenching	Overhead Customer Cable Removal	Secondary Backbone Cabling
Road Resurfacing	Frontage Street Power Pole Removal	Customer Service Cabling
Street Lights	Alley Pole Removal	Customer Cut-Overs
Curb Ramps	Backlot Pole Removal	Boundary Circuit Feeders
Permits and Inspections		Substation Circuits
Trees		
SWPPP		
Traffic Control		

Appropriate multipliers for contractor overhead and profit and design service fees will be applied to the block cost estimates as well. Each line item is explained in further detail below:

1. Civil Work

Public Notifications – Accounts for the costs associated with placing door hangers on residents' doors as well as organizing community hearings required during the undergrounding process. This line item will be directly related to the number of customers with the addition of a $2,500 lump sum for public hearings. This line item will be derived from the tally of the total number of customers (represented by meters) being serviced by the number of transformers located within each block boundary.

Joint Trenching – Accounts for the cost to excavate the utility joint trench, install conduits and backfill to prepare for AC pavement resurfacing based on the existing SDG&E pole line lengths within each project block. The costs associated with road resurfacing will not be included in this line item and will be discussed below. It is assumed that the undergrounding joint trench length will be 1.15 times greater than the existing overhead pole line lengths. As discussed in Section VIII.B.5 above, the pole line lengths were obtained from the P_Length field.

Non-Joint Trenching – Accounts for the cost to excavate communication utility trenches not part of the SDG&E joint trench. This includes the cost to install conduits and backfill to prepare for AC pavement resurfacing. Communication utility trench lengths will vary per design, however, non-joint trenching is assumed to be half of the expected joint trenching length. It is assumed that the undergrounding joint trench cost will be one-third of the cost for joint trenching efforts.

Customer Service Trenching - Accounts for excavating from the joint utility trench in the street up to each customers service meter panel. An assumed city-wide average of 50 feet was used to account for the expected length from the joint trench to each customer's meter. The cost includes

trenching and conduit work including: labor and materials for trenching, all conduit, substructure installation such as vaults, pad installations, backfill, and repairs within City streets. This cost will be generated by counting the number of service drops within a block multiplied by the assumed city-wide length of footage for the trench and multiplied by the unit cost associated with trenching on customer property. The number of customers within a block will not be used because one parcel may have several customers but only require one trench as discussed in Section VIII.B.3.

Road Re-surfacing – Cost will include all labor and materials required for road resurfacing. The cost will be directly related to the estimated trench length and will include a unit cost factor for installing new AC Pavement per City Standards as necessary. This cost will be generated by the estimated trench length obtained from the P_length field multiplied by a 1.15 multiplier and multiplied by the unit cost associated with trenching efforts.

Street Lights - Accounts for the cost of streetlights, cable and conduit, and trenching required per installation. It is assumed that one streetlight will be installed every 150 feet based on the City Street Lighting design manual in accordance with the approved Council Policy 200-18. It is also assumed that of the required street lights installed every 150 feet, only 75 percent of them will need to be installed citywide. This cost will be generated by the estimated trench length obtained from the P_length field multiplied by the unit cost associated with street light installation divided by 150 and multiplied by 75 percent.

Per Council Policy 600-18 (CP-600-18) street lighting must be "placed such that the spacing of street lights is no greater than 300 feet between intersections" and "no greater than 150 feet within 1 mile of all transit stops, as well as high crime residential and commercial districts." To calculate the number of required street lights for each project block the estimated trench length will be divided by 150 and multiplied by the street light unit cost factor. 150 feet was assumed based on City report and averaging past project total length with the number of street lights inserted.

Curb ramps – Curb ramps must be installed wherever ADA compliance is non-existent. This cost will include all improvements required for ADA installments and improvements. This quantity will be represented through the use of intersections within a given project block based on data from the "ROADS_INTERSECTION" layer obtained from the SANDAG website. The cost includes installation of ADA curb ramps. The quantity of curb ramps requiring ADA improvements will be based on the number of intersections and multiplied by four (4) curb ramps per intersection. It will be assumed that 50 percent of curb ramps within Surcharge project blocks will need to be installed.

Permits and Inspections – Includes all permitting and inspection fees for time and labor of the customer meter connections. This cost will be directly related to the number of customers

obtained from the "ServiceDrops" field and will be multiplied by the unit cost associated with permitting and inspections based on historical cost data from previous projects.

Trees – Cost accounts for the number of trees to be installed within each block. It is assumed that 20 percent of all customers obtained from "CustCount" field will opt for tree installation. The costs will assume a standard 5 Gal tree, 4.5 feet tall.

SWPPP - Accounts for the cost of Stormwater Pollution Prevention Programs (SWPPP) implementation along required joint trench length obtained from the "P_Length" field. This cost will be generated by the estimated trench length obtained from the the "P_length" field multiplied by a 1.15 multiplier and multiplied by the unit cost associated with SWPPP efforts.

Traffic Control - Accounts for all expected Traffic controls plans and traffic control implementation during construction. It is assumed that sixty (60) days of traffic control measures will be required for the majority of projects to be undergrounded.

MND's of Culturally Sensitive Areas – Costs associated with Minimum Negative Declarations (MND's) were considered for inclusion to the new Master Plan cost estimates. However, through coordination with the City, it has been determined that there is no current metric for quantifying MND's.

2. Basic Electrical Services

Customer Paneling - Accounts for all paneling costs such as: Direct Connect, Meter Adapter, Loop & Bond, Extended Loop and Bond, and grounding. This cost will include material and labor costs. This cost will be generated by the estimated service drops required within each block obtained from the "ServiceDrop" field and multiplied by the unit cost associated for paneling work.

Overhead Cable Removal - Accounts for removal of overhead power lines, does not include customer service drop overhead line removal.

Overhead Customer Cable Removal - Accounts for the removal of customer overhead power lines. It is assumed that the average distance from the joint trench to customers' meters will be 50 feet of overhead lines per each service drop.

Frontage Street Power Pole Removal - Includes demolition and labor of street power poles, associated overhead transformers, and restoration. Some existing poles are in back lots and alley ways which typically create higher block costs. These back lot and alley poles will be quantified separately to provide increased accuracy of block cost estimates.

Alley pole Removal - Accounts for all costs including demolition and labor of alley power poles, associated overhead transformers, and restoration.

Backlot Pole Removal - Accounts for all costs including demolition and labor of power poles residing in customer backlots, associated overhead transformers, and restoration.

3. Special Electrical Services

Pad Mounted Transformers - Typical single phase pad mounted transformer used in residential conversions; includes transformer labor and materials for installation. It is assumed the same quantity as the currently existing overhead transformers will be converted to surface transformers.

Primary Backbone Cabling - Primary distribution cabling feeding the transformers. Assumes average Citywide: quantity of (3) #2 conductors per length of trenching. It is assumed new undergrounding joint trench length is 1.15 times greater than P_Length.

Secondary Backbone Cabling - Secondary distribution cabling from the transformers to common pull box. Assumes average Citywide: quantity of (3) #250 conductors per length of trenching x 0.8. It is assumed new undergrounding joint trench length is 1.15 times greater than P_Length.

Customer Service Cabling - Cost will account for the conductors and labor to pull the conductors from the common pull box to the customer meter. It is assumed the average city-wide quantity will be four (4) #2 conductors per length of trenching required multiplied by 1.15 plus an additional 75 feet average distance of laterals on homeowners property (includes height of buildings for loop and bond). It will be assumed that new UG joint trench length will be 1.15 times greater than the existing SDG&E pole line lengths obtained from the P_Length field.

Customer Cut-Overs - Accounts for all material and labor costs associated with switching customers from overhead service to the underground system.

Boundary Circuit Feeders - Accounts for the cabling poles required at the boundaries of project blocks transitioning from underground to overhead. This value is dependent on the number of circuits within a project block. For purposes of this study, it will be assumed that each block will have on average three (3) unique circuit feeders (cable poles).

Substation Circuits – Accounts for all costs of extra circuits, trenching, and conduit required for the undergrounding conversion of substations.

BLOCK_COST – Block cost is the summation of all the cost factors for all civil and electrical work required for the successful completion of all undergrounding conversions including contractor overhead and profit, change order contingencies, and design service fees. Program management overhead is assumed to be 8 percent and engineering services is assumed to be 12 percent of total project costs. Field change orders will be assumed to be 10 percent of total project costs.

4. 2016 Block Costs

The BLOCK_COST field represents the cost of the current Surcharge blocks found in the City's database with the new

Master Plan's methodology applied. Resizing, reshaping, and renaming efforts will be done upon City approval of the methodology proposed herein. The estimated project costs from the 2009 MP are shown for rough comparison. The values obtained through the new master planning method are reflective of actual SDG&E utilities remaining overhead that will require undergrounding conversions which serve as the most accurate method for estimating project costs of remaining underground conversions of Surcharge Blocks. For purposes of this study, the 2009 project blocks were reevaluated using the new methodology being implemented for the new Master Plan. Sample results of the analysis are shown in Table 12.

TABLE 12 – 2016 MP PROJECT COSTS

SAMPLE BLOCK_ID1	2009_COST_EST	2016_BLOCK_COST	% Difference
1A1	$5,302,,640	$8,556,813	61%
1A2	$4,899,616	$8,220,649	68%
2A	$7,986,408	$9,126,964	14%
2AA	$7,962,085	$10,750,282	35%
3A	$8,994,158	$7,299,991	-19%
4B	$8,928,436	$13,645,972	44%
4B1	$8,954,332	$13,645,972	52%
6A	$7,364,618	$9,024,933	23%
6A2	$7,456,610	$10,524,976	41%
7AA	$7,901,637	$13,923,646	76%
7AA1	$9,811,452	$14,205,250	45%
8D	$5,421,074	$7,828,940	44%
8D1	$6,023,004	$9,529,918	58%

*This list was obtained using the "UUPProjects_17May2016.shp" GIS data provided by the City and the results of the Cost Algorithm Analysis.

Through coordination with the City, an issue addressed was the consistent under estimation of project block costs by the previous 2009 MP. The block costs analyzed using the new Master Plan's methodology result in higher costs than estimated by the previous 2009 MP. These higher costs reflect current cost data as well as an in-depth breakdown of project construction efforts.

D. Reshaping Project Blocks

The new Master Plan's Surcharge blocks will be manually altered through a polygon editing feature available in the GIS software. A copy of the City's data will be used for altering the existing project limits into the new project blocks for the new Master Plan in accordance with the methodologies discussed throughout this report.

Project blocks shape and size will be determined by natural geographic boundaries, neighborhood limits, and the ideal customer size of 200±25 customers and 6,000 linear feet of expected joint trenching as discussed in Section VII.B as well as engineering considerations. Sizing each shape to the desired number of customers and trench lengths will be accomplished iteratively based on a trial and error basis. Once a shape outline has been generated, the cost algorithm will be run to populate the newly defined shape with the resultant quantities captured by the project block's new limits. The project block's shape will then be adjusted according to its need, expanding or shrinking its boundaries until the ideal number of customers and the most logical boundary stopping locations have been met. This process will continue until all Surcharge areas within the City's database have been incorporated into the new Master Plan's project blocks. Each project block's name will also be manually input per the neighborhood naming convention.

IX. NEW MASTER PLAN PRIORITY ANALYSIS

The new Master Plan will begin actualizing the new implementation order with all currently unallocated project blocks for both Rule 20A and Surcharge projects directly following the City's current scheduled projects going through council review. Project blocks that have already been scheduled for funding will continue as scheduled and not be altered. This transition was decided through coordination with the City to expedite the new implementation method and appease resident's expectations for undergrounding conversions. The ongoing community outreach initiatives by the City will facilitate the transition to the new Master Plan as communities have been made aware of the need for an updated Master Plan and the coming changes to the planned undergrounding timeline for their blocks. This transition will also allow for projects currently in the design phase or awaiting City approval to continue as planned, which will minimize construction-extension costs, allow funds to be utilized, and avoid overall project timeline delays.

A. PRIORITY ALGORITHM

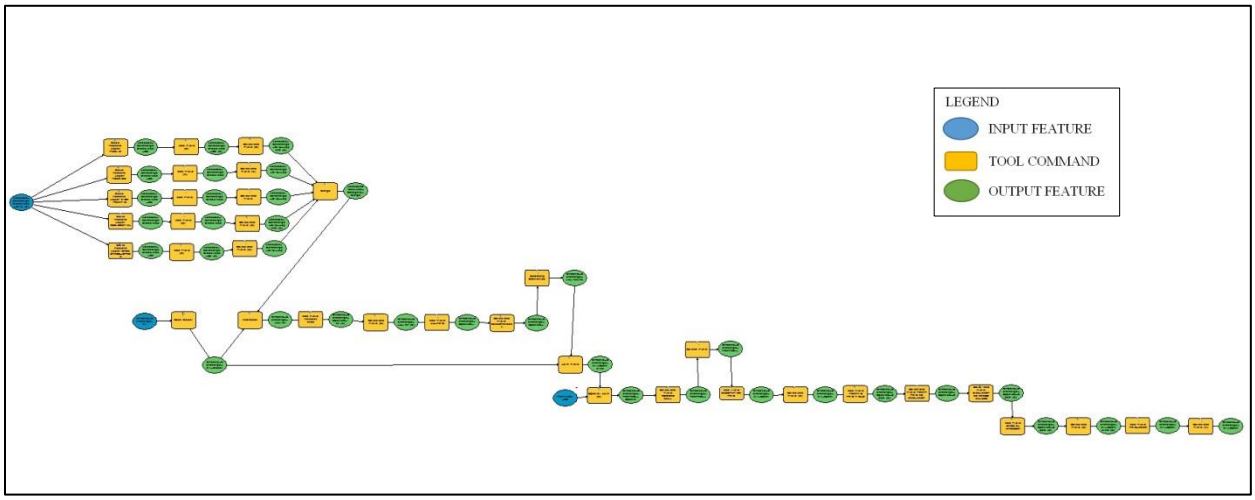
The new Master Plan will utilize a priority algorithm to analyze priority considerations in accordance with CP-600-08 and generate a priority value based on a weighted average of all the considerations used. The priority value generated will then be used in-house as a tertiary tool in assembling the new Master Plan's implementation order. The priority algorithm developed is shown in Figure 32.

The fields created to summarize the considerations for use in the priority algorithm analysis are:

TABLE 13 – GIS PRIORITY FIELDS CREATED

	GIS Data Field	Feature Described	Layer Found
1.	SUB_PRIO	Substation Location	SDG&E: S_Substation Layer
2.	SUM_LU_PRIO	Land Use	SANDAG
3.	BEST_PUB_PRIO	Best Public Benefit	Manual Edit

FIGURE 32 – PRIORITY ALGORITHM, MODELBUILDER



(Source: Priority Algorithm – MasterPlan.mxd)

Table 14 summarizes the priority ranking analysis and the attribute fields to be used within the priority algorithm.

TABLE 14 – PRIORITY RANKING SYSTEM FACTORS SUMMARY

PRIORITY FACTOR	PRIORITY VALUE	ATTRIBUTE FIELD
Substation(s)	10	SUB_Count
Best Public Benefit	0-10	BEST_PUB_PRIO
*Residential	10	LU_PRIO
*Public Facilities	8	LU_PRIO
*Tourism Areas	6	LU_PRIO
*Commercial Areas	4	LU_PRIO
*Heavy Traffic	2	LU_PRIO
*Open-Space or Other	0	LU_PRIO

*These fields will be represented as weighted averages based on percent land use and summarized in the LU_PRIO data field in the attribute table.

B. SUBSTATION PRIORITY

To help drive down costs and increase program efficiency, the new implementation order will focus on a higher priority for undergrounding SDG&E substations and electrical continuity. After discussions with SDG&E, it was agreed that centering project block prioritization on SDG&E substations will benefit the overall undergrounding process. Since substations typically

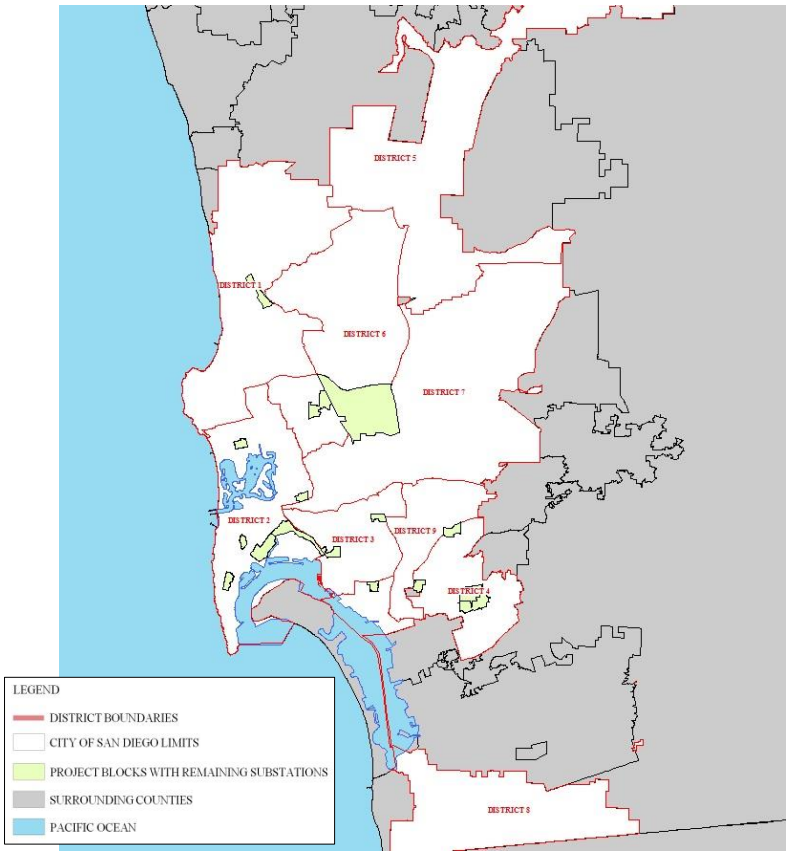
have several incoming and outgoing circuits that lead to different project blocks, efficiency suggests the substations should be converted first. This will help avoid excavating multiple trenches at substations for separate Surcharge and Rule20A projects. High voltage transmission circuits (>69kV) that enter a substation will remain overhead unless otherwise determined during the design phase. There are eighteen (18) remaining Surcharge project blocks with substations that have not been undergrounded. These Surcharge project blocks are listed below in Table 15 and shown in Figure 33. The "SUB_Count" attribute field will include the number of SDG&E substations within each block.

TABLE 15 – SURCHARGE PROJECT BLOCKS WITH REMAINING SUBSTATIONS

BLOCK NAME	DISTRICT	COST ESTIMATE	ALLOCATION YEAR	NO. OF SUBSTATIONS
1W	1	$4,757,440	2035	1
2B3	3	$12,856	2035	1
2F1	2	$9,582,586	2056	1
2I1	2	$7,507,414	2034	1
2M	2	$7,678,631	2019	1
2N	2	$7,458,404	2021	1
2Y1	2	$9,448,370	2052	1
3Y3	3	$7,668,534	2036	1
4H2	4	$7,182,978	2036	1
4T1	4	$7,931,185	2046	1
4U	4	$6,059,736	2025	1
*6IND	6	Not Available	2063	3
6A2	2	$7,456,610	2018	1
6R	6	$9,900,484	2051	1
7D1	4	$6,992,142	2027	1
8E	8	$5,340,395	2020	1

* Project Block 6IND was added to the City's project inventory after the 2009 MP was established and so does not currently have a project estimate. The project inventory assigned the project block to be undergrounded the final year of the program.
**This list was obtained using the "UUPProjects_17May2016.shp" GIS data provided by the City.
***Project Block 2B3 cost estimate is expected to be an error originating from the 2009 MP

FIGURE 33 – SURCHARGE PROJECT BLOCKS WITH SUBSTATIONS



*(Source: SDG&E – SanDeigoMasterPlan.*gdb*)*

C. LAND USE PRIORITY

A computer model was created within ArcGIS to calculate the average land use designation priority ranking within each block using the land use category grouping shown in Table 16. The land use categories were obtained from the LANDUSE_CURRENT layer from the SANDAG website. This model will generate the land use percentages and apply the weighted ranking score for each project block. These land use percentages define all land use areas within each project block boundary and the area associated with each land use category group will be calculated and then translated to a spatial average, or percent area. This land use spatial average will then be multiplied by its associated ranking value from Table 16 to produce an average land use ranking value for each block to be used within the "SUM_LU_PRIO" attribute field calculations.

TABLE 16 – LAND USE CATEGORY GROUPING

CATEGORY GROUP	LAND USE CATEGORIES	PRIORITY RANKING
RESIDENTIAL	Dormitory, Mobile Home Park, Multi-Family Residential, Multi-Family Residential Without Units, Neighborhood Shopping Center, Single Family Detached, Single Family Multiple-Units, Single Family Residential, Single Family Residential Without Units, Single Room Occupancy Units (SROs), Spaced Rural Residential, Residential Recreation, Community Shopping Center.	10
PUBLIC FACILITIES	Elementary School, Fire/Police Station, Government Office/Civic Center, Junior High School or Middle School, Library, Other Public Services, Other Recreation – High, Other Recreation – Low, Other School, Park – Active, Park and Ride Lot, Post Office, Public/Semi-Public, Rail Station/Transit Center, School District Office, Senior High School.	8
TOURISM	Beach – Active, Beach – Passive, Resort, Stadium/Arena, Tourist Attraction, Bay lagoon, lake/Reservoir, Resort, Convention Center.	6
COMMERCIAL AREA	Arterial Commercial, Automobile Dealership, Industrial Park, Communications and Utilities, Golf Course, Hotel/Motel, Industrial Park, Junkyard/Dump/ Landfill, Military, Office, Other Retail Trade and Strip Commercial, Parking Lot – Structure, Parking Lot – Surface.	4
HIGH TRAFFIC	Commercial Airport, Freeway, Other Transportation, SDSU/CSU San Marcos/UCSD, Junior College, Light Industrial, Rail Station/Transit center.	2
OPEN-SPACE	Landscape Open-Space, Open-Space Park or Preserve, Undevelopable Natural Area, Intensive Agriculture, Cemetery.	0

*Categories were obtained using the LANDUSE_CURRENT GIS layer obtained from City of San Diego SANDAG Website.

The "SUM_LU_PRIO" attribute field will assign each block a priority value based on the type of land use designated within each block. This will help classify areas with multiple land use classifications such as residential neighborhoods, public facilities, high tourism, commercial areas, high traffic density or vacant open-space areas. Each block will contain several different types of land use so a weighted spatial average will be assigned. For this calculation, the 106 different land use types designated by SANDAG for the Regional Growth Forecast will be grouped into six categories: Residential, Public Facilities, Tourism, Commercial, Heavy Traffic, and Open-Space; each with its own priority ranking of 10 to 0, respectively. Refer to Table 16 for a breakdown of the land use category grouping.

D. Best Public Benefit Priority

The BEST_PUB_PRIO attribute field will assign each block a priority value that will vary from 0 to 10 based on the degree of desired priority by the City. This priority factor will be implemented at the City's discretion and these values will be manually registered upon review by the City. Best Public Benefit is relegated to the welfare of the general public, and not the interest of a person, group, or firm. This factor is being implemented in order to adjust a utility project status to account for other projects that might be of public benefit happening within the utility undergrounding project limits including, but not limited to:

- Full repaving of streets
- Water Improvement Projects that will be disturbing a significant amount of pavement
- Sewer improvement Projects that will be disturbing a significant amount of pavement
- Increasing the amount of street lights due to safety concerns in order to adhere to the City of San Diego Street Design Manual

The City may weigh environmental issues, historically sensitive areas, and City Improvement factors such as frequency of street lights or curb ramps in a given delineated project block requiring accelerated attention.

E. Other Considerations Made

Another consideration for use within the priority analysis was the inclusion of a "Difficulty Factor" criterion. This difficulty factor would represent blocks containing a higher difficulty factor for construction implementation. Project blocks that contain more alley and back-lot poles may be placed at a lower priority, since they will typically require new electrical boxes in front of the properties that often cause complaints and community approval delays. If the existing circuits and poles in the alley serve both sides of the block, then special consideration needs to be made during design so that residents are not left with the alley poles and conductors in addition to the new electric utility boxes and transformers. However, this priority consideration was dismissed due to the likelihood of these instances predominantly occurring in older neighborhoods. City may want to avoid appearance of preference or favoritism.

Additionally, tourism areas were also considered for priority analysis, but upon review of City GIS data, it was observed that the vast majority of currently defined tourist areas have already been undergrounded. Furthermore, assumed tourism areas are already addressed within the LANDUSE_CURRENT layer.

X. NEW MASTER PLAN ANALYSIS AND DELIVERABLES

The new updated Master Plan's methodology has been applied to the current Surcharge project blocks within the City's GIS Undergrounding Program database for reference and presented herein. Upon review of this report by the City, the methodologies described herein will be applied to carry out the new Master Plan's reshaping efforts and new implementation order. Results of the report analysis are presented below for use to observe the results of the methodology discussed within this report to facilitate stakeholder review and comments. For complete results see Appendix 6.

A. SAMPLE COST FEATURES COMPARISON

TABLE 17 – BLOCK COST ANALYSIS RESULTS (SELECTED EXAMPLES)

BLOCK_ID1	INTERSECTIONS	ServiceDrop	OH_Poles	Backlot_Poles	ALLEY_Poles	XFMR_Count	Meters	SUB_Count	P_Length	BLOCK_COST
1A	11	261	97	44	19	27	321	0	10,700	$7,999,487
1A1	31	260	99	10	50	22	287	0	12,405	$8,556,813
1A2	15	259	86	17	44	27	339	0	11,469	$8,220,649
1B	26	181	95	17	43	33	263	0	12,089	$8,151,290
1C	16	187	70	10	36	25	610	0	7,313	$5,742,529
2A	21	169	128	87	0	38	859	0	13,460	$9,126,964
2AA	13	296	103	9	0	36	376	0	16,026	$10,750,282
2AA1	29	189	152	45	48	32	1,132	0	15,960	$10,175,358
2AA2	53	521	183	11	78	50	1,723	0	22,471	$15,971,175
2B	40	383	184	60	1	46	604	0	21,093	$14,361,397
3A	13	303	83	18	55	30	1,366	0	8,477	$7,299,991
3AA	41	391	155	25	80	39	1,210	0	16,238	$11,913,288
3AA1	0	219	70	2	60	30	1,359	0	5,820	$5,400,430
3B	67	863	370	123	91	82	1,793	0	42,326	$29,042,801
3BB	31	331	147	46	49	30	1,053	0	16,110	$11,195,992
4A	39	311	160	31	31	24	602	0	18,352	$11,871,715
4A1	25	368	132	26	40	28	650	0	14,758	$10,670,690
4B	36	437	163	31	65	37	707	0	17,791	$12,893,821
4B1	33	449	168	31	49	37	818	0	19,288	$13,645,972
4BB	23	397	151	4	1	36	489	0	16,963	$12,026,833
6A	25	119	114	46	10	30	165	0	14,932	$9,024,933
6A1	35	357	148	5	4	40	514	0	16,547	$11,690,865
6A2	33	246	138	1	28	35	1,163	1	15,723	$10,524,976
6AA	26	464	150	11	4	46	884	0	21,426	$14,795,742
6AA1	25	453	158	11	3	40	644	0	18,058	$13,073,806
7AA	29	388	112	8	0	32	475	0	21,805	$13,923,646
7AA1	25	461	128	8	0	43	560	0	20,508	$14,205,250
7B	13	210	79	9	44	25	1,107	0	8,588	$6,497,638
7B1	20	353	149	10	92	50	2,408	0	15,367	$11,460,473
7C	28	325	199	63	27	53	1,559	0	23,487	$15,248,671
8A1	35	189	110	9	54	26	901	0	10,118	$7,190,752
8D	9	223	102	17	47	29	429	0	10,970	$7,828,940
8D1	28	296	129	31	49	20	444	0	13,802	$9,529,918
8E	26	186	129	23	53	26	677	0	13,849	$8,901,118
8H	3	225	112	30	73	27	466	0	10,486	$7,643,440

*Individual line items costs as described in Section VIII.C are not shown for presentation purposes. For complete results refer to Appendix 6.

As observed in Table 17, Project Block 3B stands out with a projected block cost of $29,042,801due to the high number of service drops and extensive trench lengths required for its conversion compared to the other outlined project boundaries. As discussed throughout this

report, the number of service drops and estimated trench lengths compose the highest cost factors for the undergrounding conversion program. In the new Master Plan, it will be the intent to keep these parameters within a similar range to mitigate these significant project block cost discrepancies.

B. Sample Priority Features Comparison

TABLE 18 – PRIORITY ANALYSIS RESULTS (SELECTED EXAMPLES)

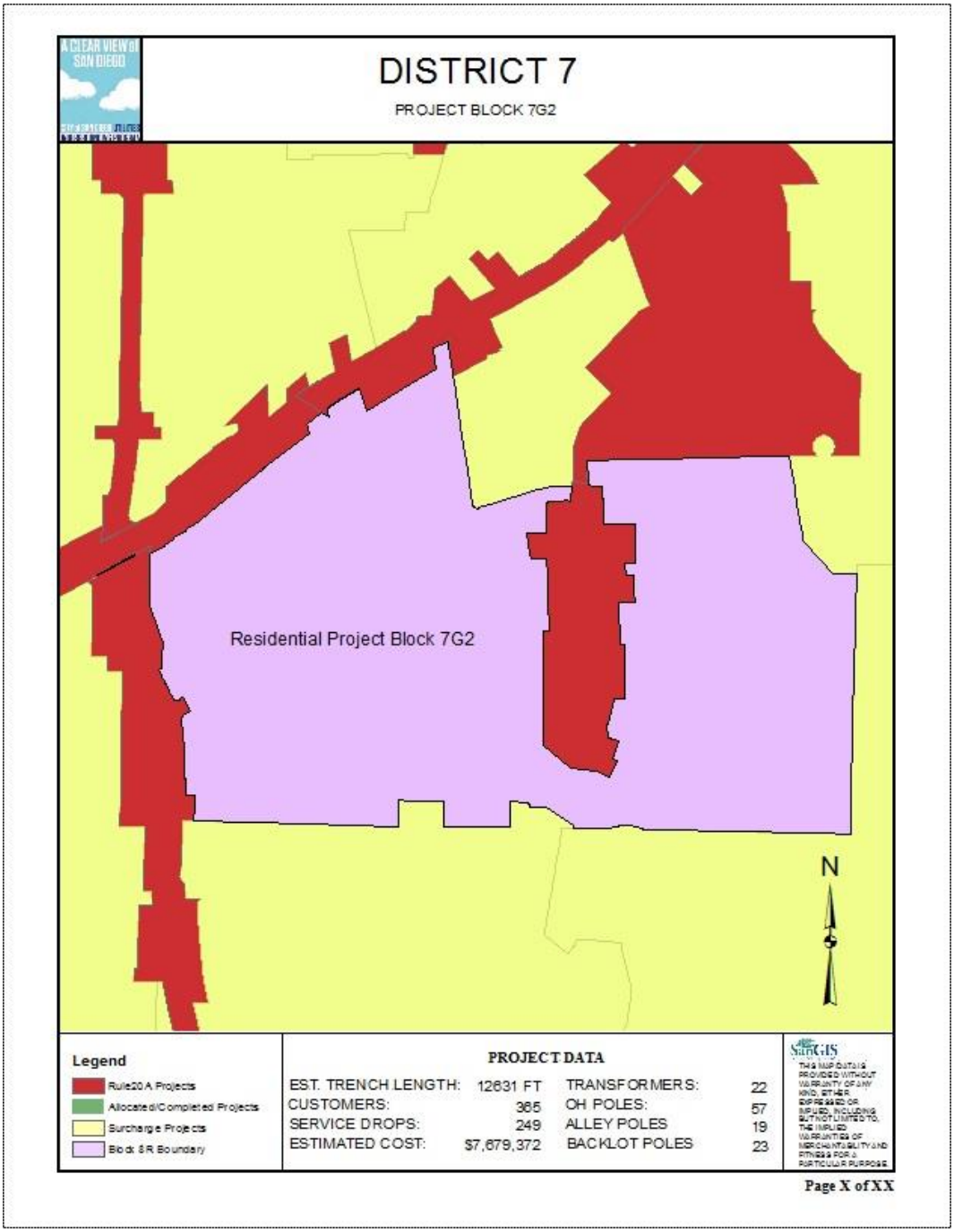
BLOCK_ID1	SUM_LU_PRIO	SUB_PRIO	BEST_PUB_PRIO	PRIO_RANK
1A	6.848	0	0	6.848
1A1	6.739	0	0	6.739
1A2	6.983	0	0	6.983
1B	7.225	0	0	7.225
1C	7.049	0	0	7.049
2A	4.154	0	0	4.154
2AA	7.025	0	0	7.025
2AA1	6.447	0	0	6.447
2AA2	7.038	0	0	7.038
2B	5.842	0	0	5.842
3A	6.695	0	0	6.695
3B	5.424	0	0	5.424
3BB1	5.539	0	0	5.539
3C	5.607	0	0	5.607
3CC	4.446	0	0	4.446
4A	4.550	0	0	4.550
4A1	6.149	0	0	6.149
4B	6.987	0	0	6.987
4B1	6.111	0	0	6.111
4BB	7.708	0	0	7.708
6A	3.544	0	0	3.544
6A1	6.484	0	0	6.484
6A2	6.674	10	0	16.674
6AA	6.814	0	0	6.814
6AA1	7.217	0	0	7.217
7AA	6.875	0	0	6.875
7AA1	7.209	0	0	7.209
7B	6.672	0	0	6.672
7B1	7.035	0	0	7.035
7C	7.182	0	0	7.182
8A1	4.982	0	0	4.982
8D	3.759	0	0	3.759
8D1	4.516	0	0	4.516
8E	4.704	0	0	4.704
8J	6.644	0	0	6.644

From the selected example project blocks in Table 18, only Project Block 6A2 contains a substation within its boundary. There are currently 18 substations remaining within Surcharge project blocks. Currently, the BEST_PUB_INT field contains zeros. The Best Public Benefit priority column will be manually input upon City review.

C. DELIVERABLES

A sample representation of the new Master Plan's deliverable was generated for this report and shown in Figure 34. All maps and data sheets for Surcharge project blocks will be generated in the Master Plan phase.

FIGURE 34 – BLOCK 7G2 SAMPLE BLOCK



XI. APPENDIX

APPENDIX 1 – 2009 MP COST ANALYSIS

APPENDIX 2 – REMAINING UG WORK – RULE 20A

APPENDIX 3 – REMAINING UG WORK – SURCHARGE

APPENDIX 4 – GIS INFORMATION VERIFICATION

APPENDIX 5 – SAMPLE BLOCK COST ESTIMATE – BLOCK 1L1

APPENDIX 6 – UPDATED 2009 MP WITH APPLIED CURENT ALGORITHMS

APPENDIX 7 – GIS TOOLS AND PROCESSES

APPENDIX 8 – SANDAG GIS DATA

APPENDIX 9 – COUNCIL POLICY 600-08

APPENDIX 10 – UNDERGROUNDING STATUS MAPS