

50% Submittal for Design Build Services for Skyline Hills Fire Station 51



Design and Construction Services

Team #16

**Michael Dedekind, Ismael Delgado, Joe Maulhardt, Fabian Aguilera,
Max Perlin, Lucas Kjeldsen**



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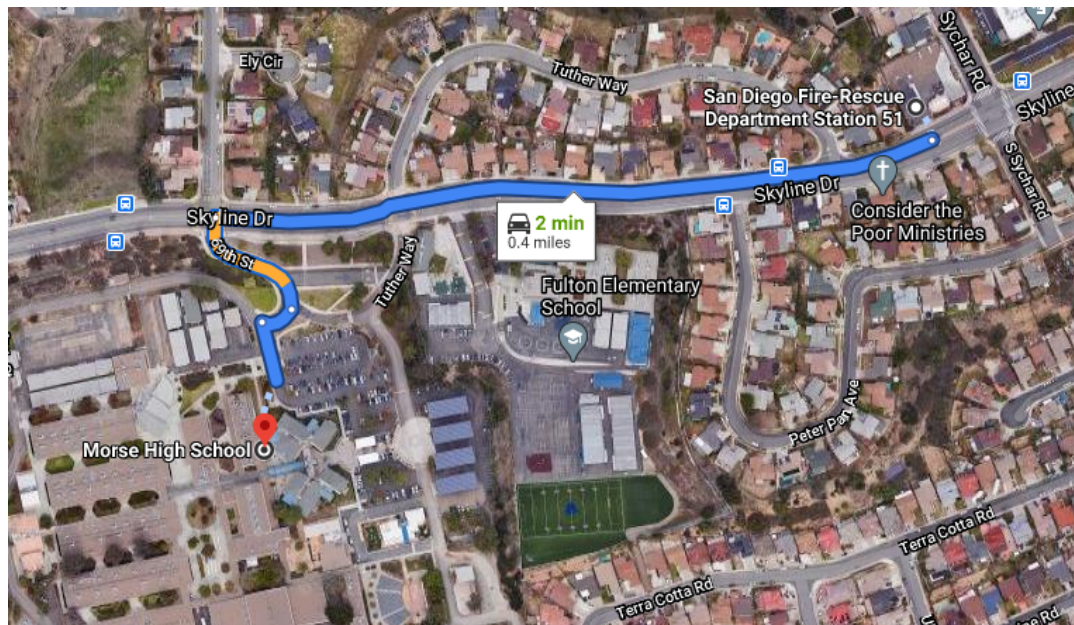
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Executive Summary

1. INTRODUCTION:

With the increase in wildfires all across California recently it is critical to continue to grow the County of San Diego's ability to maintain and fight both wildfires and local fires that occur inside of county limits. Skyline Hills Fire Station 51 has the capability to house approximately two on duty fire fighting crews along with one off duty fire crew. The new construction of Fire Station 51 has the capability to support the local Skyline community and help keep its residents safe. The fire station is also within very close proximity to three schools and multiple places of worship and can help ensure in the event of an emergency these crucial locations have the support they need. The community of Skyline is also an up and coming neighborhood and the addition of a new fire station should help with increasing property values and attract more residents to the area resulting in greater property taxes collected by the city.





2. BACKGROUND:

The current site is located at 7180 Skyline Dr, San Diego in a suburban area and is located in close proximity to local schools, shops, parks, and churches. The existing site consists of an approximately 24,390 square foot asphalt lot with a temporary fire facility which will remain operational until the permanent fire station building is completed. The nearby intersection is a standard stop light and will need to be retrofitted once the firestation is complete to allow fire trucks to exit quickly in the event of an emergency. T16 has been directed by the City of San Diego to exclude this work and assume that it will be by others at a later date.

3. PURPOSE AND OBJECTIVE:

T16 aims on this project to provide excellent and informative design and construction documents for the construction of the Skyline Hills Fire Station 51 site. T16 has assembled one of the most remarkable project teams in company history that is committed to creating a truly one of a kind and remarkable fire station for San Diego County. The documents T16 will provide will be sufficient to create a site that is suitable for a world class fire station ready to serve the local community. We hope that the city of San Diego is satisfied with our site work documents and we have the opportunity to design and build the full fire station once funding has been secured by the city.

4. FINDINGS:

Currently our design and construction team have successfully completed the 50% deliverables outlined in our original proposal to the city and making headway on the 100% submittal design set.

Our civil engineers have completed the existing condition and site development set of drawings with no issues. The next task for our civil engineering team is to start work on the demolition drawings, followed by the grading plan, and wrapping up with the site utilities plan. Our engineers have found that the current site is relatively flat which should reduce the budget for grading costs and minimize the need to export or import soil to the site. The most current civil drawings can be found in appendix B.

T16's stormwater, water, and sewer specialist has successfully completed the required studies in these areas and will relay their findings to our civil engineers so they can incorporate them into their drawings. The storm water and water/sewer studies and their recommendations can be seen in appendix D & E.

Our geotechnical specialist has successfully completed the required geotechnical study and found the soil beneath the site to be favorable as a subgrade for the new asphalt pavement which should reduce costs in this area since little subgrade will need to be imported to the site.



Any additional required soil mitigation measures for the future structure will be included in the 100% submittal package. The geotechnical engineer's report can be read in appendix F and his future soil mitigation plan will be present in appendix G in the 100% submittal.

Lastly our construction engineering team has completed a preliminary site schedule along with a site budget using historical cost averages. Our preliminary site schedule includes two phases to allow the temporary facility to remain operational while site work is being completed. Our schedule is approximately 6 months in duration and includes additional float time in the case of a delay. Our current budget estimate has calculated the cost of this project to be approximately \$438,000 with an average cost of \$18/SF. Changes may be made to this estimate as civil design is completed further. Construction estimate data can be found in appendix I while the schedule can be found in appendix H. Forthcoming documents to be submitted in the 100% submittal include SWPPP, phasing plan, and site logistics plan.

5. RECOMMENDATIONS:

Following the initial research and design phase a few insights were gained that can be used by the city to increase schedule speed or cost effectiveness. Firstly it was stated by the City of San Diego that the temporary facility onsite must remain operational at full capacity during the duration of the construction of the new project. This constraint created the need to create two phases for the site work which lengthens the construction schedule considerably and increases costs since all scopes must be done twice. Upon further research there is an additional fire station located just two miles away from the fire station 51 site. If allowable we recommend relocating the current fire station 51 crews to this alternate fire station for the time being until site work is 100% complete and then reinstalling the temporary facilities until the county can secure the funding to design and construct the fire station building. This would allow T16 to reduce sitework duration from 6 months to 4 months and result in a savings of approximately \$100,000. It may also be beneficial to begin design for the fire station building so our firm can create drawings and documents that integrate with the fire station when it is built. By doing so could help mitigate the chances of having to redo work for items such as utility line relocation, site electrical rerouting, and asphalt rework.

6. CONCLUSION:

Overall T16 believes that no matter which direction the City of San Diego would like to go this project will be a success due to the excellent geological conditions of the site as well as the geographical location of the site. We hope to have the opportunity to not only design and prepare the site but also have the opportunity to design the fire station in the future once funding is secured by the city.



Project Personnel



MICHAEL DEDEKIND, Project Manager / Scheduler

Experience Description: 2 years of project engineer experience and 1 year of estimating experience on commercial projects.



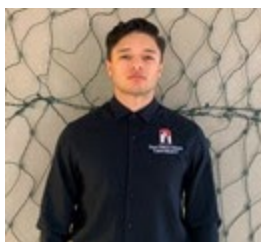
JOE MAULHARDT, Site Civil Engineer

Experience Description: Pursuing civil engineering degree from San Diego State University



LUCAS KJELDSEN, Site Civil Engineer

Experience Description: Superintendent on the 2021 AGC Pre-Construction team and interned at a geotechnical firm for one summer



FABIAN AGUILERA, Storm Water Engineer / SWPPP

Experience Description: LEED GA and 3 years' experience in Project Engineering



MAX PERLIN, Geotechnical Engineer / Scheduler

Experience Description: 2 years experience as a Project Engineer in commercial and school construction projects.



ISMAEL DELGADO, Construction Engineer

Experience Description: 2 years experience as a Project Engineer for a Civil Engineering Contractor. 2 years experience as an Electrical Estimator for Bergelectric Corp.

Appendix A

Basis of Design



BASIS OF DESIGN

Skyline Hills Fire Station 51

3/26/21

Prepared For:

City of San Diego

Prepared By:

T16 Design & Construction Services



Design and Construction Services



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1.0 Site Development

1.1 Purpose and Objectives

The purpose of site development for this project is to develop the plot of land for the Skyline Hills Firestation 51 to provide a comfortable living situation for the firefighters and their equipment. The developed land must meet all codes and restrictions set forth by the City of San Diego.

1.2 Codes and Standards

1.2.1 City

1.2.1.1 The City of San Diego

1.2.2 State

1.2.2.1 California Building and Fire Codes

1.2.3 Agency

1.2.3.1 County of San Diego

1.3 Site Development Assumptions & Criteria

The criteria for the design of the site development were to accommodate the needs and requests that the client, the City of San Diego, made for their fire station. This includes housing for ten fire personnel, a building area of approximately 10,700 square feet, and 2-3 stories. For parking, we were to include 3 public spaces, one of which is ADA compliant, and 20 crew member spaces in a fenced, secure area.

1.4 Site Development Methodology & Approach

The approach and methodology behind the site development were based on the information provided like the general requirements and the pictures of the site. Where information was missing, we made general assumptions in order to carry out the design.



2.0 Storm Water

2.1 Codes and Standards

- LEED v4 Homes Design and Construction
 - LEED BD+C: Homes and Multifamily Low-rise
 - SSc4: Rainwater Management
 - SSc5: Heat Island Reduction
- a) San Diego
- b) California
- c) The U.S. Green Building Council (USGBC)

2.2 Storm Water Assumptions & Criteria

Owner will approve plans to install vegetative roof. Roof will have a slope of 0. Roof will have enough room to be 50% or more vegetated.

3.0 Water/Sewer

3.1 Codes and Standards

- City of San Diego Water Facility Design Guidelines 2021
 - 3.5.2.4 Fire Hydrants
 - 3.5.2.5 Fire Service
 - 3.5.2.6 Water Service
 - 3.5.2.7 Water Meters
- California Plumbing Code 2016
 - 701.2 Drainage Piping
 - 713.0 Sewers Required
 - 7.20.0 Sewer and Water Pipes
 - Table 610.3 Water Supply Fixture Units (WSFU) and Minimum Branch Pipe Sizes



- Table 610.4 Fixture Unit Table For Determining Water Pipe and Meter Sizes
- Table 702.1 Drainage Fixture Unit Values (DFU)
- Table 703.2 Maximum Unit Loading and Maximum Length of Drainage and Vent Piping
- California Fire Code 2019
 - 507.5 Fire Hydrant Systems

- a) San Diego
- b) California
- c) The City of San Diego and California Building Standards Commission

3.2 Water/Sewer Assumptions & Criteria

Slope of the street and site area is 0. Occupancy of the building is expected to be 10 persons. Fire hydrant already within jurisdiction is operational. It is assumed that the water supply line will be a maximum of 150 feet.

4.0 Geotechnical

4.1 Codes and Standards

- 4.1.1 No primary codes and standards were used to carry out this study. Regional geology and seismic activity were researched using public government databases.

4.2 Geotechnical Assumptions & Criteria

- 4.2.1 Site soil characteristics are assumed to be similar to that of known soil deposits in the surrounding area.
- 4.2.2 Site topography is assumed to be flat (slope is less than 1%) based on existing paved condition.



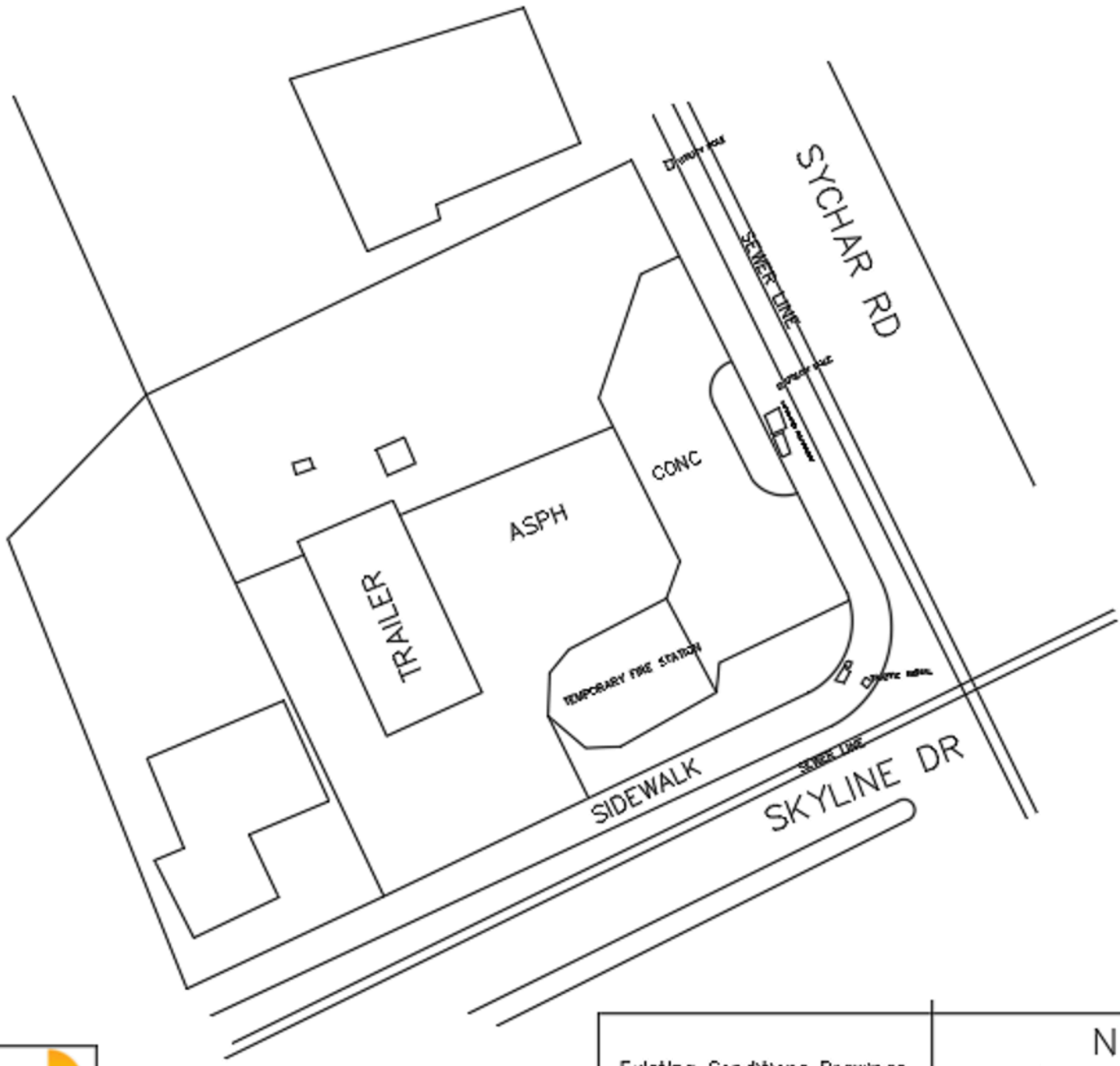
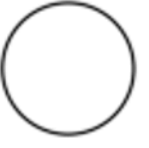
5.0 Construction Engineering

5.1 Construction Engineering Assumptions & Criteria

- 5.1.1 Budgeted based on the six months project schedule.
- 5.1.2 Assumed no material escalation since the project is to start soon.
- 5.1.3 Only budgeting site work. Building construction to be in the future.
- 5.1.4 Assumed for the need of a superintendent the whole project duration.
- 5.1.5 Included money for temporary facilities for the duration of the project.
- 5.1.6 Assumed site utilities will run at least half the perimeter of the site.
- 5.1.7 Included striping for the specified parking spaces and the ADA compliant parking space.
- 5.1.8 Assumed the need of a clean up crew at least two hours each week.

Appendix B

Plans & Exhibits



SKYLINE HILLS FIRE STATION 51

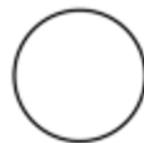
7180 SKYLINE DR
SAN DIEGO, CA 92114

50%
SUBMITTAL 03/26/2021

Existing Conditions Drawings

NOTES
FOURTH COMING WITH 100% SUBMITTAL

T16

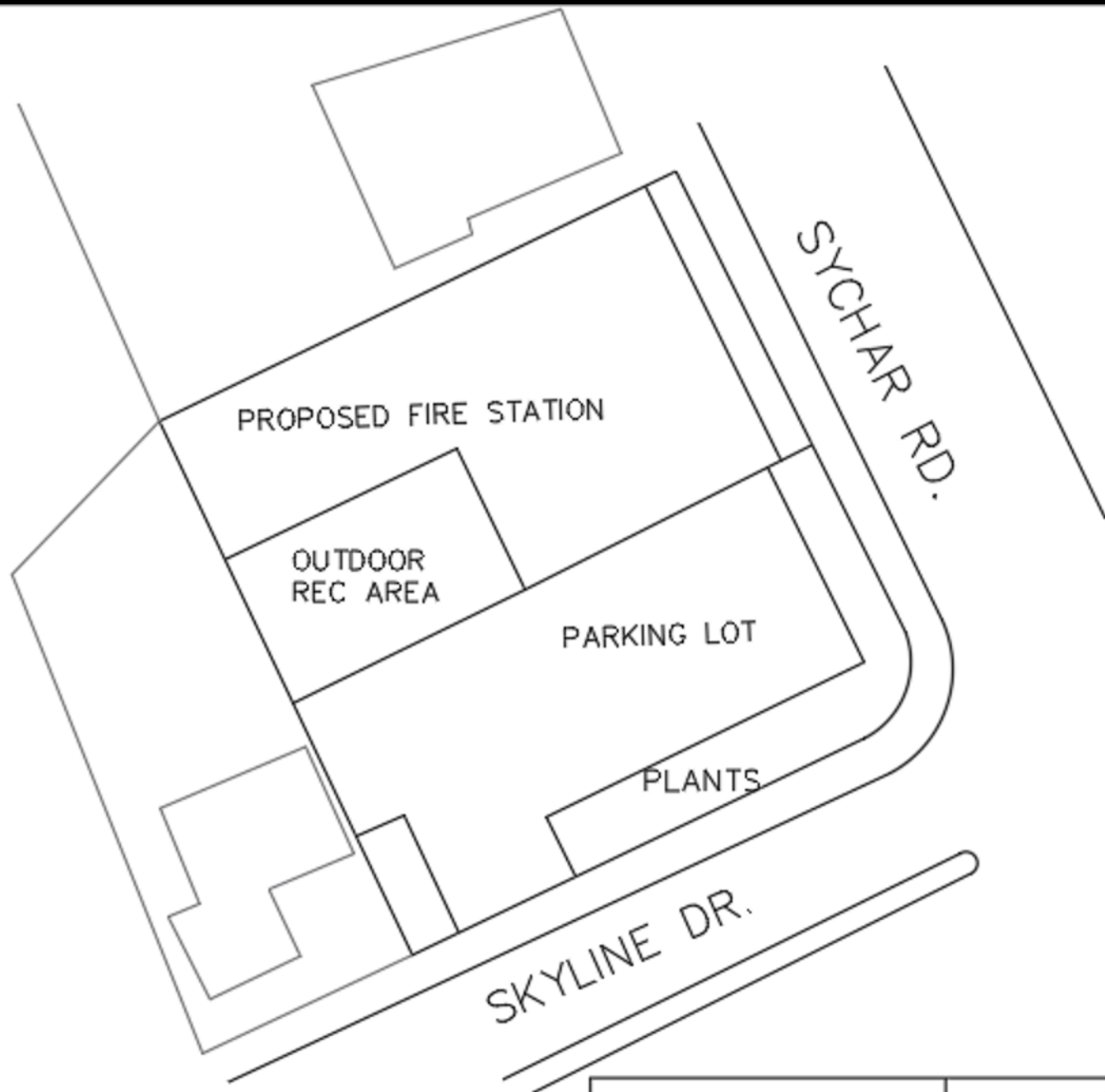


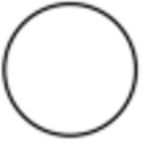
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7180 SKYLINE DR
SAN DIEGO, CA 92114

50%
SUBMITTAL

03/26/2021





FORTHCOMING WITH 100% SUBMITTAL

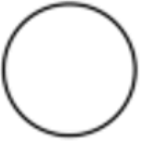
SKYLINE HILLS FIRE STATION 51

7180 SKYLINE DR
SAN DIEGO, CA 92114



DEMOLITION DRAWINGS

NOTES
FOURTH COMING WITH 100% SUBMITTAL



SKYJNE HILLS FIRE STATION 51
 7180 SKYLINE DR
 SAN DIEGO, CA 92114

FORTHCOMING WITH 100% SUBMITTAL



GRADING/VERTICAL CONTROL PLAN

NOTES
 FOURTH COMING WITH 100% SUBMITTAL



SKYLINE HILLS FIRE STATION 51

7180 SKYLINE DR
SAN DIEGO, CA 92114

FORTHCOMING WITH 100% SUBMITTAL



SITE UTILITIES PLAN

NOTES
FOURTH COMING WITH 100% SUBMITTAL

Appendix C

Site Civil Study

Site Civil Study

For:

San Diego Fire-Rescue Department Station 51
7180 Skyline Dr, San Diego, CA 92130

Operator:

T16 Design and Construction Services

Site Civil Contact:

Lucas Kjeldsen and Joe Maulhardt

T16 Design and Construction Services
Email: clkjeldsen@sdsu.edu
jmaulhardt@sdsu.edu

Preparation Date:
03/24/2021

Estimated Project Dates: May – December 2021
Start of Construction: 05/21/2021
Completion of Construction: 12/14/2021

SHFS.5.6 Site Civil Study

Narrative

SHFS.5.6.3.2 Project Description

The Skyline Fire Station 51 located at 7180 Skyline Hills Dr, San Diego, California 92114. The plot is approximately 23,000 ft², and the fire station will take up approximately 9700 ft² of the plot. As seen from Exhibit 1.1, the sight is relatively flat with minimal grading needed.

Scope of Work

The scope of work for the site civil in this project includes site development drawings, existing condition drawings, demolition drawings, grading plan, and site utilities. For this site civil study, we will just be covering the 50% submittals, the existing conditions drawing and the site development plan.

Existing Conditions

In the existing conditions our team identified the temporary fire station that will remain active through the site development and construction of the new fire station. In addition plots of land that change from concrete to asphalt were properly labeled. The fire station is on the corner of Skyline Dr. and Sychar Rd. with the sewer lines running below the street. To add to this the utility lines and transformers are on the street side of Sychar Rd. There is also a temporary contractors trailer set up that will remain active through the build phase.

Site development plan

Firestation:

We placed the fire station on the north side of the site based off of where the temporary fire station currently is. The RFP said the approximate area is to be around 10700 SF. We found that the fire station would be able to fit all of the requirements in an area of about 9700 SF with multiple stories, and as an added bonus for the firefighters, we could fit in an outdoor recreation area where we plan to install a BBQ, some turf, and a sitting area. The building will be slightly moved back from the sidewalk as well to allow firetrucks easier access.

Parking Lot:

The parking lot is required to have 1 ada compliant public space, 2 regular public parking places, and 20 crew parking spaces. Assuming standard parking spaces are 18' x 8.5',

23 parking spaces would total to 3519 square feet. We decided to allot about 9100 square feet for the entire parking lot which will be plenty of room to fit all of the cars.

Plants:

Around the outside of the parking lot, we plan to have succulents planted. Behind the plants, the secure fencing will be installed with a sliding gate to close off the parking lot when needed.

Exhibits

Exhibit 1.1



Appendix D

Water/Sewer Study

Water/Sewer Study

For:

San Diego Fire-Rescue Department Station 51
7180 Skyline Dr, San Diego, CA 92130

Operator:

T16 Design and Construction Services

Storm Water Engineer/SWPPP Contact:

Fabian Aguilera

T16 Design and Construction Services

Email: faguilera5588@sdsu.edu

Preparation Date:

03/08/2021

Estimated Project Dates:

Start of Construction:

Completion of Construction:

CODES AND STANDARDS

Overview

The primary codes and guidelines used in the study and design of the proposed water/sewer utilities are listed below:

- City of San Diego Water Facility Design Guidelines 2021
 - 3.5.2.4 Fire Hydrants
 - 3.5.2.5 Fire Service
 - 3.5.2.6 Water Service
 - 3.5.2.7 Water Meters
 - Table 2-2 Unit Water Demands Table
- California Plumbing Code 2016
 - 701.2 Drainage Piping
 - 713.0 Sewers Required
 - 7.20.0 Sewer and Water Pipes
 - Table 702.1 Drainage Fixture Unit Values (DFU)
 - Table 703.2 Maximum Unit Loading and Maximum Length of Drainage and Vent Piping
 - Table 610.3 Water Supply Fixture Units (WSFU) and Minimum Branch Pipe Sizes
 - Table 610.4 Fixture Unit Table For Determining Water Pipe and Meter Sizes
- California Fire Code 2019
 - 507.5 Fire Hydrant Systems

The primary basis of design was provided by the City of San Diego Water Facility Design Guidelines 2021 which outlined meter sizing, and domestic water demand criteria.

WATER/SEWER

Purpose and Objective

The purpose of analyzing water and wastewater for the proposed Fire Station is to accurately study the domestic water demands, meter sizing, minimum flow to new fire hydrant and fire hydrant coverage. The objective is to provide recommendations for upgrades in the case of potential capacity issues and support the cost estimating and construction analysis.

Water

Our building has a total water supply fixture unit (WSFU) of 33.5. According to California Plumbing Code 2016, a building with 33.5 WSFU, maximum allowable water supply length of 150 ft. and pressure range between 46 to 60 psi requires a **1.25 inch water supply pipe**.

Sewer

Our building has a total drainage fixture unit value (DFU) of 36. According to California Plumbing Code 2016, a building with 36 DFU requires a **4-inch horizontal sewer pipe**. Assigned DFUs are given in Table 702.1 of CPC 2016. Corrugated Flexible Pipe will be used for our drainage system. We will have drains running underground from the backside of the building to the sanitary sewer line connected to the manhole on Sychar Rd. Refer to figure 1 for pipe placement site map.

Domestic Water Demand

For most projects, average annual water demands are determined based on the unit water demand criteria found on the table 2-2 from City of San Diego Water Facility Design Guidelines 2021. The city of San Diego requires water services to be 1-inch minimum size; 1½-inch and 3-inch services are not allowed. All water service connections to PVC pipe will be made with a saddle for our 2-inch water service made of copper pipe. The **water service for this project will be 2 inches** and perpendicular to the water main.

Meter Sizing and Upgrades

According to California Plumbing Code 2019 Chapter 6 – Water Supply and Distribution, a **2-inch water meter** will suffice for a demand of 1500 gallons/day (1.0 gpm). Water meters must be located on the public right-of-way (SDRSD WS-03) or in an adequate easement. Water meters 2 inches in size and smaller, must be installed in accordance with all current regional and City of San Diego directives and standard drawings. In case of capacity issues, our 2-inch water meter can be **upgraded to a 3-inch water meter** that will require a backflow preventer device. These meters must be built in an aboveground installation with reinforced concrete slab and protective fence.

Fire Hydrant Coverage

Since this is a residential area we will be using a 4-inch port and one 2½-inch port. According to California Fire Code 2019 507.5.1 a facility or building must have a fire hydrant on a fire apparatus access road within **400 feet of its jurisdiction**. As there already is a fire hydrant across the street at the corner of Sychar Road and Skyline Drive's intersection we will not be needing to install a new fire hydrant for this project. Refer to figure 4 and 5 for fire hydrant location and jurisdiction. The **furthest boundary of this project is 271.2 ft away** from the fire hydrant which is well within its jurisdiction.

Minimum Flow to Fire Hydrant

California Fire Code 2019 states that regardless of the average spacing, fire hydrants shall be located such that all points on streets and access roads adjacent to a building are within the distances listed in the table CFC 105.1. Our project only requires one fire hydrant, meaning our fire flow requirement is **1,750 gallons per minute (gpm) or less**.

CALCULATIONS

Water

Total Water Supply Fixture Units (WSFU) are calculated below:

Fixture/Appliance	WSFU	Amount	Total
Toilet	2.5	5	12.5
Shower Head	2	4	8
Lavatory Faucet	1	5	5
Kitchen Faucet	1.5	1	1.5
Dish Washer	1.5	1	1.5
Drinking Fountain	0.5	2	1
Clothes Washer	4	1	4
Total Building WSFU			33.5

Table Calcs for WSFU

METER AND STREET SERVICE (Inches)	BUILDING SUPPLY AND BRANCHES (Inches)	MAXIMUM ALLOWABLE LENGTH (feet)														
		40	60	80	100	150	200	250	300	400	500	600	700	800	900	1000
PRESSURE RANGE – 30 to 45 psi¹																
¾	½ ²	6	5	4	3	2	1	1	1	0	0	0	0	0	0	0
¾	¾	16	16	14	12	9	6	5	5	4	4	3	2	2	2	1
¾	1	29	25	23	21	17	15	13	12	10	8	6	6	6	6	6
1	1	36	31	27	25	20	17	15	13	12	10	8	6	6	6	6
¾	1¼	36	33	31	28	24	23	21	19	17	16	13	12	12	11	11
1	1¼	54	47	42	38	32	28	25	23	19	17	14	12	12	11	11
1½	1¼	78	68	57	48	38	32	28	25	21	18	15	12	12	11	11
1	1½	85	84	79	65	56	48	43	38	32	28	26	22	21	20	20
1½	1½	150	124	105	91	70	57	49	45	36	31	26	23	21	20	20
2	1½	151	129	129	110	80	64	53	46	38	32	27	23	21	20	20
1	2	85	85	85	85	85	85	82	80	66	61	57	52	49	46	43
1½	2	220	205	190	176	155	138	127	120	104	85	70	61	57	54	51
2	2	370	327	292	265	217	185	164	147	124	96	70	61	57	54	51
2	2½	445	418	390	370	330	300	280	265	240	220	198	175	158	143	133
PRESSURE RANGE – 46 to 60 psi¹																
¾	½ ²	7	7	6	5	4	3	2	2	1	1	1	0	0	0	0
¾	¾	20	20	19	17	14	11	9	8	6	5	4	4	3	3	3
¾	1	39	39	36	33	28	23	21	19	17	14	12	10	9	8	8
1	1	39	39	39	36	30	25	23	20	18	15	12	10	9	8	8
¾	1¼	39	39	39	39	39	39	34	32	27	25	22	19	19	17	16
1	1¼	78	78	76	67	52	44	39	36	30	27	24	20	19	17	16

Table CPC 610.4 Fixture Unit Table For Determining Water Pipe and Meter Sizing

Sewer

Total Drainage Fixture Units are calculated below:

Fixture/Appliance	DFU	Amount	Total
Toilet	3	5	15
Shower Head	2	4	8
Lavatory Faucet	1	5	5
Kitchen Faucet	2	1	2
Dish Washer	2	1	2
Drinking Fountain	0.5	2	1
Clothes Washer	3	1	3
Total Building DFU			36

Table Calcs for DFU

SIZE OF PIPE (inches)	1¼	1½	2	3	4	5	6	8	10	12
Maximum Units										
Drainage Piping ¹										
Vertical	1	2 ²	16 ³	48 ⁴	256	600	1380	3600	5600	8400
Horizontal	1	1	8 ³	35 ⁴	216 ⁵	428 ⁵	720 ⁵	2640 ⁵	4680 ⁵	8200 ⁵
Maximum Length										
Drainage Piping										
Vertical, (feet)	45	65	85	212	300	390	510	750	—	—
Horizontal (unlimited)										
Vent Piping										
Horizontal and Vertical ⁶										
Maximum Units	1	8 ³	24	84	256	600	1380	3600	—	—
Maximum Lengths, (feet)	45	60	120	212	300	390	510	750		

Table 703.2 CPC Maximum Unit Loading and Length of Drainage/Vent Piping.

Domestic Water Demand

Land Use Category	Unit Water Demand
Residential	150 gallons/person-day
Central Business District	6000 gallons/net acre-day
Commercial and Institutional	5000 gallons/net acre-day
Fully Landscaped Park	4000 gallons/net acre-day
Hospitals	22500 gallons/net acre-day
Hotels	6555 gallons/net acre-day
Industrial	6250 gallons/net acre-day
Office	5730 gallons/net acre-day
Schools	4680 gallons/net acre-day

Table 2-2 Unit Water Demands Table.

Residential water demands are calculated as:

Residential Water Demand (gallons/day) = Residential Population x 150 gallons/person-day

Residential Water Demand (gallons/day) = 10-person x 150 gallons/person-day

Residential Water Demand (gallons/day) = 1500 gallons/day or 1.00 gallon/minute

FIRE-FLOW REQUIREMENT (gpm)	MINIMUM NUMBER OF HYDRANTS	AVERAGE SPACING BETWEEN HYDRANTS^{a, b, c} (feet)	MAXIMUM DISTANCE FROM ANY POINT ON STREET OR ROAD FRONTAGE TO A HYDRANT^d
1,750 or less	1	500	250
2,000-2,250	2	450	225
2,500	3	450	225
3,000	3	400	225
3,500-4,000	4	350	210
4,500-5,000	5	300	180
5,500	6	300	180
6,000	6	250	150
6,500-7,000	7	250	150
7,500 or more	8 or more ^e	200	120

Table CFC 105.1 Number and Distribution of Fire Hydrants.

EXHIBITS



Figure 1: Pipe placement.



Figure 2: Existing fire hydrant within jurisdiction.



Figure 3: Location of fire hydrant compared to furthest boundary of project.

Appendix E

Stormwater Study

Storm Water Analysis

For:

San Diego Fire-Rescue Department Station 51
7180 Skyline Dr, San Diego, CA 92130

Operator:

T16 Design and Construction Services

Storm Water Engineer/SWPPP Contact:

Fabian Aguilera

T16 Design and Construction Services

Email: faguilera5588@sdsu.edu

Preparation Date:

03/24/2021

Estimated Project Dates: May – December 2021

Start of Construction: 05/21/2021

Completion of Construction: 12/14/2021

STORM WATER ANALYSIS

Stormwater Management Objectives

- i. Develop a storm water management.
- ii. Storm water treatment plan.
- iii. Set guidelines for water harvesting.
- iv. Set guidelines for water reuse.
- v. Set guidelines for storm water quality improvements.
- vi. Meet LEED Gold standards.

Codes and Guidelines

The primary reference guide used in the study and design of the proposed stormwater treatment and rainwater harvesting/reuse are listed below:

- LEED v4 Homes Design and Construction
 - LEED BD+C: Homes and Multifamily Low-rise
 - SSc4: Rainwater Management
 - SSc5: Heat Island Reduction

Site Design BMP

A sediment trap will be installed along the northern perimeter of the site to capture stormwater run-off from the site area. The sediment trap will convey stormwater to the storm drain inlet in the northwest corner of the site. The inlet will be raised 1 foot above the bottom of the swale to allow for infiltration of the runoff. The sediment trap will have a trapezoidal shape with a slope ratio of 2:1. The bottom of the sediment trap will be at minimum 2 feet above the seasonal high-water table and bedrock. The slopes of the swale will be stabilized with a dense cover of water tolerant, erosion resistant grasses, mulch, and erosion control blankets immediately after final grade is reached.

Storm Water Treatment

Green Infrastructure (GI) is a soil- and vegetation-based approach to wet-weather management that is cost-effective, sustainable, and environmentally friendly. Green infrastructure involves management approaches and technologies that help infiltrate, evapotranspiration, capture and reuse stormwater to maintain or restore the natural hydrology. Low-Impact Development (LID) is an approach to managing rainwater runoff that emphasizes on-site natural features to protect water quality by replicating the natural land cover hydrologic regime of watersheds and addressing runoff close to its source. Examples include better site design principles (e.g., minimizing land disturbance, preserving vegetation, minimizing impervious cover) and design practices (e.g., rain gardens, vegetated swales and buffers, permeable pavement, rainwater harvesting, soil amendments). These are engineered practices that may require specialized design assistance.

The parking lot for our project will take up 35% of available space so instead of building a traditional impervious blacktop parking lot we will install permeable pavement to assist in achieving LEED Gold Standards and naturally treat the storm water. Permeable pavement is designed to allow percolation or

infiltration of stormwater through the surface into the soil below where the water is naturally filtered, and pollutants are removed. In contrast normal pavement is an impervious surface that sheds rainfall and associated surface pollutants forcing the water to run off paved surfaces directly into nearby storm drains and then into streams and lakes. This will earn us 2-3 points in rainwater management for use of low impact development and green infrastructure. Refer to Figure 1 for example of permeable pavement.

According to The United States Environmental Protection Agency (EPA) permeable pavement has been shown to:

1. Reduce stormwater runoff. (Even when the previous pavement structure is saturated, its rough surface texture continues to slow surface flow of stormwater.)
2. Replenish groundwater.
3. Reduce flooding which may overload combined sewer sewage treatment plants.
4. Require less land set aside and cost for development of retention basins.
5. Reduce pollutants in run-off.
6. Reduce irrigation of area plantings based on the seepage of rain into the sub soil surfaces.
7. Reduce thermal pollution (see also: temperature.)
8. Lessen evaporative emissions from parked cars.
9. Reduce glare and automobile hydroplaning (skidding) accidents.
10. Reduce pavement ice buildup.

The use of permeable pavement is among the Best Management Practices (BMPs) recommended by the EPA and by other agencies and geotechnical engineers across the country for the management of stormwater runoff on a regional and local basis. This pavement technology creates more efficient land use by eliminating the need for retention ponds, swales, and other stormwater management devices. In doing so, previous pavement can lower overall project costs on a first-cost basis.

Rainwater Harvesting and Reuse

To further assist in achieving LEED Gold Standards it is assumed a vegetated roof will be installed. Vegetated roofs are a design in which plants are used to create a green space on top of a building. Typical green roofs consist of multiple layers, including a durable waterproof foundation, a root management system, drainage layers, and some type of growing medium. This will earn us 1-2 points in heat island reduction for use of a vegetated roof that covers 50% or more of roof area. Refer to figure 2 for example of vegetated roofing.

Advantages of vegetative roof systems include:

1. Aids water runoff control.
2. Improves air quality.
3. Provides energy savings all year due to improved insulation.
4. Lengthens roof membrane lifespan.
5. Adds a versatile aesthetic.

With this system in place rainwater will be naturally harvested and autonomously reused for the vegetation on the roof.

EXHIBITS



Figure 1: Example of permeable parking lot.



Figure 2: Example of a vegetated roof.

Appendix F

Geotechnical Study

Geotechnical Report

For:

San Diego Fire-Rescue Department Station 51
7180 Skyline Dr, San Diego, CA 92130

Operator:

T16 Design and Construction Services

Geotechnical Contact:

Max Perlin

T16 Design and Construction Services

Email: mperlin9649@sdsu.edu

Report Preparation Date:

03/22/2021

Start of Construction: May 21, 2021
Completion of Construction: December 14, 2021

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Purpose/Overview

The purpose of this geotechnical report is to provide the City of San Diego with recommendations, research and analysis of local geophysical properties as they relate to civil site development. The scope of proposed site improvement includes the addition of a new parking lot as well as pavement for sidewalks and driveways for emergency vehicles, such as fire trucks. The existing site is currently overlain with cracked and weathered pavement. Once demolished, the subgrade will be investigated for geophysical characteristics, such as shear strength and maximum density to determine any soil mitigation measures necessary for site development. There will not be any on-site soil investigations until existing pavement is removed. This report also includes analysis of regional climate, seismicity and geology for the purpose of including assumptions that will assist in the design process.

Climate

San Diego has a Mediterranean to semi-arid climate, which is characterized by warm, dry summers and mild winters with some rain. San Diego has mild, mostly dry weather with approximately 200 days above 70 degrees Fahrenheit. The extended summer and dry period lasts from May to October. Temperatures are mild to warm in the summer. The average high and low temperatures during the summer are 70-78 degrees Fahrenheit and 55-66 degrees Fahrenheit respectively. Temperatures exceed 90 degrees Fahrenheit approximately four days a year. Winter is the rainy period and lasts from November to April. Temperatures are mild and somewhat rainy during the winter. The average high and low temperatures during the winter are 66-70 degrees Fahrenheit and 50-56 degrees Fahrenheit respectively. There is approximately 10 inches of rainfall in San Diego annually. However precipitation may range from 3 to 30 inches during any given year.

Site Location

The proposed project is located relatively central in the city of San Diego. Located West of the 125 freeway and East of the 805 freeway This project is located on the Northwest corner of city streets Skyline Drive and Sychar Road at 7180 Skyline Drive, San Diego 92130. (See Exhibit 1)

Site Conditions

The site is being proposed for the development of the San Diego Fire-Rescue Department Station 51. Project development includes various site civil improvements including new paving, underground utility tie-in, and emergency traffic signal design. The area around the site is predominantly used for residential housing, private businesses, and recreational community facilities (park, schools, etc.). A San Diego Police Department is located across the street from the proposed project site. Presumably, the site area is relatively flat, since the entire site area is overlain in pavement.

Regional Geology

Based on the analysis of a Web Soil Survey provided by the United States Department of Agriculture, there are two major types of soil deposits surrounding the proposed site location. The largest deposit in the area contains the soil type Olivenhain. Characteristics of Olivenhain include cobbly loam with some clay loam to a depth of about five feet. The second surrounding soil type is Diablo. This soil type contains clayey loam. These are the soil types that were likely used as subgrade for the existing pavement. Recommendations for subbase soil mitigation measures are forthcoming in 100% design submittal when pavement structure will be fully designed. (See Exhibit 2)

Regional Seismicity

There are two major potentially active fault zones within the City of San Diego that are known to generate most of the local earthquakes. The Rose Canyon fault zone extends along the South San Diego Coast. The La Nacion fault system extends through central San Diego, just east of the I-805 freeway. In San Diego, these fault zones are either considered potentially active or inactive. Therefore, it is difficult to determine the potential for ground shaking. The proposed location of the San Diego Fire Rescue Station 51 is adjacent to the La Nacion fault zone. There are no faults that run through the site. However, a seismic event occurring from the slippage of a fault within La Nacion zone would likely shake the proposed site grounds due to the distance from the site. Subbase soil mitigation recommendations may be affected by the potential of seismic activity depending on existing soil conditions. (See Exhibit 3)

REFERENCES

United States Department of Agriculture Web Soil Survey - [Web Soil Survey - Home \(usda.gov\)](http://websoilsurvey.sc.egov.usda.gov/)

SEISMIC SAFETY ELEMENT - City of San Diego - [Microsoft Word - GP Working Doc_muw.doc \(sandiego.gov\)](#)

United States Geological Survey Interactive Quaternary Faults Map - [Faults \(usgs.gov\)](http://quaternaryfaults.usgs.gov/)

EXHIBIT 1: Site Location



Officer
Christopher
Wilson
Memorial Park

San Diego Police
Department

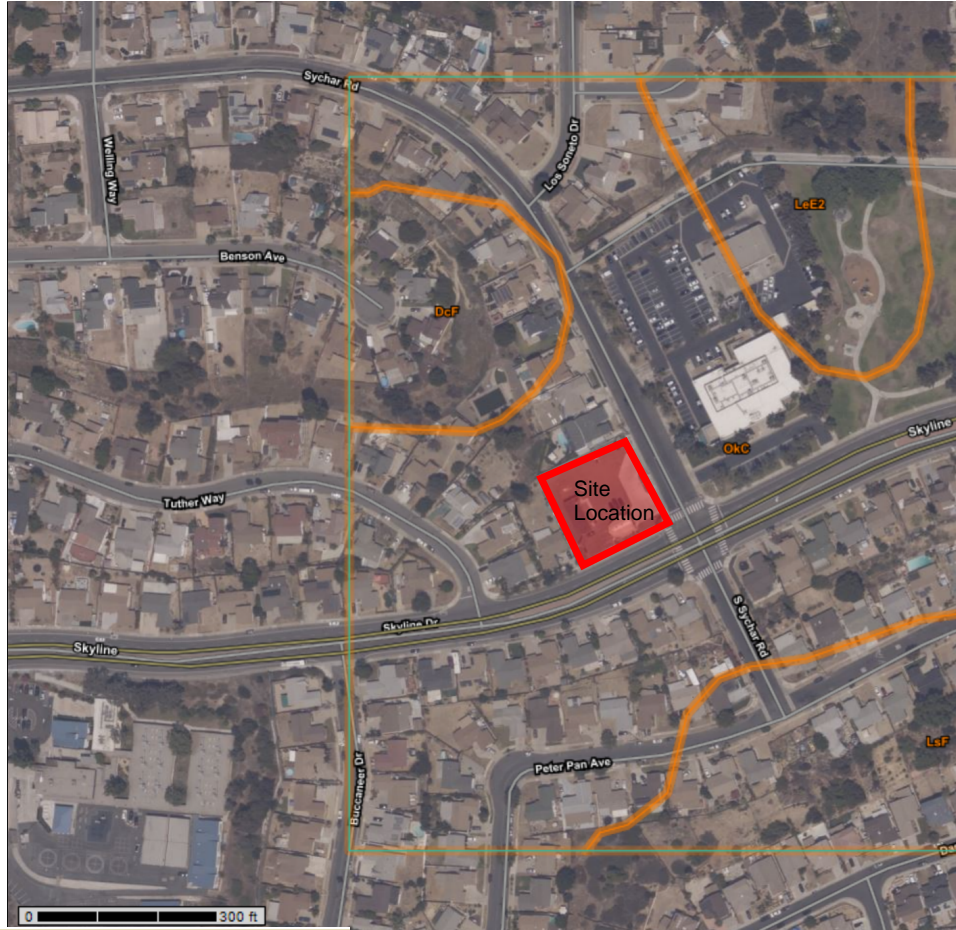
San Diego Fire-Rescue
Department Station 51

Consider the
Poor Ministries

Elegant Xtensionz
Salon & Boutique
Temporarily closed

Google

EXHIBIT 2: City of San Diego Fire and Rescue Station 51 - Regional Geology Mapped by USDA Online Web Soil Survey



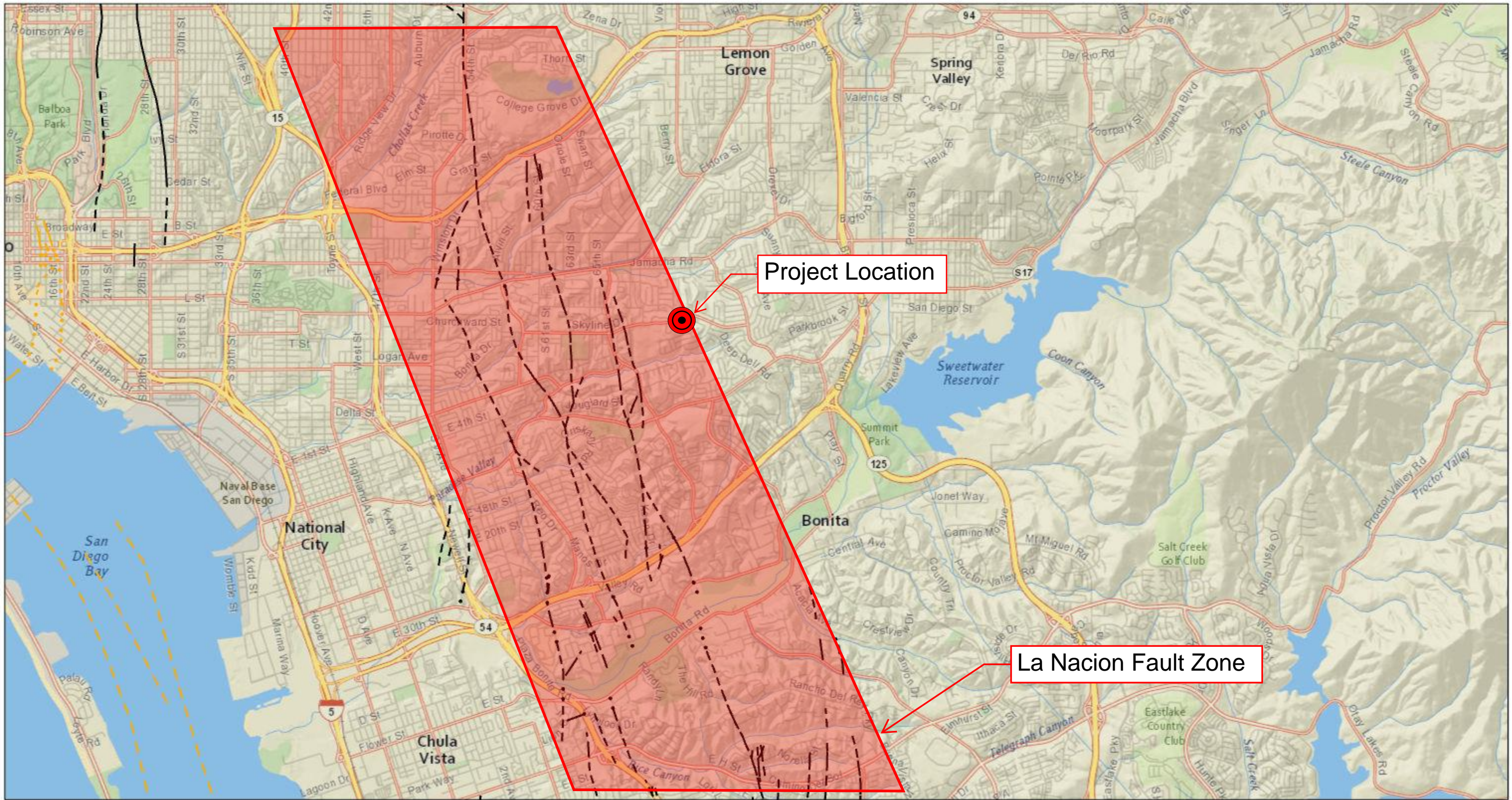
San Diego County Area, California

Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification	
					Unified	AASHTO
DcF—Diablo-Urban land complex, 15 to 50 percent slopes						
Diablo	50	D	0-15	Clay	CH	A-7
			15-32	Clay, silty clay loam	CH, CL	A-7
			32-36	Weathered bedrock	—	—
Urban land	30		0-6	Variable	—	—
LeE2—Las Flores loamy fine sand, 15 to 30 percent slopes, eroded						
Las flores	85	D	0-14	Loamy fine sand	SM	A-2
			14-22	Sandy clay, clay	CH, CL	A-7
			22-38	Sandy clay, clay	CH, CL	A-7
			38-48	Loamy coarse sand	SM	A-1
			48-52	Weathered bedrock	—	—

San Diego County Area, California

Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification	
					Unified	AASHTO
LsF—Linne clay loam, 30 to 50 percent slopes						
Linne	85	C	0-15	Clay loam	ML	A-6, A-7
			15-37	Clay loam	ML	A-6
			37-41	Weathered bedrock	—	—
OkC—Olivenhain-Urban land complex, 2 to 9 percent slopes						
Olivenhain	50	D	0-10	Cobbly loam	CL	A-4
			10-42	Very cobbly clay, very cobbly clay loam	CL	A-6, A-7
			42-60	Cobbly loam, cobbly clay loam	CL	A-6

EXHIBIT 3: U.S. Geological Survey Quaternary Faults

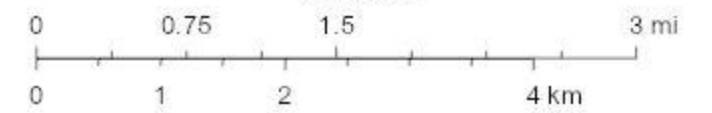


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Fault Areas	National Database
Class B	Historic (< 150 years), well constrained location
historic	Historic (< 150 years), moderately constrained location
late Quaternary	Historic (< 150 years), inferred location
latest Quaternary	Latest Quaternary (<15,000 years), well constrained location
middle and late Quaternary	Latest Quaternary (<15,000 years), moderately constrained location
	Latest Quaternary (<15,000 years), inferred location

Late Quaternary (< 130,000 years), well constrained location
Late Quaternary (< 130,000 years), moderately constrained location
Late Quaternary (< 130,000 years), inferred location
Middle and late Quaternary (< 750,000 years), well constrained location
Middle and late Quaternary (< 750,000 years), moderately constrained location
Middle and late Quaternary (< 750,000 years), inferred location

1:72,224



National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

Appendix G

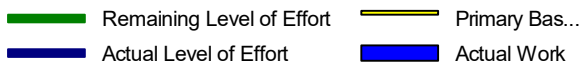
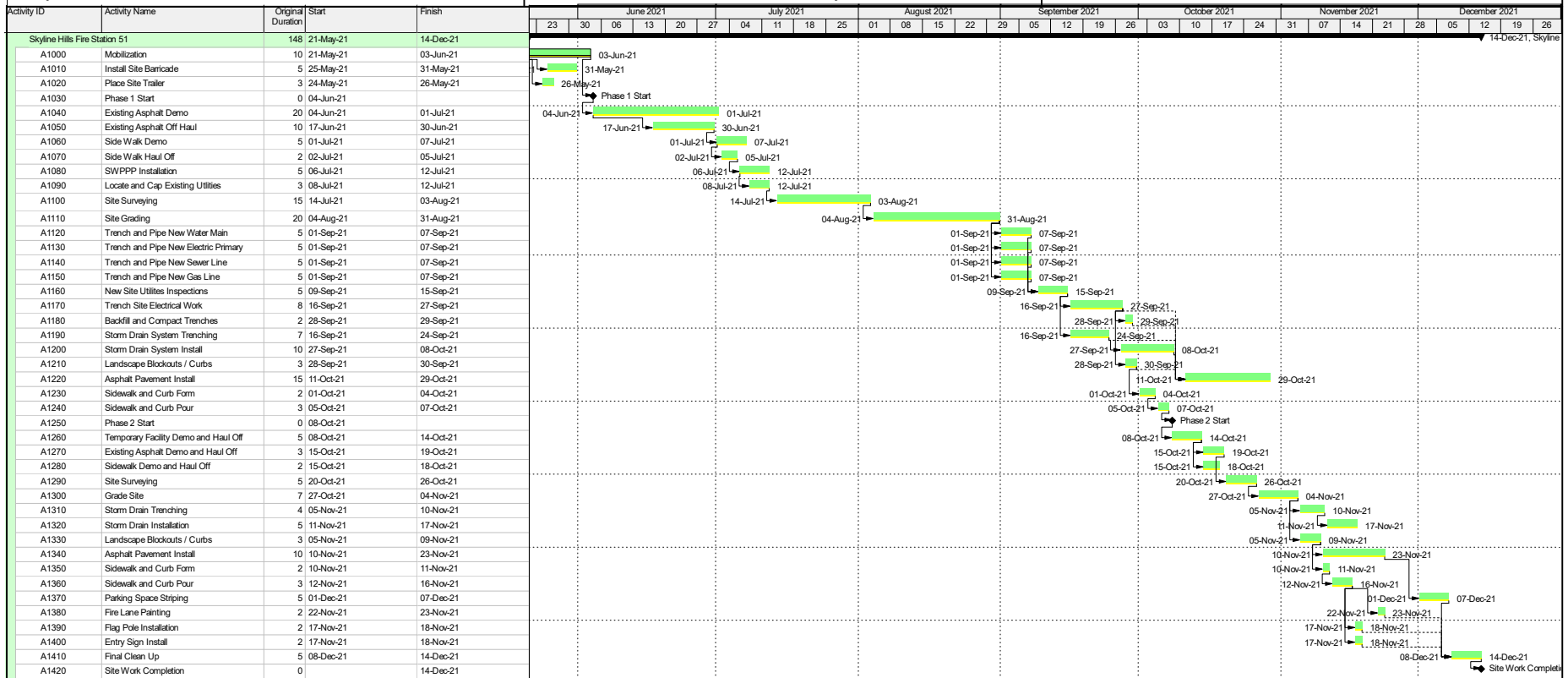
Soil Mitigation Report

Soil Mitigation Report

Forthcoming in 100% Submittal

Appendix H

Site Construction Schedule



Appendix I

Site Construction Estimate

PROJECT: Skyline Hills Fire Station 51				1		
OWNER: City of San Diego	BLDG SF	10,700	Duration MO:	6	LOCATION:	San Diego, CA
ARCHITECT: T16	# OF FLOORS:	2	Site SF:	24,390	DATE:	March 24, 2021
MANAGER: T16	1ST SF:	7,000	Attention: City of San Diego			
	2ND SF:	3,700				
ESTIMATOR: Ismael Delgado	Building SF	10,700	FILE NAME: FIRESTATION DETAIL BREAKDOWN			
GENERAL CONDITIONS BUDGET DESCRIPTION	QTY	UNIT	UNIT COST	AMOUNT	COMMENTS	
STAFF	6	MO	7,640	45,838		
FACILITIES	6	MO	6,540	39,238		
GENERAL CONDITIONS BUDGET	6	MO	14,179.33	85,076		
SITework BUDGET DESCRIPTION	QTY	UNIT	UNIT COST	AMOUNT	COMMENTS	
SITework BUDGET	24,390	SF	5.24	307,373		
FIRE STATION BUILDING BUDGET DESCRIPTION	QTY	UNIT	UNIT COST	AMOUNT	COMMENTS	
FIRE STATION BUILDING BUDGET	24,390	GSF	16.09	392,449		
SUMMARY					\$ PER SF	
SUBTOTAL: SOFT SIDE, GENERAL CONDITIONS, SITework:				\$392,448.50	\$36.68	
CONTINGENCY @ 5.00%				\$19,622.43	\$19,622.43	
SUBTOTAL				\$412,070.93	\$38.51	
INSURANCES @ 1.25%				\$5,150.89	\$5,150.89	
SUBTOTAL				\$417,221.81	\$38.99	
CONTRACTOR'S FEE @ 5.00%				\$20,861.09	\$20,861.09	
TOTAL BUDGET				\$438,082.90	\$17.96	

Skyline Hills Fire Station 51

1000 - GENERAL CONDITIONS

6 month overall duration

Sales & Use Tax Rate:

7.750%

DESCRIPTION	Quantity	UOM	% Time On Proj.	Cost Type 1		2		3		4		6		5,7,8,9	LINE ITEM TOTALS	COMMENTS
				UNIT PRICE	LABOR COST	UNIT PRICE	MATERIAL COST	UNIT PRICE	SUB-CONTRACT	UNIT PRICE	EQUIPMENT	Rate	LABOR BURDEN	OTHER COSTS		
Sup. /Auto/Expenses	6.0	MO	100%	4,100.00	24,600	300.00	1,940		0	600.00	3,600	35%	8,610	0	38,750	
Project Engineer	3.0	MO	50%	3,500.00	5,250		0		0		0	35%	1,838	0	7,088	
Subtotal of Staff Costs				1,145,230.00	29,850		1,940		0		3,600		10,448	0	45,838	\$ 7640 per month
- Misc Costs	1.0	MO	n/a		0	800.00	862		0		0	57%	0	0	862	
- Office Trailers	6.0	MO	n/a		0		0	600.00	3,600		0	57%	0	0	3,600	
- Office Supplies	1.0	MO	n/a		0	250.00	269		0		0	57%	0	0	269	
- Telephone/Fax/Computer Lines	1.0	MO	n/a		0	800.00	862		0		0	57%	0	0	862	
- Install Phone Eq & Lines	1.0	LS	n/a	1,700.00	1,700	1000.00	1,078	1500.00	1,500		0	57%	969	0	5,247	
- Drinking Water For GC Trailer	6.0	MO	n/a		0	100.00	647		0		0	57%	0	0	647	
- Temp. Sanitary Facilities	6.0	MO	n/a		0		0	450.00	2,700		0	57%	0	0	2,700	
- Onsite Fax/Copy Machines	1.0	MO	n/a		0	800.00	862		0		0	57%	0	0	862	
- Install Computer lines & Equip	1.0	LS	n/a	2,600.00	2,600	1000.00	1,078		0		0	57%	1,482	0	5,160	
- Trash Containers & Dump Fees	1.0	MO	n/a		0		0		0	970.00	970	57%	0	0	970	
- Move-In & Move-Out	1.0	LS	n/a	3,500.00	3,500	1000.00	1,078		0		0	57%	1,995	0	6,573	
- Construction Signs	1.0	EA	n/a		0	1500.00	1,616		0		0	57%	0	0	1,616	
- Building Permits & Fees	1.0	LS	n/a		0	7500.00	8,081		0		0	57%	0	0	8,081	
- General Safety	1.0	MO	n/a		0	500.00	539		0	500.00	500	57%	0	0	1,039	
- Misc. Equipment & Tools	1.0	MO	n/a		0		0		0	750.00	750	57%	0	0	750	
Subtotal Temporary Facilities					7,800		16,972		7,800		2,220		4,446	0	39,238	\$ 6540 per month
TOTAL GENERAL CONDITIONS					37,650		18,912		7,800		5,820		14,894	0	85,076	\$ 14180 per month

ITEM	SITWORK BUDGET	QTY	UNIT	UNIT COST	AMOUNT	CSI SUBTOTAL	COMMENTS	UNIT COST SUBTOTAL
01050	ON SITE	24,390	SF					
	FIELD ENGINEERING					6,098		FIELD ENGINEERING
1	Surveying	24,390	SF	0.25	6,098			\$0.25 per sf
02200	DEMOLITION AND SITE REQUIREMENTS					34,663		DEMOLITION AND SITE REQUIREMENTS
4	Temporary Barricades	310	LF	6.00	1,860			
5	Miscellaneous Backfill	1	LS	15,000.00	15,000			
6	Finish Grade Site	24,390	SF	0.25	6,098			
7	Construction Water	6	MO	500.00	3,000			
8	SWPP Maintenance	6	MO	450.00	2,700			
02500	SITE UTILITIES							SITE UTILITIES
11	FIRE WATER	310	LF	15.00	4,650	4,650		FIRE WATER
12	DOMESTIC WATER	310	LF	12.00	3,720	3,720		DOMESTIC WATER
13	SITE SANITARY SEWER	310	LF	15.00	4,650	4,650		SITE SANITARY SEWER
02550	SITE GAS					2,325		SITE GAS
14	Site Gas Line From POC to Building	155	LF	15.00	2,325			\$0.1 per sf
02580	SITE ELECTRICAL					31,200		SITE ELECTRICAL
15	Underground Electrical Building Service	310	LF	20.00	6,200			
19	Parking Area Lights & Poles	10	EA	2,500.00	25,000			
02600	DRAINAGE & CONTAINMENT					9,300		DRAINAGE & CONTAINMENT
20	Under Slab/Footing Drainage System	310	LF	10.00	3,100			\$0.38 per sf
21	Foundation Drain Bldg. Perimeter	620	LF	10.00	6,200			
02630	STORM DRAIN SYSTEM					3,350		STORM DRAIN SYSTEM
23	Storm Drain System Piping	310	LF	10.00	3,100			\$0.14 per sf
24	Catch Basins, Grates & Frames	1	EA	250.00	250			
02740	A C PAVING					109,520		A C PAVING
26	6" AC on 12" Class II Base	13,690	SF	8.00	109,520			\$4.49 per sf
02760	PAVING SPECIALTIES					3,520		PAVING SPECIALTIES
27	Striping Parking Spaces	20	EA	15.00	300			\$0.14 per sf
28	Handicap Striping & Signs	1	EA	20.00	20			
29	Painting Fire Lane	310	LF	10.00	3,100			
30	Fire Lane Signs	1	EA	100.00	100			
02770	SITE CONCRETE					85,780		SITE CONCRETE
33	6" Curb	310	LF	18.00	5,580			\$3.52 per sf
34	City Sidewalk	3,720	SF	10.00	37,200			
37	Driveway Approaches	4,300	SF	10.00	43,000			
02820	SITE FURNISHINGS					2,500		SITE FURNISHINGS
47	Flagpole	1	EA	2,500.00	2,500			
01700	FINAL CLEANING					6,098		FINAL CLEANING
50	Interim Clean-up	24,390	SF	0.10	2,439			\$0.25 per sf
51	Final Cleaning	24,390	SF	0.15	3,659			
	TOTAL ONSITE IMPROVEMENTS	24,390	SF	12.60	307,373	307,373		\$12.6 per sf

Job Name: Skyline Hills Fire Station 51				Budget Date: 3/24/2021	
Job No.: 7180 Skyline Hills Dr					
Client: City of San Diego				Estimator: Ismael Delgado	
Location: San Diego, CA					
Architect: T16		Budget	Spent	Filename: Skyline Fire Station 51	
SPEC. SECTION				Money Left	
CSI DIVISION 0 - MISC. CONSIDERATIONS					
	CONTINGENCY	19,622	-	19,622	
	CONTRACTOR'S FEE	20,861	-	20,861	
	PROJECT INSURANCE	5,151	-	5,151	
				-	
CSI DIVISION 1 - GENERAL CONDITIONS					
	01000 GENERAL CONDITIONS	85,076	-	85,076	
	01050 FIELD ENGINEERING	6,098	-	6,098	
				-	
CSI DIVISION 2 - SITEWORK & EARTHWORK					
	02200 DEMO, EARTHWORK & SITE REQUIREMENTS	34,663	-	34,663	
	02240 CLEANUP	6,098	-	6,098	
	02405 FIRE WATER	4,650	-	4,650	
	02405 DOMESTIC WATER	3,720	-	3,720	
	02405 SITE SANITARY SEWER	4,650	-	4,650	
	02405 STORM DRAIN SYSTEM	3,350	-	3,350	
	02408 SITE ELECTRICAL	31,200	-	31,200	
	02410 SITE GAS	2,325	-	2,325	
	02500 A/C PAVING	109,520	-	109,520	
	02550 SITE CONCRETE	85,780	-	85,780	
	02620 DRAINAGE & CONTAINMENT	9,300	-	9,300	
	02760 PAVING SPECIALTIES	3,520	-	3,520	
	02820 SITE FURNISHINGS	2,500	-	2,500	
		-	-	-	
TOTAL BUDGET		438,083	-	438,083	



Appendix J

Site Logistics Plan

Site Logistics Plan

Forthcoming in 100% Submittal

Appendix K

Site Phasing Plan

Site Phasing Plan

Forthcoming in 100% Submittal

Appendix L

SWPPP

SWPPP

Forthcoming in 100% Submittal